

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

FOR THE FISCAL REPORT PERIOD

April 13, 1991 - May 11, 1991

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May 24, 1991

**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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CONTRACT NO: NRC-02-88-005

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San Antonio, Texas

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TABLE OF CONTENTS

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

TABLE OF CONTENTS (CONT'D)

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

1. SUMMARY

1.1 Technical Status

NMSS Element 1 - CNWRA Operations

NRC and Center management continued effective coordination meetings and conferences addressing a range of day-to-day and long-term management topics (Section 2).

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. Extensive modifications will be made to these tables when the Staffing Plan is revised and approved in accordance with revisions to the Operations Plans and Project Plans. Intensive recruitment efforts continued for positions in the hydrogeology, geochemistry, and performance assessment. Recruitment was completed for the radiochemist position and an offer for employment has been made. Review and analysis continued on resumes and other interview information which were previously obtained.

The Center Five-Year Plan is being revised consistent with NRC comments. Closure is awaited on the Center's responses to NRC comments on the ADP Plan. The Operations Plans for the Division of High-Level Waste Management and the Office of the Licensing Support System Administrator, and the Project Plans for the Office of Nuclear Regulatory Research were revised and submitted at the end of this period.

Work continued to implement the responses to the Corrective Action Request that arose from an Internal QA Audit which was conducted December 4-6, 1990, at the Center. Quality Assurance activities focused on continued development and implementation of the Center QA system (particularly in the area of quality activity planning), surveillances, review of technical operating procedures and development of quality assurance procedures, and QA indoctrination and training. Revision 2, Change 2 of the Center Quality Assurance Manual was issued May 9, 1991.

NMSS Element - 2 Waste Systems Engineering and Integration

Discussions were held regarding the relationship between 10 CFR 60.112 and 60.122. Resolution on how to treat this relationship, which is pivotal to the structure and integrity of the Regulatory Requirements, continues to be awaited (Section 3).

Center staff worked closely with the NRC on the development of guidance and associated examples for selection of CDS types and subsequent development of the CDSs.

Training materials were developed and revised for two courses, one on systems engineering fundamentals and the other on SRA.

A requirements analysis regarding modifications to PASS Version 2.0 to improve processing speed and functionality was completed and submitted to NRC. This evaluation calls for the development of an interactive analysis and input module which will greatly improve both efficiency and user friendliness of use of PASS in the SRA work. Work continues on

development and implementation of software quality assurance and configuration control procedures.

Commencing in this period and consistent with NRC direction, any activities formerly conducted within WSE&I Tasks 4-8 will be moved to and reported in the individual Program Elements.

NMSS Element 3 - External Quality Assurance

Activities this period were limited to planning for future work (Section 4).

NMSS Element 4 - Geologic Setting

GS Element staff participated in the April 26-28, 1991, volcanism field trip to Lunar Crater in south-central Nevada. In addition, staff attended the ACNW workshop on "Geophysical Testing Methods for Characterization of a HLW Repository Site in Tuff."

Interactions continued on the development of a work plan on Probabilistic Seismic Hazard Analysis. Review of background materials continued. The scope of the work plan was revised based on comments on the draft work plan, and it was incorporated in the updated Operations Plans.

Work on the Ground Water Travel Time (GWTT) study consisted primarily of follow-up conversations to solicit input on potential technical alternatives to the current GWTT requirement.

Intensive technical assistance activities continued on the Natural Resources Assessment Methodology with a focus on development of the technical basis for potential regulatory guidance. Efforts continue to focus on preparing a cohesive integrated report which will be submitted to NRC for review next period.

NMSS Element 5 - Engineered Barrier Systems

A work plan to develop a NUREG/CR report on the Substantially Complete Containment (SCC) elicitation study, which was conducted as part of the ongoing Feasibility Study, was completed and transmitted to NRC as part of the the Operations Plan update (Section 6). As a second part of the follow-on SCC studies, a work plan was also developed to prepare an example that would demonstrate the technical feasibility of implementing a quantitative assessment of SCC.

Activities related to the performance of the engineered barrier subsystem continued with a focus on testing of the Watson crevice corrosion model. The model continued to be evaluated over a range of chloride concentrations and pHs at temperatures of 25°C and 100°C.

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

Staff members chaired sessions at the Second International High Level Radioactive Waste

Management Conference in Las Vegas, Nevada.

NMSS Element 6 - Repository Design, Construction, and Operations

Staff completed its extensive reviews of DOE responses to Site Characterization Analysis comments, and submitted its evaluation in a letter report to the NRC on April 16, 1991 (Section 7).

Staff participated in the NRC briefing of the ACNW on the draft Staff Technical Position on "Underground Facility Design - Thermal Loads," which the Center assisted NRC in preparing. The selection of Compliance Determination Strategy (CDS) type and development of compliance determination methods for coordinating the ESF and repository designs were initiated.

Work on Activities 1 and 2 on the Repository Operational Criteria (ROC) study continued, with the in-depth analyses of the 46 ROC Topics (Activity 1) being completed. The draft report on this work was transmitted to NRC on April 25, 1991. Several briefings to NRC staff and management preceded submittal of this important report.

NMSS Element 7 - Performance Assessment

Preliminary work continued on development of a Compliance Determination Strategy for the total system performance objective, consistent with the previously developed Performance Assessment Strategy (Section 8). The Regulatory Requirements and Regulatory Elements of Proof report was revised to incorporate NRC comments.

Discussions continued this period regarding the impact of budget reductions and reallocations on the Iterative Performance Assessment work. Discussions were also held regarding required revisions in the approach being followed in the waste package failure module work.

Total System Code development work continued. Development of a closed form solution was completed for non-dispersive transport of a decaying species through a multilayered fractured media, with diffusion into the surrounding rock matrix. The current version of the code was transmitted to NRC for their use. Work continues on developing an interface between this code and the Fast Probabilistic Integration code, and with an associated graphical plotting code.

The paper "Issues in Modeling Source-Term from Vitrified High-Level Waste Form" by Manaktala and Sagar, was published in the Proceedings of the Third International Conference on Nuclear Fuel Reprocessing and Waste Management, which was held in Sendai, Japan.

NMSS Element 8 - Transportation Risk Study

No report. Project completed.

Research Project 1 - Overall Research

Laboratory experimentation continued in Building 57 on three Center research projects and in other SwRI facilities (Section 10). Additional equipment continues to be set up in Building

57. The latest modifications to the building were completed in support of materials and earth sciences research activities; ancillary modifications continued.

The first CNWRA Annual Report on Research activities was transmitted to NRC in camera-ready form for publication as a NUREG/CR. Staff continued work on the first Research Quarterly Report for calendar year 1991.

The status of each of the ten research Project Plans is provided in Section 10 of this PMPR.

Research Project 2 - Geochemistry

The first set of experiments on the kinetics of analcime dissolution was completed. The results were summarized in the Quarterly Research Report. Modeling was conducted to analyze the kinetic data from the analcime dissolution studies.

The calculations related to the Alligator Rivers Natural Analogue study were completed and documented in the Quarterly Research Report.

Research Project 3 - Thermohydrology

Relocation of the thermohydrologics experimental apparatus to Building 57 was completed with the reassembly of the equipment. This relocation was undertaken to provide better temperature and humidity controls for the future experiments. Capabilities of the densitometer are being critically evaluated using parallel measurements with the Tempe cell.

Two experiments of Test Series 7 have been tentatively formulated, based on the findings of Tests 5 and 6. Significant modifications of test geometry and instrumentation have been made.

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. The field data acquisition system was effectively linked to a computer at the Center, thus providing a means to remotely acquire all of the data except the closure measurements (which are manually read).

The paper "Field Investigations for Seismic Effects on Mechanical and Geohydrological Response of Underground Structures in Jointed Rocks" was presented at the Second International High-Level Radioactive Waste Management Conference in Las Vegas, Nevada.

Research Project 5 - Integrated Waste Package Experiments

A review of the literature on localized corrosion was completed and transmitted to NRC.

The effects of bicarbonate on localized corrosion of 316L and alloy 825 was investigated further. In addition, initial tests on CDA-102 and CDA-715 were completed. Analyses indicate that the polarization curves for bicarbonate and chloride are in good agreement with literature results for these copper-based materials. Additional experiments are planned to

investigate the effects of chloride at high bicarbonate levels.

Preparations continued for long-term localized corrosion and slow strain rate studies.

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

Revisions were made to the literature review which was submitted April 1, 1991.

Research Project 7 - Geochemical Analogs

Activities focused on preparation and analysis of petrographic thin sections. X-ray diffraction studies continued, using the materials obtained from the Peña Blanca site. Staff conducted field evaluations of other potential analog sites located at the McDermitt Caldera and Virgin Valley, Nevada.

Staff made an invited presentation on the project to the Nuclear Waste Technical Review Board (NWTRB) at their meeting on April 16-17, 1991.

Research Project 9 - Sorption Modeling

The literature review on this project continued, with resulting information being placed into a special database for ease of access and use.

The Center awaits NRC response on the work plan on Experimental Studies on Uranium Sorption on Geologic Media, which was revised based on Center technical and management reviews. The draft work plan was forwarded to NRC for comment on March 29, 1991.

Research Project 10 - Performance Assessment

Work continued using PORFLO-3 on Test Case 10 of the INTRAVAL experiment at Las Cruces. A presentation was made to the plenary session for Working Group 1 at the INTRAVAL meeting in Seattle April 22-25, 1991. A saturated fractured porous medium problem was selected as the first test problem for the SNL code DCM-3.

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

LSSA Support - Development of Access Protocols for Technical Data

Discussions continued on LSSA comments on the previously submitted report (Section 11). A summary of the Center views is being developed in preparation for a meeting with the LSSA staff on May 15-16, 1991.

Waste Solidification Systems

Review of the off-gas sampling data and analysis report was completed (Section 12). As part of this activity, staff visited Commonwealth Edison facilities to discuss their experiences with the Dresden and other nuclear plants. Reviews of NRC Regulatory Guide 1.143 and ANS Standard 55.4 were also conducted.

Evaluation of changes in DOE plans for the Integrated Radwaste Treatment System continued. A meeting is being planned for early June to discuss the planned changes, in preparation for review of the SAR and preparation of the SER by October 1991.

1.2 Major Problems

Previously reported cost variances have been addressed through control measures and project baseline revisions. The latter were submitted in the revised Operations and Project Plans.

1.3 Forecast for Next Period

The recently submitted Operations Plans and Project Plans should be approved, and implementation of those plans will commence. In addition, staffing will continue to be a high priority activity, within the constraints of funding. The Center ADP Plan and Staffing Plan will be revised when comments are received from NRC. The Five-Year Plan will be revised and submitted. Change 2 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 further analyses, selection of Compliance Determination Method types, development of Compliance Determination Strategies, and loading approved SRA results into the database. Two systems engineering and SRA courses will be conducted. PARC activities will continue as backup materials to the RR/REOP report and regulatory uncertainties are prepared for entry into the database. Demonstration and training on Version 2.0 of PASS will continue for Center and NRC staff, as appropriate. Revision of the associated Users Guide and further modifications to the code will also continue, as required. The Configuration Management and Control Manual for CNWRA computer systems will continue to be implemented. Effort will also be devoted to development of an Overall Review Strategy, consistent with NRC comments on the LARS Recommendation Report.

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

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

The EBS Element will initiate work on an example problem to demonstrate the technical feasibility of a quantitative assessment of SCC. In addition, preparation of the report

documenting the results of the elicitation study will continue. 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. Work on the ROC will continue in accordance with the revised Operations 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 preparation of a Compliance Determination Strategy.

The first Quarterly Report for CY91 will be completed. Work will continue on all projects, in accordance with the approved Plans. Center staff will interact with the NRC on two proposed new research initiatives.

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

Work will continue on activities in Tasks 1 and 2 of the WSS Program Element, with a meeting planned to take place at West Valley June 6-7, 1991. Task 3 will also be initiated.

1.4 Summary Financial Status

Table 1 below indicates the financial status of the Center in the context of "authorized" funds established by the NRC. Table 2 displays planned and actual costs without allowance for fee to date on both a per period and a cumulative basis. In addition, these data do not include commitments, and variances are shown on both a dollar and percentage basis. Total commitments of the Center are \$212,336. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

In addition, 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. Changes in spending plans will be reflected during the next period, following approval of the revised Operations and Project Plans.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$11,898,801
FY91 Funds Costed to Date (b)	\$ 6,321,017
FY91 Funds Uncosted (c)	\$ 5,577,784
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 (5/10/91)

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. Cragolino
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/IISOPE GEOCHEMISTRY	
REGULATORY ANALYSIS	S. Spector (Law)
RELIABILITY	J. Wu
RISK ASSESSMENT/ANALYSIS	
ROCK MECHANICS	A. Chowdhury, M. Ahola
SEISMOLOGY	R. Hofmann
STRUCTURAL GEOLOGY/TECTONICS	G. Stirewalt, S. Young
SYSTEMS ENGINEERING	D.T. Romine, P. Mackin
VOLCANOLOGY/IGNEOUS PROCESSES	

CENTER CORE STAFF - HIRING PROFILE AND STATUS (5/10/91)

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 ENGN			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							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	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					1	1	1	1	1	0
PERFORMANCE ASSESSMENT (b)		1	2	3	3	4	4	4	4	1
QUALITY ASSURANCE	1	2	2	2	2	2	2	2	2	0
RADIOCHEMISTRY//ISOTOPE GEOCHEMISTRY (c)							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	1	1	1	1	1	1	1	1	1	1
ROCK MECHANICS		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					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*	49	14	63
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	601629	833898	850755	811297	954290	970559	1004343	1004245	1006984	1035543	956001	910098	965750	7031016
ACT. PERIOD COST	770452	763102	864860	879889	893163	765415	853464	730671	0	0	0	0	0	6321017
VARIANCE, \$	-168823	70796	-14105	131408	61127	205144	150878	273573	0	0	0	0	0	709998
VARIANCE, %	-28.1	8.5	-1.7	16.2	6.4	21.1	15.0	27.2	0.0	0.0	0.0	0.0	0.0	10.1
EST. FY CUMUL	601629	1435527	2286283	3097579	4051870	5022428	6026771	7031016	8038000	9073543	10029544	10939642	11905392	
ACTUAL FY CUMUL	770452	1533555	2398415	3078304	3971467	4736881	5590348	6321017	0	0	0	0	0	
PERCENT COMPLETE	0.065	0.129	0.201	0.259	0.334	0.398	0.470	0.531	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	168823	-98027	-112132	19276	80403	285547	436425	709998	0	0	0	0	0	
VARIANCE, %	28.1	-6.8	-4.9	0.6	2.0	5.7	7.2	10.1	0.0	0.0	0.0	0.0	0.0	

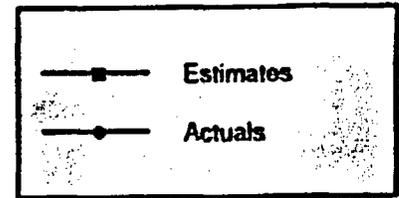
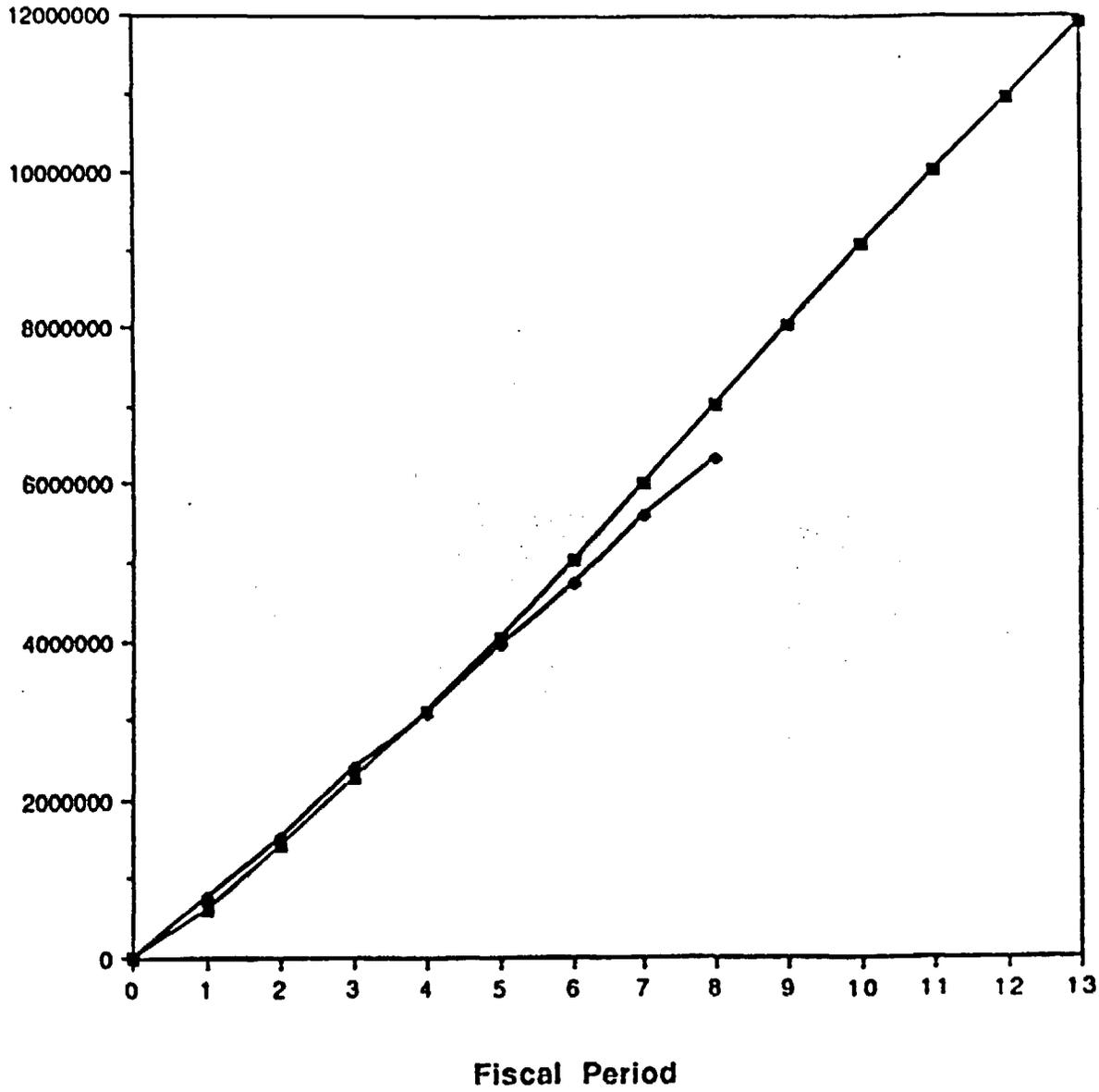
NOTES:

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

1-12

Dollars



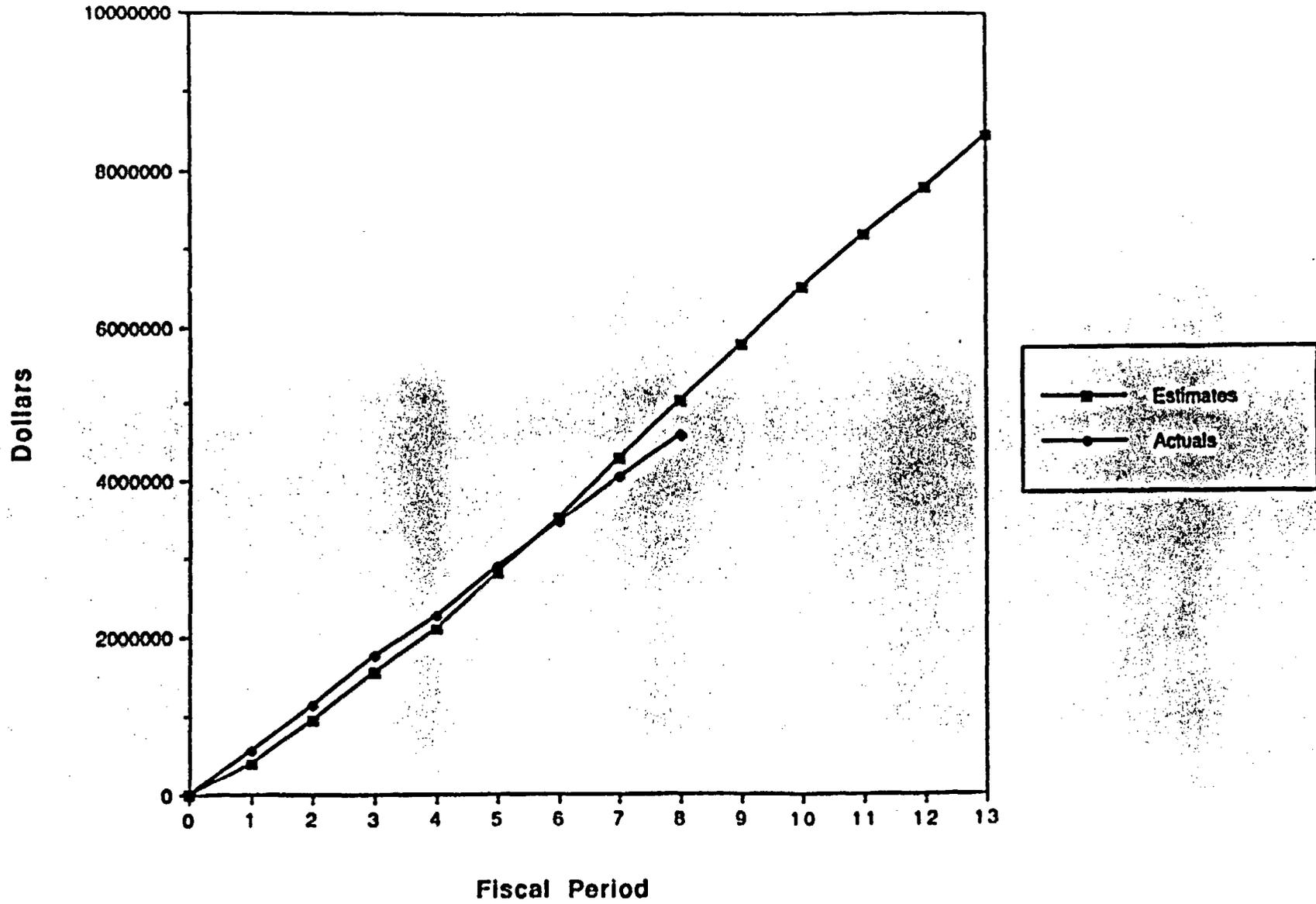
Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST. PERIOD COST	385369	569722	599578	557304	712291	713304	752978	759847	721049	753000	664750	594661	659282	5050393
ACT. PERIOD COST	561733	574543	638508	488560	646698	582490	567385	537776	0	0	0	0	0	4597691
VARIANCE, \$	176364	-4821	-38928	68744	65593	130814	185593	222071	0	0	0	0	0	452702
VARIANCE, %	-45.8	-0.8	-6.5	12.3	9.2	18.3	24.6	29.2	0.0	0.0	0.0	0.0	0.0	9.0
EST. FY CUMUL	385369	955091	1554669	2111973	2824264	3537568	4290546	5050393	5771442	6524442	7189192	7783853	8443136	
ACTUAL FY CUMUL	561733	1136276	1774781	2263342	2910040	3492530	4059915	4597691	0	0	0	0	0	
PERCENT COMPLETE	0.067	0.135	0.210	0.268	0.345	0.414	0.481	0.545	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	176364	181185	-220113	-151369	-85776	45038	230631	452702	0	0	0	0	0	
VARIANCE, %	-45.8	-19.0	-14.2	-7.2	-3.0	1.3	5.4	9.0	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 YID total.

3702 HLW



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	1771312
ACT. PERIOD COST	189342	172182	208364	176210	232994	158052	267658	178115	0	0	0	0	0	1582917
VARIANCE, \$	-1216	64313	31395	71553	-15935	71233	-54130	21182	0	0	0	0	0	188395
VARIANCE, %	-0.6	27.2	13.1	28.9	-7.3	31.1	-25.4	10.6	0.0	0.0	0.0	0.0	0.0	10.6
EST. FY CUMUL	188126	424621	664381	912144	1129203	1358488	1572016	1771312	2026659	2291368	2560598	2841420	3114500	
ACTUAL FY CUMUL	189342	361524	569888	746098	979093	1137144	1404802	1582917	0	0	0	0	0	
PERCENT COMPLETE	0.061	0.118	0.183	0.240	0.314	0.365	0.451	0.508	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-1216	63097	94492	166046	150111	221344	167214	188395	0	0	0	0	0	
VARIANCE, %	-0.6	14.9	14.2	18.2	13.3	16.3	10.6	10.6	0.0	0.0	0.0	0.0	0.0	

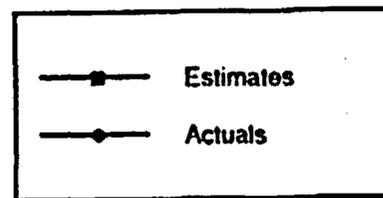
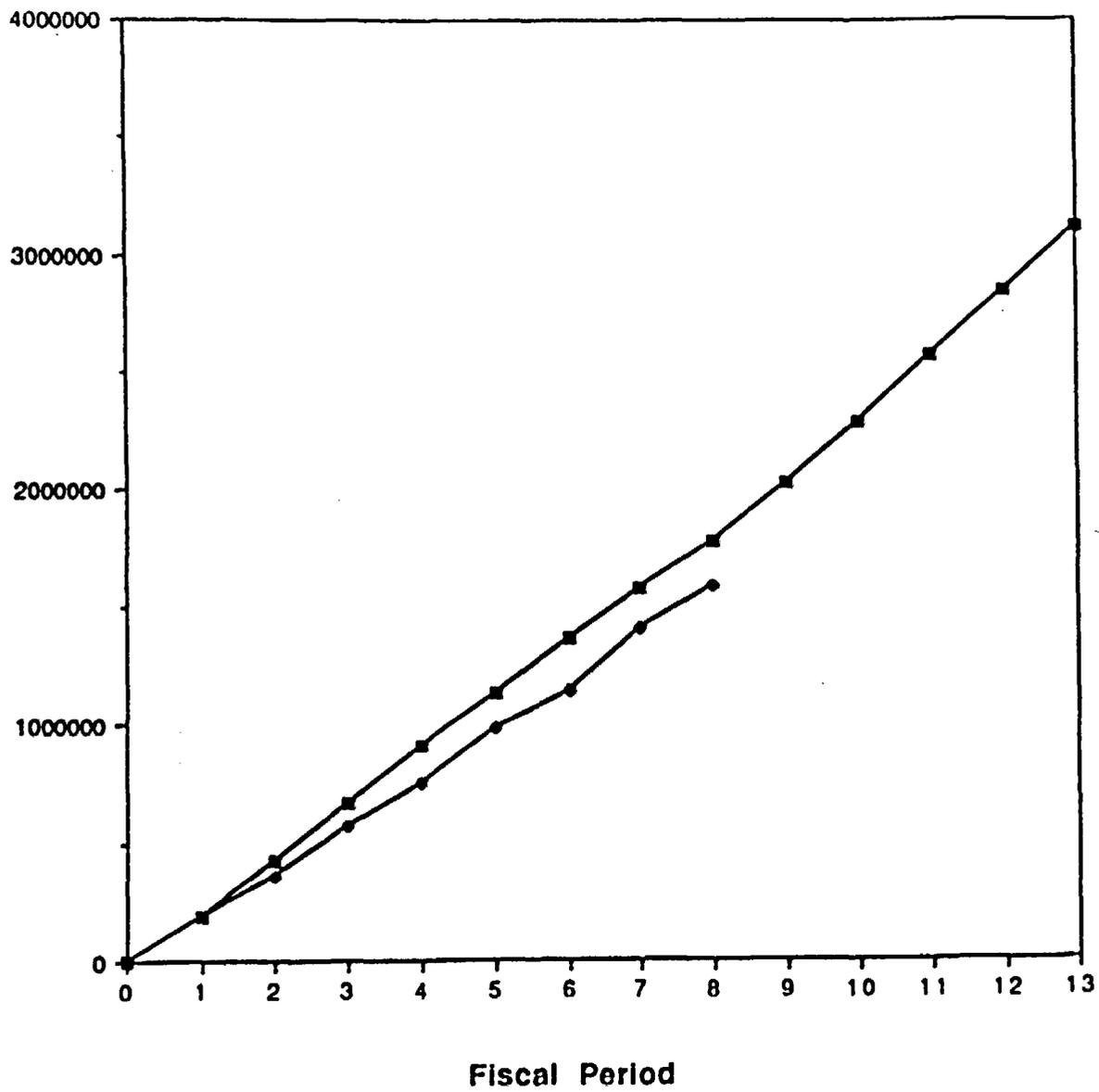
NOTES:

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 RES

1-16

Dollars



2. CNWRA OPERATIONS

NRC Program Element Manager: Shirley L. Fortuna

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

CNWRA Element Manager: Henry F. Garcia

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

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

2.1 Technical Status

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

Task 1 - Management and Technical Support

Effective coordination of work activities continued during this period. Center management participated in various meetings including the Center Review Group and Regulatory Relationship meetings with cognizant personnel from the Division of High Level Waste Management (DHLW) and Office of Nuclear Regulatory Research (RES) at the White Flint and Nicholson Lane NRC offices. Preparations for the ACNW Meeting and Operations/Project Plans presentation coupled with the continuing dialogue on the Center's budget for the following two fiscal years consumed a large measure of management's attention.

Task 2 - Develop and Sustain Technical and Analytical Capabilities

The Center is continuing input of various documents 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

Although no Center core staff were added during this period, one candidate for the position of radiochemist/isotope geochemist will join the staff in August. 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 are aware of potential funding constraints that may impact their pursuit of such candidates. The revision of the staff requirements consistent with such constraints will affect the composition of the Staffing Plan, which awaits final guidance from NRC for its presentation.

Task 4 - Operations Plans and Five Year Plan Development

Comments received on the draft version of the Center Five-Year Plan are being incorporated into its final version. The Center completed revisions to the Operations and Project Plans. The Center is still anticipating 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 Quality Assurance Procedures (QAPs), surveillance of work at the Center Laboratory, and assistance to the technical staff in developing and implementing Technical Operating Procedures. Work continued on the Corrective Action Request initiated as a result of the December internal audit. The corrective actions provide for phased implementation of software configuration control/documentation and existing data controls based on the Center's schedule of activities important to quality and progress is being made to meet the objectives. Based upon the lessons learned from the External QA Element and Center internal audits, Revision 2, Change 2 to the Center Quality Assurance Manual was issued May 9, 1991. Controlled copies were distributed to key Center and NRC HLW staff.

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

2.2 Major Problems

None.

2.3 Forecast for Next Period

The Center will deliver the final version of its Five-Year Plan on the final day of May. After receipt of NRC comments, the final versions of the Center ADP and Staffing Plans will be completed. Contingent on the availability of sufficient funding, the Center's recruitment efforts will continue to be focused on the geosciences and performance assessment disciplines. The Center will brief NRC on and commence implementation of

the revised Operations/Project Plans. The PMPR will be produced for the ninth period of FY91. Attendance at professional development events and participation in professional/technical society activities will be encouraged. Work will continue on the introduction of new data in the Technical Document and Correspondence Control Indexes.

Revision 2, Change 2 of the CQAM will continue to be implemented, along with continued procedure development and surveillance. Planning for the QA Program audit, which is anticipated for late July/early August, will continue during this period.

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 \$9,846. 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. Revisions to the spending plans will be reflected in the next PMPR, following approval of the Operations Plans.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$2,190,639
FY91 Funds Costed to Date (b)	\$1,365,795
FY91 Funds Uncosted (c)	\$ 824,844
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).

Element Status Cost Report

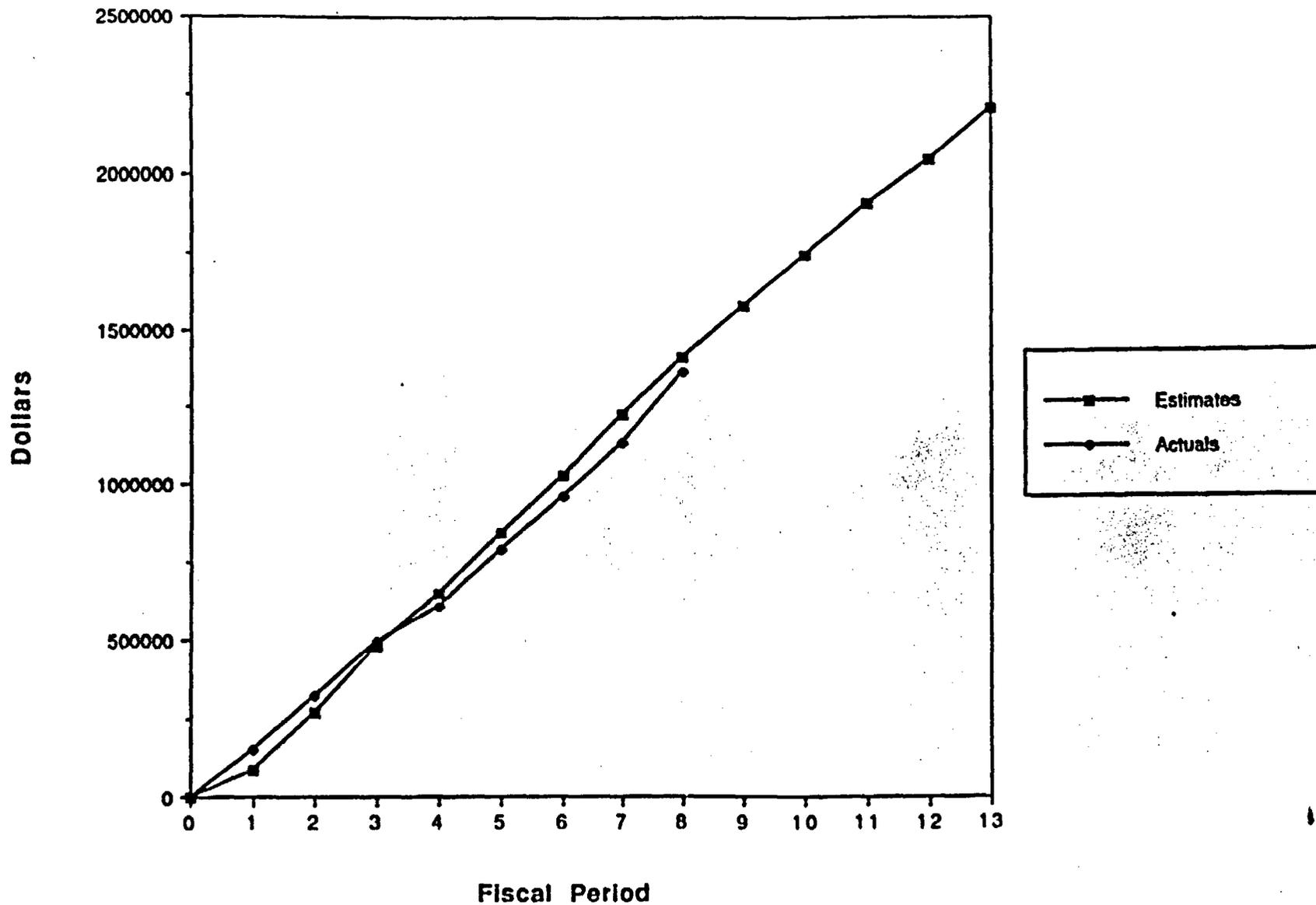
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST. PERIOD COST	83748	188826	208393	162437	198761	188426	195169	182795	168243	167357	159632	140246	160563	1408555
ACT. PERIOD COST	154970	171371	169190	111360	182216	176821	168984	230883	0	0	0	0	0	1365795
VARIANCE, \$	-71222	17455	39203	51077	16545	11605	26185	-48088	0	0	0	0	0	42760
VARIANCE, %	-85.0	9.2	18.8	31.4	8.3	6.2	13.4	-26.3	0.0	0.0	0.0	0.0	0.0	3.0
EST. FY CUMUL	83748	272574	480967	643404	842165	1030591	1225760	1408555	1576798	1744155	1903787	2044033	2204596	
ACTUAL FY CUMUL	154970	326341	495530	606891	789107	965927	1134911	1365795	0	0	0	0	0	
PERCENT COMPLETE	0.070	0.148	0.225	0.275	0.358	0.438	0.515	0.620	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-71222	53767	-14563	36513	53058	64864	90849	42760	0	0	0	0	0	
VARIANCE, %	-85.0	-19.7	-3.0	5.7	6.3	6.3	7.4	3.0	0.0	0.0	0.0	0.0	0.0	

NOTES.

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

3702-070 CNWRA OPS

5-2



3. WASTE SYSTEMS ENGINEERING AND INTEGRATION

NRC Program Element Manager: Philip M. Altomare

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

CNWRA Element Manager: D. Ted Romine

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

Subcontractor/Consultant: J. Cooper

3.1 Technical Status

During this period, a major effort of the Center staff of this element involved preparation of modified operations plans consistent with recent Center/NRC Management Meetings concerning scope, schedule changes, and deliverables. Additional activities included: (1) discussions on April 25 between NRC/Center Staff regarding the relationship of Sections 112 and 122 of 10 CFR Part 60. (2) Participation with NRC in developing guidelines for selection of CDS type, a CDS Synopsis format, and in CDS type selection for the RR's of Mining Regulations, Natural Resources, Flooding and Retrievability; (3) discussions related to the LARS/ORS concept; (4) revision of the CDS portion of the SRA procedure consistent with the current LARS approach within the Overall Research Strategy (ORS) and the development of an initial CDS for RR0002 Retrievability as an example; (5) optimizing and extending features of PASS Version 2.0 based on lessons learned, including the requirements analysis for an interactive input subsystem; (6) ongoing configuration control and Documentation of PASS and the PADB; (7) preparation for a repeat of the Systems Engineering Course and the first SRA course; and (8) preparation of draft white papers on uncertainty and the role of SRA in the licensing process.

Task 1 - Statutory and Regulatory Analysis

On April 2, two presentations were made to the NRC staff. The first explained the purpose, content and development process of the RR/REOP Report. The second treated similar subjects for the report of the RFA and the "Sufficiency Test" of Part 60 based on the RFA. These presentations were intended to help prepare the staff for a review of these documents. Subsequent to the presentation of the RR/REOP Report, a specific concern discussed earlier regarding the relationship of Section 112 and 122 of 10 CFR Part 60 was raised. A meeting was held on April 25, 1991, at the NRC office in White Flint to discuss the NRC/CNWRA views. Meeting conclusions are expected from the NRC next period.

Also during this period, a Center response was submitted on a question raised regarding the depth of analysis of the geologic setting represented in the draft RFA report. NRC comments on the RFA draft report are anticipated during Period 9.

During this period, joint NRC/CNWRA preparation of draft guidelines for selection of CDS type was completed and a telecon training session was conducted by Robert Johnson (NRC) on April 26th for the NRC/CNWRA staff involved with this activity for Mining Regulations, Natural Resources, Flooding and Retrievability. Initial results of these efforts have been jointly discussed during this period. Additionally, a draft CDS synopsis guideline has been under development and review during this period that will be consistent with the SRA process, PASS data base and LARP requirements. The initial worked example, utilizing this guideline, will be Retrievability (RR0002). An initial draft of the CDS for Retrievability is being developed this period and it is anticipated that this will be reviewed and finalized during the next period.

Training materials for the second presentation of the Systems Engineering Course to the NRC staff on May 22 and 23, 1991, and the first SRA training course scheduled for presentation to NRC/CNWRA Management on May 28 and 29 and NRC Staff on June 12 and 13 were refined and developed during this period. Specific examples of SRA from Retrievability are being developed for the SRA training package. NRC review and approval of this training package is expected next period.

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

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

Task 2 - Program Architecture Development and Support System

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

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

The review status flags for the data currently loaded in the PADB were set using a procedure that meets current configuration control requirements for the PADB. The maintenance concept for adding, changing and deleting data in the PADB and modifying the PASS software was finalized and software changes are being made at this time.

The lessons learned in the ongoing implementation of PASS V2.0 and loading of the PADB are being documented.

Task 3 - HLWM Program Analysis and Integration

Commencing with this period and consistent with NRC discussion and the Operations Plan updates, no further activities will be pursued under this task.

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

Commencing with this period and consistent with NRC discussion and the Operations Plan updates, no further activities will be pursued under this task.

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

Commencing with this period and consistent with NRC discussion and the Operations Plan updates, no further activities will be pursued under this task.

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

Commencing with this period and consistent with NRC discussion and the Operations Plan updates, no further activities will be pursued under this task.

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

Commencing with this period and consistent with NRC discussion and the Operations Plan updates, no further activities will be pursued under this task.

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

Activity on the Overall Review Strategy (ORS) that occurred during this period was confined to a number of discussions due to the limited availability of appropriate Center and NRC staff.

3.2 Major Problems

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

3.3 Forecast for Next Period

Element activities during the next period will be focused on:

- Completing the updating of the Operations Plans by May 13 and briefing NRC on May 14, 1991.
- Finalizing the relationship of Sections 112 and 122 of 10 CFR Part 60.

- Continued loading into the PADB of approved SRA information on various Regulatory Requirement Topics, as time permits.
- Preparations for PASS Version 2.0 and SRA training of NRC staff along with the development of examples of SRA from Retrievability (RR0002).
- Continued optimization and extension of features in PASS Version 2.0
- Continued implementation of the Configuration Management and Control for PASS and the PADB.
- Continue prototyping PASS Version 2.0, Interactive Input Subsystem.
- Continued implementation of software changes for PADB maintenance in PASS.
- Anticipating receipt of NRC annotated outline of the Overall Review Strategy (ORS) Document to initiate Center participation in Task Force on said subject.
- Jointly finalizing guidelines for CDS type selection and developing guidelines for CDS activities on the three RR Topics to be worked by the NRC staff, and finalizing a preliminary Compliance Determination Strategy for RR0002 Retrievability.
- Presentation of the repeat of Systems Engineering Course to be presented to NRC (May 22-23, 1991). A summary of this course will be presented to Center staff on May 20.
- Final preparation and presentation of a course on SRA to be first presented to NRC and CNWRA Management staff on May 28-29, 1991, in Washington, and subsequently presented to NRC staff June 12-13 also in Washington.

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 \$53,255. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

It is anticipated that any remaining cost variances will be remedied when the Operations Plans are revised and work efforts are focused and rescheduled consistent with guidance on activity prioritization and resource availability. Revisions to the spending plans will be reflected in the next PMPR, following approval of the Operations Plans.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$2,329,667
FY91 Funds Costed to Date (b)	\$1,420,805
FY91 Funds Uncosted (c)	\$ 908,862
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).

Element Status Cost Report

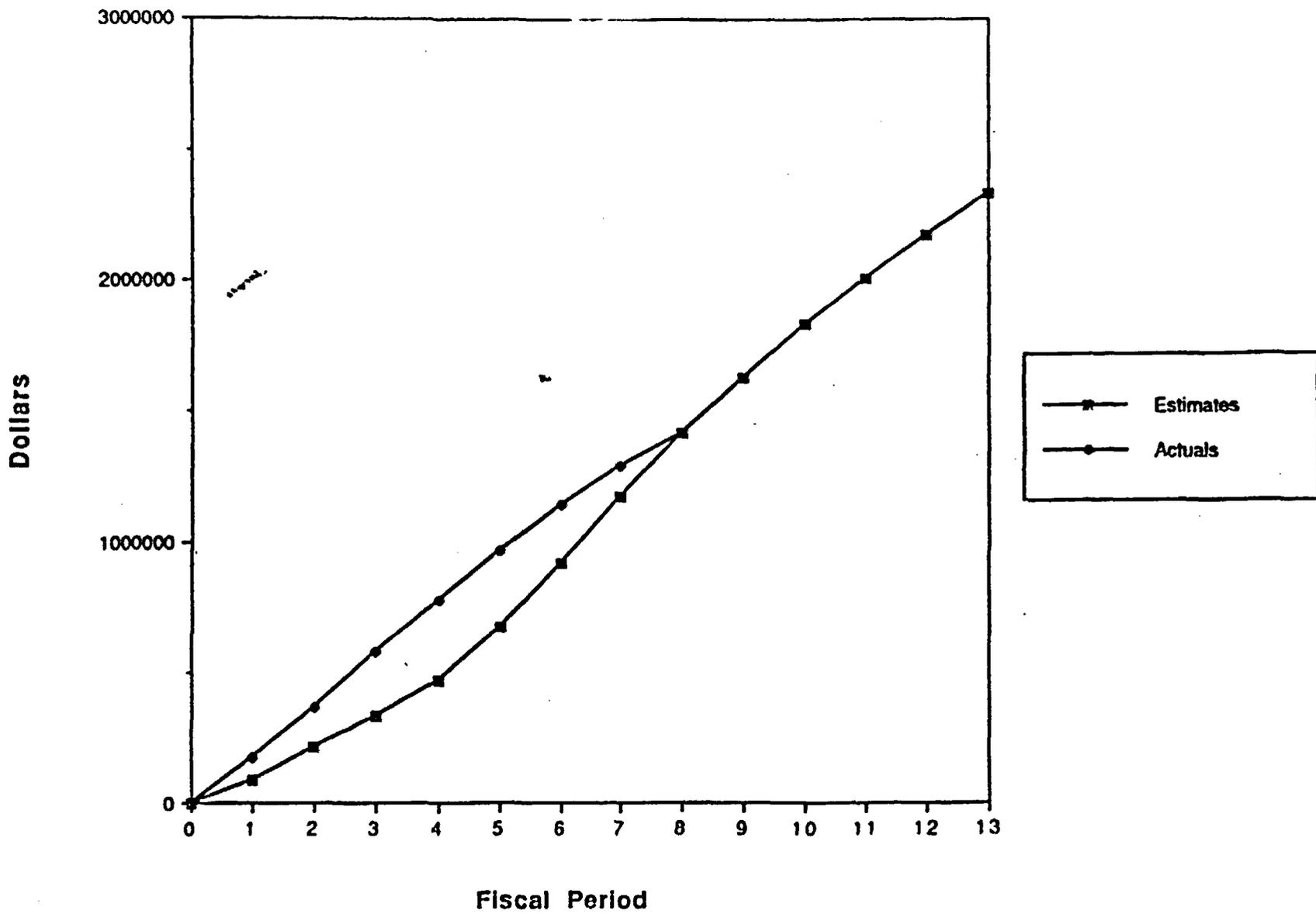
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	88130	121982	119294	134867	211174	239971	257346	247080	210701	205460	172290	166842	163199	1419843
ACT. PERIOD COST	175483	191583	207239	203017	190578	168953	156728	127224	0	0	0	0	0	1420805
VARIANCE, \$	-87353	-69601	-87945	-68150	20596	71018	100618	119858	0	0	0	0	0	-961
VARIANCE, %	-99.1	-57.1	-73.7	-50.5	9.8	29.6	39.1	48.5	0.0	0.0	0.0	0.0	0.0	-0.1
EST. FY CUMUL	88130	210112	329406	464273	675447	915418	1172764	1419843	1630544	1836004	2008294	2175136	2338335	
ACTUAL FY CUMUL	175483	367066	574305	777322	967900	1136853	1293581	1420805	0	0	0	0	0	
PERCENT COMPLETE	0.075	0.157	0.246	0.332	0.414	0.486	0.553	0.608	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-87353	156954	-244900	-313049	-292454	-221435	-120817	-961	0	0	0	0	0	
VARIANCE, %	-99.1	74.7	-74.3	-67.4	-43.3	-24.2	-10.3	-0.1	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

3-7



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

No Audit Observation Team (AOT) field work occurred during the reporting period, although regular communication took place with NRC quality assurance professionals. Participation on NRC Audit Observation Teams allows the Center QA staff to maintain familiarity with the DOE HLW activities which are often similar to the Center work and both require rigorous QA systems. There were discussions and plans made for the regarding the U.S. Geological Survey DOE audit at Denver in May of 1991.

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

During this period, Center QA personnel regularly interfaced with NRC QA staff by telephonic and E-Mail communications and kept each other informed on developments in the HLW field. A Center Washington Technical Office staff member attended the NRC/DOE bimonthly QA meeting and provided a short electronic report to Center QA staff.

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

No activity this period.

Task 4 - Review DOE QA Program Documents

No activity this period.

4.2. Major Problems

None.

4.3 Forecast for Next Period

Center activities in this area will continue as directed by the NRC Program Element Manager for External QA, and as identified by the Center QA Director. These activities will include participation in the NRC AOTs for the DOE audits of the U.S.G.S. at Denver and of Lawrence Livermore National Laboratory.

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 fiscal year. It is anticipated that these costs variances will be remedied when the Operations Plans are revised and the pace of audit observations is factored into the costs estimates of this revision. Revisions to the spending plans will be reflected in the next PMPR, following approval of the Operations Plans.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$ 171,592
FY91 Funds Costed to Date (b)	\$ 47,918
FY91 Funds Uncosted (c)	\$ 123,674
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).

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	20466	14312	12702	12931	10187	9150	8984	10264	12175	13060	15397	21392	30707	88995
ACT PERIOD COST	7162	9534	3322	2382	4809	9834	4278	0	0	0	0	0	0	47918
VARIANCE, \$	13304	4777	9380	10549	5378	2553	-850	5986	0	0	0	0	0	51076
VARIANCE, %	65.0	33.4	73.8	81.6	52.8	27.9	-9.5	58.3	0.0	0.0	0.0	0.0	0.0	51.6
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	43640	47918	0	0	0	0	0	
PERCENT COMPLETE	0.037	0.087	0.104	0.117	0.142	0.176	0.228	0.250	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	13304	18081	27461	38011	43389	45941	45091	51076	0	0	0	0	0	
VARIANCE, %	65.0	52.0	57.8	62.9	61.5	57.6	50.8	51.6	0.0	0.0	0.0	0.0	0.0	

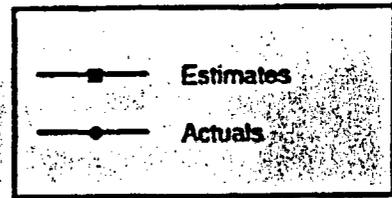
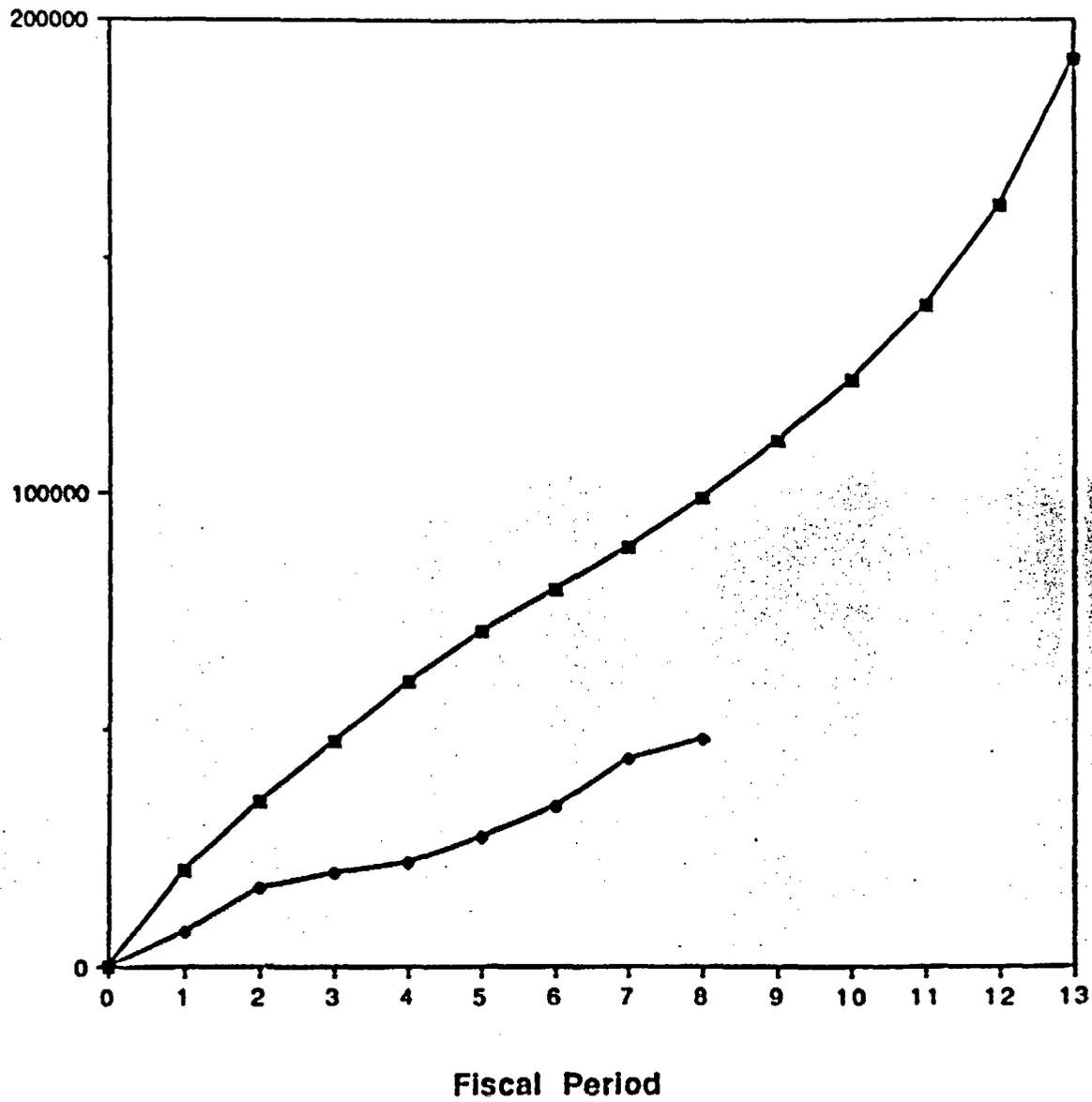
NOTES:

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

3702-040 QA

4-4

Dollars



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 April 17 and 24, and other NRC meetings at Rockville, Maryland pertinent to the Center's Geologic Setting Element (GSE) technical activities. S. Young and G. Stirewalt participated in the International High-Level Radioactive Waste Management Meeting in Las Vegas where they presented a paper on balancing of geologic cross sections through Yucca Mountain, Nevada. This talk represented presentation of work accomplished in the GSE Task 2 early in FY91 to the scientific community. J. Russell represented the GSE at the April 25 NRC-CNWRA Meeting on the relationships between 10 CFR 60.112 and 60.122 which was held in the NRC's offices at Rockville, Md. Another major effort consisted of preparation of a revised FY91-92 Operations Plans for the DHLWM.

Geologic Setting Program Element Interfaces With Other Center Activities

Center geoscientists conducted work for the Performance Assessment, WSE&I, and Repository Design 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. Center geoscientists were also heavily involved with the conduct of geochemistry research performed in three Center research projects. Three candidates for the Center staff position entitled "radiochemist/isotope geochemist" were interviewed in Period 8, an offer for employment was made to one individual. Additional information is present 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

G. Stirewalt participated in the April 26 through 28 ACNW volcanism field trip to Lunar Crater in south-central Nevada. He also attended an ACNW workshop conducted April 22 in Bethesda, Md. on "Geophysical Testing Methods for Characterization of a HLW Repository Site in Tuff." W. M. Murphy reviewed a report by T. Pigford on liquid metal

reactor waste in response to a request by the NRC staff.

Subtask 1.2 - Review DOE's Study Plans

No activity occurred in this subtask during the reporting period.

Subtask 1.3 - Support NRC in On-Site Visits

No activity occurred in this subtask during the reporting period.

Task 2 - Regulatory and Technical Guidance Development

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

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

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

Definition of the scope (and therefore cost and schedule) of the Center's continuing work in the draft work plan was revised by the Center in concert with discussions with pertinent NRC technical staff. The work plan was integrated into Change 2 of the CNWRA FY91-92 Operation Plans for the DHLWM.

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 8. 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. Activities for this subtask included solicitation of input on potential technical alternatives from individuals who had participated in Workshop V in Tucson, Arizona.

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 8. The technical basis for potential regulatory guidance options continued to be developed. 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 8. The Center staff presented to cognizant NRC staff a summary of work progress for this subtask. A major activity in this subtask during the reporting period was preparation of the manuscript which will constitute the draft report which will be submitted to the NRC in Period 9.

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. The draft options paper on natural resources assessment methodology will be submitted to the NRC during Period 9. Support will be provided to NRC/DOE technical exchange meetings and related meetings, as appropriate. Period 9 activities will include preparation of a presentation on the CNWRA FY91-92 Operations Plans for the Division of High-Level Waste Management to the NRC management staff summarizing work activities, schedules, costs and deliverables. Task 2 work in "Tectonics" will be initiated and will consist of preparation of a detailed work plan and start of work defined in the work plan.

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 \$28,047. 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 elimination of most of the variance. 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 GSE 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. Revisions to the spending plans will be reflected in the next PMPR, following approval of the Operations Plans.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$ 727,355
FY91 Funds Costed to Date (b)	\$ 407,528
FY91 Funds Uncosted (c)	\$ 319,827
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).

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	12022	32114	42705	49189	59138	47315	47491	77642	80525	82622	76926	73250	123268	367616
ACT. PERIOD COST	85455	57066	83661	29066	49284	25869	41321	35807	0	0	0	0	0	407528
VARIANCE, \$	-73433	-24952	-40956	20122	9854	21447	6170	41836	80525	82622	76926	73250	123268	-39913
VARIANCE, %	-610.8	-77.7	-95.9	40.9	16.7	45.3	13.0	53.9	0.0	0.0	0.0	0.0	0.0	-10.9
EST. FY CUMUL	12022	44135	86841	136029	195167	242483	289973	367616	448140	530763	607689	680939	804207	
ACTUAL FY CUMUL	85455	142521	226182	255248	304531	330400	371721	407528	448140	530763	607689	680939	804207	
PERCENT COMPLETE	0.106	0.177	0.281	0.317	0.379	0.411	0.462	0.507	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-73433	-98385	-139341	-119219	-109364	-87918	-81748	-39913	0	0	0	0	0	
VARIANCE, %	-610.8	-222.9	-160.5	-87.8	-56.0	-36.3	-28.2	-10.9	0.0	0.0	0.0	0.0	0.0	

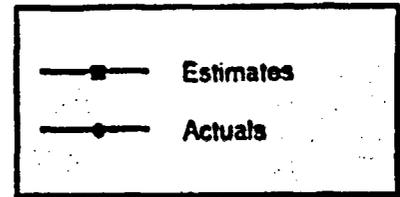
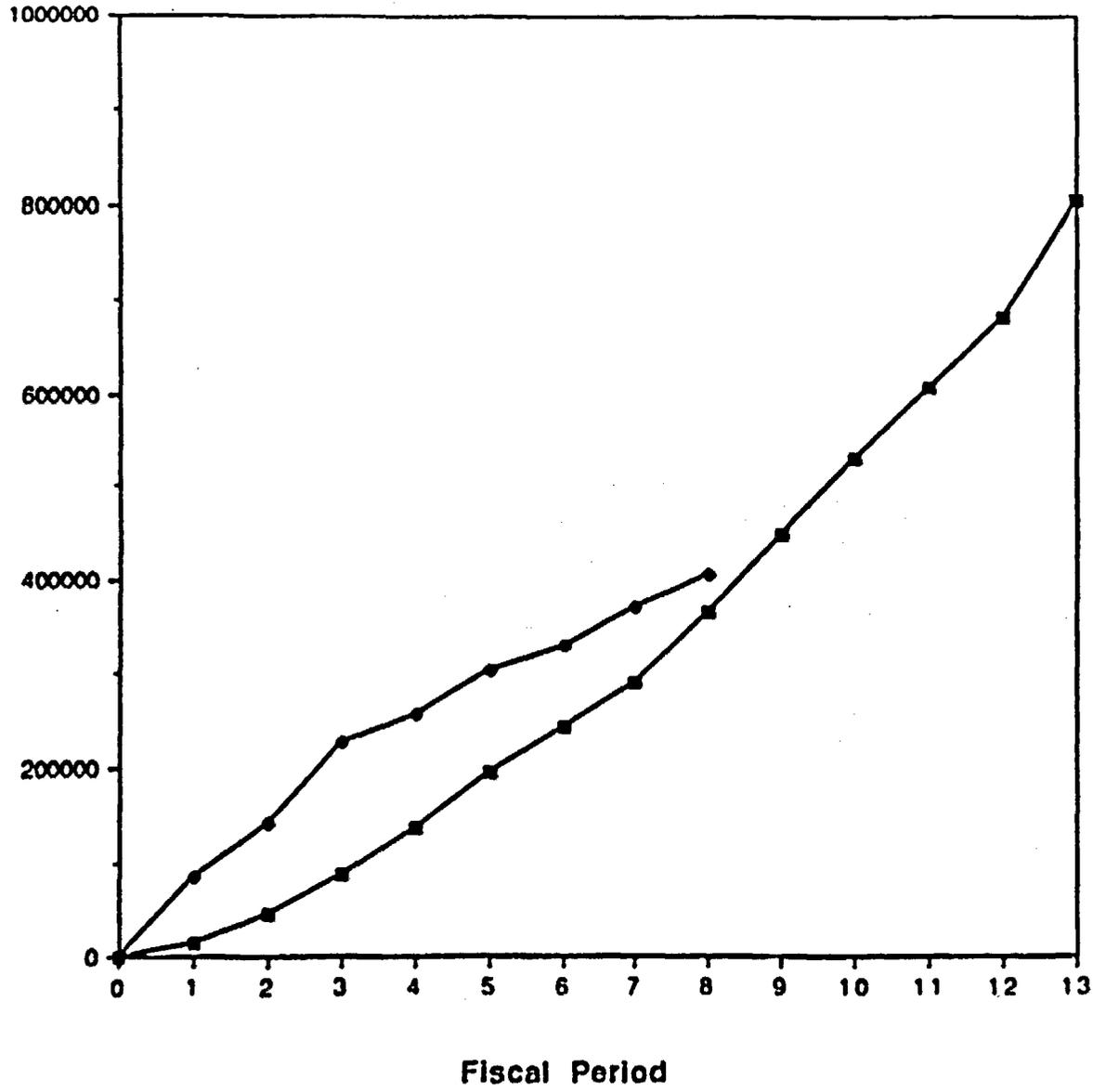
NOTES:

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

3702-000 GS

9-5

Dollars



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. Cragolino, H. Manaktala, P. Nair, W. Patrick,
N. Sridhar, E. Tschoepe, A. Whiting, and Y. Wu

Subcontractors/Consultants: H. Pennick

6.1 Technical Status

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

Professional Activities

- P. Nair (part time) and H. Manaktala attended the Second International High Level Radioactive Waste Management Conference held in Las Vegas, Nevada, April 29 - May 02, 1991. At the conference H. Manaktala chaired two technical sessions, namely, "Vitrified Waste Form Characteristics", and "Spent LWR Fuel Characteristics". Manaktala also participated in a post-conference field trip to observe excavations of the elevator shaft and passageway in the foundation of the Hoover Dam. The field trip was organized by the NRC attendees at the conference. A separate trip report provides additional details of the conference and the field trip. Manaktala also participated in the program planning meetings for the third conference in the series, which will be held in Las Vegas, Nevada, April 12-16, 1992.
- P. Nair attended the Technical Paper Selection Committee meeting of the FOCUS '91 Conference in Las Vegas on May 2, 1991. The FOCUS '91 Conference will be held in Las Vegas on September 29 - October 2, 1991 with the theme on Nuclear Waste Packaging. The various sessions for the conference are being developed.

Task 1 - Prelicensing Activities

No planned activity.

Task 2 - Regulatory and Technical Guidance Development

During this period, the SCC work plan in Attachment A of the EBS Operations Plan was modified to include Activity 4, "Documentation of Alternatives Prioritization Study".

for the EBS activities related to the uncertainty identified with the phrase "substantially complete containment." The objective of this activity is to produce a report which will discuss the background, methodology, elicitation process, results, and conclusions of the prioritization study. The Prioritization Study was performed earlier in this fiscal year to elicit staff opinion concerning the preferred avenue for reducing the uncertainty. Alternatives for reducing the uncertainty included rulemaking or guidance, and, if rulemaking, whether it should be qualitative or quantitative. Supporting documentation provided by CNWRA during the previous activities is expected to be included in the report. This report will be prepared through NRC/Center collegial interaction in which NRC will collaborate in the development of the report. Portions of the report to be prepared by CNWRA have been drafted and await review by NRC Staff who will co-author the report.

As directed by NRC, a work plan was prepared to develop an example problem to evaluate the containment in waste packages. The work plan was included in the recent EBS Operations Plan modifications as Attachment B. The methodology under consideration will incorporate material degradation models in a fault tree structure. The plan also includes the use of the technology available in the EBSPAC effort in Task 3. It is anticipated that the worked example will provide a stronger basis for developing guidance (TP) to the DOE and, if necessary, rulemaking on the subject of SCC.

Task 3 - Analysis Codes and Methods

During this period, the primary EBSPAC activities included incorporating the affect of temperature into the crevice corrosion model and investigating the effects crevice geometry and environment have on crevice corrosion. The geometric variables studied are crevice gap and crevice depth. The environmental variables studied are chloride, pH, and temperature.

The temperatures were introduced into the crevice corrosion model through the incorporation of temperature dependent hydrolysis constants and temperature dependent diffusion coefficients. The model allows one to simulate the temperature effects in an isothermal environment at temperatures of 25°C and 100°C. Also, the model allows one to input hydrolysis constants and diffusion coefficients for up to five different temperatures. When this mode of analysis is chosen, the temperature is determined as a function of time and is used to interpolate the temperature dependent data in order to extract the needed constants at different times during the simulation. The incorporation of temperature effects into the crevice corrosion model is an advancement over the results provided in the literature.

Multiple test cases were run to study the modelled effects of chloride and pH at temperatures of 25°C and 100°C for various crevice gap/depth volume equivalents. These results predict that an increase in temperature from 25°C to 100°C will cause a substantial decrease in pH.

One major advance with respect to previous models in the literature, which have been confined to 25°C, has been the incorporation of the effects of temperature up to 100°C. For this purpose, data bases including EQ3 were searched for hydrolysis constants as a

function of temperature, diffusivity as a function of temperature, and the effect of transition metal chlorides on pH as a function of temperature. The resulting model predicts that an increase in temperature significantly decreases the pH inside the crevice which then decreases the time to initiate crevice corrosion. This corresponds rather well with experimental evidence on the dependence of crevice corrosion on temperature. Further modifications to the crevice corrosion model are being made incorporating the effects of bicarbonate and other anionic species.

Additional capital equipment was received for the waste form leaching studies and is in the process of being installed in the Center Laboratory Facilities.

H. Manaktala provided peer review of a technical article (submitted by an author from outside CNWRA) on the leaching of wasteforms. The article is intended for publication in the "Waste Management" journal published by the Pergamon Press, New York, N. Y.

H. Manaktala is reviewing the literature related to spent LWR fuel characteristics that may be relevant to its performance in a geological repository. Such characteristics will be included in the spent fuel leaching module that will be developed at CNWRA for the near-field source-term. [This part of the work is being funded by the Performance Assessment (PA) Element of the Center].

6.2 Major Problems

None.

6.3 Forecast for Next Period

Work will be initiated on 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 \$4,730. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Expenditures for this program element are about 20% greater than planned. This results primarily from greater than anticipated support activities to the SCC potential rulemaking and accelerated activities on EBSPAC. Modifications to the spending plan and consequent accomplishment of work were considered in the Operation Plans update which were submitted at the end of this period. Revisions to the spending plans will be

reflected in the next PMPR, following approval of the Operations Plans.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$ 557,748
FY91 Funds Costed to Date (b)	\$ 322,180
FY91 Funds Uncosted (c)	\$ 235,568
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).

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST PERIOD COST	19874	16136	35642	36443	40255	41668	37578	42311	48931	64746	65277	75320	75495	269908
ACT. PERIOD COST	48573	48246	43728	31568	38172	46765	35275	29851	0	0	0	0	0	322180
VARIANCE, \$	-28699	-32110	-8086	4875	2083	-5097	2302	12460	0	0	0	0	0	-52272
VARIANCE, %	-144.4	-199.0	-22.7	13.4	5.2	-12.2	6.1	29.4	0.0	0.0	0.0	0.0	0.0	-19.4
EST. FY CUMUL	19874	36010	71652	108096	148351	190019	227597	269908	318838	383584	448861	524181	599676	
ACTUAL FY CUMUL	48573	96820	140548	172118	210288	257053	292329	322180	0	0	0	0	0	
PERCENT COMPLETE	0.081	0.161	0.234	0.287	0.351	0.429	0.487	0.537	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-28699	-60809	-68896	-64020	-61937	-67034	-64732	-52272	0	0	0	0	0	
VARIANCE, %	-144.4	-168.9	-96.2	-59.2	-41.8	-35.3	-28.4	-19.4	0.0	0.0	0.0	0.0	0.0	

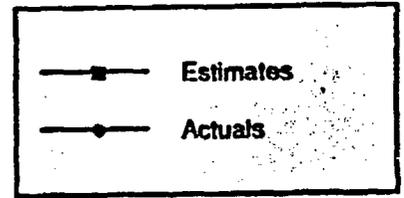
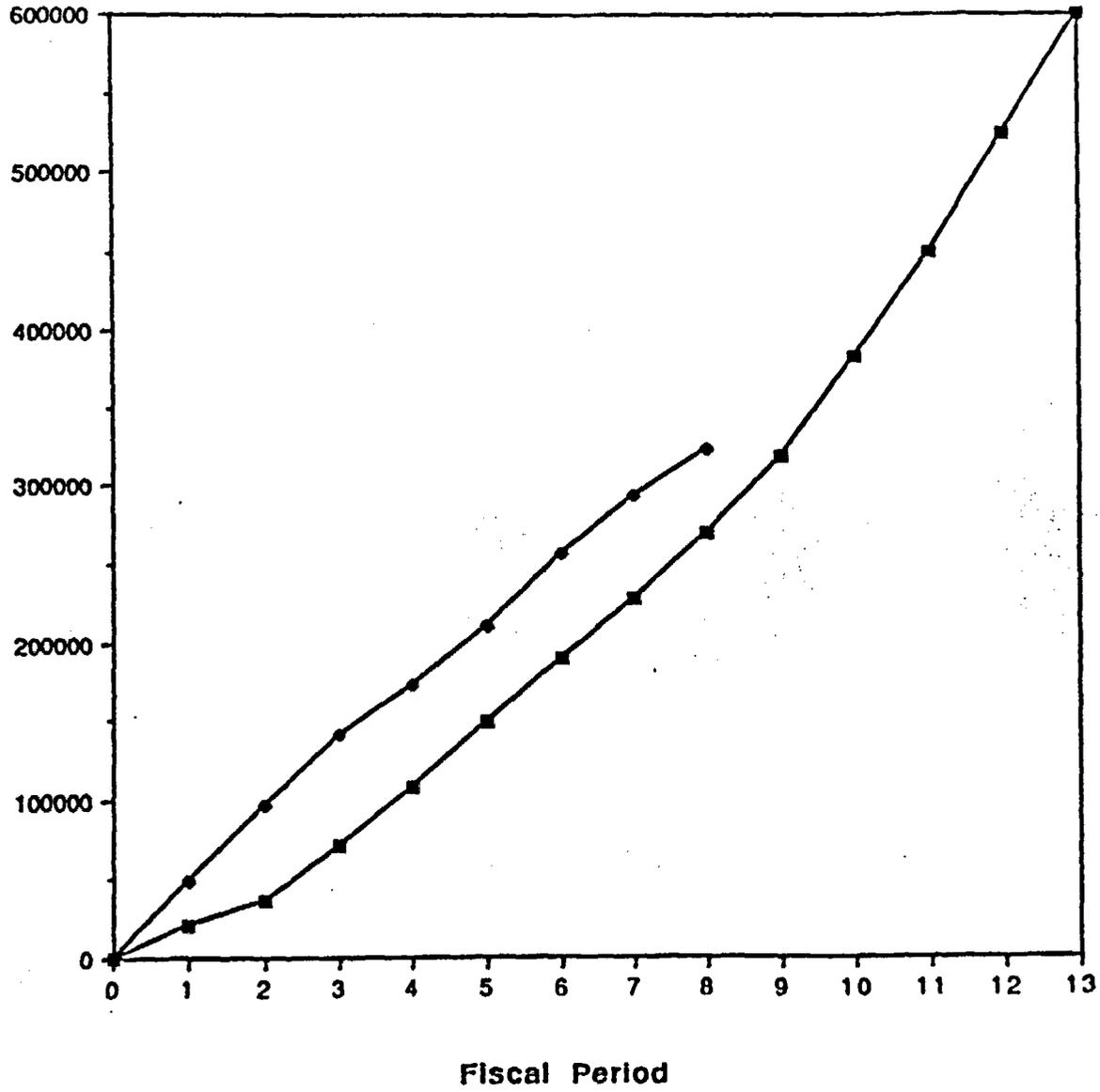
NOTES:

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

9-9

Dollars



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 and Seismic Rock Mechanics Research Project.

Professional Activities

S. Hsiung attended the Second Annual International High-Level Radioactive Waste Management Conference in Las Vegas on April 28 thru May 3, 1991. He presented a paper in the "Geotechnical Exploration" session of the Conference on April 30, 1991.

Task 1 - Relicensing Activities

The evaluation of DOE responses to NRC Site Characterization Analysis (SCA) was completed during this period. One objection, twenty-five comments, and thirty-one questions in the SCA are relevant to RDCO. The DOE responses to these comments, questions, and objections were evaluated by S. Hsiung, L. Lorig, and J. Daemen. The results of this evaluation were submitted to NRC on April 16, 1991 as RDCO Intermediate Milestone No. 20-3702-021-010-000.

Task 2 - Regulatory and Technical Guidance Development

A. Chowdhury of CNWRA and T. Brandshaug of Itasca visited the NRC on April 23, 1991, to participate in the ACNW briefing of the preliminary draft Staff Technical Position (STP) on "Underground Facility Design - Thermal Loads."

The selection of CDS type and the development of the CDS for coordinating the ESF design with the repository design were initiated during this period. S. Hsiung, M. Ahola, and H. Karimi are carrying out these activities.

Task 3 - Analysis Codes and Methods

Not funded in FY91.

Task 6 - Repository Operational Criteria Feasibility Studies

Activities 1 and 2 of the Repository Operational Criteria (ROC) Feasibility Studies were carried out during this period. In-depth analysis of all the 46 ROC Topics has been completed. The draft ROC Report #1 (NUREG/CR-#1) was submitted to NRC on April 25, 1991, as RDCO Intermediate Milestone No. 20-3072-026-153-000. J. Hageman, S. Hsiung, H. Karimi, M. Ahola, E. Tschoepe, R. Field, J. Burkes, R. Hofmann, G. Stirewalt, A. Chowdhury, L. Lorig, and J. Daemen performed ROC activities. On April 16-18, 1991, J. Hageman made presentations on the ROC Feasibility Studies at NRC headquarters. On April 16, 1991, he made a 6 hour presentation on the general aspects, approach, and topics of the ROC Feasibility Studies. The attendees were the NRC staff who will comprise the NRC team to review the draft of the ROC Activity 1 report. On April 17, 1991, he briefed J. Youngblood and J. Linehan with emphasis on the status of the results of the ROC Feasibility Studies. J. Hageman briefed R. Bernero on the ROC Feasibility Studies on April 18, 1991.

7.2 Major Problems

None.

7.3 Forecast for Next Period

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

7.4 Element Financial Status

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

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

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

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	58383	70499	66805	75618	51651	45657	33877	576819
ACT. PERIOD COST	27495	50848	80077	70259	104466	87520	81489	45766	0	0	0	0	0	547921
VARIANCE, \$	52835	43641	-868	-13996	-26305	-38216	-13127	24733	0	0	0	0	0	28898
VARIANCE, %	65.8	46.2	-0.8	-24.9	-33.7	-77.5	-19.2	35.1	0.0	0.0	0.0	0.0	0.0	5.0
EST. FY CUMUL	80330	174820	254229	310491	388653	437957	506320	576819	643624	719242	770893	816550	850227	
ACTUAL FY CUMUL	27495	78343	158420	228679	333145	420666	502155	547921	0	0	0	0	0	
PERCENT COMPLETE	0.032	0.092	0.188	0.269	0.392	0.495	0.591	0.644	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	52835	96477	95808	81812	55508	17291	4165	28898	0	0	0	0	0	
VARIANCE, %	65.8	55.2	37.7	26.3	14.3	3.9	0.8	5.0	0.0	0.0	0.0	0.0	0.0	

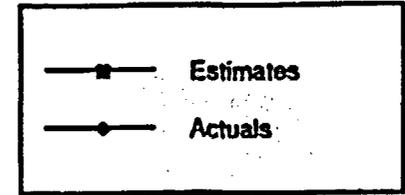
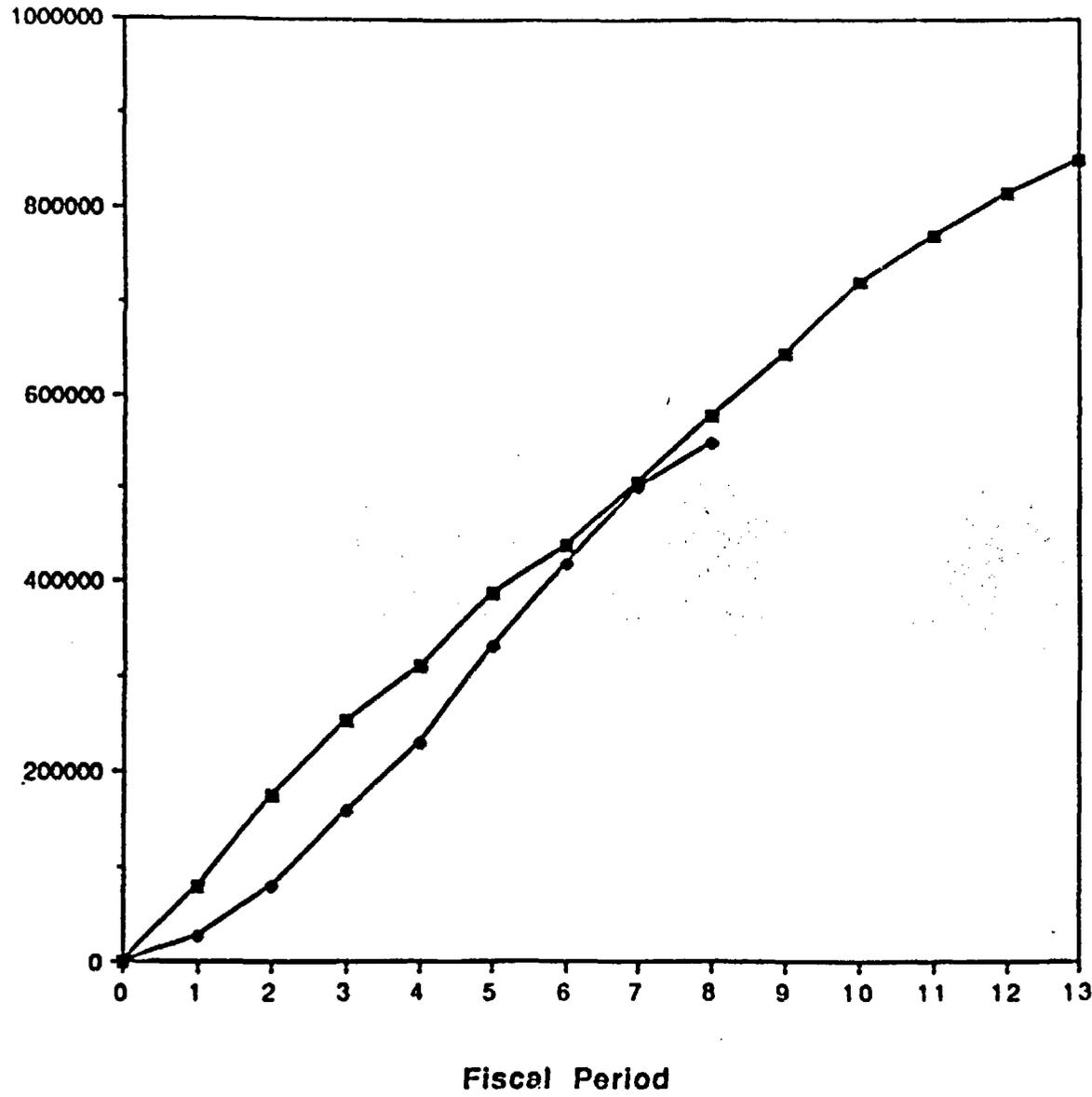
NOTES:

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 RDGO

5-7

Dollars



8. PERFORMANCE ASSESSMENT

NRC Program Element Manager: S. Coplan

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

CNWRA Element Manager: Budhi Sagar

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

Subcontractors/Consultants: None

8.1 Technical Status

Task 1 - Prelicensing Reviews

No activity this period.

Task 2 - Regulatory and Technical Guidance Development

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

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

Subtask 2.2 - Implementing the EPA HLW Standard

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

Task 5 - Iterative Performance Assessment

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

A technical paper titled, "Issues in Modeling Source-Term from Vitrified High-Level Waste Form," authored by Drs. Manaktala and Sagar of CNWRA, was published in the Proceedings of the Third International Conference on Nuclear Fuel Reprocessing & Waste Management-RECOD'91, held in Sendai, Japan, April 14-18, 1991.

Dr. Manaktala had a meeting at the NRC HQ at White Flint on April 24, 1991, with K. Chang of the NRC leader of Subtask 412 with the responsibility to "Develop a Mechanistic Model of Waste Package Failure" under the Phase 2 of the Iterative Performance Assessment (IPA). The discussions were centered on revising the scope of the subtask so that the stated objectives are met within the time frame of the Phase 2 exercise, while being responsive to the needs of the overall objective of the subtask, i.e. to estimate the time for failure of the waste package, the failure rate, and distribution of failures as a function of time. K. Chang committed to provide a draft 'revised scope of work' for the subtask by the end of May, 1991 for review by the task leaders and coordinators of IPA Phase 2 and for discussions during the next conference call.

Dr. Manaktala is reviewing the literature related to LWR fuel characteristics that may be relevant to its performance in a geological repository. Such characteristics will be included in the spent fuel leaching module that will be developed at CNWRA for the near-field source term.

A closed form analytical solution for the non-dispersive transport of a decaying species through a multilayered fractured media with diffusion into the surrounding rock matrix has been derived by Dr. Gureghian. The computer code "MULTFRAC" yielding the spatial and temporal concentration and cumulative mass flux distribution in a dual porosity medium has been developed. This code is currently being verified. A copy of the current version of MULTFRAC with an abbreviated user's guide was transmitted to R. Codell on May 15, 1991. The derivation of closed-form sensitivity coefficients is in progress.

The integration of the MULTFRAC and FPI (Fast Probabilistic Integration) has been initiated by Dr. Gureghian. The interface FORTRAN routine has been defined and the coding is in progress.

An interactive one-dimensional graphics program, GENPLOT, which is based on NCAR software has been developed. GENPLOT is being used by L. Tweedy in the verification of MULTFRAC.

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. Commitments in the Element are \$6,740. 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 considerably in recent periods. Revisions to the spending plans will be reflected in the next PMPR, following approval of the Operations Plans.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$1,482,508
FY91 Funds Costed to Date (b)	\$ 467,409
FY91 Funds Uncosted (c)	\$1,015,099
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).

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	908657
ACT. PERIOD COST	44461	45894	51289	40908	77173	89965	73753	63967	0	0	0	0	0	467409
VARIANCE \$	36339	55969	50144	64266	37441	67504	64295	65290	0	0	0	0	0	441248
VARIANCE %	45.0	54.9	49.4	61.1	32.7	49.1	46.6	50.5	0.0	0.0	0.0	0.0	0.0	48.6
EST. FY CURRUL	80799	182662	284095	389270	503884	641353	779401	908657	1042327	1186464	1310041	1381996	1454369	
ACTUAL FY CURRUL	44461	90355	141844	182552	259725	329689	403442	467409	0	0	0	0	0	
PERCENT COMPLETE	0.031	0.062	0.097	0.126	0.179	0.227	0.277	0.321	0.000	0.000	0.000	0.000	0.000	
VARIANCE \$	36339	92308	142452	206718	244159	311663	375958	441248	0	0	0	0	0	
VARIANCE %	45.0	50.5	50.1	53.1	48.5	48.6	48.2	48.6	0.0	0.0	0.0	0.0	0.0	

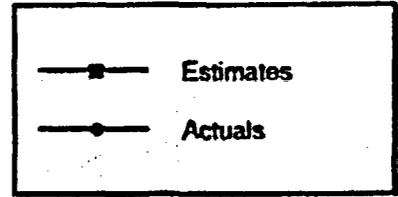
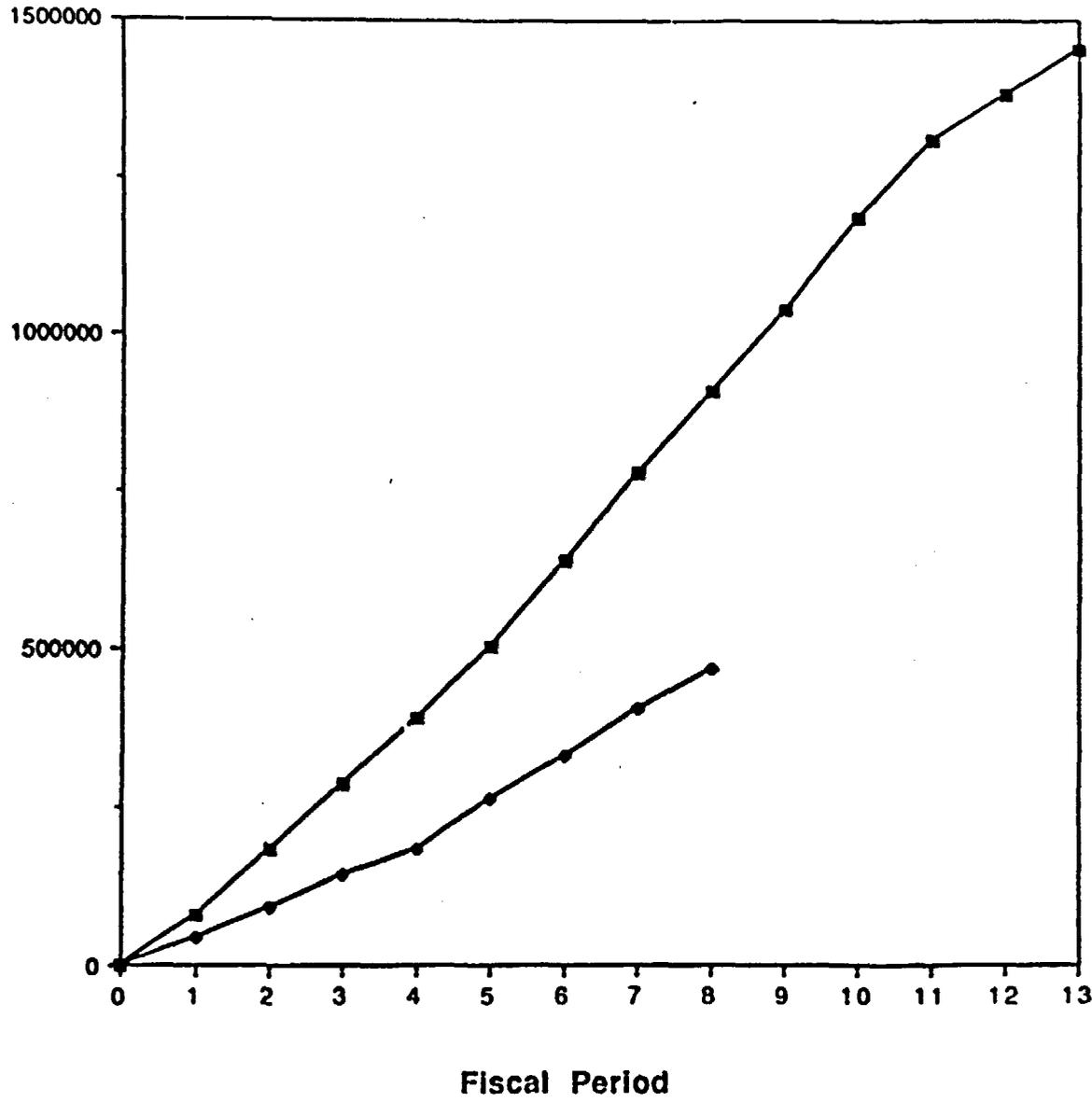
NOTES:

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

S-8

Dollars



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

The first Research Annual Report was completed and transmitted to NRC in camera-ready form. Work continued on the Quarterly Report.

Research Project 1 - Overall Research Plan

For overall research W. M. Murphy prepared an announcement to be mailed together with the preliminary agenda to perspective participants in the natural analogs workshop. The dates of July 23-25 are proposed for the workshop to be held in San Antonio.

The University of Arizona's (UAZ) draft "Experimental Plan-Nonisothermal Hydrologic Transport Study at the Apache Leap Tuff Site" was reviewed during this period. The review comments were discussed with T. Rasmussen of UAZ during his visit to the Center on April 15-16, 1991.

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

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

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

Research Project 2 - Geochemistry

The first set of experiments to study the kinetics of analcime dissolution was completed. The experimental geochemistry section of the Center's Quarterly Research Progress Report was prepared, which incorporated the results of those experiments. Kinetic data interpretation is currently being undertaken, and a second, more extensive set of experiments is being designed, based on previous results.

Revisions to the Geochemistry Research Project section of the Center's Operations Plans were completed.

For the modeling task of the Geochemistry research project, W. M. Murphy analyzed kinetic data for analcime dissolution studies, and revised the quarterly research report based on modeling of groundwater and mineral chemistry of the Alligator Rivers analog site.

Research Project 3 - Thermohydrology

Review and evaluation of the data collected during Test 6 has continued. Of interest are the moisture content data that were collected using the gamma-ray densitometer. It appears that some of the recent modifications to the densitometer have had some success in reducing the level of noise inherent with using a densitometer.

The experimental apparatus that was moved to Building 57 has been reassembled. The traversing system, the gamma-ray densitometer and the data acquisition system are now operational. The capabilities of the densitometer are being further assessed through the use of a positive pressure Tempe cell. The relationships between suction pressure and moisture content within the Tempe cell are being measured. The moisture content is also being measured using the densitometer. The results of the two moisture content measurements will be evaluated as a review of the accuracy of the gamma-ray densitometer.

The configuration of two experiments that will be part of the Test 7 Series has been tentatively formulated. These experiments will be two-dimensional and have some similarities with Tests 5 and 6. Significant modifications in the proposed Test 7 configuration include offsetting the location of the fracture so that it is closer to one heat exchanger than the other while still remaining vertical, including the heat element as a point source within the matrix of the test container, and including additional points of measurement and dye injection. It is thought that the modifications in the configuration of Test 7 will provide more useful data for use in the similitude studies than the data collected in Tests 5 and 6. Materials for these experiments were ordered, however not all of the materials have arrived.

The project plan for the Thermohydrology Research Project is currently being revised. A draft copy of the plan with costs has been prepared for review.

Research Project 4 - Seismic Rock Mechanics Studies

As in the previous periods, the collection of instrumented field studies data from the Lucky Friday Mine, Mullan, Idaho, continued. Significant displacement response of rock was observed, however, no measurable geohydrologic response has been noted. The data acquisition system computer located at the Lucky Friday Mine has been connected to 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. Effort continued 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.

S. Hsiung presented a paper entitled "Field Investigations for Seismic Effects on Mechanical and Geohydrologic Response of Underground Structures in Jointed Rocks" at the Second Annual International High-Level Radioactive Waste Management Conference that was held in Las Vegas on April 28 - May 3, 1991.

Research Project 5 - Integrated Waste Package Experiments

A review of localized corrosion of candidate container materials was prepared and delivered to NRC as an intermediate milestone report. The report contained reviews of DOE and NRC sponsored research on localized corrosion as well as literature outside the high-level waste area.

The effect of bicarbonate on localized corrosion of 316L stainless steel and alloy 825 was investigated further. For alloy 825, the effect of bicarbonate on pitting potential is not significant, but there is a decrease in repassivation potential which has a minimum at about 1000 ppm bicarbonate. The reason for this is not understood at present. No significant effect of bicarbonate was seen for 316L stainless steel.

Bicarbonate analysis of various solutions is being carried out using the ASTM D-513-88, Practice A procedure. The analysis results agree rather closely with the calculated additions of bicarbonate. A decrease in bicarbonate concentration during the tests is noted which is probably due to exsolution of CO₂.

The initial electrochemical tests on CDA-102 and CDA-715 have been completed. The cyclic polarization curves for bicarbonate and chloride solutions agree rather closely with the curves published by Thomas and Tiller on copper. Unlike the case of stainless steels, addition of bicarbonate has a major effect on the passivation of copper based materials. Chloride, in the absence of bicarbonate, does not cause localized corrosion, but only general corrosion and a loose deposit of scale which is probably CuCl. Further experiments on the effect of chloride in high bicarbonate solutions will be carried out. These initial tests have given an insight into the type of test matrix that must be employed to test Cu-based materials.

Modifications to the glassware for long-term, localized corrosion tests are proceeding. Some problems with oscillations of the potentiostat were also noted and were corrected. We are also awaiting a new, upgraded software for data acquisition.

Preparation of the slow strain rate machines for task 2 is continuing. We are awaiting the machining of coupling rods and the delivery of the LVDT and signal conditioners for the load cells.

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

Revisions were made to the draft literature review report and preparation of input to a special publication on model validation commenced.

Research Project 7 - Geochemical Analogs

During Period 8, progress continued in Task 2 (Investigation of Sites and Development of Workplans). Preliminary petrographic studies of thin sections of rocks from the Peña Blanca, Mexico, site were completed and x-ray diffraction analyses continued. Set up of sample preparation facilities for the radioactive ore samples was completed. Arrangements were made for whole rock analysis of the Peña Blanca host rocks (major and trace elements) at Texas Tech University. Field research at uranium deposits at McDermitt Caldera and Virgin Valley, Nevada, was carried out from April 18-19, 1991.

A presentation on the usefulness of natural analog studies in general and on the status of the CNWRA Natural Analog Research Project was made by W. M. Murphy at the NWTRB meeting on natural analogs held on April 16-17, 1991. A trip report was prepared for the Technical Review Board meeting on natural analogs and the McDermitt region field trip.

Efforts were also devoted to preparation of the FY91-92 Project Plan for this project.

Research Project 9 - Sorption Modeling

The literature review of Task 1 continued. An annotated bibliographic database is being developed using the bibliographic database PROCITE.

Revisions to the Sorption Modeling Project section of the Center's Quarterly Research Progress Report subsequent to internal review were completed.

Revisions to the Sorption Modeling Research Project Plan and the pertinent section of the Center's Operations Plans were completed.

The Center is awaiting NRC response to the Work Plan on Experimental Studies on Uranium Sorption on Geologic Media, which was submitted to NRC on March 29, 1991, for review and approval.

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

Research Project 10 - Performance Assessment

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

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

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

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

Task 7: Methodology for Validation of Models. Effort has been primarily directed toward finishing our work on Phase 1 of the International INTRAVAL project. Work has continued using PORFLO-3 to perform flow and transport modeling of the Las Cruces Trench experiment which for INTRAVAL has been designed as Test Case 10. A short presentation was made during the plenary session for working group 1 at the INTRAVAL meeting held in Seattle, Washington, April 22-25, 1991. Following the presentation of our modeling results, it was suggested by others involved in modeling the Las Cruces trench that the initial conditions used in our model appeared to be inverted. Indeed, this proved to be the case. However, subsequent modeling has shown that the shape and rate of movement of the modelled bromide plume is hardly affected by inverting the initial conditions. It appears that the movement of the plume is primarily controlled by the structure of the soil hydraulic properties and in particular by the saturated hydraulic conductivity field. During the Seattle meeting, the Las Cruces Trench subgroup convened outside of the general working group 1 session in which it was proposed that CNWRA continue its investigation of the value of hydraulic data in calibrating the transport portion of the model.

Work is continuing on developing an options report for the groundwater travel time rule in 10 CFR 60.113. A probabilistically based GWTT rule using methods described by Neuman at the January, 1991 Tucson workshop is being evaluated. It appears that the development of a performance assessment based methodology for validation of flow and transport models within phase 2 of the INTRAVAL project may be a fruitful strategy. A detailed proposal for work which will link these two tasks is being developed.

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 \$72,755. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

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

Costs for the Geochemistry Research Project are somewhat less than planned due to initiation of work on other research projects.

Cost incurred to date for the Thermohydrology Research Project are slightly 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 as a result of moving Task 4 and 5 thermohydrology experiments to Building 57 to improve maintenance of environmental controls.

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

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 for the Geochemical Analogs Research Project are in agreement with planned expenditures.

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. Revisions to the spending plans will be reflected in the next PMPR, following approval of the Project Plans.

Overall Research

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$ 157,002
FY91 Funds Costed to Date (b)	\$ 89,206
FY91 Funds Uncosted (c)	\$ 67,796
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)	\$ 121,936
FY91 Funds Uncosted (c)	\$ 146,395
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)	\$ 136,485
FY91 Funds Uncosted (c)	\$ 150,186
Recommended Adjustment to Complete (+/-)	\$ -0-
See the enclosed Element Status Cost Report	

Seismic Rock Mechanics

Table 4. Financial Status	
FY91 Funds Authorized (a)	\$ 433,591
FY91 Funds Costed to Date (b)	\$ 481,449
FY91 Funds Uncosted (c)	\$ (47,858)
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)	\$ 291,228
FY91 Funds Uncosted (c)	\$ 152,631
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)	\$ 93,994
FY91 Funds Uncosted (c)	\$ 91,743
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)	\$ 91,023
FY91 Funds Uncosted (c)	\$ 410,409
Recommended Adjustment to Complete (+/-)	\$ -0-
See the enclosed Element Status Cost Report	

Sorption

Table 8. Financial Status	
FY91 Funds Authorized (a)	\$ 366,716
FY91 Funds Costed to Date (b)	\$ 114,287
FY91 Funds Uncosted (c)	\$ 252,429
Recommended Adjustment to Complete (+/-)	\$ -0-
See the enclosed Element Status Cost Report	

Performance Assessment

Table 9. Financial Status	
FY91 Funds Authorized (a)	\$ 545,470
FY91 Funds Costed to Date (b)	\$ 163,310
FY91 Funds Uncosted (c)	\$ 382,160
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

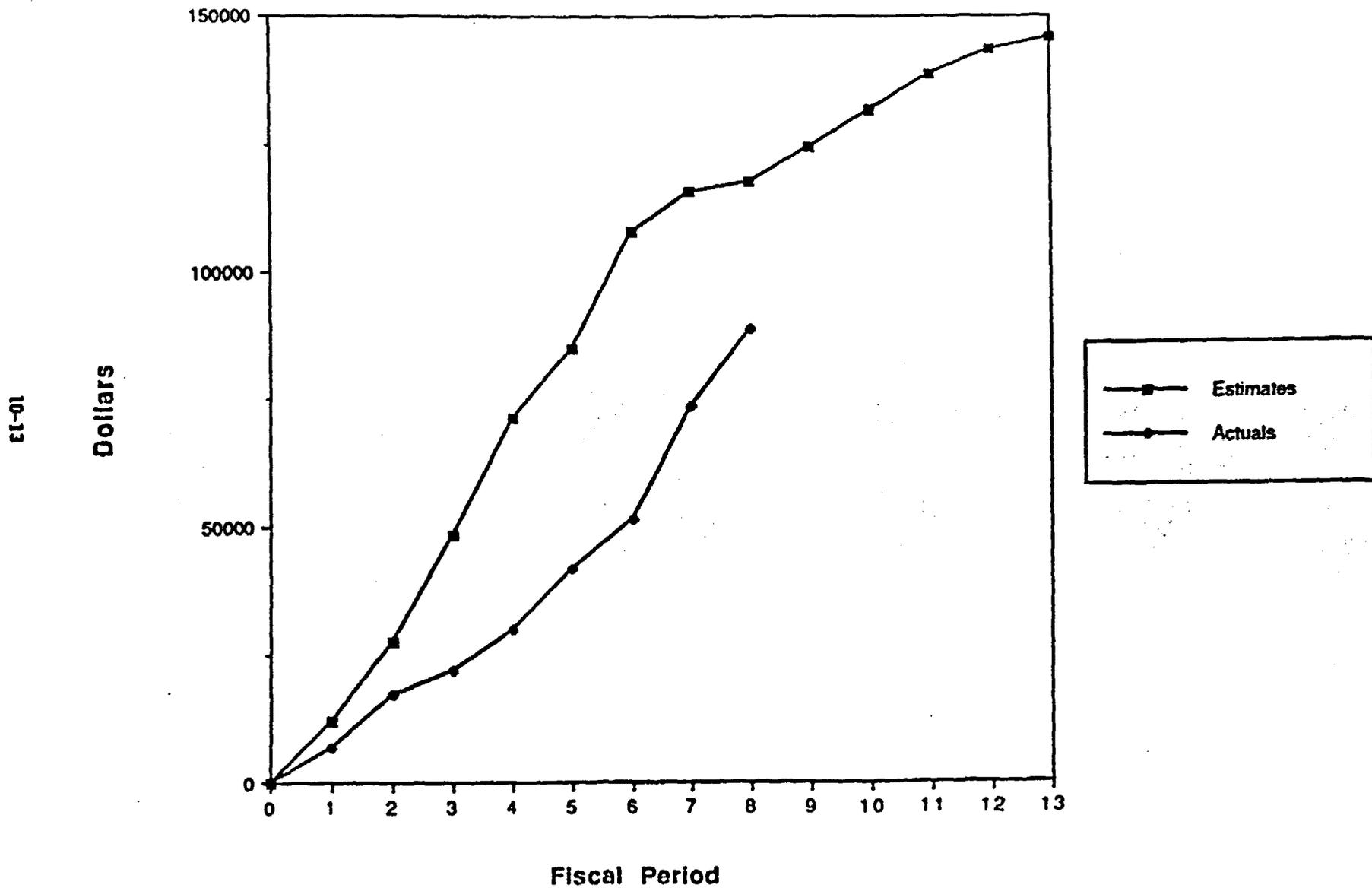
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST. PERIOD COST	11937	15330	21023	23146	13828	22883	7990	1941	6456	7244	6643	4918	2219	118079
ACT. PERIOD COST	6531	10352	4930	7918	11720	9852	22117	15786	0	0	0	0	0	89206
VARIANCE, \$	5406	4978	16094	15228	2108	13031	-1427	-13845	0	0	0	0	0	28873
VARIANCE, %	45.3	32.5	76.6	65.8	15.2	56.9	-176.8	-713.1	0.0	0.0	0.0	0.0	0.0	24.5
EST. FY CUMUL	11937	27266	48290	71436	85264	108147	116136	118079	124535	131779	138422	143340	145559	
ACTUAL FY CUMUL	6531	16883	21812	29731	41451	51303	73420	89206	0	0	0	0	0	
PERCENT COMPLETE	0.045	0.116	0.150	0.204	0.285	0.352	0.504	0.613	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	5406	10384	26477	41705	43813	56845	42717	28873	0	0	0	0	0	
VARIANCE, %	45.3	38.1	54.8	58.4	51.4	52.6	36.6	24.5	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.

10-12

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	21922	17846	17390	16689	18432	19665	19799	17816	20549	19799	18640	19754	20569	149559
ACT. PERIOD COST	20509	19661	19305	23727	13462	8229	7585	9457	0	0	0	0	0	121936
VARIANCE, \$	1413	-1815	-1915	-7038	4970	11436	12214	8359	0	0	0	0	0	27623
VARIANCE, %	6.4	-10.2	-11.0	-42.2	27.0	58.2	61.7	46.9	0.0	0.0	0.0	0.0	0.0	18.5
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	112478	121936	0	0	0	0	0	
PERCENT COMPLETE	0.082	0.161	0.239	0.334	0.388	0.421	0.452	0.490	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	1413	-402	-2317	-9355	-4385	7050	19264	27623	0	0	0	0	0	
VARIANCE, %	6.4	-1.0	-4.1	-12.7	-4.8	6.3	14.6	18.5	0.0	0.0	0.0	0.0	0.0	

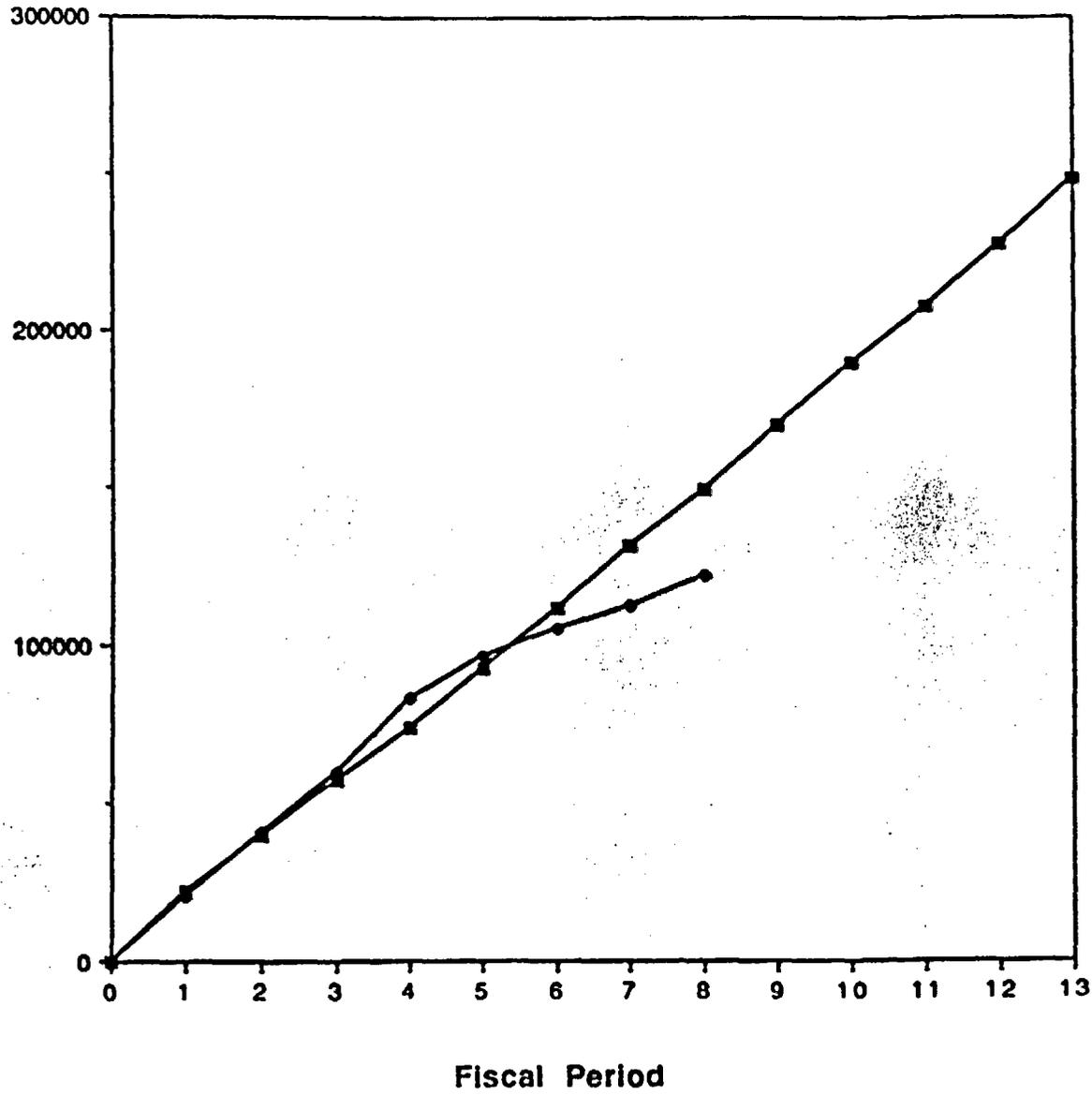
NOTES:

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

10-15

Dollars



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	143091
ACT. PERIOD COST	12308	16186	19105	13326	19636	15115	23681	17127	0	0	0	0	0	136485
VARIANCE, \$	5050	1511	-1169	5968	-2202	2507	-5974	915	0	0	0	0	0	6607
VARIANCE, %	29.1	8.5	-6.5	30.9	-12.6	14.2	-33.7	5.1	0.0	0.0	0.0	0.0	0.0	4.6
EST. FY CUMUL	17358	35055	52992	72286	89720	107342	125049	143091	167810	194452	216281	239902	266280	
ACTUAL FY CUMUL	12308	28494	47599	60925	80561	95676	119357	136485	0	0	0	0	0	
PERCENT COMPLETE	0.048	0.107	0.179	0.229	0.303	0.359	0.448	0.513	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	5050	6561	5392	11361	9159	11668	5692	6607	0	0	0	0	0	
VARIANCE, %	29.1	18.7	10.2	15.7	10.2	10.9	4.6	4.6	0.0	0.0	0.0	0.0	0.0	

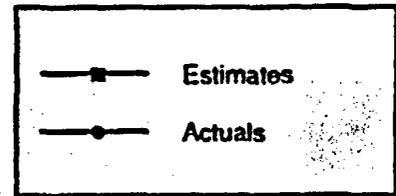
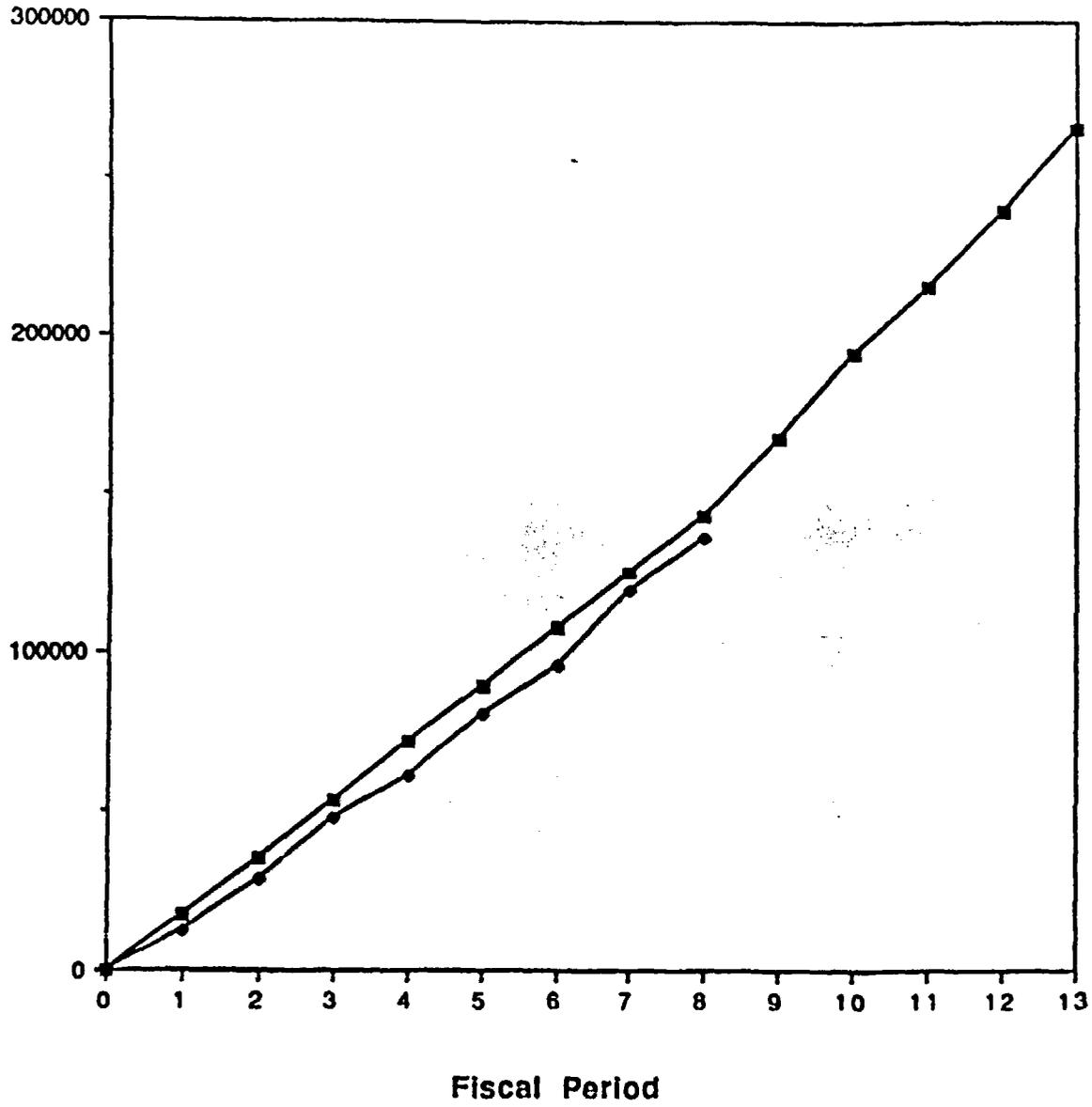
NOTES:

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

10-17

Dollars



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	306778
ACT. PERIOD COST	77802	50665	81510	50832	96173	21514	92278	10673	0	0	0	0	0	481449
VARIANCE, \$	-38447	-8474	-39430	-9263	-54468	20255	-56697	11854	0	0	0	0	0	-174671
VARIANCE, %	-97.7	-20.1	-93.7	-22.3	-130.6	48.5	-159.3	52.6	0.0	0.0	0.0	0.0	0.0	-56.9
EST. FY CUMUL	39355	81546	123626	165196	206901	248670	284251	306778	328806	350840	370533	388440	402343	
ACTUAL FY CUMUL	77802	128467	209977	260809	356983	378497	470775	481449	0	0	0	0	0	
PERCENT COMPLETE	0.193	0.319	0.522	0.648	0.887	0.941	1.170	1.197	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-38447	-46921	-86351	-95614	-150082	-129827	-186524	-174671	0	0	0	0	0	
VARIANCE, %	-97.7	-57.5	-69.8	-57.9	-72.5	-52.2	-65.6	-56.9	0.0	0.0	0.0	0.0	0.0	

NOTES:

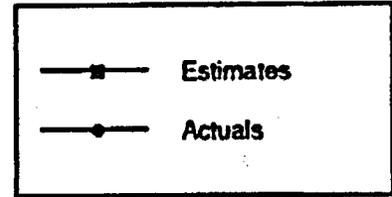
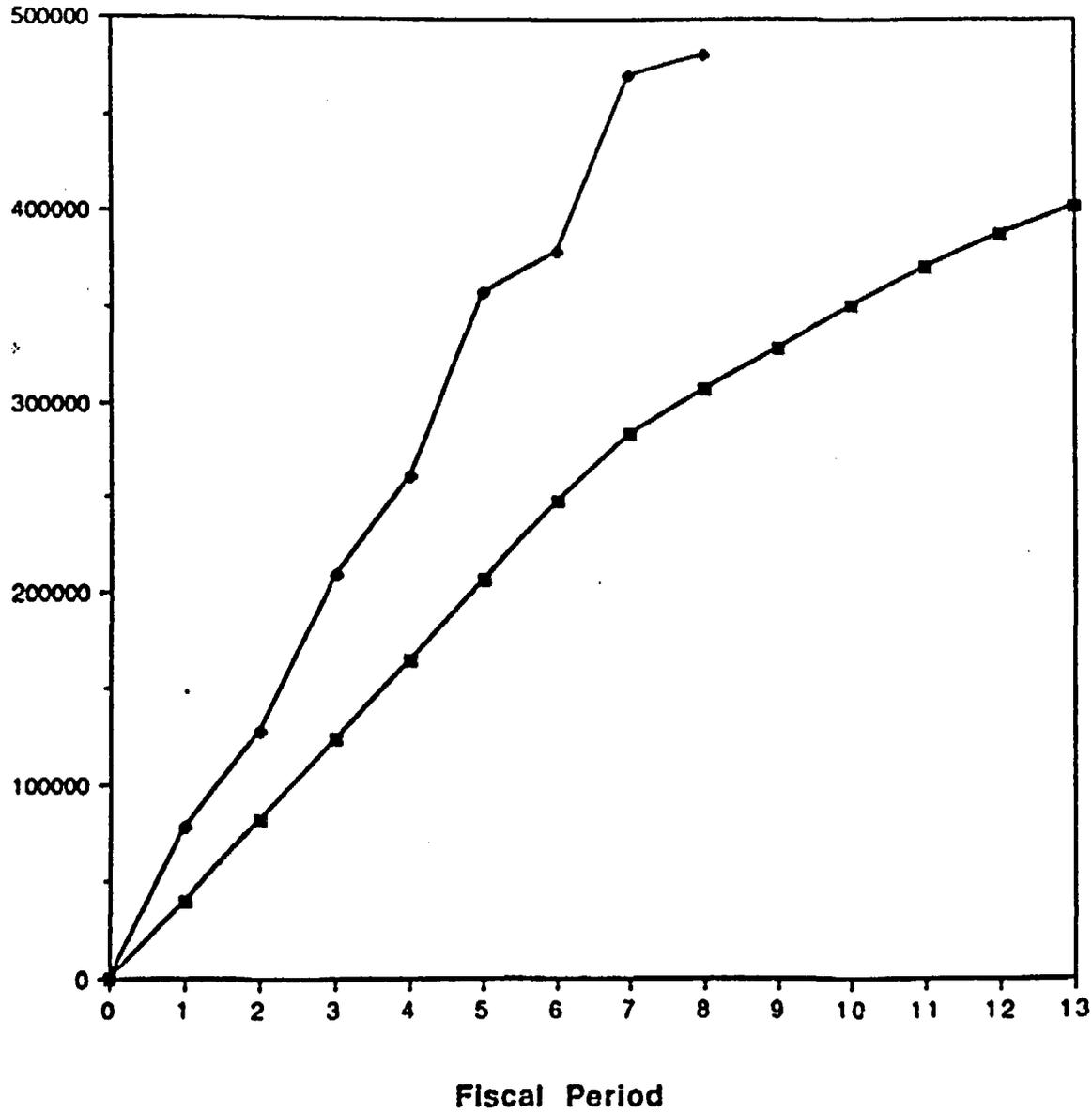
1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

10-18

3704-030 SEISMIC

10-19

Dollars



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	231216
ACT. PERIOD COST	39685	41780	39362	30588	31659	26702	44003	37449	0	0	0	0	0	291228
VARIANCE, \$	-8382	-5696	-4181	6957	-9765	-4736	-21196	-13013	0	0	0	0	0	-60012
VARIANCE, %	-26.8	-15.8	-11.9	18.5	-44.6	-21.6	-92.9	-53.3	0.0	0.0	0.0	0.0	0.0	-26.0
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	253780	291228	0	0	0	0	0	
PERCENT COMPLETE	0.096	0.198	0.293	0.368	0.445	0.509	0.616	0.707	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-8382	-14078	-18259	-11302	-21067	-25803	-47000	-60012	0	0	0	0	0	
VARIANCE, %	-26.8	-20.9	-17.8	-8.1	-13.0	-14.0	-22.7	-26.0	0.0	0.0	0.0	0.0	0.0	

NOTES:

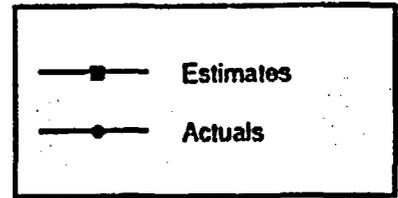
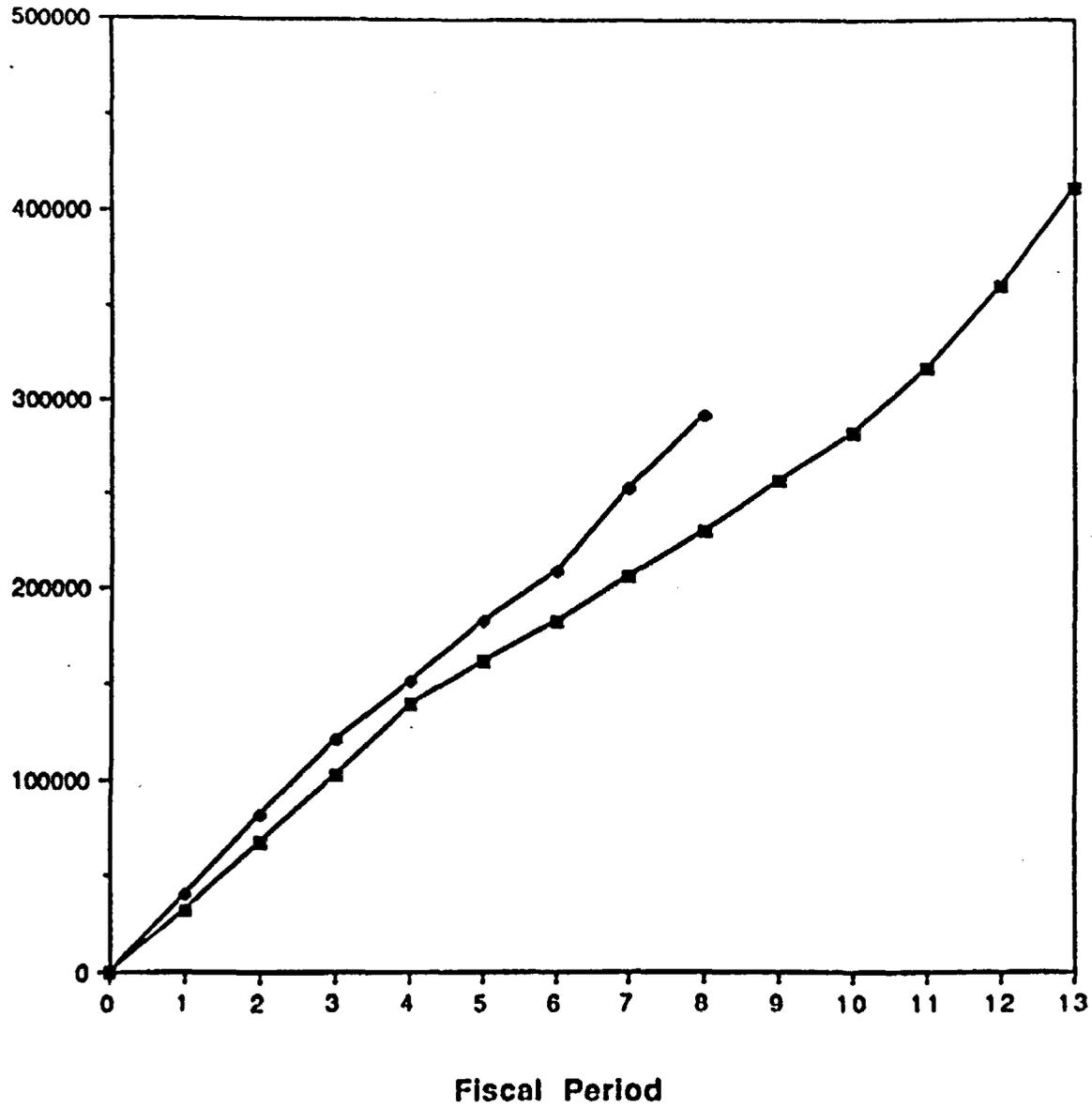
1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

10-20

3704-040 IWPE

10-21

Dollars



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	106722
ACT. PERIOD COST	14481	8372	11191	8291	13113	11982	16445	10119	0	0	0	0	0	93994
VARIANCE, \$	-517	4555	2669	4214	889	978	-4135	4075	0	0	0	0	0	12728
VARIANCE, %	-3.7	35.2	19.3	33.7	6.3	7.5	-33.6	28.7	0.0	0.0	0.0	0.0	0.0	11.9
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	83875	93994	0	0	0	0	0	
PERCENT COMPLETE	0.084	0.133	0.198	0.246	0.322	0.391	0.487	0.546	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-517	-4038	6708	10921	11810	12788	8653	12728	0	0	0	0	0	
VARIANCE, %	-3.7	-15.0	16.5	20.5	17.6	15.9	9.4	11.9	0.0	0.0	0.0	0.0	0.0	

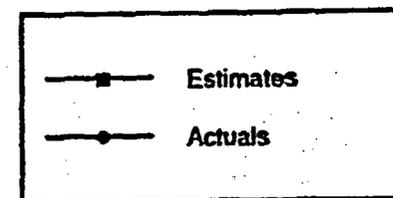
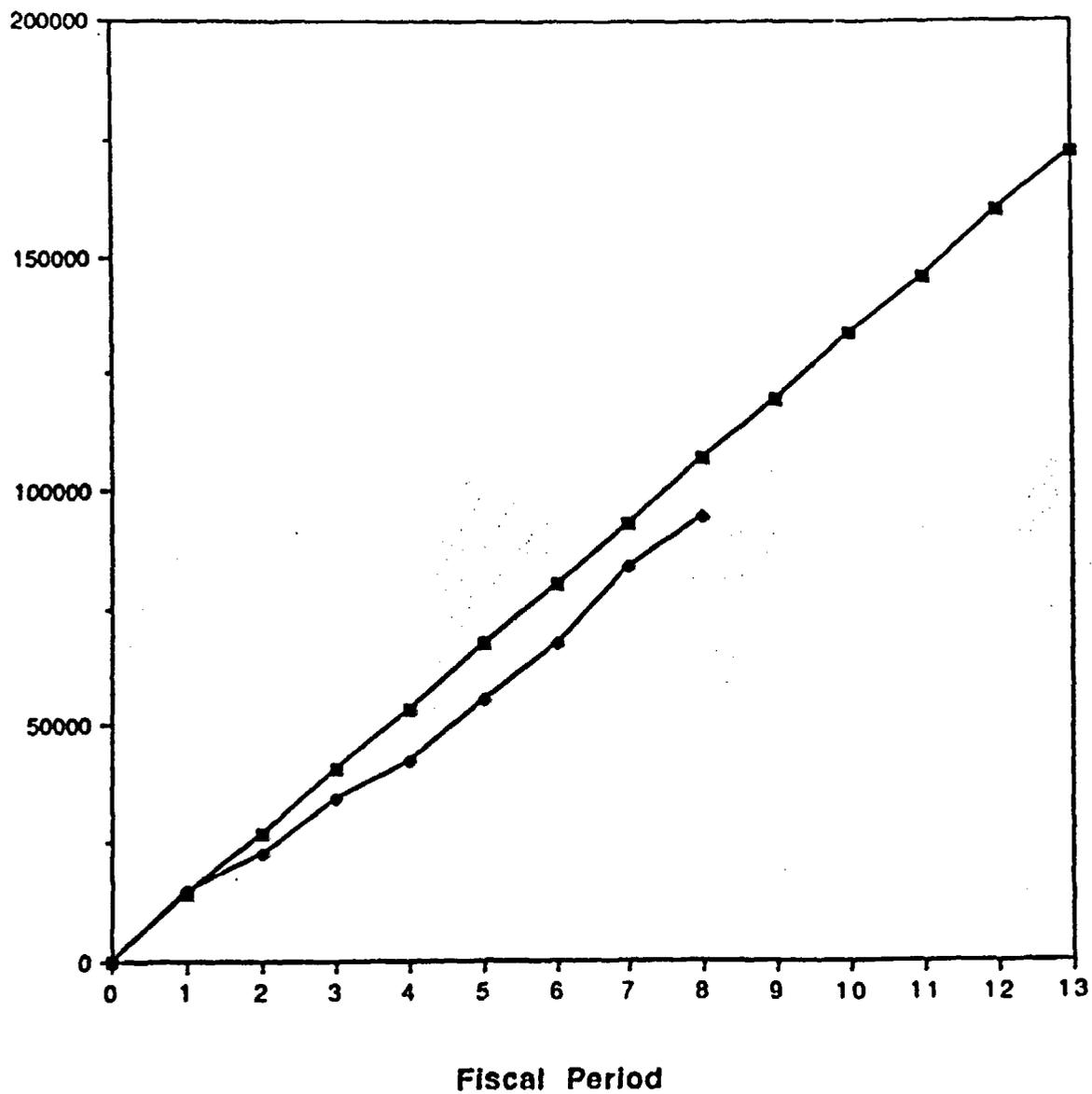
NOTES:

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 STOCHASTIC

10-23

Dollars



ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST. PERIOD COST	14907	8102	10135	10062	9943	10258	9968	14269	56195	59317	50920	50944	50831	87642
ACT. PERIOD COST	6316	4767	4006	5982	9627	20988	16965	22372	0	0	0	0	0	91023
VARIANCE, \$	8592	3334	6129	4081	316	-10730	-6999	-8104	0	0	0	0	0	-3381
VARIANCE, %	57.6	41.2	60.5	40.6	3.2	-104.6	-70.2	-56.8	0.0	0.0	0.0	0.0	0.0	-3.9
EST. FY CUMUL	14907	23009	33144	43207	53149	63407	73373	87642	143836	203153	254072	305016	355847	
ACTUAL FY CUMUL	6316	11083	15089	21071	30697	51686	68650	91023	0	0	0	0	0	
PERCENT COMPLETE	0.018	0.031	0.042	0.059	0.086	0.145	0.193	0.256	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	8592	11926	18056	22136	22452	11721	4723	-3381	0	0	0	0	0	
VARIANCE, %	57.6	51.8	54.5	51.2	42.2	18.5	6.4	-3.9	0.0	0.0	0.0	0.0	0.0	

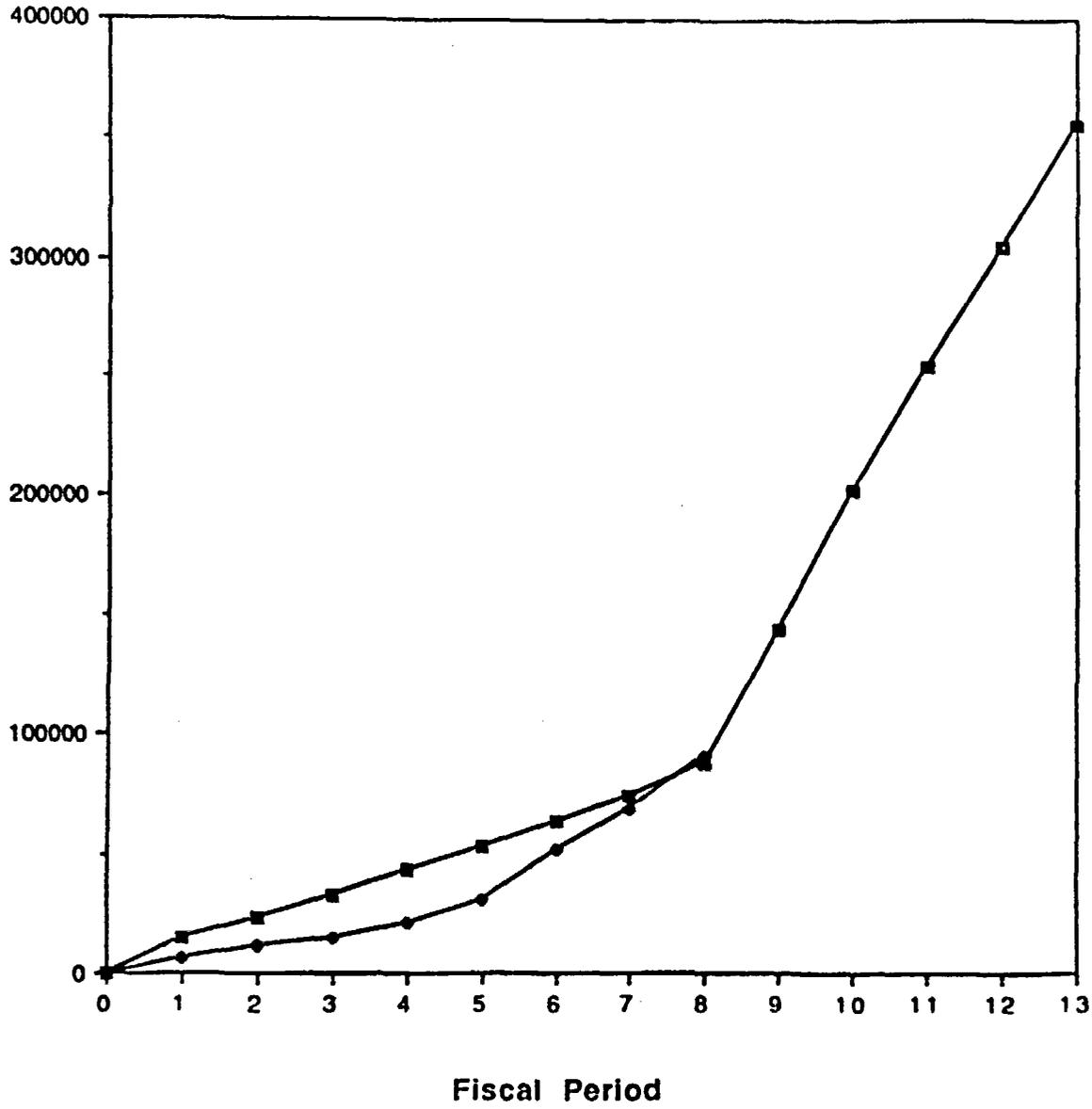
NOTES:

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 FY total.

3704-060 ANALOGS

10-25

Dollars



ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST. PERIOD COST	9907	17088	18400	18888	17619	23490	27379	27112	27828	29985	43899	43947	34650	159883
ACT. PERIOD COST	2830	9028	14847	5942	23268	19731	22760	15881	0	0	0	0	0	114287
VARIANCE, \$	7077	8060	3553	12946	-5649	3759	4619	11231	0	0	0	0	0	45596
VARIANCE, %	71.4	47.2	19.3	68.5	-32.1	16.0	16.9	41.4	0.0	0.0	0.0	0.0	0.0	28.5
EST. FY CUMUL	9907	26995	45395	64283	81902	105392	132771	159883	187711	217696	281595	305542	340192	
ACTUAL FY CUMUL	2830	11858	26705	32647	55914	75645	98405	114287	0	0	0	0	0	
PERCENT COMPLETE	0.008	0.035	0.078	0.096	0.164	0.222	0.289	0.336	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	7077	15137	18690	31636	25988	29747	34368	45596	0	0	0	0	0	
VARIANCE, %	71.4	56.1	41.2	49.2	31.7	28.2	25.9	28.5	0.0	0.0	0.0	0.0	0.0	

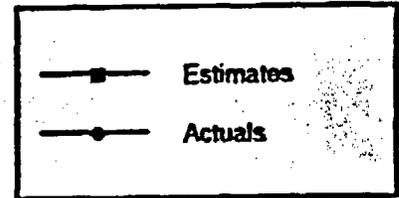
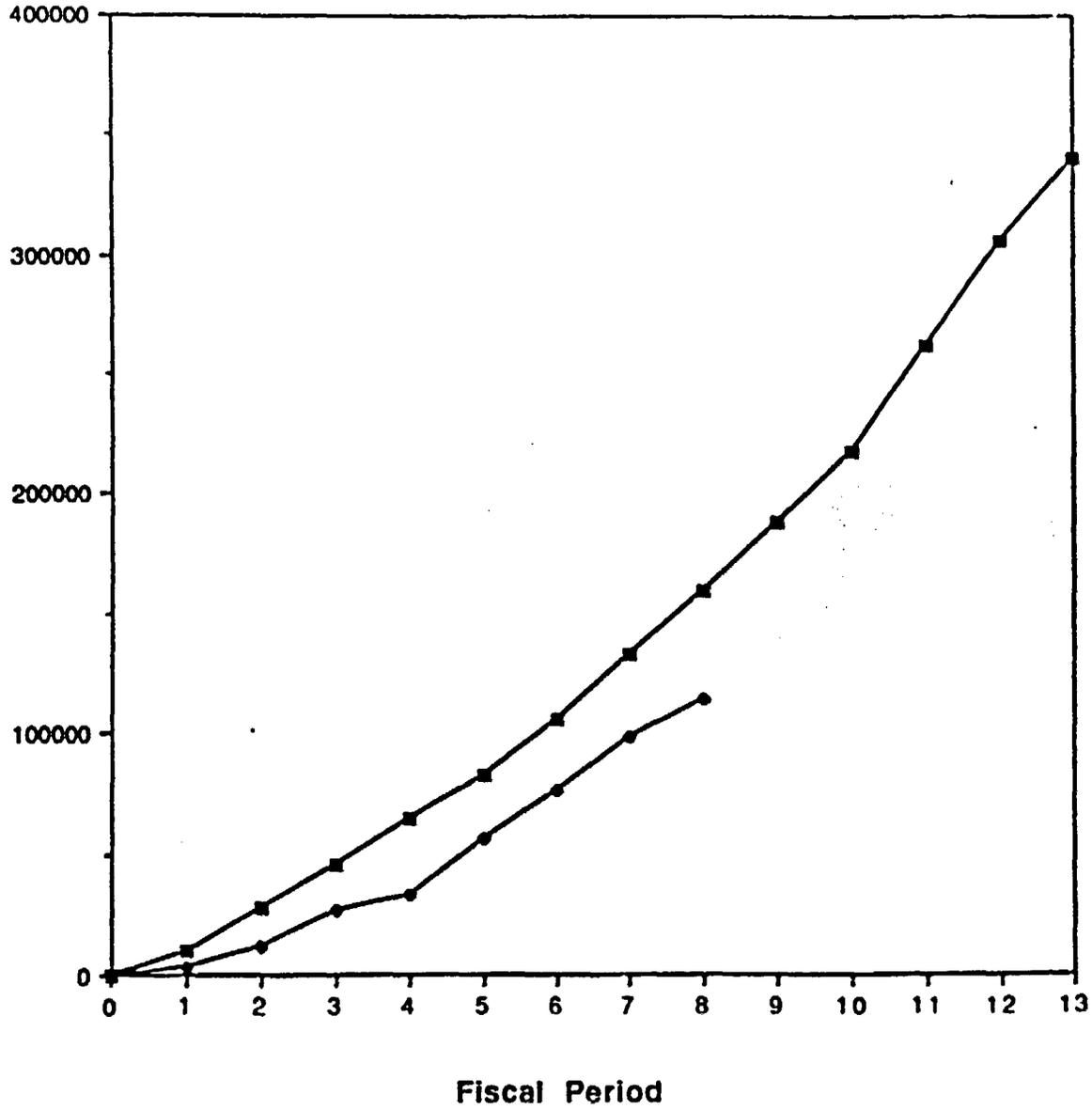
NOTES:

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

10-27

Dollars



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	316580
ACT. PERIOD COST	8881	11369	14110	29603	14336	23938	21822	39250	0	0	0	0	0	163310
VARIANCE, \$	18089	41991	27118	16242	25342	12237	15301	-3049	0	0	0	0	0	153270
VARIANCE, %	67.1	78.7	65.8	35.4	63.9	33.8	41.2	-8.4	0.0	0.0	0.0	0.0	0.0	48.4
EST. FY CUMUL.	26970	80330	121558	167403	207081	243256	280379	316580	353149	390256	428123	467636	505843	
ACTUAL FY CUMUL.	8881	20250	34360	63964	78300	102238	124060	163310	0	0	0	0	0	
PERCENT COMPLETE	0.018	0.040	0.068	0.126	0.155	0.202	0.245	0.323	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	18089	60080	87198	103439	128781	141018	156319	153270	0	0	0	0	0	
VARIANCE, %	67.1	74.6	71.7	61.8	62.2	58.0	55.8	48.4	0.0	0.0	0.0	0.0	0.0	

NOTES:

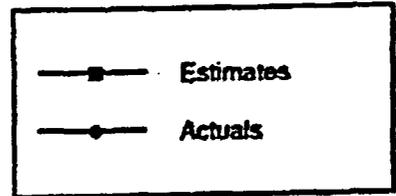
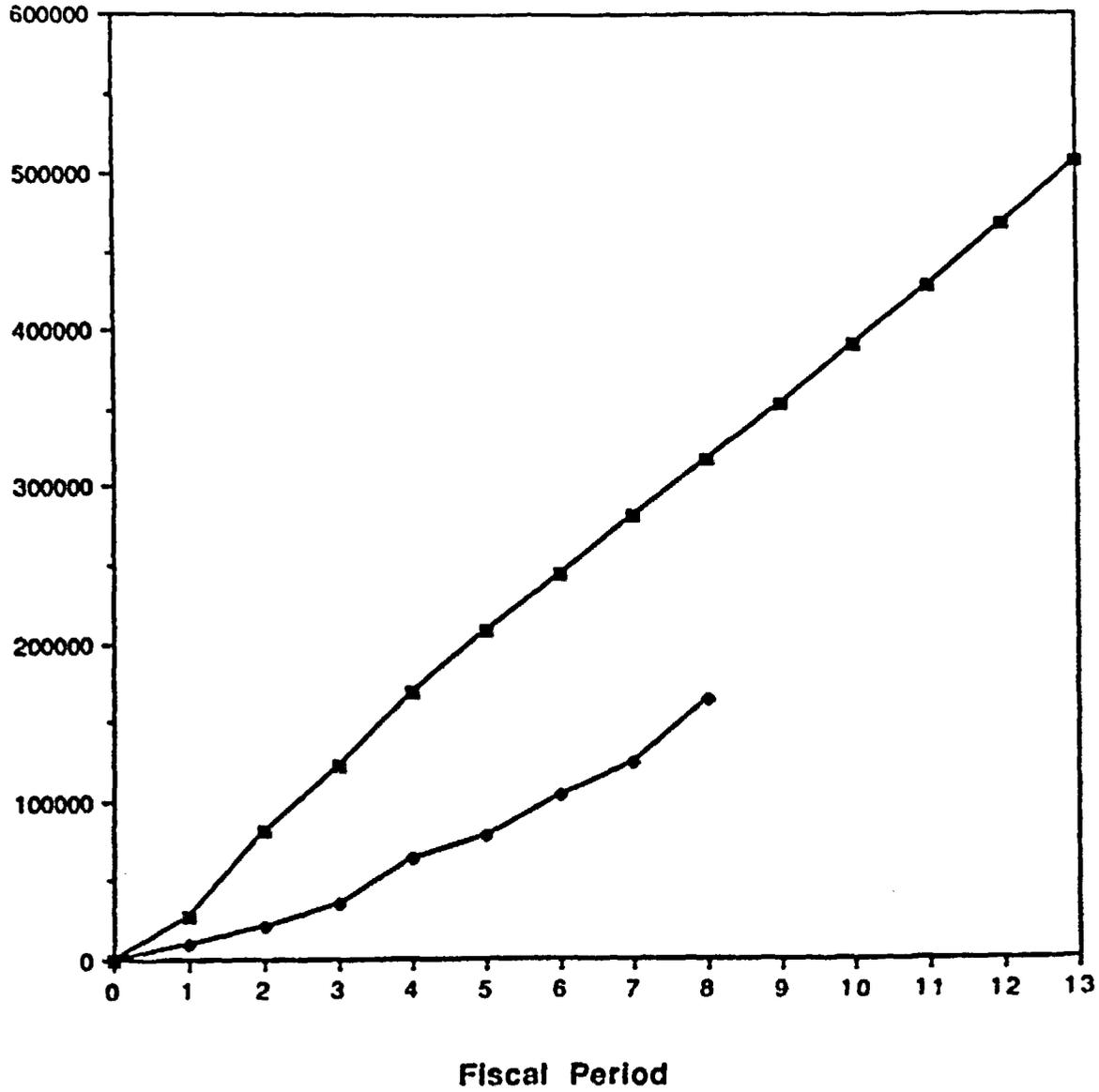
1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from November 1990 Operations Plan or Project Plan.
3. TOTAL column reflects YTD total.

10-28

3704-110 RESEARCH PA

62-29

Dollars



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

Discussions continued on the LSSA offices comments on the Center's report on the Technical Data Definitions and LSS participants infrastructures. An agenda and summary of the Center's views on issues are being prepared for discussion at the scheduled project meeting of the Center and LSSA staff on May 15 and 16, 1991. Each of the LSSA comments has been reviewed and plans have been made to answer each question and provide references where necessary, response to critiques and suggestions and resolve misunderstandings and differences at the upcoming meeting.

11.2 Major Problems

None to report.

11.3 Forecast for Next Period

Staff will meet in May at the NRC offices to discuss and resolve the comments of the LSSA Office on the report. The strategy for resolving each issue will be discussed. A plan for further work and resolution of outstanding differences will be developed together with the LSSA. The drafting of the plan for access protocols to LSS technical data will begin.

11.4 Element Financial Status

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

Costs incurred to date compare favorably with planned expenditures. Revisions to the spending plans will be reflected in the next PMPR, following approval of the Operations Plans.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$ 180,037
FY91 Funds Costed to Date (b)	\$ 84,690
FY91 Funds Uncosted (c)	\$ 95,347
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).

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	116804
ACT. PERIOD COST	19377	16377	11153	4505	8896	18789	4397	1195	0	0	0	0	0	84690
VARIANCE, \$	8757	11304	265	-1841	1765	-8130	4562	15434	0	0	0	0	0	32114
VARIANCE, %	31.1	40.8	2.3	-69.1	16.6	-76.3	50.9	92.8	0.0	0.0	0.0	0.0	0.0	27.5
EST. FY CUMUL	28134	55815	67233	69897	80558	91217	100175	116804	128996	131877	137866	148687	167175	
ACTUAL FY CUMUL	19377	35755	46908	51413	60309	79098	83495	84690	0	0	0	0	0	
PERCENT COMPLETE	0.116	0.213	0.281	0.308	0.361	0.473	0.499	0.507	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	8757	20060	20325	18484	20249	12119	16680	32114	0	0	0	0	0	
VARIANCE, %	31.1	35.9	30.2	26.4	25.1	13.3	16.7	27.5	0.0	0.0	0.0	0.0	0.0	

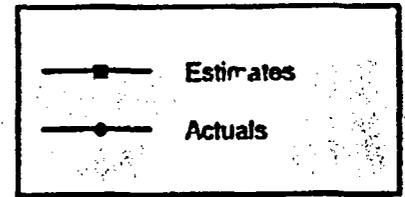
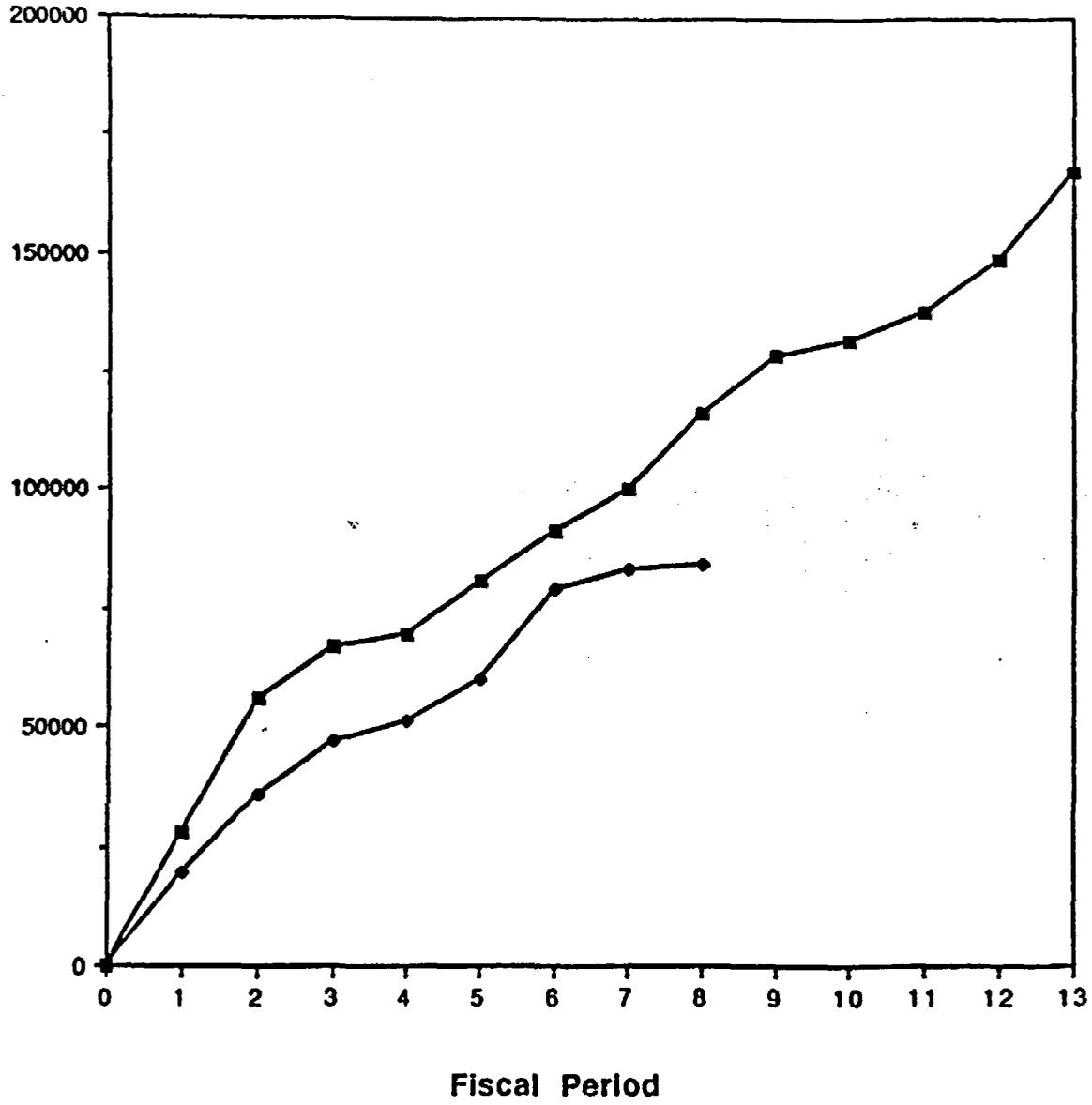
NOTES:

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 LSSA

11-4

Dollars



12. WASTE SOLIDIFICATION SYSTEMS

NRC Program Element Manager: Davis Hurt

CNWRA Element Manager: Prasad Nair

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

Subcontractor/Consultant: G. Lamping

12.1 Technical Status

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

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

Review of the sampling data and analysis presented in the WVPD report, "Impact of Melter Air Sparging on Off-Gas Composition," dated March 9, 1989 was completed. As part of Subtask B, P. Nair and G. Lamping visited and discussed details regarding operations and maintenance of off-gas systems at the Commonwealth Edison Nuclear Engineering Offices at Downers Grove. The discussions were held with Ms. P. J. Garnier-Davis, Senior Engineer, to review their experiences with off-gas systems at Dresden and other nuclear plants. Information was also gathered on national standards for the design and performance of off-gas system components such as air filter units and sampling instrumentation.

Reviews were performed of NRC Regulatory Guide 1.143 and of ANS Standard 55.4 concerning the design of gaseous radioactive waste processing system.

Task 2 - Sludge Mobilization and Mixing

The change in the DOE's plan for Integrated Radwaste Treatment System (IRTS) was evaluated with respect to this task activities. The DOE's present plan to initiate sludge washing activities with a 129 feet heel in the 8D-2 tank. The previous plan had the start of the washing process to start with a 38 feet heel. The change will most likely require more washes of the mixed sludge to maintain the same efficiency. Further review of this aspect is expected during a meeting at West Valley in early June 1991. The change is expected to impact minimally the sludge washing addendum to SAR. DOE's schedule now shows the completion of NRC's sludge washing SER activity by early October 1991. This assumes the availability of an early draft of the SAR and additional interactions among DOE, WVPD, NRC, and CNWRA.

Task 3 - Seismic Analysis of the Vitrification Facility

No activity this reporting period.

12.2 Major Problems

None.

12.3 Forecast for Next Period

Work will be initiated on Tasks 3. Work will continue on Task 1 and Task 2 as planned. H. Karimi and G. Lamping plan to attend a meeting at West Valley on June 6-7, 1991, in support of Task 1 and Task 2 activities.

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. Revisions to the spending plans will be reflected in the next PMPR, following approval of the Operations Plans.

Table 1. Financial Status	
FY91 Funds Authorized (a)	\$ 194,000
FY91 Funds Costed to Date (b)	\$ 55,719
FY91 Funds Uncosted (c)	\$ 138,281
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).

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
EST. PERIOD COST	0	0	0	3565	14279	17311	28878	28473	18396	14953	16031	23794	14900	92507
ACT. PERIOD COST	0	0	6837	10614	4574	6084	14024	13586	0	0	0	0	0	55719
VARIANCE, \$	0	0	-6837	-7048	9704	11227	14854	14887	0	0	0	0	0	36787
VARIANCE, %	0.0	0.0	0.0	-197.7	68.0	64.9	51.4	52.3	0.0	0.0	0.0	0.0	0.0	39.8
EST. FY CUMUL	0	0	0	3565	17844	35156	64034	92507	110903	125856	141887	165681	180582	
ACTUAL FY CUMUL	0	0	6837	17451	22025	28109	42133	55719	0	0	0	0	0	
PERCENT COMPLETE	0.000	0.000	0.038	0.097	0.122	0.156	0.233	0.309	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	0	0	-6837	-13885	-4181	7047	21901	36787	0	0	0	0	0	
VARIANCE, %	0.0	0.0	0.0	-389.4	-23.4	20.0	34.2	39.8	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 YID total.

3706 WSS

12-4

Dollars

