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

FOR THE FISCAL REPORTING PERIOD
January 20, 1990 - February 16, 1990

PMPR No. 90-05

March 2, 1990

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

TITLE: Center for Nuclear Waste
Regulatory Analyses

FIN: D1035-8

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CENTER PRESIDENT: John E. Latz
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CONTRACT NO: NRC-02-88-005

ESTIMATED BUDGET: \$42,550,000

SITE: 6220 Culebra Road
San Antonio, Texas

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

PERIOD OF THIS REPORT: 01/20/90 - 02/16/90

1. SUMMARY

1.1 Technical Status

NMSS Element 1 - CNWRA Operations

Discussions were held regarding NRC comments on the preliminary draft Center Management Plan which was transmitted to the NRC last period. Corporate and individual conflict of interest matters were also discussed.

The current status of Center staffing is indicated in the attached tables which reflect changes that are being made to the Staffing Plan in accordance with the Operations Plans. Additional changes are being planned to accommodate budget adjustments resulting from the DOE program stretch-out. Intensive interviewing and recruitment efforts continued for positions in the geosciences, rock mechanics, and performance assessment. Drs. E. Percy and G. Stirewalt, and Mr. S. Young will join the Center staff next period.

Comments were received on the revised Division of High Level Waste Operations Plans, and comments are awaited on the Overall Research Project Plan for FY90-91. These documents were transmitted to the NRC for approval December 1, 1989, and November 30, 1989, respectively. These Plans will be updated, as appropriate during Period 7. Preparation of the Center Five Year Plan continued with inputs provided by each of the other Elements and Projects.

Quality Assurance activities focused on (a) implementation of the key Program Architecture development guidance documents, with emphasis on analysis of regulatory and institutional uncertainties

(particularly, WSEI Major Milestone 110), (b) review of several technical products within the Elements (see accomplishments of those Elements), and (c) revisions to the CQAM. In addition, an internal audit was conducted of selected research activities.

NMSS Element 2 - Waste Systems Engineering and Integration

Further efforts were directed toward the identification of Regulatory and Institutional Uncertainties in 10 CFR Part 60, and the development of rationale and references for those uncertainties (Section 3). Comments received from the NRC staff were used to guide refinement of these analyses and revision of the draft report "Identification and Evaluation of Regulatory and Institutional Uncertainties in 10 CFR Part 60" (Milestone 110, CNWRA 90-003) which was transmitted in draft form on January 5, 1990. A meeting was held January 30, 1990, to discuss remaining staff comments on the report.

Discussions were held on January 22-23, 1990, on the requirements document for Versions 2.0 and 3.0 of PASS, which was transmitted to NRC November 30, 1989. Although a tentative approval for Version 2.0 was received, formal comments and approval are awaited.

Extensive support activities related to the Technical Positions on Thermal Load and Retrievability, as well as development of information related to the Regulatory Requirements concerning "Substantially Complete Containment" and "Adverse Condition--Extreme Erosion," continued. Regulatory analysis activities associated with the LARS and EIRS are reported in the Special Projects Element section, and those associated with the PARS are reported in the Performance Assessment section of this report.

NMSS Element 3 - External Quality Assurance

The CNWRA Director of QA participated in the NRC/DOE Bimonthly QA Meeting at White Flint. No audit or surveillance work was conducted this period (Section 4).

NMSS Element 4 - Geologic Setting

Staff participated in the February 6-7, 1990, DOE/NRC/NV Technical Exchange Meeting on calcite-silica vein deposits (Section 5). Review comments on the DOE Study Plan on Characterization of the Yucca Mountain Quaternary Regional Hydrology were completed and forwarded to NRC February 15. As part of this review, discussions were held regarding the mathematical formulations in the Szymanski report.

Geologic Setting Element activities included work on Steps 1, 3, 4, and 7 of the Natural Resources technical position. A major working group meeting on this topic is planned for next period.

Extensive testing of graphics workstations continued this period, including demonstrations by the vendors and "benchmark" testing by the Center staff. NRC-HLW staff members D. Chery and M. Blackford participated in demonstrations of this equipment and software, as well as use of the Site and Engineering Properties Database on the SwRI VAX computer on January 22, 1990.

NMSS Element 5 - Engineered Barrier Systems

A supplement and revision to the EBS Program Element Operations Plan for FY90 was received from the NRC on February 9, 1990. An impact assessment and cost estimate will be prepared on this next period (Section 6).

Activities related to the potential rulemaking on "Substantially Complete Containment" continued. The workshop on this topic is planned for April 2-4, 1990, with a total of nine peers to participate. The draft report "Technical Considerations for Evaluating Substantially Complete Containment of HLW within the Waste Package" was extensively revised during this period. In addition, the first-level review of the companion report "Uncertainty Evaluation Methods for Waste Package Performance Assessments" was completed and comments were incorporated in the draft. These two reports form the technical basis for the potential rulemaking.

Work continued in the area of codes and methods development. Staff participated in the ASTM Subcommittee meetings on Repository Materials and Nuclear Waste which were held in Las Vegas, NV, on January 22-24, 1990. CNWRA participation in round-robin testing to evaluate the variability in the "Nuclear Waste Glass Product Consistency Test Method" was discussed. In addition, models pertinent to uniform and localized corrosion were reviewed and evaluated. The results of this study will be documented in an Appendix to the Milestone 49 report which was transmitted to NRC last year.

NMSS Element 6 - Special Projects

Work in this Subelement focused on development of the format and contents for the License Application Review Strategy (LARS) and the Environmental Impact Statement (EIS) review strategy (Section 7). An analysis of interfaces between environmental statutes other than the National Environmental Policy Act and the EIS review was completed, and the assessment of the NRC role in EIS review continued.

NMSS Element 7 - Repository Design, Construction, and Operations

Activities aimed at development of the technical positions on thermal loads and waste retrievability continued this period (Section 8). A technical exchange and progress review meeting was held with the cognizant NRC staff January 22, 1990, to discuss the work to date on Program Architecture and the technical position on thermal loads. Extensive support was provided to conduct related

regulatory analysis (Program Architecture) activities under the WSE&I Element (see Section 3).

NMSS Element 8 - Performance Assessment

Comments were provided on the revised scope of work for the technical position on scenario identification and evaluation.

Work continued on development of the proposed rulemaking that was formerly referred to as the design basis accident. Several cycles of comments on both the work plan for this activity and the draft of this proposed rulemaking were prepared and discussed with the cognizant NRC staff. In addition, a draft assessment of the 'implementability' of the proposed rule was prepared and forwarded to the NRC.

The first Performance Assessment Workshop, was held February 15-16, 1990, in Bethesda. In addition to NRC NMSS and RES, both SNL staff and members of the EBS, GS, and PA Program Elements of the Center participated. A joint meeting on technology transfer was held with NRC and SNL.

NMSS Element 9 - Transportation Risk Study

NRC made a decision to suspend all Center TRS activities as a result of the DOE program stretch out (Section 10). Orderly phase out of the project is underway with a planned completion of May 30, 1990.

Extraction of shipment data from the entries to SAND84-7174 is essentially complete. Preliminary analyses of maximum and median doses from incident-free transportation were completed. Analyses of scenarios for incident-free transportation continue using dose calculations done in NUREG-0170 with scenarios developed from the SAND84-7174 database.

Research Project 1 - Overall Research

Comments are awaited on the revised Overall Research Plan for Fiscal Years 1990 and 1991 which was transmitted to the NRC on November 30, 1989.

Research Project 2 - Geochemistry

Revisions and additions were completed to the annual milestone report "Progress in Experimental Studies on the Thermodynamic and Ion Exchange Properties of Clinoptilolite" and the document was forwarded to the NRC (Section 11).

Characterization of clinoptilolite from several locations was completed. Based on these evaluations, the material from Death Valley Junction, CA, has been selected for use in the experiments.

A technical review, including a demonstration of techniques developed, was conducted for the Task 1 activity "Application of Cryo-Electron Microscopy and X-Ray Microanalysis to Geochemical Characterization of Pore Waters".

The computer program SOLCALC, previously developed by R. Pabalan at Berkeley, was revised and validated against data available in the literature. The code will be used to derive thermodynamic exchange constants from published experimental ion exchange data.

Research Project 3 - Thermohydrology

Development, assembly, and adaptation of the gamma-ray densitometer traversing system was completed, and it was calibrated and subjected to shake-down testing this period. The initial separate effect experiment commenced February 20, 1990.

Testing was conducted on the TOUGH code (for modeling unsaturated flow) which was installed and made operational on the SwRI VAX 8700.

Research Project 4 - Seismic Rock Mechanics

A technical report on the qualification study of the code HONDO II against closed-form solutions was completed and transmitted to the NRC February 21, 1990. Qualification studies of the three-dimensional finite element code SPECTROM 331 were initiated. The paper "Verification Studies on the UDEC Computational Model of Jointed Rock" was completed and submitted for presentation at the International Conference on Mechanics of Jointed and Faulted Rock, which will be conducted in Vienna, Austria, April 18-20, 1990.

Negotiations continued regarding instrumented field studies at the Lucky Friday Mine in Idaho. The proposal calls for field studies of (a) dynamic effects on underground openings and (b) seismic effects on the hydrologic regime. A site visit was conducted to select the preferred test locations and to negotiate with the drilling contractor.

Large-diameter core drilling for acquisition of jointed welded tuff specimens from the Apache Leap Site, Arizona, was completed. These specimens will be prepared for testing of rock joint properties.

The report "Development of a Rock Joint Dynamic Shear Test Apparatus" was completed and forwarded to the NRC February 2, 1990. In addition, development of appropriate procedures for conducting such tests was completed.

Research Project 5 - Integrated Waste Package Experiments

Studies to investigate the statistical variation in pitting parameters continued. This series of tests will use 304L stainless steel as a baseline material and three concentrations of chloride.

Staff visited with Prof. Bryan Wilde to discuss the status of hydrogen absorption studies that are being conducted for the Center at the Ohio State University. Staff also visited with Cortest (a NRC contractor) while in the Columbus area.

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

Staff participated in the February 5-7, 1990, INTRAVAL meeting in Las Vegas, NV, presenting information on the stochastic analysis of hydrologic data relevant to the Las Cruces Trench Experiment.

Research Project 7 - Geochemical Analogs

The final Research Project Plan for this project was completed and forwarded to the NRC for approval.

1.2 Major Problems

None to report.

1.3 Forecast for Next Period

The schedule for revising the Division of High Level Waste Operations Plans and the Overall Research Project Plan will be established and work will commence on their revision during the next period. It may be necessary to rerun the budgets and schedules to (a) reflect experience to date (i.e. the first five fiscal periods have elapsed since the Plans were drafted) and (b) address the impacts of the DOE program stretch-out and attendant budget reductions.

Numerous briefings, interactions, and meetings are planned during the next period for both the NMSS and RES components of the program.

Revision of the Center Management Plan and continued development of the Five-Year Plan will take place. Staffing will continue to be a high priority activity. Implementation of Revision 1 of the Center Quality Assurance Manual will continue, as will development of Revision 2. Emphasis will continue on the oversight of the Program Architecture development and review, and preliminary research project activities. The internal QA audit of selected research projects should be completed.

Development of the Program Architecture and PASS will continue. The Milestone 110 report on Regulatory and Institutional Uncertainties in 10 CFR Part 60 (CNWRA 90-003) will be revised and transmitted in final form. Interactions with the NRC concerning "baselining" the Program Architecture will continue, as will development of supporting technical operating procedures. Primary training of Center and support staff in the new procedures will continue. Development of Version 2.0 of PASS will be accelerated.

Extensive effort will be devoted to development of the statutory and regulatory basis for rulemakings and technical positions.

Center and SwRI quality assurance professionals will participate in audit observation and other quality assurance activities, as requested.

The Geologic Setting Element activities will continue to focus on technical assistance on the Natural Resources Technical Position, and preparation of plans for the commencement of work on various other TPs. Staff will support DOE/NRC Technical Exchange Meetings, as appropriate.

The EBS Element will conduct technical assistance work related to the Regulatory Requirement "Substantially Complete Containment." The two draft reports will be revised in accordance with peer review comments. Preparations for the workshop on SCC will be completed. The Appendix to Milestone 49 will be completed. Activities will continue regarding EBS performance assessment with a focus on mechanistic and thermal modeling.

Activities in the SP Element will focus on the LARS and EIRS.

Activities within the RDCO Element will be related primarily to technical positions on retrievability and thermal loads. In addition to the base activities in Program Architecture, increased activity on the technical positions is anticipated. A meeting on this subject involving NRC, Center, and contractor personnel will be held early next period.

Within the PA Element, the scope of the scenario identification and evaluation technical position will be finalized. Review of pertinent SNL documents will continue. Work on the proposed rulemaking on design basis accident dose limit will continue. The scope of Center participation in the second phase of the iterative performance assessment will be established.

The Transportation Risk Study staff will continue the RADTRAN analyses of representative shipments and related sensitivity analyses. Risk results should be available by the end of next period.

Work will continue in the Geochemistry, Thermohydrology, Seismic Rock Mechanics, and Integrated Waste Package Experiments Projects in accordance with approved plans. Work will continue on approved portions of the Stochastic Modeling and Geochemical Natural Analog Projects; the Plan for the former project will be revised to reflect NRC comments and the latter will be approved. Recommended revisions to the IWPE Project Plan will be outlined and submitted to the NRC.

1.4 Summary Financial Status

Table 1, below, indicates the financial status of the overall Center program in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and cumulative basis. In addition, variances are shown on both a dollar and percentage basis. These data do not include commitments in the amount of \$410,040. Similar data are presented for each Element/Project in the respective sections of this periodic report. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Underruns experienced to date result from (a) continuation of planning activities (which are less labor-intensive than the conduct of the associated technical work), (b) staffing being somewhat under plan, (c) lack of activity in Task 1 of the HLW Operations Plans due to the DOE program stretch-out, and (d) slower than anticipated start up of the new research projects (due in large part to staffing constraints as noted in item b). With the exception of the Center Operations and WSE&I Elements, all of the HLW Elements have been influenced by these factors. The TRS project has been essentially unaffected; expenditures and progress being influenced somewhat by the priority work load in WSE&I. For projects that were approved prior to this fiscal year, research activities and associated expenditures are essentially on or ahead of plan. Planning for significant revisions to the IWPE Project have led us to reduce expenditures in this area until the revised scope of work is approved.

It appears to be appropriate to revise the spending plans and associated scope of work to reflect the impacts of the factors identified above. This matter will be discussed with the NRC CNWRA Program Management in the coming weeks.

Table 1. Financial Status

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$4,799,104
c) Total FY90 Funds Available	\$4,799,104
Funds Costed to Date	\$2,777,487
Funds Uncosted	\$2,021,617
Recommended Adjustment to Complete (+/-)	\$ -0-

See the enclosed Element Status Cost Report.

Notes:

- a) The current unspent amount from previous portions of each FIN.
- b) See "Total Contract Amount" in corresponding the Element page of the "Project Status Report."
- c) Sum of (a) and (b)
- d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as
"(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

CENTER CORE STAFF -- HIRING PROFILE

EXPERTISE/EXPERIENCE	FY 88	FY 89	FY 90				FY 91	FY 92	TOTAL REQUIRED	CURRENTLY OPEN (2ND QTR)
			1Q	2Q	3Q	4Q				
ADMINISTRATION	5	5	5	5	5	5	5	5	5	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 ENGINEERING (b)				1	1	1	1	1	1	1
GEOCHEMISTRY (b) (a) (d)	2	2	3	5	5	5	5	5	5	2
GEOHYDROLOGY (b) (a)		2	2	4	4	4	4	4	4	2
GEOLOGY	1	1	2	2	2	2	2	2	2	0
GEOMORPHOLOGY (b)				1	1	1	1	1	1	1
GEOSTATISTICS (b)				1	1	1	1	1	1	1
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	0
METEOR/CLIMATOLOGY (b)				1	1	1	1	1	1	1
MINING ENGINEERING	1	1	1	1	1	1	1	1	1	0
NUMERICAL MODELING (b) (a)			1	1	1	1	1	1	1	1
PERFORMANCE ASSESSMENT (b) (a) (d)		1	2	3	3	4	4	4	4	2
QUALITY ASSURANCE	1	2	2	2	2	2	2	2	2	0
RADIOCHEMISTRY / ISOTOPE GEOCHEMIST (b) (d)				1	1	1	1	1	1	1
REGULATORY AND POLICY ANALYSIS (e)	2	3	3	3	3	3	3	3	3	0
RELIABILITY	1	1	1	1	1	1	1	1	1	0
ROCK MECHANICS (b) (d) (a)		1	2	3	3	3	3	3	3	2
STRUCTURAL GEOLOGY (e)				1	1	1	1	1	1	0
SYSTEMS ENGINEERING (b)	1	1	1	2	2	2	2	2	2	1
TRANSPORTATION	1	1	1	1	1	1	1	1	1	0
VOLCANOLOGY/IGNEOUS GEOLOGY (b) (a)				1	1	1	1	1	1	1
TOTAL REQUIRED	21	28	36	50	50	51	51	51	51	15

Notes:

- (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.
- * Plan being revised downward.

Staffing Summary

	Professional	Support	Total
Current	34	10	44
Planned This Date*	42	9	51
Planned End of FY90	51	9	60

CENTER CORE STAFF -- CURRENT PROFILE (02/16/90)

EXPERTISE/EXPERIENCE	
ADMINISTRATION	J. Latz, R. Adler, H. Garcia, W. Patrick, A. Whiting
DATA BASE MANAGEMENT AND DATA PROCESSING	S. McFaddin, M. Pape
ELECTROCHEMISTRY	G. Cragolino
ENGINEERING GEOLOGY/GEOLOGICAL ENGINEERING	
GEOCHEMISTRY	W. Murphy, R. Pabalan, E. Percy
GEOHYDROLOGY	R. Ababou, R. Green
GEOLOGY	J. Russell, M. Miklas
GEOMORPHOLOGY	
GEOSTATISTICS	
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
METEOR/CLIMATOLOGY	
MINING ENGINEERING	S-M. Hsiung
NUMERICAL MODELING	
PERFORMANCE ASSESSMENT	B. Sagar
QUALITY ASSURANCE	B. Mabrito, R. Brient
RADIOCHEMISTRY	
REGULATORY AND POLICY ANALYSIS	P. LaPlante (Env Sci), S. Spector (Law), G. Stirewalt (Geology)
RELIABILITY	J. Wu
ROCK MECHANICS	A. Chowdhury
STRUCTURAL GEOLOGY	S. Young
SYSTEMS ENGINEERING	D. T. Romine
TRANSPORTATION	R. Weiner (Risk Analyst)
VOLCANOLOGY/IGNEOUS GEOLOGY	

3700-000

CENTER COMPOSITE

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	667121	814499	764150	716994	726774	767969	707476	727194	758610	772104	767863	746922	746252	3689538
ACTUAL PERIOD COST	481422	515564	593272	515124	672104	0	0	0	0	0	0	0	0	2777486
VARIANCE, \$	185699	298935	170878	201870	54670	0	0	0	0	0	0	0	0	912052
VARIANCE, %	27.8	36.7	22.4	28.2	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7
EST. FY CUMUL COST	667121	1481620	2245769	2962764	3689538	4457507	5164984	5892178	6650788	7422892	8190755	8937677	9683929	
ACTUAL FY CUMUL COST	481422	996986	1590257	2105381	2777486	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.130	0.270	0.431	0.571	0.753	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	185699	484634	655512	857382	912052	0	0	0	0	0	0	0	0	
VARIANCE, %	27.8	32.7	29.2	28.9	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

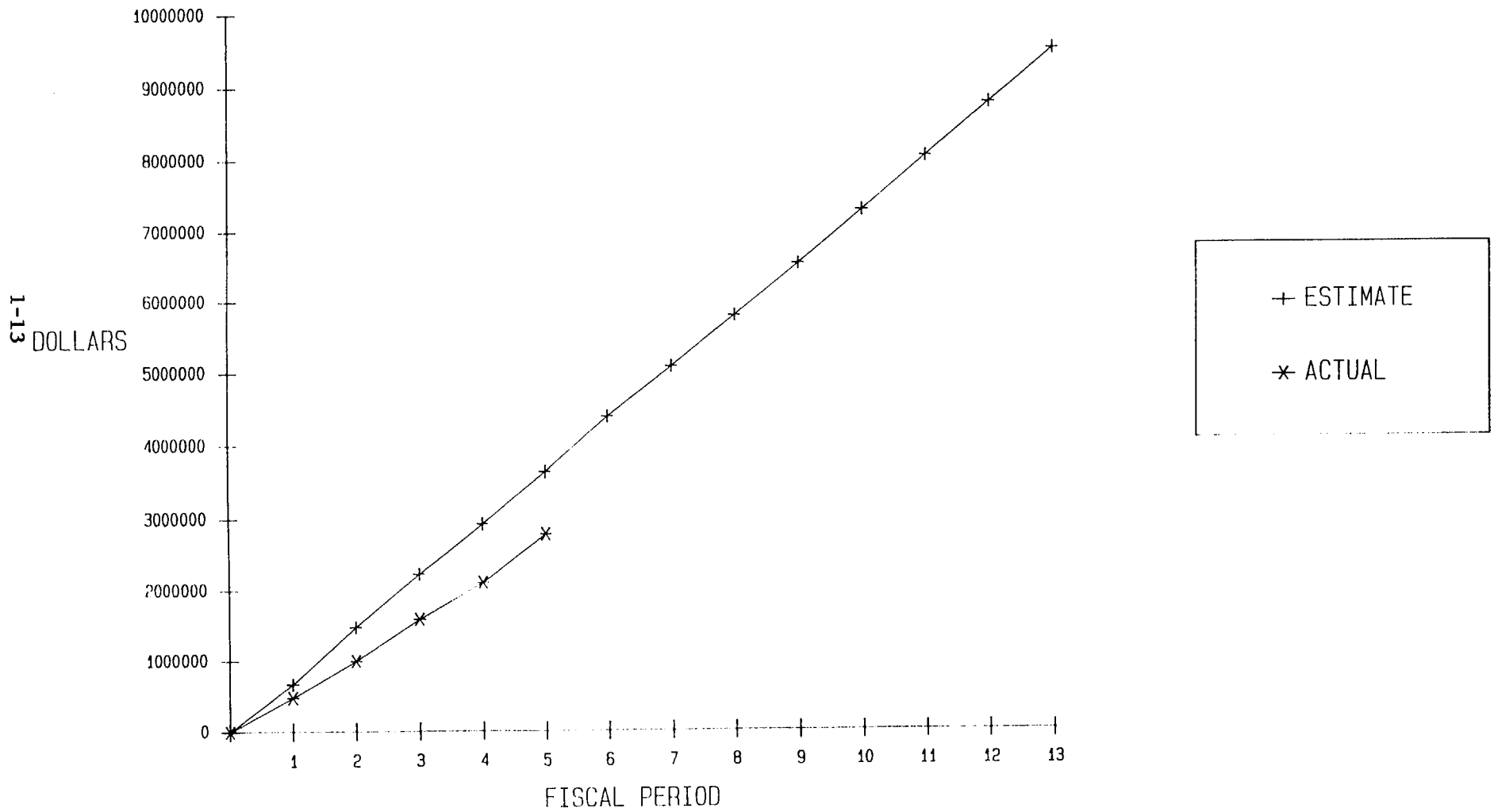
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NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.
4. TRS Estimates are taken from the Year 2 Project Plan submitted on 04/04/89 (Revision 1).

3700-000 CENTER COMPOSITE - FY 90

Estimate vs. Actual



2. CNWRA OPERATIONS

NRC Program Element Manager: Shirley L. Fortuna

NRC Project Officers: Mark S. Delligatti

CNWRA Element Manager: Henry F. Garcia

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

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

2.1 Technical Status

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

Task 1 - Management and Technical Support

Effective coordination of work activities continued during this period. Informal discussions were held relative to the changes in the Center Management Plan. Administrative and fiscal matters which affect the management of the Center, e.g., communications, subcontract modifications, conflict of interest and budgets, were reviewed with both the Program Management, Office of General Counsel and Contracts Administration staff pursuant to the execution, both directly and peripherally, of program-related deliverables.

Task 2 - Develop and Sustain Technical and Analytical Capabilities

The Center is maintaining its input of various documents into the Technical Document Index, and will begin input into the Correspondence Control Index next period.

Task 3 - Staffing Activities

The Center's recruitment efforts continued with Drs. Asad Chowdhury, John Russell, and Budhi Sagar reviewing selected applications and arranging for interviews for promising applicants in rock mechanics, the geosciences, and performance assessment. A few applicants were selected for interviews, especially those in a senior technical capacity. Drs. E. Percy and G. Stirewalt, and Mr. S. Young will join the Center next period.

National advertisements for employment opportunities at the Center continue to be administered by the SwRI's Personnel Department.

Task 4 - Operations Plans and Five Year Plan Development

The budget revision, both for the Division of High Level Waste and the Office of Nuclear Regulatory Research, has occasioned a reassessment of the aggregate Center resource base, and cognizant Center staff have been asked to scrutinized further their respective sections of the Operations and Project plans in anticipation of necessary modifications. The Center Five-Year Plan continues to be developed, and will be presented in draft form next period.

Task 5 - CNWRA Internal QA

The development and implementation of the Center Quality system continued with Technical Operating Procedure and Quality Assurance Procedure preparation, COI Management Committee activities, changes being written for the Center Quality Assurance Manual Revision 2, Quality System Indoctrination and Training, and a quality survey being conducted at the University of Arizona. Center final products are being reviewed by cognizant Center QA personnel to ensure that technical or peer reviews have taken place and appropriate criteria have been met. The Center QA staff has developed a standard set of quality requirements for organizations performing research and analysis activities which will be incorporated in a QA procedure.

The third Center Internal Audit of CY89 was completed during this reporting period. Participating in Center Internal Audit 89-C-3 were J. Russell, S. Svedman, M. Lewis, R. Green, and R. Brient (CNWRA Quality Assurance). B. Englehardt of the SwRI Quality Assurance Department conducted the internal audit. The status of certain deliverable reports and documents were examined as were certain programmatic elements of the research project. The experiments accomplished to date were audited for their programmatic relevance, and a finding was made regarding maintenance of laboratory notebooks.

2.2 Major Problems

None to report.

2.3 Forecast for Next Period

The schedule for submitting the final version of the above mentioned Operations and Research Project Plans will be discussed during a management meeting. The Center will host and participate in various Center management-related meetings, e.g., Research Management, Todreas Committee, NRC Commissioners. The PMPR will be produced for the sixth period. Attendance at professional development events and participation in professional/technical society activities will be

encouraged. The Center's recruitment efforts, especially in the geosciences, performance assessment and rock mechanics disciplines, continues in earnest. The draft Five-Year Plan will continue in production. The Center's QA staff will conduct the required quality surveys, maintain their reviews to ensure that applicable reports, plans or other documents have received the appropriate technical reviews, and continue working with COI/Qualification matters.

2.4 Element Financial Status

Table 1, below, indicates the financial status of the Element program in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and cumulative basis. In addition, variances are shown on both a dollar and percentage basis. These data do not include commitments in the amount of \$4,700. Spending is slightly over target for the established budgets, as a result of continued emphasis on preparation of Operations and 5-Year Plans. No changes to budget or schedule are recommended at this time.

Prior Year Unfunded Cost	\$ -0-
FY90 Funds Allocated	\$1,228,189
Total FY90 Funds Available	\$1,228,189
Funds Costed to Date	\$ 856,945
Funds Uncosted	\$ 371,244
Recommended Adjustment to Complete (+/-)	\$ -0-

See the enclosed Element Status Cost Report.

Notes:

- a) The current unspent amount from previous portions of each FIN.
- b) See "Total Contract Amount" in the corresponding element page of the "Project Status Report."
- c) Sum of (a) and (b)
- d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3702-070

CNWRA OPS

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	140713	198121	178713	133643	137487	175201	138081	131358	134454	155737	156011	138507	136492	788676
ACTUAL PERIOD COST	176916	158050	166556	131875	223547	0	0	0	0	0	0	0	0	856945
VARIANCE, \$	-36203	40071	12156	1767	-86061	0	0	0	0	0	0	0	0	-68270
VARIANCE, %	-25.7	20.2	6.8	1.3	-62.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-8.7
EST. FY CUMUL COST	140713	338834	517546	651189	788676	963877	1101958	1233316	1367770	1523507	1679518	1818025	1954517	
ACTUAL FY CUMUL COST	176916	334966	501522	633398	856945	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.224	0.425	0.636	0.803	1.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-36203	3868	16024	17791	-68270	0	0	0	0	0	0	0	0	
VARIANCE, %	-25.7	1.1	3.1	2.7	-8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

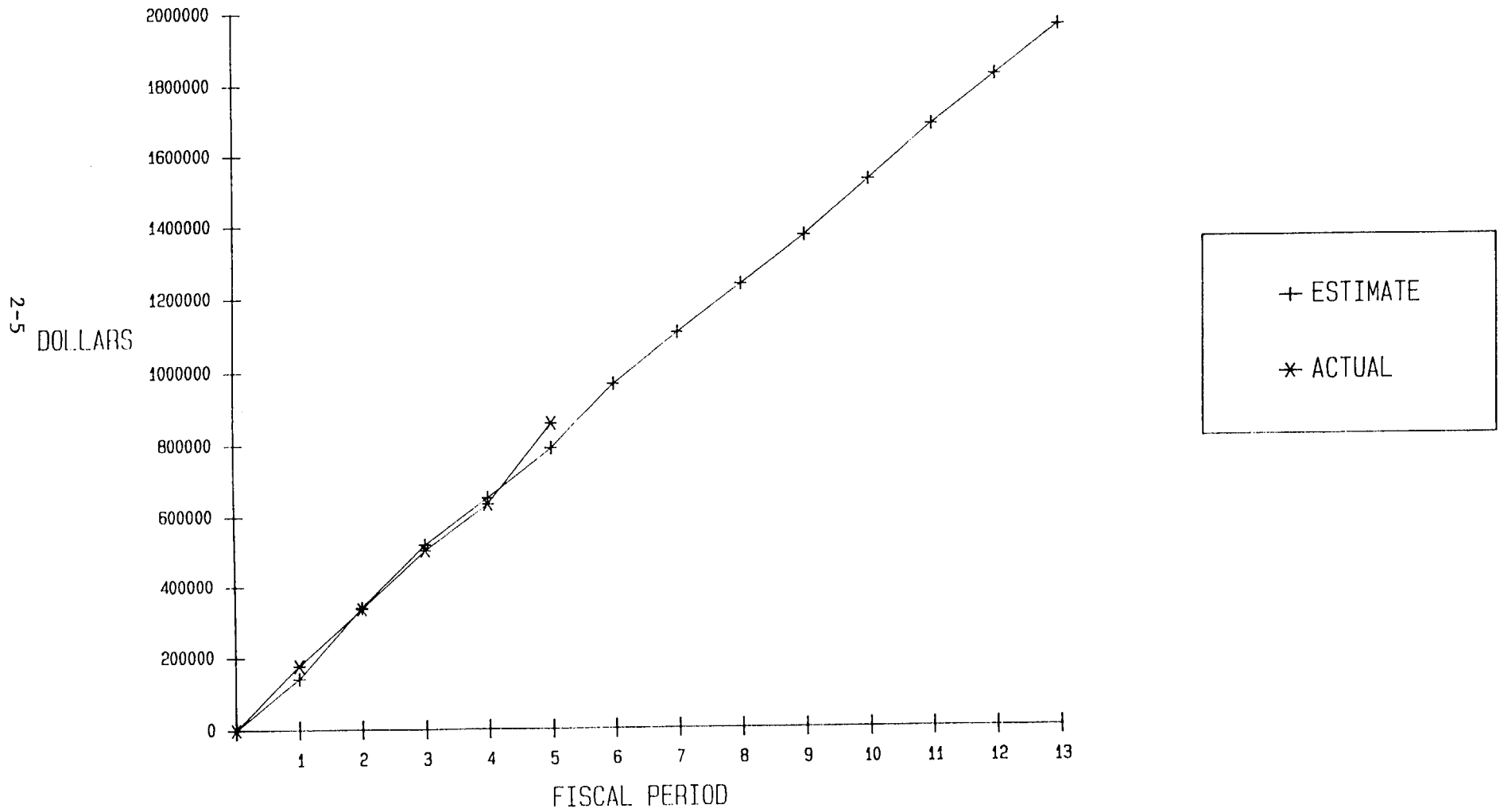
2-4

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3702-070 CNWRA OPS - FY 90

Estimate vs. Actual



3. WASTE SYSTEMS ENGINEERING AND INTEGRATION

NRC Program Element Manager: Philip M. Altomare

NRC Project Officer for
Program Architecture: Michael P. Lee

CNWRA Element Manager: D. Ted Romine

Key Personnel: R. Adler, R. Johnson, J. Latz, W. Patrick, A. Whiting,

Subcontractors/Consultants: None

3.1 Technical Status

Major efforts in pursuit of the WSE&I Major Milestone 110, "Identification and Evaluation of Regulatory and Institutional Uncertainties in 10 CFR Part 60," continued during this period with the objective of producing a final version of the Milestone 110 (CNWRA 90-003) report for the NRC by February 28, 1990.

Task 1 - Statutory and Regulatory Analysis

Major emphasis this period included working toward finalizing and submitting the final report of the Major Milestone 110 scheduled to be received by the NRC on February 28, 1990.

The NRC internal technical review continued on the CNWRA's January 5 Milestone 110 draft document, with final comments provided at a meeting held January 30, 1990, at White Flint where the Center's position on the relationship of sections 112 and 122 in 10 CFR Part 60 was discussed. At that meeting, a schedule was finalized for producing the Milestone 110 (CNWRA 90-003) Final Report by February 27, and having it in the NRC's hands by the 28th of February. (Reference Minutes of January 30, 1990 CNWRA/NRC Meeting Report by W. Patrick).

Throughout this period, the Center has continued, in a minor way, reviewing comments that have been received to date on "Erosion" and "Substantially Complete Containment". NRC conditionally approved TOP-001-02 and the submittals of "Erosion" and "Substantially Complete Containment" for baselining the Program Architecture. A meeting will be scheduled in the future for the Center to brief the NRC on these items and Program Architecture in general.

Center work on developing a "functional" system evaluation to determine the "sufficiency" of 10 CFR Part 60 continued to be deferred to maximize the effort on the CNWRA 90-003 Report.

During this period, limited work continued on the development of TOP-001-05 "Procedure for Attribute Analysis."

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

Loading of the 1989 revisions to the 10 CFR Part 60 regulations into the PASS continued this period. The Center received an approval to a formal written request of January 1, 1990, to WESTLAW which will allow downloading other regulations and statutes for use in the PA Database. The design of Version 2.0 of the PASS continued in accordance with the Requirements Definition Report which was submitted November 30, 1989. Development of a PASS user's manual for Version 1.0 continued throughout this period.

At a meeting held January 22 and 23, discussions were held with NRC staff regarding the OS/2 and the PASS development for Versions 2.0 and 3.0. This meeting was held at the CNWRA offices in San Antonio, with representatives from the NRC NMSS and IRM Offices attending. During the meeting time a tentative "go-ahead" was received by the CNWRA to start programming PASS Version 2.0. Based on this approval, work on revising the Version 2.0 schedule was initiated.

Training in the use of the PASS and the PADB was provided for Center and contractor staff.

Task 3 - HLWM Program Analysis and Integration

Due to the press of Milestone 110 (CNWRA 90-003 Report) activities and the changing work priorities and resource availabilities, caused by the resource constraints identified in the January 16-17, NRC/CNWRA Management Meeting, limited development of the key milestone interface points and schedules for technical positions and rulemaking efforts between the Center and the NRC was accomplished this period. The transient state of these items was discussed during a meeting held on January 24 at the San Antonio offices of the CNWRA with P. Altomare in attendance. It was felt that more definitive information would be available during the next reporting period on which to provide more realistic schedules.

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

Program Architecture activities on thermal loads and waste retrievability continued during this reporting period. A. Chowdhury, S. Hsiung and C. Tschoepe of the Center, T. Brandshaug and L. Lorig of Itasca, and M. Logsdon and B. Basse of ABC performed these activities. T. Brandshaug, M. Logsdon, and B. Basse visited the Center during the week of February 5, 1990, to work on Program Architecture on thermal loads. Regulatory Analysis of 10 CFR Part 60 relevant to RDCO continued during this reporting period in support of the generation of a Draft Technical Position scheduled to be provided to the NRC by the RDCO Element in early March. Phil Altomare is scheduled to visit the CNWRA on February 22, to review the Program Architecture aspect of the activity.

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

A low level of activity was continued this period on the Adverse Geochemical Processes Regulatory Requirement Topic (RRT).

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

Activities in this area are discussed in the EBS Element portion of this report.

Task 7 - Special Projects Related Program Architecture Development

Activities in this area are discussed in the SP Element portion of this report.

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

Activities in this area are discussed in the PA Element portion of this report.

3.2 Major Problems

None.

3.3 Forecast for Next Period

Element activities during the next period will be focused on:

- o Finalization of the WSE&I Major Milestone 110 deliverable (CNWRA 90-003 Report) and anticipated attendant briefings.
- o Completion of the Technical Operating Procedure TOP-001-05 "Procedure for Attribute Analysis."
- o Preparation of a revised schedule for the delivery of Version 2.0 of the PASS consistent with the results from the meeting held January 22-23 at the CNWRA.
- o Establishment of a schedule for the "functional" system evaluation of 10 CFR Part 60.
- o Establishment of a firm date for briefing the NRC on TOP 001-02, "Erosion" and "Substantially Complete Containment."
- o Establishment of a revised schedule for the delivery of the Systems Engineering Management Plan.
- o Establishment of a revised schedule for developing the statutory and regulatory basis for the Rulemakings and Technical Positions being worked by RDCO, GS, EBS, and PA Elements, consistent with newly established priorities and schedules. (Reflecting the effect of any reduction in scope or schedule brought about by resource constraints defined in the NRC-CNWRA Management Meeting held at White Flint on January 16-17, 1990)

- o Continued PADB training of Center and contractor staff on Version 2.0 and preparation of PASS Users Manual for Version 1.0.
- o Continued loading of 1989 revisions of regulations having received official approval for downloading from WESTLAW.
- o Continue to develop the AS/PMC programs to include expanded capabilities for commitment control, as well as support for the 5-Year Plan for the Center and interface to other scheduling levels.
- o Finalizing the development of the 5-Year Plan.
- o Participating in a Revision of the Operations Plans consistent with the resource constraints identified in the January 16-17 meeting.

3.4 Element Financial Status

Table 1, below, indicates the financial status of the Element program in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and cumulative basis. In addition, variances are shown on both a dollar and percentage basis. These data do not include commitments in the amount of \$99,036. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Taking commitments into account, spending is on target; no changes in budget are recommended at this time.

Table 1. Financial Status

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$1,332,040
c) Total FY90 Funds Available	\$1,332,040
Funds Costed to Date	\$ 657,355
Funds Uncosted	\$ 674,685
Recommended Adjustment to Complete (+/-)	\$ -0-

See the enclosed Element Status Cost Report.

Notes:

- a) The current unspent amount from previous portions of each FIN.
- b) See "Total Contract Amount" in the corresponding Element page of the "Project Status Report."
- c) Sum of (a) and (b)
- d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3702-030

WSE&I

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	112865	181601	162590	163849	171634	160558	145964	130761	137264	154709	148767	149756	122271	792537
ACTUAL PERIOD COST	129467	148656	161537	109168	108528	0	0	0	0	0	0	0	0	657355
VARIANCE, \$	-16602	32945	1053	54681	63106	0	0	0	0	0	0	0	0	135182
VARIANCE, %	-14.7	18.1	0.6	33.4	36.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.1
EST. FY CUMUL COST	112865	294465	457055	620904	792537	953095	1099060	1229820	1367085	1521794	1670561	1820317	1942589	
ACTUAL FY CUMUL COST	129467	278123	439659	548828	657355	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.163	0.351	0.555	0.692	0.829	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-16602	16343	17396	72076	135182	0	0	0	0	0	0	0	0	
VARIANCE, %	-14.7	5.5	3.8	11.6	17.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

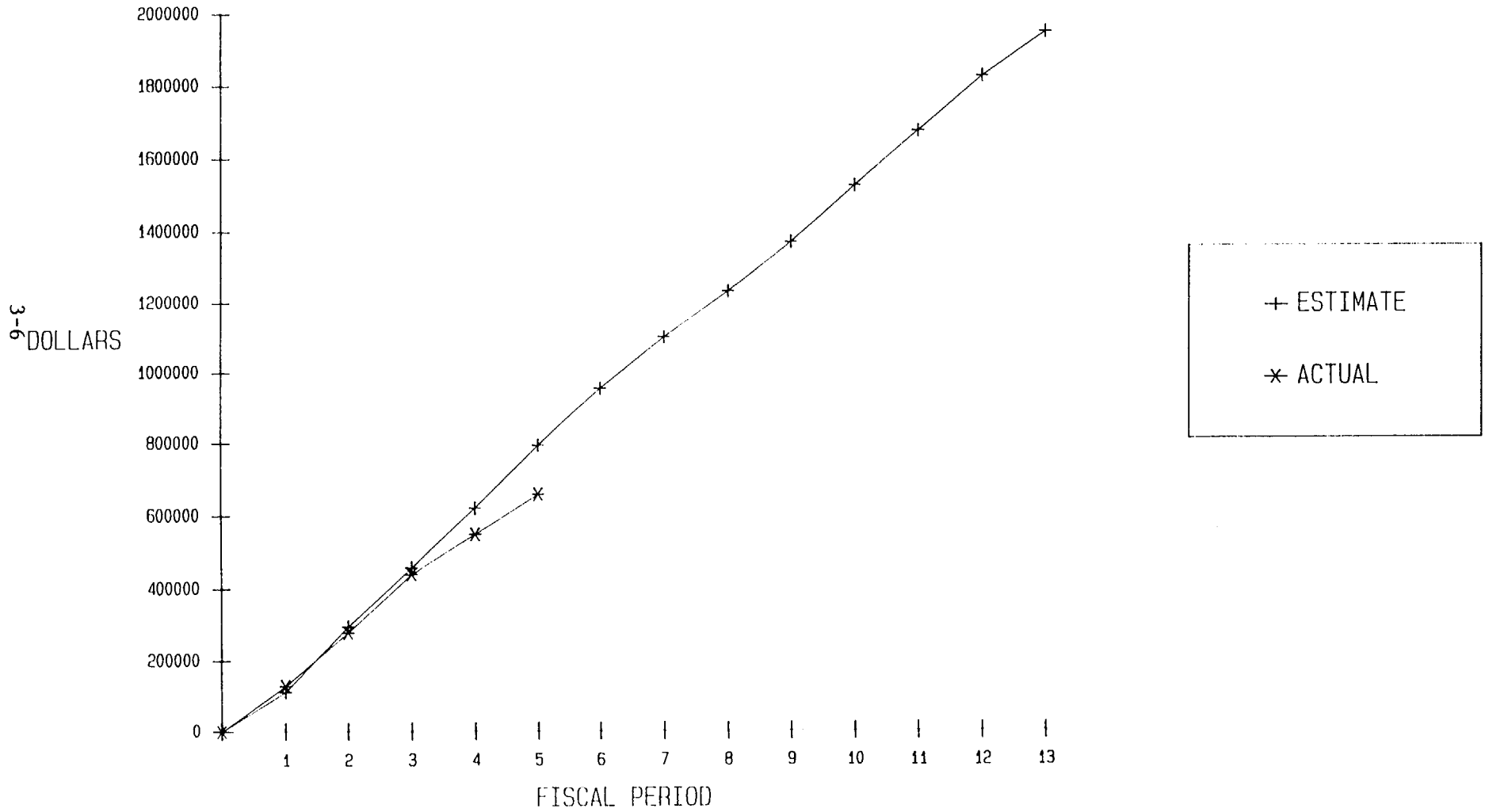
3-5

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YID total.

3702-030 WSE&I - FY 90

Estimate vs. Actual



4. QUALITY ASSURANCE

NRC Program Element Manager: Mark S. Delligatti

NRC Project Officer for External QA Task: James E. Kennedy

CNWRA Element Manager: Bruce E. Mabrito

Key Personnel: Bruce E. Mabrito, Robert D. Brient, Thomas C. Trbovich,
Robert E. Engelhardt, Michael R. Gonzalez

Subcontractors/Consultant: William M. Bland, Jr., P.E., John H. Doyle

4.1 Technical Status

The Director of QA attended the NRC/DOE Bimonthly QA Meeting at the White Flint offices. Periodic teleconference meetings were held with the NRC NMSS QA staff to discuss quality assurance matters and developments which affect the HLW program.

Task 1 - Audit DOE QA Program for Site Characterization

During this period the Center Director of Quality Assurance continued oversight and coordination of this phase of this Element.

The Director of Quality Assurance, along with NRC QA staff, interfaced with DOE, State of Nevada, and Edison Electric Institute representatives during and after the NRC/DOE Bimonthly QA Meeting February 15, 1990. Plans by the DOE affecting the NRC Quality Assurance workload were reviewed by the appropriate NRC staff and Center QA resources to support such activities were discussed.

Task 2 - Conduct Quality Assurance On-Site Visits

Discussions continue to take place with the NRC QA staff on the best approach and most efficient manner to make QA on-site visits beneficial to the HLW program. These discussions took place during the visit to the White Flint NRC office and during the periodic teleconference meetings amongst the NRC QA staff and Center QA personnel. Additionally, NMSS QA staff kept Center QA personnel apprised of field activities affecting the DOE HLW QA program.

Task 3 - Update QA Review Plan and Staff Technical Positions
(Unfunded)

No activity this period.

Task 4 - Review Management Control Documents and QA Plan Revisions
(Unfunded)

No activity this period.

4.2. Major Problems

None.

4.3 Forecast for Next Period

Activities will continue to focus on the DOE and NRC schedules for auditing and surveillance of DOE contractors involved in the HLW site characterization program. Attendance at the next NRC/DOE Bimonthly QA meeting March 21, 1990 by the Center QA Director is forecast, along with Center assistance on the Los Alamos National Laboratory Audit Observation Team and possibly Center participation in the DOE Sample Management Facility on-site visit.

4.4 Element Financial Status

Table 1 below, indicates the financial status of this Element in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and a cumulative basis. In addition, variances are shown on both a dollar and percentage basis. These data do not include commitments in the amount of \$700. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

The rate of expenditure to date has been about one third of the planned rate. This is a direct result of there being limited audit observation work during the first fiscal quarter. No change in budget is recommended at this time.

Table 1. Financial Status

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$ 45,008
c) Total FY90 Funds Available	\$ 45,008
Funds Costed to Date	\$ 15,273
Funds Uncosted	\$ 29,735
Recommended Adjustment to Complete (+/-)	\$ -0-
See the enclosed Element Status Cost Report.	

Notes:

- The current unspent amount from previous portions of each FIN.
- See "Total Contract Amount" in the corresponding Element page of the "Project Status Report."
- Sum of (a) and (b)
- Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3702-040

QA

Element Status Cost Report

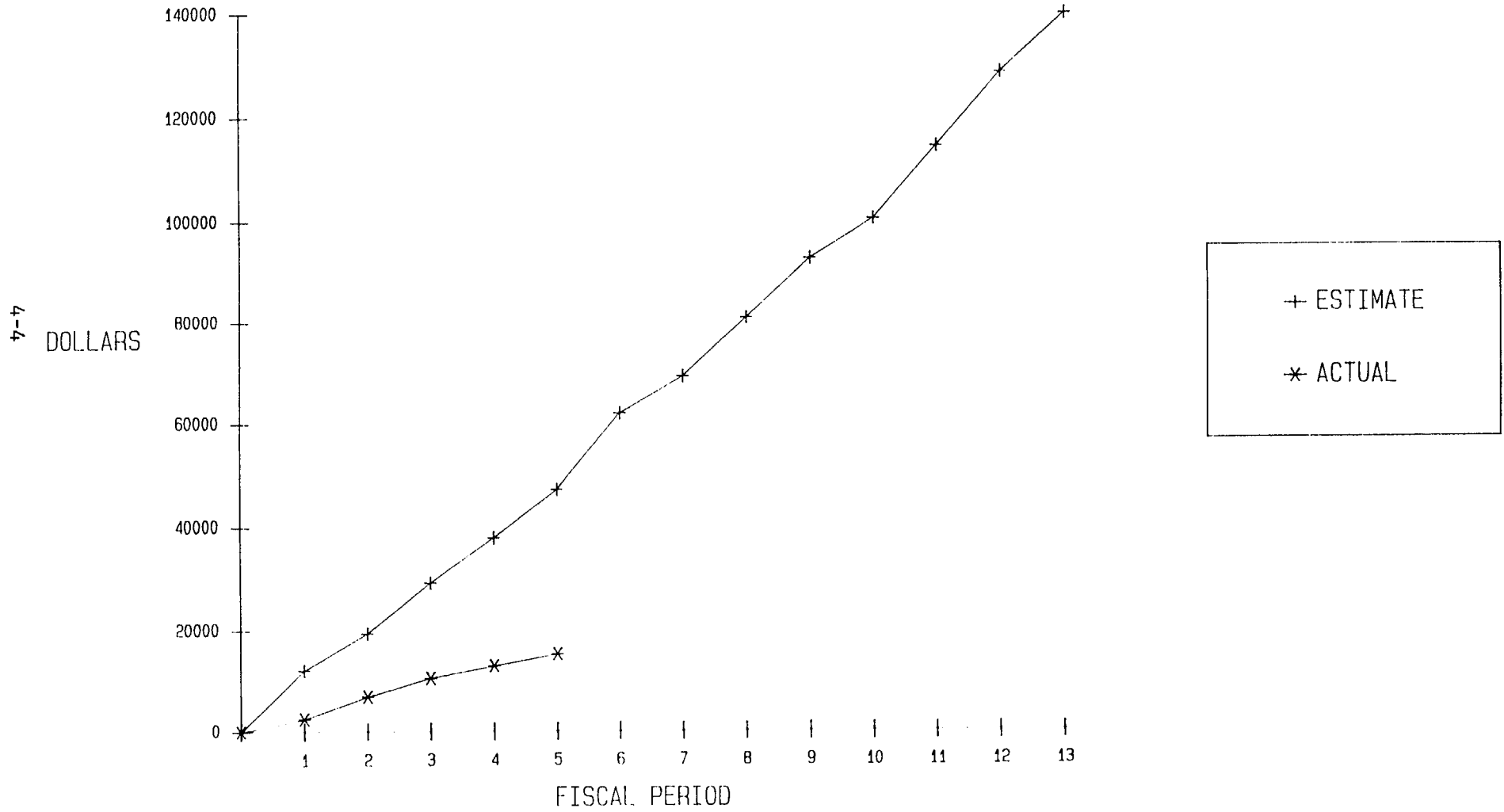
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	12139	7263	9892	8615	9221	14801	7252	11544	11862	7723	13786	14051	11366	47129
ACTUAL PERIOD COST	2549	4472	3627	2366	2258	0	0	0	0	0	0	0	0	15273
VARIANCE, \$	9589	2791	6264	6249	6963	0	0	0	0	0	0	0	0	31856
VARIANCE, %	79.0	38.4	63.3	72.5	75.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67.6
EST. FY CUMUL COST	12139	19402	29293	37908	47129	61930	69182	80725	92588	100311	114097	128148	139513	
ACTUAL FY CUMUL COST	2549	7021	10648	13014	15273	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.054	0.149	0.226	0.276	0.324	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	9589	12381	18645	24894	31856	0	0	0	0	0	0	0	0	
VARIANCE, %	79.0	63.8	63.6	65.7	67.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3702-040 QA - FY 90

Estimate vs. Actual



5. GEOLOGIC SETTING

NRC Program Element Manager: David Brooks

NRC Project Officer for Task 1: John Trapp

NRC Project Officer for Tasks 2 and 4: Tin Mo

NRC Project Officer for Subtask 4.1: William Ford

NRC Project Officer for Task 3: Jeff Pohle

CNWRA Element Manager: John L. Russell

Key Personnel: M. Board, A. Brown, R. Hart, M. Logsdon, L. Lorig,
J. Russell, W. Murphy, R. Pabalan, M. Miklas, R. Ababou
R. Green

Subcontractors/consultants: Itasca Consulting Group, Inc., Adrian Brown
Consultants, Inc.

5.1 Technical Status

In addition to those activities discussed below, other major work activities during the period were the development of the Geologic Setting Program Element components of the Center's 5-Year Plan and recruitment of technical staff. These activities are reported in the Overall Center Operations Program Element. Center geoscientists conducted work for the RDCO and EBS Program Elements promoting integration of technical input from the geosciences into technical assistance activities of the RDCO and EBS Program Elements. M. Miklas predominately performed work related to Program Architecture development conducted within the WSE&I Program Element.

Task 1 - Prelicensing Activity

W. Murphy, R. Pabalan, and L. McKague represented the Center at the NRC/DOE Technical Exchange Meeting on calcite-silica vein deposits at Yucca Mountain and vicinity. The Center representatives provided technical assistance to the NRC by participation in meetings held in Las Vegas on February 6, and through participation in discussions which occurred during a field trip to the Yucca Mountain area on February 7. Information obtained during the technical exchange was considered in the review of the "Characterization of the Quaternary Regional Hydrology Study Plan."

J. Russell, M. Miklas, R. Green, W. Murphy, and R. Pabalan reviewed portions of the DOE Study Plan 8.3.1.5.2.1 (Characterization of the Yucca Mountain Quaternary Regional Hydrology) which was selected by the NRC for Center review and prepared point papers for comments generated from the review. The final submittal of the review comments in point paper format were delivered to the NRC on February 15.

R. Ababou conducted preliminary discussions with Rex Wescott regarding the adequacy of development in the Szymanski (1989) report, of mathematical formulations to numerically estimate groundwater flow and levels as a function of regional tectonic extensional strain and geothermal effects. This activity is associated with the review of the DOE Study Plan 8.3.1.5.2.1 (Characterization of the Yucca Mountain Quaternary Regional Hydrology).

Task 2 - Regulatory and Technical Guidance Development

Technical assistance work was conducted to support the development of the Natural Resources Technical Position. The work was performed by the Center, including its subcontractor, Adrian Brown Consultants, Inc. Work was accomplished on Steps 1, 3, 4, and 7 of the technical direction from the NRC to the Center.

The contouring, 3-D net, and true 3-D modeling capabilities of Dynamic Graphics software installed on a Silicon Graphics Iris 3-D computer workstation which is at the Center on a demonstration/evaluation basis, was demonstrated to D. Chery and M. Blackford on January 22, 1990. The ability to use DOE's Site and Engineering Properties Database (SEPDB), which is installed on a SwRI VAX computer, was also demonstrated. M. Blackford was given a tour of SwRI, emphasizing the Institute's capabilities in geophysics and related disciplines.

Task 3 - Analysis, Codes, and Methods

No activity. This task is held in reserve for potential future activity. No funding presently exists for this task.

Task 4 - Review Plan Preparation

No activity. This task is held in reserve for potential future activity. No funding presently exists for this task.

Task 5 - Support Development and Maintenance of Program Architecture

This task is reported by the Waste Systems Engineering and Integration Program Element.

5.2 Major Problems

None.

5.3 Forecast for Next Period

A major activity will be technical assistance supporting the development of a Natural Resources Assessment Methodology Technical Position. Work on other TPs will commence and support will be provided to technical exchange meetings, as appropriate. J. Russell will continue to discuss with D. Brooks and other NRC staff

detailed planning for tasks designated in the Operations Plan for FY90 and 91.

5.4 Element Financial Status

Table 1, below, indicates the financial status of the Element program in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and cumulative basis. In addition, variances are shown on both a dollar and percentage basis. These data do not include commitments in the amount of \$33,990. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Expenditures are significantly under plan, although the rate of work and associated expenditures has increased significantly over the last three periods. Staff additions during Periods 5 and 6 will substantially increase the capacity to perform work within this Element. Adjustments to the budget may be appropriate when the Operations Plans are revised.

Table 1. Financial Status

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$484,609
c) Total FY90 Funds Available	\$484,609
Funds Costed to Date	\$159,352
Funds Uncosted	\$325,257
Recommended Adjustment to Complete (+/-)	\$ -0-

See the enclosed Element Status Cost Report.

Notes:

- a) The current unspent amount from previous portions of each FIN.
- b) See "Total Contract Amount" in the corresponding Element page of the "Project Status Report."
- c) Sum of (a) and (b).
- d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3702-000 GS

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	86956	65597	52228	66451	74610	76227	89411	114906	116869	111008	129603	117059	110230	345841
ACTUAL PERIOD COST	4921	27704	32741	48320	45665	0	0	0	0	0	0	0	0	159352
VARIANCE, \$	82035	37893	19486	18130	28945	0	0	0	0	0	0	0	0	186489
VARIANCE, %	94.3	57.8	37.3	27.3	38.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.9
EST. FY CUMUL COST	86956	152553	204780	271231	345841	422068	511479	626385	743255	854262	983866	1100925	1211154	
ACTUAL FY CUMUL COST	4921	32625	65366	113686	159352	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.014	0.094	0.189	0.329	0.461	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	82035	119928	139414	157545	186489	0	0	0	0	0	0	0	0	
VARIANCE, %	94.3	78.6	68.1	58.1	53.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

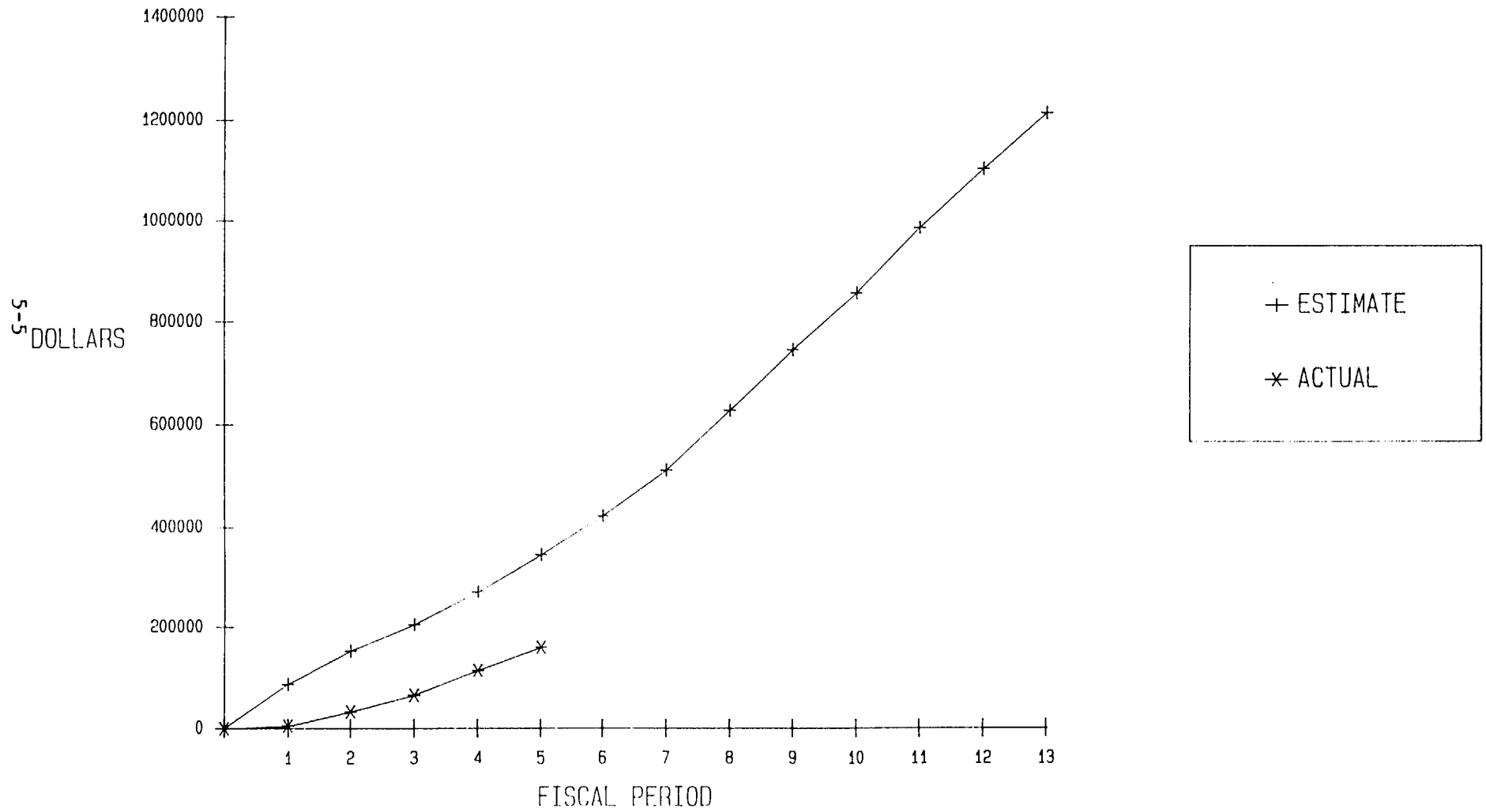
5-4

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3702-000 GS - FY 90

Estimate vs. Actual



6. ENGINEERED BARRIER SYSTEM

NRC Program Element Manager: Jerome R. Pearring

NRC Project Officer for Tasks 1-4: Kien C. Chang

CNWRA Element Manager: Prasad K. Nair

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

Subcontractors/Consultants: Systems Support, Inc.

6.1 Technical Status

During this reporting period the EBS staff continued its support to the WSE&I Program Element in the development and review of the Regulatory and Institutional Uncertainty Report. EBS staff also supported the development of the Technical Position on Thermal Loads under the WSE&I Program Element.

Task 1 - Prelicensing Activities

A supplement and revision to the EBS Program Element Operations Plan for FY90 was received from NRC on February 9, 1990. The request will be part of the Task 1.4 activity. The Center is preparing an impact assessment and developing a spending plan to be submitted in the next period.

Task 2 - Regulatory and Technical Guidance Development

The major activity under this task for this reporting period was the continuation of the feasibility study being conducted for the potential rulemaking on Substantially Complete Containment (SCC). The Center requested and NRC approved revised dates for the intermediate and major milestones for the SCC activity. The new dates for the seminar/workshop are April 2-4, 1990. Dr. Spencer Bush, an internationally recognized consultant in the areas of material sciences, reliability engineering, nuclear regulatory assessment and plant life extension has been selected by the Center to be the Chairman of the Peer Review Group to attend the SCC seminar/workshop. A total of nine peers is planned. The Center is currently in the process of completing the roster for the Peer Review Group. A draft of the peer review charter will be prepared in the next period.

(A) Technical Considerations Report

The draft report entitled, "Technical Considerations for Evaluating Substantially Complete Containment (SCC) of HLW within the Waste Package," prepared by H. Manaktala (CNWRA) and C. Interrante (NRC) was revised during this reporting period. The latest draft incorporates comments received from the three external peer reviewers, the NRC staff, revisions to the Environmental

section by CNWRA's Geologic Setting Group, and a new sub-section on Tectonics and Seismic Hazards contributed by the Itasca Consulting Group. In addition, new sections on Metallurgical Stability of Joints and Closure Welds, Uniform Corrosion, and Localized Corrosion have been added. References have been added to a number of sections. Additional pertinent references are not available at this time, but will be added in two future installments prior to releasing the draft report for the workshop and prior to releasing the final report (after the workshop).

(B) Uncertainty Evaluation Methodology Report

The first level external peer review comments and comments from the NRC and Center staff on the preliminary draft report, "Uncertainty Evaluation Methods for Waste Package Performance Assessments" were incorporated in the report. The report is co-authored by Y.-T. Wu, A. Journal (Stanford University), L. Abramson (NRC), and P. Nair. The report is being partially revised to improve the flow and to integrate the varying depths of the technical details in the Appendices.

Task 3 - Analysis Codes and Methods

P. Nair and Y. Wu participated in the Performance Assessment (PA) workshop held at Bethesda on February 15-16, 1990. At the workshop P. Nair presented the technical aspects of the EBS Performance Assessment Code (EBSPAC) and Y. Wu discussed the Fast Probabilistic Performance Assessment (FPPA) technology being developed for EBSPAC. Preliminary results using the FPPA methodology for corrosion analyses were also presented at the seminar. The workshop was attended the staff from NRC, Sandia Labs, and CNWRA. This workshop was conducted to exchange information on the status of system and subsystem performance assessment activities. An area for the EBS Element to focus in the future with the system PA is the source term development.

H. Manaktala participated in the ASTM Sub-committee C-26.13 (Repository Materials) and Sub-committee C-26.07 (Nuclear Waste) meetings in Las Vegas, Nevada, January 22-24, 1990. The main purpose of attending the meetings was to review a draft standard practice, "ASTM Standard Practice for Prediction of the Long-Term Behavior of Waste Package Materials Including Waste Forms Used in Geological Disposal of High-Level Nuclear Wastes," and resolve the negative sub-committee ballot votes on the referenced draft standard practice. There were three (3) negative and fourteen (14) positive votes; remaining sub-committee members either abstained from voting or had not responded prior to the meeting. The comments in the negative votes were resolved, and it was determined that the Standard Practice required re-balloting at the sub-committee level. Additional details are provided in a separate trip report issued on the subject.

During the above described sub-committee meetings, the subject of CNWRA's participation in the next round of round-robin tests to

determine the variability in the "Nuclear Waste Glass Product Consistency Test (PCT) Method" developed at the Savannah River Laboratory was discussed. Based on the discussions, a program plan has been prepared to develop capability at CNWRA for conducting leaching tests on vitrified wasteforms. Additional details and schedule of proposed activities through September 1991 will be submitted to the NRC for technical guidance.

Several models pertinent to localized corrosion and uniform corrosion were reviewed. These were classified as mechanistic and probabilistic models, and initiation and propagation models. A preliminary analysis of the models was completed and the salient features of selected models were documented in a report to be submitted as part of an Appendix to the EBS Milestone [49] report.

Task 4 - Review Plan Preparation

No currently planned activities.

Task 5 - Support Development and Maintenance of Program Architecture

This task is reported by the Waste Systems Engineering and Integration Program Element.

6.2 Problems

None.

6.3 Forecast for Next Period

Review of the ongoing wasteform studies will continue. Details of a plan for conducting preliminary wasteform studies will be submitted to the NRC PEM for technical guidance.

The Appendix to EBS Program Element Milestone [49] will be completed and submitted to NRC.

Revised versions of the two SCC related reports will be transmitted to NRC. Arrangements for the peer review panel for the SCC workshop on April 2-4, 1990 will be completed.

Impact and cost estimates for the new scope of work under Task 1.4 of the EBS Program Element Operations Plan will be prepared.

The review of mechanistic modelling and the development of thermal modelling capability will continue.

6.4 Financial Status

Table 1, below, indicates the financial status of the Element program in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and cumulative basis. In addition,

variances are shown on both a dollar and percentage basis. These data do not include commitments in the amount of \$11,231. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Current allocations and expenditure rates are consistent with the plan. Recent increases in activities in the Element have more than halved the cumulative percentage variance in the past three periods. An adjustment to the early-time budgets may be made when the Operations Plans are revised.

Table 1. Financial Status

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$296,406
c) Total FY90 Funds Available	\$296,406
Funds Costed to Date	\$196,182
Funds Uncosted	\$100,224
Recommended Adjustment to Complete (+/-)	\$ -0-

See the enclosed Element Status Cost Report.

Notes:

- a) The current unspent amount from previous portions of each FIN.
- b) See "Total Contract Amount" in the corresponding Element page of the "Project Status Report."
- c) Sum of (a) and (b)
- d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3702-010 EBS

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	65915	70137	42960	37039	45348	42744	43598	39883	33398	32934	32828	27937	20219	261400
ACTUAL PERIOD COST	25455	33175	49114	39165	49273	0	0	0	0	0	0	0	0	196182
VARIANCE, \$	40460	36962	-6154	-2126	-3925	0	0	0	0	0	0	0	0	65218
VARIANCE, %	61.4	52.7	-14.3	-5.7	-8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.9
EST. FY CUMUL COST	65915	136052	179012	216052	261400	304144	347742	387625	421023	453956	486784	514721	534940	
ACTUAL FY CUMUL COST	25455	58630	107744	146909	196182	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.097	0.224	0.412	0.562	0.751	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	40460	77422	71268	69143	65218	0	0	0	0	0	0	0	0	
VARIANCE, %	61.4	56.9	39.8	32.0	24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

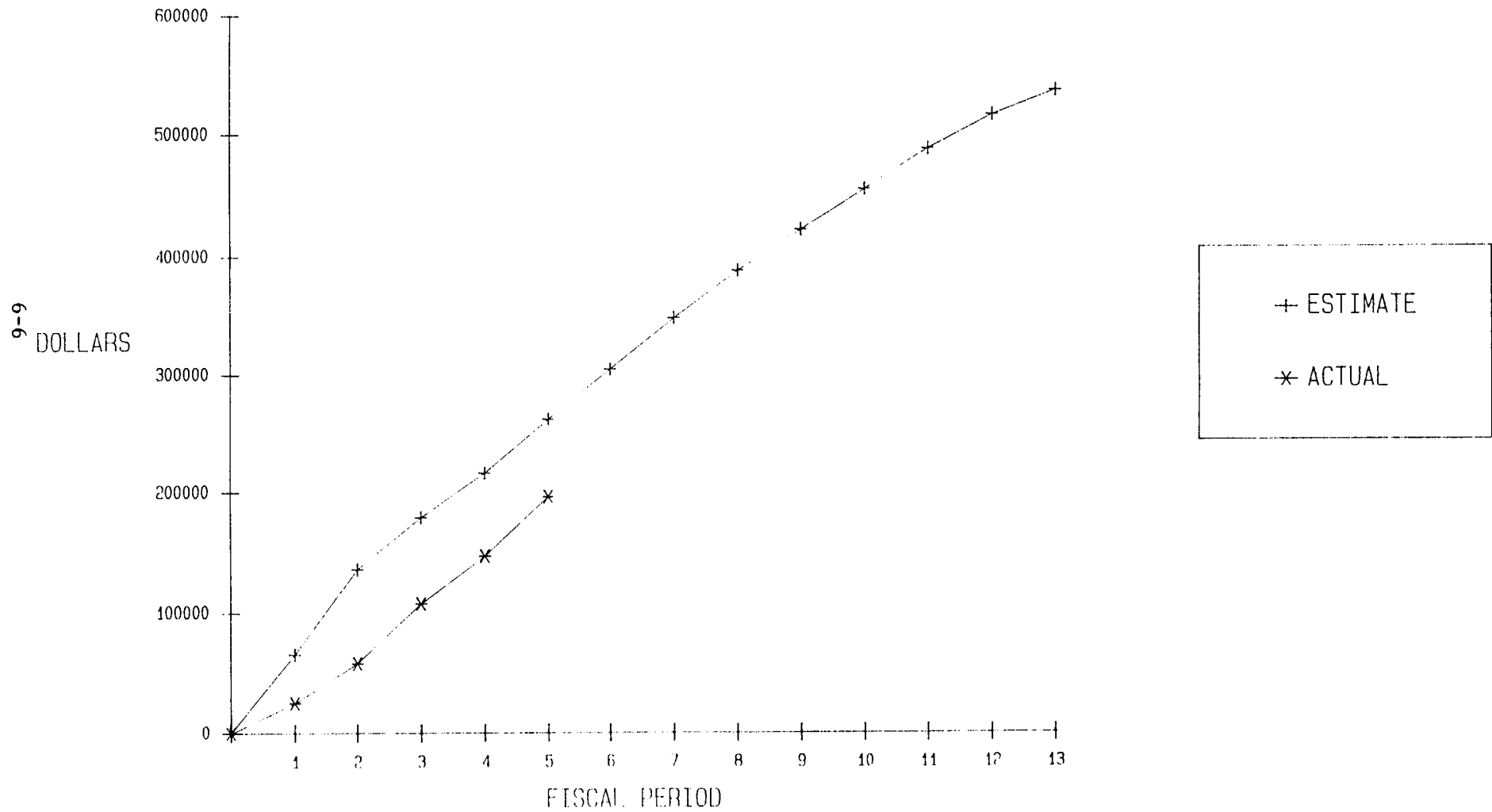
5-6

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3702-010 FBS - FY 90

Estimate vs. Actual



7. SPECIAL PROJECTS ELEMENT

NRC Program Element Manager: Mark S. Delligatti

NRC Project Officers: Robert L. Johnson, Julia A. Corrado

CNWRA Subelement Manager: John P. Hageman

Key Personnel: J. Hageman, S. Spector, R. Weiner, P. LaPlante

Subcontractors/Consultants:

7.1 Technical Status

Task 1 - Prelicensing Support

Discussions were held among J. Hageman, R. Weiner (Center), R. Johnson and M. Delligatti (NRC) on the format and contents of the License Application Review Strategy (LARS). It was suggested that Section 1 should list what the NRC should do for a review strategy and Section 2 should present the rationale for each recommended alternative of the review strategy.

J. Wolf (NRC) in a teleconference addressed specific comments and questions on the Environmental Impact Statement (EIS) Review Strategy. A brief synopsis of this teleconference and a previous one with J. Wolf was informally forwarded to the Project Officer, R. Johnson and Program Element Manager, M. Delligatti. S. Spector has completed a preliminary analysis of environmentally related statutes other than the National Environmental Policy Act that may be incorporated within EIS Review Strategy. Also, the potential NRC role in the EIS activities from the proposed and final rule changes to 10 CFR Parts 2, 51, and 60 is being summarized as the bases for the EIS Review Strategy. This summary will first present the NRC role and the rationale for an EIS Review Strategy. The NEPA with amendments and interpretive notes and decisions is also being summarized to help clarify the DOE's role in the EIS preparation and the NRC's role as a commenting agency.

7.2 Major Problems

None this period.

7.3 Forecast for Next Period

Strategy meetings and teleconferences on the LARS outline and specific LARS topic agenda items are pending. Preliminary drafts of the EIS Review Strategy and the interface and requirements of other environmentally related statutes are planned for completion.

7.4 Element Financial Status

Table 1, below, indicates the financial status of the Element program in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and cumulative basis. In addition,

variances are shown on both a dollar and percentage basis. These data do not include commitments in the amount of \$500. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Cost under runs, particularly those that occurred in Period 1, have been minimized on a period-by-period basis as work effort intensified in subsequent periods. Once the outlines for the strategy documents are completed, and other technical exchange meetings have occurred, more intensive efforts can be devoted to these tasks. No change in budget is recommended at this time.

Table 1. Financial Status

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$153,105
c) Total FY90 Funds Available	\$153,105
Funds Costed to Date	\$ 76,336
Funds Uncosted	\$ 76,769
Recommended Adjustment to Complete (+/-)	\$ -0-

See the enclosed Element Status Cost Report.

Notes:

- a) The current unspent amount from previous portions of each FIN.
- b) See "Total Contract Amount" in the corresponding Element page of the "Project Status Report."
- c) Sum of (a) and (b)
- d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3702-050 SP

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	28252	20585	23006	19573	26054	26565	22781	28568	33472	29108	26011	36127	40717	117469
ACTUAL PERIOD COST	9087	16951	14712	16785	18801	0	0	0	0	0	0	0	0	76336
VARIANCE, \$	19165	3634	8293	2788	7253	0	0	0	0	0	0	0	0	41133
VARIANCE, %	67.8	17.7	36.0	14.2	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0
EST. FY CUMUL COST	28252	48837	71843	91415	117469	144035	166815	195383	228856	257964	283975	320102	360819	
ACTUAL FY CUMUL COST	9087	26038	40750	57535	76336	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.077	0.222	0.347	0.490	0.650	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	19165	22799	31093	33880	41133	0	0	0	0	0	0	0	0	
VARIANCE, %	67.8	46.7	43.3	37.1	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

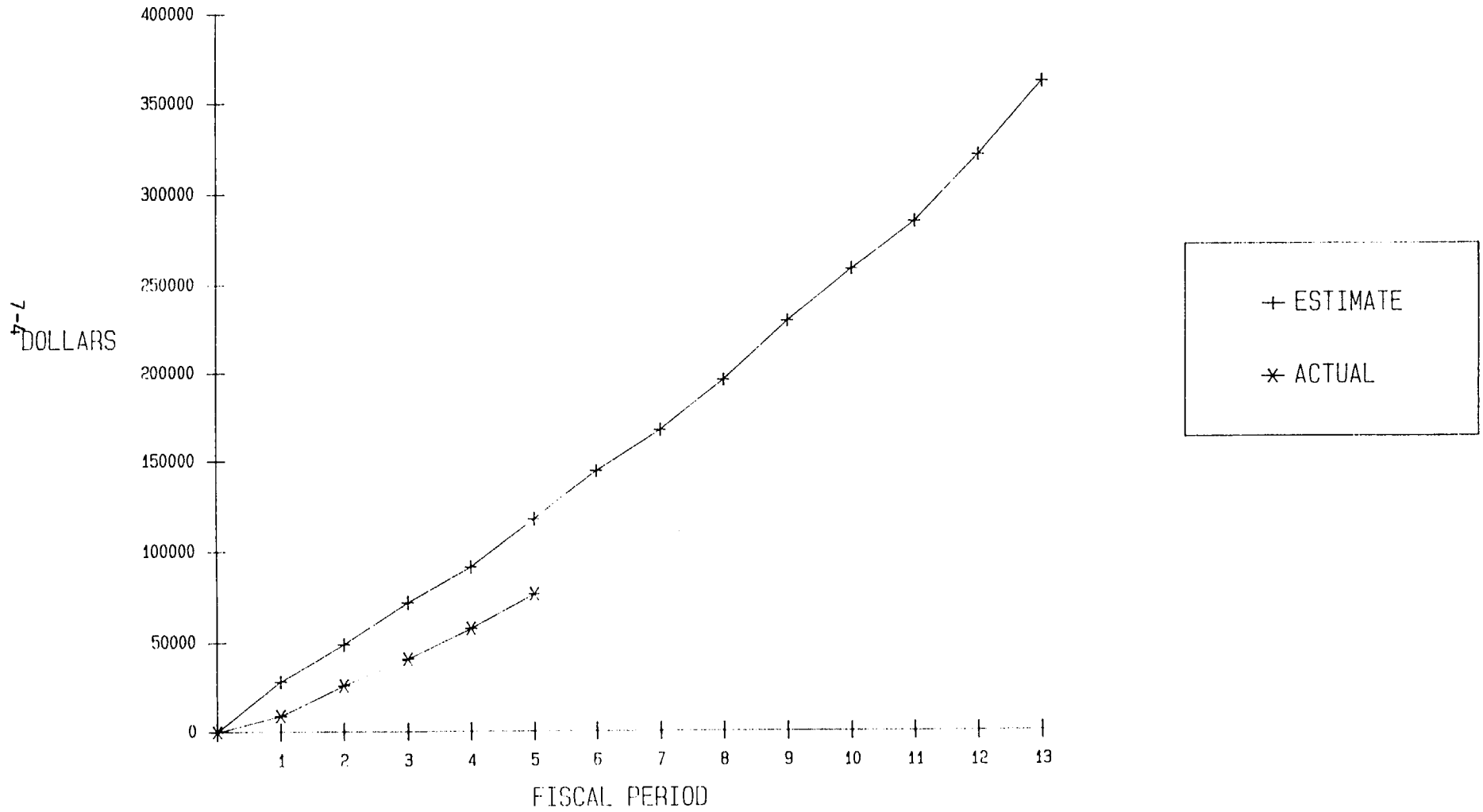
7-3

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3702-050 SP - FY 90

Estimate vs. Actual



8. REPOSITORY DESIGN, CONSTRUCTION, AND OPERATIONS

NRC Program Element Manager: Jerome R. Pearring

NRC Project Officer for Tasks 1-4: John Buckley

CNWRA Element Manager: Asadul H. Chowdhury

Key Personnel: A. Chowdhury, S. Hsiung, L. Lorig, T. Brandshaug,
J. Daemen

Subcontractors/consultants: Itasca, ABC

8.1 Technical Status

Task 1 - Prelicensing Activities

Some planning activities have been carried out during this reporting period.

Task 2 - Regulatory and Technical Guidance Development

The technical position development activities that have been performed during this reporting period include work on an approach/methodology to reduce technical uncertainties relevant to thermal loads and waste retrievability. A. Chowdhury (CNWRA), S. Hsiung (CNWRA), C. Tschoepe (CNWRA), T. Brandshaug (Itasca), L. Lorig (Itasca), M. Logsdon (ABC), and B. Basse (ABC) performed these activities. A. Chowdhury and T. Brandshaug attended a meeting at NRC on January 22, 1990, to review and discuss with NRC technical personnel the Program Architecture and technical position activities to date on thermal loads. A meeting report on this has been submitted to NRC during this period. T. Brandshaug, M. Logsdon, and B. Basse visited the Center during the week of February 5, 1990, to work on the technical position on thermal loads.

Task 3 - Analysis Codes and Methods

Not funded in FY90.

Task 4 - Review Plan Preparation

Not funded in FY90.

Task 5 - Support Development and Maintenance of Program Architecture

This activity is reported on in the WSE&I Element report.

8.2 Major Problems

None.

8.3 Forecast for Next Period

Program Architecture and technical position activities on thermal loads and waste retrievability will continue during the next reporting period. A. Chowdhury, S. Hsiung, C. Tschoepe, T. Brandshaug, L. Lorig, M. Logsdon, and B. Basse, will perform these activities. T. Brandshaug, B. Basse, J. Buckley (NRC), and P. Altomare (NRC) will visit the Center on February 22, 1990, for a meeting on Program Architecture and technical position on thermal loads. L. Lorig will visit the Center on March 6-7, 1990, to work on Program Architecture on waste retrievability.

During the next period, the RDCO Program Element will perform work on the Center Five-Year Plan and Uncertainty Analysis for 10 CFR Part 60 requirements.

8.4 Financial Status

Table 1, below, indicates the financial status of the Element program in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and cumulative basis. In addition, variances are shown on both a dollar and percentage basis. These data do not include commitments in the amount of \$40,800. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

This Element has been expending resources at a rate significantly below plan. This is a direct result of (a) focus of work in related supporting activities that are funded in the WSE&I Element and (b) lack of activities in Task 1 as a result of DOE program stretch out. It is anticipated that the rate of expenditure will increase as effort is focused on the Technical Positions in the coming periods.

Table 1. Financial Status

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$155,324
c) Total FY90 Funds Available	\$155,324
Funds Costed to Date	\$ 32,678
Funds Uncosted	\$122,646
Recommended Adjustment to Complete (+/-)	\$ -0-

See the enclosed Element Status Cost Report.

Notes:

- a) The current unspent amount from previous portions of each FIN.
- b) See "Total Contract Amount" in the corresponding Element page of the "Project Status Report."
- c) Sum of (a) and (b)
- d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as
 "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3702-020

RDCO

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	41951	42260	41961	38293	31783	31931	35447	29907	27313	22511	29708	29452	25607	196248
ACTUAL PERIOD COST	8976	6710	5385	5019	6587	0	0	0	0	0	0	0	0	32678
VARIANCE, \$	32974	35549	36575	33275	25196	0	0	0	0	0	0	0	0	163570
VARIANCE, %	78.6	84.1	87.2	86.9	79.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.3
EST. FY CUMUL COST	41951	84210	126171	164465	196248	228179	263627	293534	320847	343358	373066	402518	428125	
ACTUAL FY CUMUL COST	8976	15687	21072	26091	32678	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.046	0.080	0.107	0.133	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	32974	68524	105099	138374	163570	0	0	0	0	0	0	0	0	
VARIANCE, %	78.6	81.4	83.3	84.1	83.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

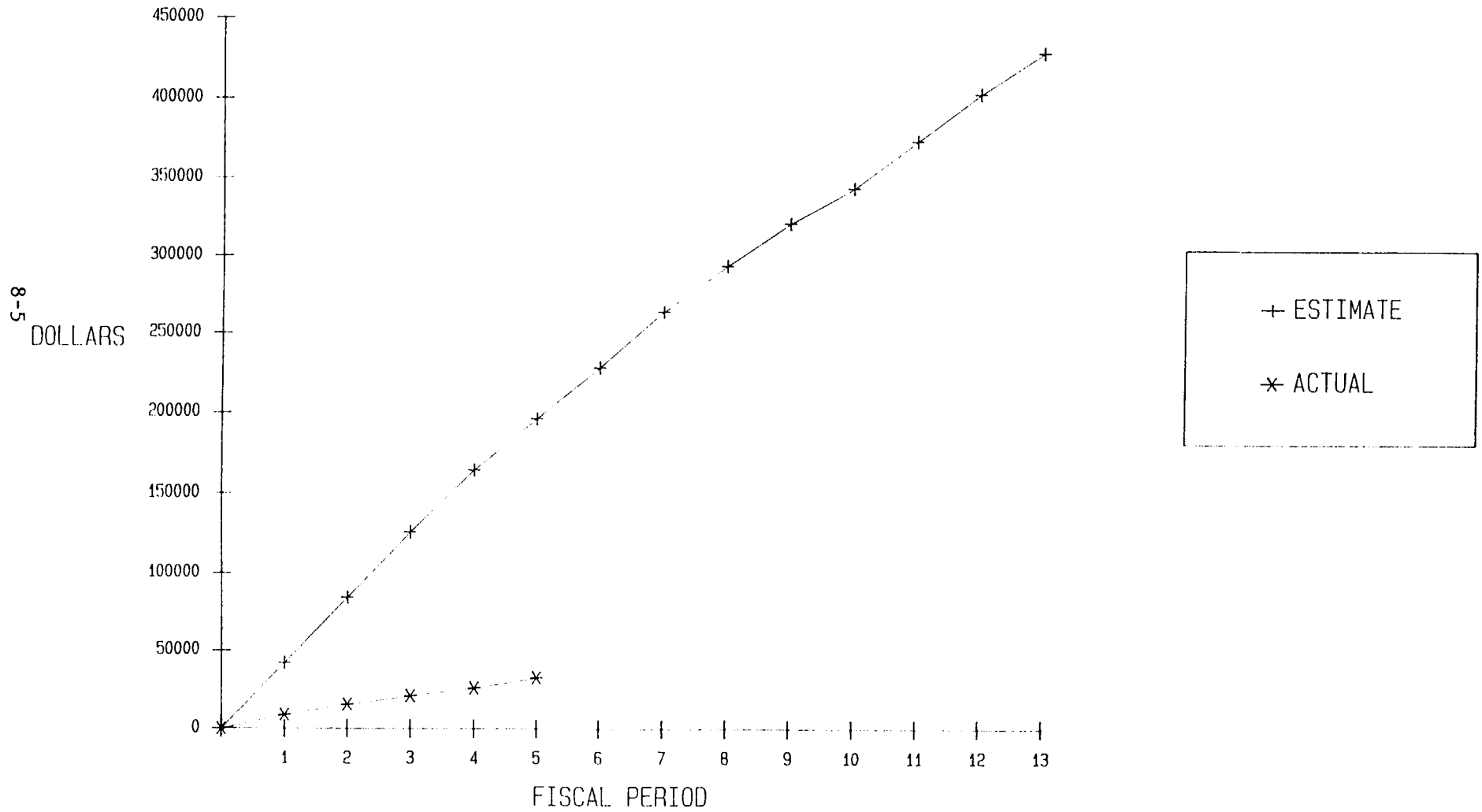
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4-

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3702-020 RDCO - FY 90

Estimate vs. Actual



9. PERFORMANCE ASSESSMENT

NRC Program Element Manager: Pauline Brooks

NRC Project Officers: None Assigned

CNWRA Element Manager: Budhi Sagar

Key Personnel: R. Ababou, R. Green, J. Hageman, W. Murphy, P Nair,
Y. WU

Subcontractors/Consultants: R. Fields

9.1 Technical Status

Task 1 - Prelicensing Reviews

No activity this period.

Task 2 - Regulatory and Technical Guidance Development

Subtask 2.1 - Conforming Amendment to the EPA Standard

No activity this period.

Subtask 2.2 - Implementing the EPA Standard

No activity this period.

Subtask 2.3 - Development of a Methodology for Scenario
Identification and Evaluation

Commented on the revised scope of work. Comments
have been incorporated by NRC.

Subtask 2.4 - Development of Guidance for Evaluating Data and
Parameter Uncertainty

Review of SNL documents continued.

Subtask 2.5 - Development of Guidance for Verification and
Validation of Computer Programs Used in Performance
Assessment

Review of SNL documents related to this Subtask
continued.

Subtask 2.6 - Development of Guidance for Formal Use of Expert
Judgment

No activity this period.

Subtask 2.8 - Design Basis Accident Dose Limit Rulemaking

J. Hageman, and R. Field continued their participation along with the NRC staff in developing a draft of the proposed rulemaking. Three parallel activities are going on under this subtask: 1) development of a work plan for completing the subtask; 2) writing of an 'implementability' document for the proposed rule; and 3) drafting of the rule. Discussions among working group members on the draft rule took place via two teleconferences. J. Hageman held several discussions with P. Brooks on the work plan. An 'implementability document' was prepared and submitted to the NRC for review.

Task 4 - Review Plan Preparation

Subtask 4.2 - Performance Assessment Review Strategy

No activity this period

Task 5 - Iterative Performance Assessment

The first workshop on Performance Assessment was held at the Maryland National Bank Building on February 15-16, 1990. The workshop was attended by staffs of NRC (NMSS and RES), CNWRA, and SNL. NRC staff discussed in detail results of the recently completed MOU1 exercise. The SNL staff presented summaries of the new performance assessment codes (unsaturated flow code and NEFTRAN-III) that are under development at Sandia. Participants from the Center gave presentations on PA technology currently under development. These included discussion on EBSPAC (for engineered barrier system PA), hydrology, geochemistry, and total system PA. It was decided that a smaller subgroup will meet later to decide on the work to be done during the second iteration of performance assessment.

B. Sagar discussed the work that the Center staff may perform for the second iteration of performance assessment in a teleconference with S. Coplan, P. Brooks, J. Randall, and N. Eisenberg. It was decided that further discussions will be needed to define this work.

9.2 Major Problems

We expect to do work on PARS (Subtask 4.2) which has no funding. Discussions are underway to transfer funds from Task 5 to Task 4.

9.3 Forecast for Next Period

R. Weiner will work with P. Brooks and D. Fehringer and other NMSS staff to finalize the scope of the TP on scenario identification and evaluation, and to write a work plan for this activity. Review of SNL documents produced under FIN All65 on techniques for determining probabilities and of evaluating scenarios will continue.

Work on Subtask 2.8 will continue.

Center staff participation in the second iteration of the total system performance assessment will be finalized.

9.4 Element Financial Status

Table 1 below, indicates the financial status of this Element in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and a cumulative basis. In addition, variances are shown on both a dollar and percentage basis. These data do not include commitments in the amount of \$6,297. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

The rate of expenditure in this Element has been significantly under plan due to (a) concentration on planning activities during initiation of tasks under this Element, (b) low staff availability as hiring continues in this crucial area, and (c) lack of activity in Task 1 due to DOE program stretch out. This situation has begun to be rectified as activities in Tasks 4 and 5 intensify.

Table 1. Financial Status

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$252,299
c) Total FY90 Funds Available	\$252,299
Funds Costed to Date	\$136,952
Funds Uncosted	\$115,347
Recommended Adjustment to Complete (+/-)	\$ -0-

See the enclosed Element Status Cost Report.

Notes:

- The current unspent amount from previous portions of each FIN.
- See "Total Contract Amount" in the corresponding Element page of the "Project Status Report."
- Sum of (a) and (b)
- Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3702-060

PA

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	50673	49527	49705	49822	56358	62611	45675	56920	60311	51962	50768	40802	59047	256086
ACTUAL PERIOD COST	17497	18629	21922	30415	48489	0	0	0	0	0	0	0	0	136952
VARIANCE, \$	33176	30899	27783	19408	7869	0	0	0	0	0	0	0	0	119135
VARIANCE, %	65.5	62.4	55.9	39.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.5
EST. FY CUMUL COST	50673	100201	149906	199728	256086	318697	364372	421292	481603	533565	584333	625135	684182	
ACTUAL FY CUMUL COST	17497	36126	58047	88462	136952	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.068	0.141	0.227	0.345	0.535	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	33176	64075	91858	111266	119135	0	0	0	0	0	0	0	0	
VARIANCE, %	65.5	63.9	61.3	55.7	46.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

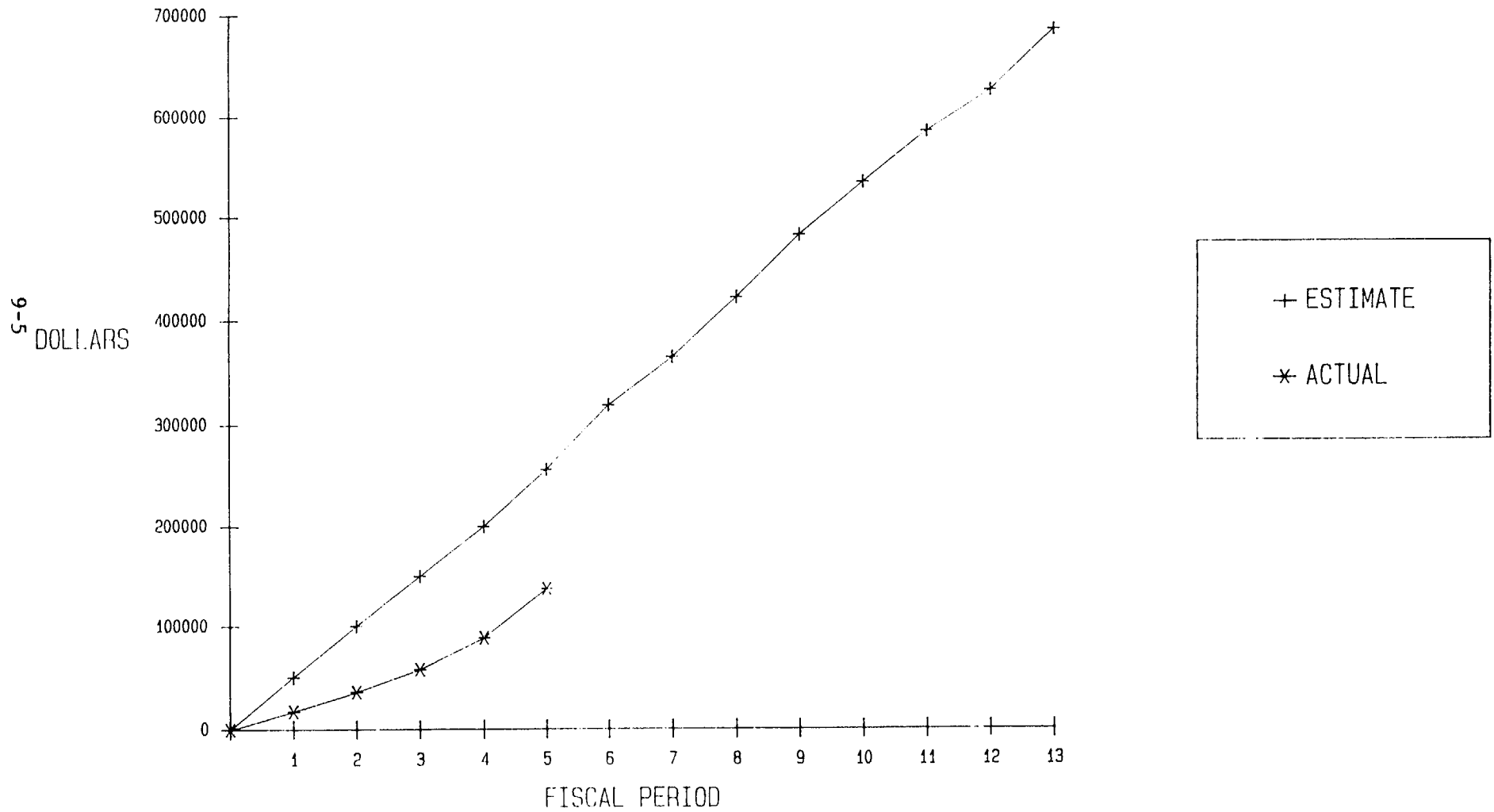
7-6

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3702-060 PA - FY 90

Estimate vs. Actual



10. 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, J. Buckingham

Subcontractor/Consultant:

10.1 Technical Status

Task 1 - Completion of Overview and Scoping

No further activity assigned. Project is suspended as of May 31, 1990.

Task 2 - Evaluation and Assessment of Data, Models, and Codes - Recommendations and Uncertainty and Sensitivity Analysis

Subtask 2.1 - Evaluation of Data and Databases

J. Buckingham has almost completed extracting shipment-based and package-based data from the original entries to the SAND84-7174 database.

Subtask 2.2 - Evaluation of Models and Codes

Preliminary RADTRAN analysis of maximum and median doses from incident-free transportation is complete. RADTRAN analysis continues.

Subtask 2.3 - Uncertainty and Sensitivity Analysis

No further activity assigned. Project is suspended as of May 31, 1990.

Task 3 - Analysis of Regulations Governing Radioactive Materials Transportation

Responses to NRC comments on the preliminary draft of Chapter 2 of the TRS (the analysis of transportation regulations) awaited Center internal review when the project was terminated. There will be no redraft of Chapter 2 - it remains as submitted.

Task 4 - Discussion and Analysis of Transportation Alternatives

No further activity assigned. Project is suspended as of May 31, 1990.

Task 5 - Analyses of Radiological Effects of Radioactive Materials Transportation

Subtask 5.1 - Radiological Effects and Risk Analysis of Normal Transportation

Analysis of scenarios for normal (incident-free) transportation is continuing, using the dose calculations done in NUREG-0170 with scenarios developed from the SAND84-7174 database. Comparison with Table 4-16 in NUREG-0170 is complete. R. Weiner will present a paper on preliminary results at Waste Management 90, Tucson, AZ, February 26, 1990.

Subtask 5.2 - Radiological Effects and Risk Analysis of Transportation Accidents

No further activity assigned. Project is suspended as of May 31, 1990.

Subtask 5.3 - Security and Safeguards Considerations

No further activity assigned. Project is suspended as of May 31, 1990.

Subtask 5.4 - Radiation Dose and Risk Analysis

Construction of scenarios for representative shipments continues.

Task 6 - Analysis of Non-Radiological Impacts of Radioactive Materials Transportation, and Consideration of Human Factors

No further activity assigned. Project is suspended as of May 31, 1990.

10.2 Major Problems

None.

10.3 Forecast for Next Period

R. Weiner and P. LaPlante will continue the RADTRAN analysis of representative shipments. It is anticipated that there will be risk results to report at the end of the next period.

10.4 Subelement Financial Status

Table 1, below, indicates the financial status of this Element in the context of "allocated" and "available" funds established by the

NRC. Table 2 displays planned and actual costs to date on both a per period and cumulative basis. In addition, variances are shown on both a dollar and percentage basis.

Allocation and expenditure of funds appears to be appropriate at this time but will be reevaluated in light of NRC's decision regarding curtailment of transportation-related activities.

Table 1. Financial Status

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$ 88,479
c) Total FY90 Funds Available	\$ 88,479
Funds Costed to Date	\$ 62,288
Funds Uncosted	\$ 26,191
Recommended Adjustment to Complete (+/-)	\$ -0-

See the enclosed Element Status Cost Report.

Notes:

- a) The current unspent amount from previous portions of each FIN.
- b) See "Total Contract Amount" in the corresponding Subelement page of the "Project Status Report."
- c) Sum of (a) and (b)
- d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3703-000 TRS

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	15235	15035	16369	15601	21213	21154	24456	22411	23887	22559	22554	27844	29871	83453
ACTUAL PERIOD COST	9382	12154	16785	10897	13070	0	0	0	0	0	0	0	0	62288
VARIANCE, \$	5853	2881	-416	4704	8143	0	0	0	0	0	0	0	0	21165
VARIANCE, %	38.4	19.2	-2.5	30.2	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.4
EST. FY CUMUL COST	15235	30270	46639	62240	83453	104607	129063	151474	175361	197920	220474	248318	278189	
ACTUAL FY CUMUL COST	9382	21535	38320	49218	62288	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.112	0.258	0.459	0.590	0.746	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	5853	8735	8319	13022	21165	0	0	0	0	0	0	0	0	
VARIANCE, %	38.4	28.9	17.8	20.9	25.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

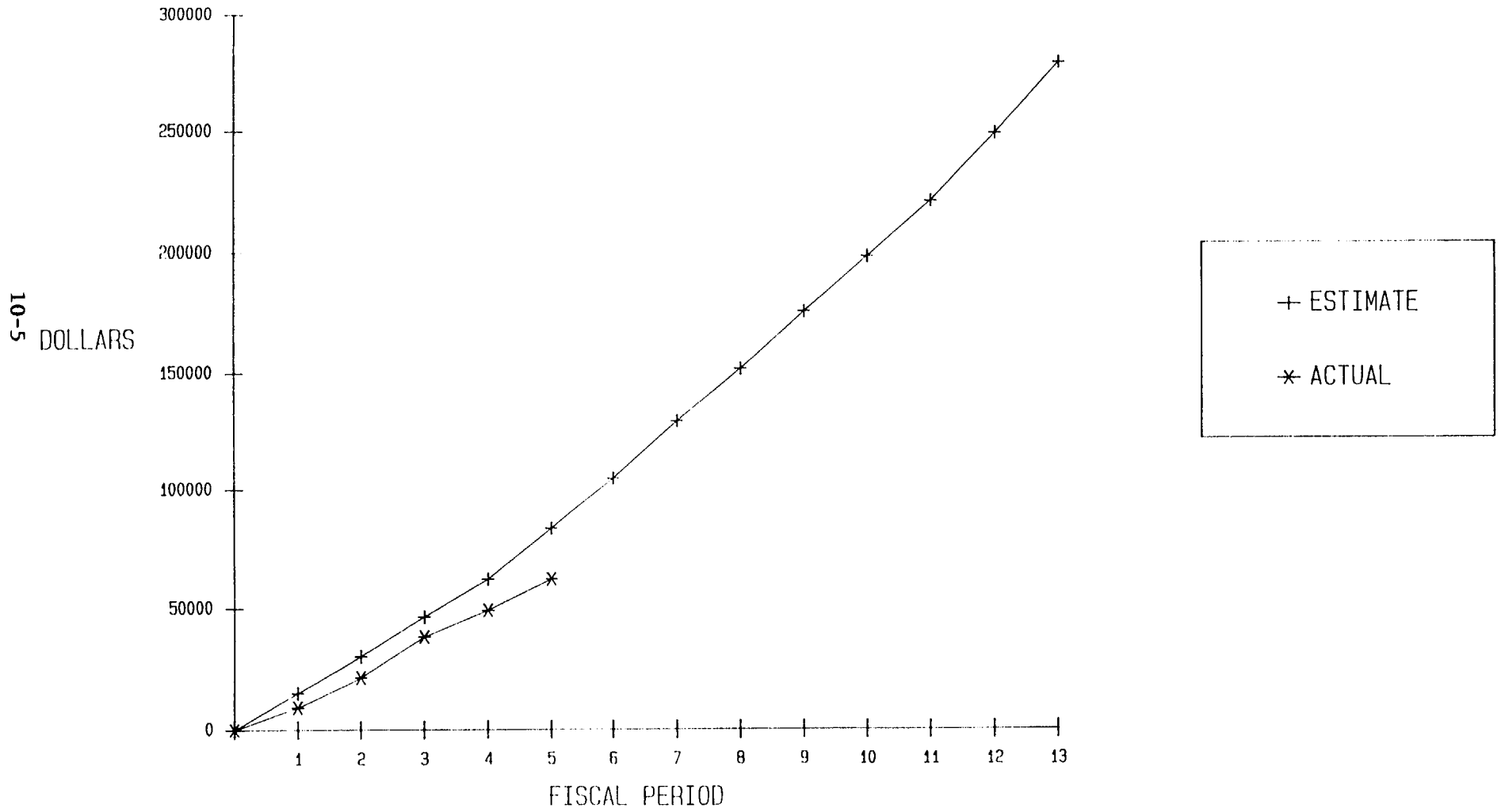
10-01

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.
4. TRS Estimates are taken from the Year 2 Project Plan submitted on 04/04/89 (Revision 1).

3703-000 TRS - FY 90

Estimate vs. Actual



11. RESEARCH

NRC Program Element Manager: William R. Ott

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

NRC Project Officer for
Thermohydrology Research Project: Linda A. Kovach

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

NRC Project Officer for
Stochastic Analyses Research Project: Thomas Nicholson

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

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

CNWRA Project Manager for
Overall Research Project: Prasad Nair

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

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

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

CNWRA Project Manager for
Stochastic Analysis Research Project: John L. Russell

CNWRA Project Manager for
Seismic Rock Mechanics Research Project: Asad Chowdhury

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

Key Personnel: B. Brady, G. Cragolino, F. Dodge, C. Freitas, S. Hsiung,
D. Kana, M. Lewis, F. Lyle, H. Manaktala, W. Murphy, P.
Nair, R. Pabalan, J. Russell, N. Sridhar, B. Vanzant, A.
Chowdhury, R. Ababou, R. Green

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

11.1 Technical Status

Laboratory experiments for three Center Research Projects continued to be carried out in Building 57. The experimental facilities for the Seismic Rock Mechanics project are set up in the high bay area within the Engineering and Material Sciences Division's Building 128. The Center is also using analytical equipment and analyses from the Chemistry and Chemical Engineering Division at the Institute.

Research Project 1 - Overall Research Plan

A revised Overall Research Plan for Fiscal Years 1990 and 1991, was submitted to the NRC on November 30, 1989. The status of the Research Project Plans, as identified in the Overall Research Project Plan, is shown below.

<u>Project</u>	<u>Title</u>	<u>Revised Plan Completion Date</u>	<u>Approval Status</u>
Res. 1-Overall Research Plan		11/30/89	Pending Approval
Res. 2-Geochemistry		01/13/89	Approved
Res. 3-Thermohydrology		05/12/89	Approved
Res. 4-Seismic Rock Mechanics		10/30/89	Approved
Res. 5-Integrated Waste Package		12/30/88	Revision planned
Res. 6-Stochastic Analysis of Unsaturated Flow and Transport		10/26/89	Revision planned for 03/30/90
Res. 7-Geochemical Analog of Contaminant Transport		01/4/90	Pending Approval
Res. 8-Long Term Climatological Effects on Ground-Water Recharge and Site Hydrology		SOW received	Project Plan development pending

Research Project 2 - Geochemistry

Revisions and additions requested by G. Birchard on the annual milestone report titled, "Progress in Experimental Studies on the Thermodynamic and Ion Exchange Properties of Clinoptilolite," for the experimental task of the project were made by R. Pabalan. The report was reviewed for technical and programmatic content by the Center, and was submitted to the NRC during Period 5. The report summarizes the theoretical background for the experimental studies, the data generated in sample characterization, and procedures for experimental work.

Characterization of zeolite samples from several localities in the U.S. was completed. X-ray diffraction, scanning electron microscopy coupled with energy dispersive x-ray spectrometry, and petrographic microscopy were used to characterize the samples. Based on the sample characterization investigations, samples from Death Valley Junction, California were chosen as the clinoptilolite samples which will be used to conduct the experiments proposed in the Geochemistry Research Project Plan. Work was initiated to prepare sufficient quantities of powdered samples of different

grain sizes to provide ample material for the experiments. Procedures to eliminate mineral impurities in the samples using heavy liquids were tested.

A technical review of the status of the Task 1 activity entitled, "Application of cryo-electron microscopy and x-ray microanalysis to geochemical characterization of pore waters," was conducted on February 1. J. Russell, W. Murphy, and R. Pabalan visited the University of Texas-San Antonio facilities where the research is being conducted, and where given a demonstration of the techniques which have been utilized by S. Birnbaum. Although completion of the work has previously been hampered by delays associated with equipment breakdowns, the techniques for quench freezing pore waters to an amorphous state and for transferring the sample to a cryogenic stage on a scanning electron microscope were demonstrated. Sublimation of the amorphous "ice" allowed scanning electron microscope observation of the distribution of the "ice" and energy dispersive x-ray spectrometry was used to demonstrate the capability of determining selected chemical elements in the "ice."

W. Murphy wrote a review of a paper submitted to *Geochimica et Cosmochimica Acta* on hydrothermal kaolinite-muscovite reactions at the request of the author. W. Murphy also briefed G. Cragnolino, a new Center staff member working in the EBS area, on the Yucca Mountain groundwater chemistry.

The computer program SOLCALC, which was developed by R. Pabalan at the University of California-Berkeley, was revised. Ion interaction parameters for aqueous electrolyte mixtures NaCl-KCl, NaCl-CaCl₂, NaCl-SrCl₂, and CaCl₂-SrCl₂ available in the literature were reviewed and added to SOLCALC. Validation of the program was conducted by comparing calculated activity coefficients, osmotic coefficients, and/or mineral solubilities with experimental data available in the literature. This program will be used to derive thermodynamic exchange constants from published experimental ion exchange data, for example, by Ames (1964).

Research Project 3 - Thermohydrology

The traversing tracking and data acquisition system for the separate effects experiments is operational and has been used during "shake down" runs. The completed system has performed as designed. A gamma-ray densitometer has been incorporated onto the traversing tracking and data acquisition system to provide x-y distributions of water versus gas saturation of the media in the test apparatus. The assembled tracking system was calibrated by comparing it to a standard Starrett scale. Tensiometers were calibrated by checking the pressure transducer using a manometer. Thermistors were calibrated at five temperatures.

The initial separate effect experiment was commenced on February 20, 1990, using a 24 in. high, 24 in. wide, and 3 in. depth test chamber containing 160 micron diameter spherical glass beads.

Water was mixed with the beads to achieve an approximately 35% initial saturation of the pore space. The initial experiment is being conducted under isothermal conditions. There are a total of nine thermistors and five tensiometers installed in the test chamber for this experiment. One additional thermistor is used to monitor the ambient temperature external to the test chamber. After monitoring initial conditions, water was injected at one location. Temperature, pressure and moisture content were initially recorded every 30 minutes. The interval was later increased to one hour. The purpose of this experiment is to check the equipment for reliability and to observe the possible movement of water under the above mentioned conditions. The experiment will have a duration of approximately eight days.

An internal QA audit of the thermohydrology project was performed on January 24, 1990. A single unsatisfactory finding regarding compliance with quality assurance requirements was identified during the audit.

The TOUGH code has been installed on both a VAX 8700 (a SwRI based computer) and was installed on a Silicon Graphics work station (on loan to the CNWRA). The program appears to perform as intended when run using the VAX 8700, however, it was not made operational on the work station. Additional adaptation and verification of the program would be required to use a Silicon Graphics work station to run the program.

R. Green provided much Center input for the planning of a meeting to discuss certain aspects of thermohydrology with technical investigators at Lawrence Berkeley and Lawrence Livermore National Laboratories. He also traveled to Tucson, Arizona where he discussed research related to thermohydrology with individuals at the University of Arizona who are conducting hydrologic research. He visited the Apache Leap Field Experiments Site on January 30, with representatives from the University of Arizona.

Research Project 4 - Seismic Rock Mechanics Studies

The major activities related to the Seismic Rock Mechanics Research Project that took place during this reporting period include: (i) the qualification studies of computer codes, (ii) instrumented field study effort, (iii) the tuff specimens acquisition effort, and (iv) seismic rock mechanics experimental apparatus and instrumentation development and calibration.

A technical report for the completed qualification studies of the two-dimensional finite element code HONDO II against some benchmark analytical problems was prepared during this reporting period and was submitted to NRC on February 21, 1990. Qualification studies of the three-dimensional finite element code SPECTROM 331 was initiated during this period. A technical paper entitled "Verification Studies on the UDEC Computational Model of Jointed Rock", has been submitted for presentation at the International Conference on Mechanics of Jointed and Faulted Rock to be held in Vienna, Austria, April 18-20, 1990.

Negotiation continued between the Center and the Lucky Friday Mine, Idaho, to permit the Center to conduct instrumented field studies at the Lucky Friday Mine for (a) dynamic effects on underground openings and (b) seismic effects on the hydrologic regime. A. Chowdhury of CNWRA, B. Brady, M. Board and W. Blake (on-site consultant) of Itasca visited the Lucky Friday Mine, Mullan, Idaho on February 6, 1990 to discuss the project planning and instrumentation location selection in detail. The 5200 Station and 5700 Station of the Lucky Friday Mine were selected for instrumented field studies for (i) dynamic effects on underground openings, and (ii) seismic effects on the hydrologic regime, respectively. Discussion took place with Lucky Friday Mine Geologist T. Devoe concerning coordination between the Lucky Friday Mine, Fausett Diamond Drilling Company and the Center for carrying out drilling work and site preparation. Negotiation between the Fausett Diamond Drilling Company and the Center is continuing concerning the contract for drilling 1200 ft. long, 3 in. diameter bore hole for studying seismic effects on the hydrologic regime. On February 7, 1990 A. Chowdhury and B. Brady visited the Spokane Research Center of the Bureau of Mines.

Collection of jointed tuff specimens from the Apache Leap Site, Arizona has been completed during this reporting period. S. Hsiung (CNWRA) supervised the rock specimen collection activities at the site.

A technical report for the custom-made rock joint dynamic shear test apparatus was prepared during this period and was submitted to NRC on February 5, 1990. This also included the preparation of the Center Technical Operating Procedure TOP-007: "Procedure for Assembling and Testing Jointed-Rock Tuff Specimens Using a Dynamic Simulator which Produces Dynamic Shear and Compressive Normal Loads".

A. Chowdhury reviewed a research proposal for NSF entitled "Development of a Viscoplastic Constitutive Model for Cohesive Soils Applicable to Monotonic and Cyclic Loading."

Research Project 5 - Integrated Waste Package Experiments

The new experimental program plan is near completion. It is anticipated that it will be submitted in March 1990. Essentially, this will divide the overall program in to five tasks: Localized Corrosion, Stress Corrosion Cracking, Materials Stability, Microbiologically Induced corrosion, and Other Degradation Modes (Including Hydrogen Embrittlement and Internal Canister Corrosion).

The EG&G Model 273 potentiostat was received from PAR after repairs. After receipt, ASTM G-5 and G-61 tests were conducted and the results were found to be in reasonable agreement with ASTM curves. A report documenting these evaluations was prepared.

Experiments on the statistical variability of potentiodynamic polarization parameters were started. It was found after the

initial run that, in Simulated J-13 water, the open-circuit potential showed considerable variation (50 - 100 mV) with the position of the reference electrode and the solution used in the salt bridge. Although this is expected because of the low conductivity of the simulated J-13 water, it emphasizes the point that even seemingly minor details can have a significant impact on experimental results. Use of a slightly more concentrated electrolyte in the salt bridge eliminated the problem. Another problem was the EG&G salt bridge design which may introduce unknown thermal liquid-junction potentials. Other experimental design changes included accommodation of a condenser and changes in sparger. It was felt that an overhaul of the cell design was necessary to conduct this experiment reproducibly and accurately. The glassware and samples for the modified cell design are being manufactured.

Samples of all the alloys have been submitted to Division 6 metallography lab for optical and SEM analysis. The main purpose is to document the starting microstructures and surface chemical compositions of the alloys.

N. Sridhar and P. Reed (NRC) visited Prof. Bryan Wilde at Ohio State University to discuss status of the Hydrogen absorption program and further action items. It appears that this program should continue to its contracted conclusion at the end of this year. Some assistance was given to Dr. Wilde's students in procuring material and in some of the experimental details. While at Columbus, N. Sridhar visited the Cortest labs (Dr. John Beavers) for discussion on some of the IWPE related experimental studies being conducted at Cortest.

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

R. Ababou participated during February 5-7, 1990, in an INTRAVAL meeting which occurred at Las Vegas. He presented information on stochastic analysis of hydrologic data pertinent to the Las Cruces trench experiment and other related topics at the meeting. Graphic representations of flow and transport data used in the presentation at the meeting were made at the Center utilizing a Silicon Graphics Iris workstation using Dynamic Graphics software.

Research Project 7 - Geochemical Analogs

The final revised Geochemical Analogs Research Project Plan was prepared by W. Murphy, approved by the Center, and submitted to the NRC for approval. Work on planning a Geochemical Analogs Workshop was accomplished in the Overall Research Project.

11.2 Major Problems

None.

11.3 Forecast for Next Period

An outline of recommended changes to the IWPE project plan will be prepared and submitted to the NRC. The Plan for Project 7 will be approved and the Project 6 Plan will be revised to reflect NRC comments. Other research activities will continue in accordance with the approved Project Plans.

11.4 Element Financial Status

Table 1, below, indicates the financial status of the Research program in the context of "allocated" and "available" funds established by the NRC. Table 2 displays planned and actual costs to date on both a per period and cumulative basis. In addition, variances are shown on both a dollar and percentage basis. There are outstanding subcontractor commitments totalling \$212,786 related to these projects. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Delays in new project start-ups, primarily due to need for additional staff in geosciences, has resulted in underruns in the Overall Research Project. The Geochemistry project is somewhat under target at this time. Although the Thermohydrology and Seismic Rock Mechanics Projects indicate that expenditures are substantially greater than planned, this is not the case. The revised spending plans for these projects will accommodate the indicated expenditures. Spending in the IWPE Project has been purposely reduced, pending establishment and approval of a revised Project Plan.

Table 1. Financial Status

Overall

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$110,865
c) Total FY90 Funds Available	\$110,865

Funds Costed to Date	\$ 60,773
Funds Uncosted	\$ 50,092

Recommended Adjustment to Complete (+/-)	\$ -0-
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Geochemistry

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$104,419
c) Total FY90 Funds Available	\$104,419

Funds Costed to Date	\$ 76,691
Funds Uncosted	\$ 27,728

Recommended Adjustment to Complete (+/-)	\$ -0-
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Thermohydrology

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$108,484
c) Total FY90 Funds Available	\$108,484

Funds Costed to Date	\$124,845
Funds Uncosted	\$ (16,361)

Recommended Adjustment to Complete (+/-)	\$ -0-
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Seismic Rock Mechanics

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$200,755
c) Total FY90 Funds Available	\$200,755

Funds Costed to Date	\$195,505
Funds Uncosted	\$ 5,250

Recommended Adjustment to Complete (+/-)	\$ -0-
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Integrated Waste Package

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$201,522
c) Total FY90 Funds Available	\$201,522

Funds Costed to Date	\$119,217
Funds Uncosted	\$ 82,305

Recommended Adjustment to Complete (+/-)	\$ -0-
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Stochastic Analysis

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$ 10,000
c) Total FY90 Funds Available	\$ 10,000

Funds Costed to Date	\$ 5,590
Funds Uncosted	\$ 4,410

Recommended Adjustment to Complete (+/-)	\$ -0-
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Geochemical Analogs

a) Prior Year Funds Uncosted	\$ -0-
b) FY90 Funds Allocated	\$ 27,600
c) Total FY90 Funds Available	\$ 27,600

Funds Costed to Date	\$ 1,505
Funds Uncosted	\$ 26,095

Recommended Adjustment to Complete (+/-)	\$ -0-
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Notes:

- a) The current unspent amount from previous portions of each FIN.
- b) See "Total Contract Amount" in the corresponding Element page of the "Project Status Report."
- c) Sum of (a) and (b)
- d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure of monies from this category of funding for those commitments outstanding in FY89 under the then current Elements/Projects.

3704-000 OVERALL

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	5491	36066	48114	36359	11733	11185	14787	18746	14624	13949	5076	8067	34459	137762
ACTUAL PERIOD COST	13507	11781	11352	12086	12047	0	0	0	0	0	0	0	0	60773
VARIANCE, \$	-8016	24285	36762	24273	-315	0	0	0	0	0	0	0	0	76989
VARIANCE, %	-146.0	67.3	76.4	66.8	-2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.9
EST. FY CUMUL COST	5491	41557	89670	126030	137762	148947	163734	182480	197104	211053	216129	224195	258654	
ACTUAL FY CUMUL COST	13507	25288	36640	48726	60773	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.098	0.184	0.266	0.354	0.441	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-8016	16268	53030	77304	76989	0	0	0	0	0	0	0	0	
VARIANCE, %	-146.0	39.1	59.1	61.3	55.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

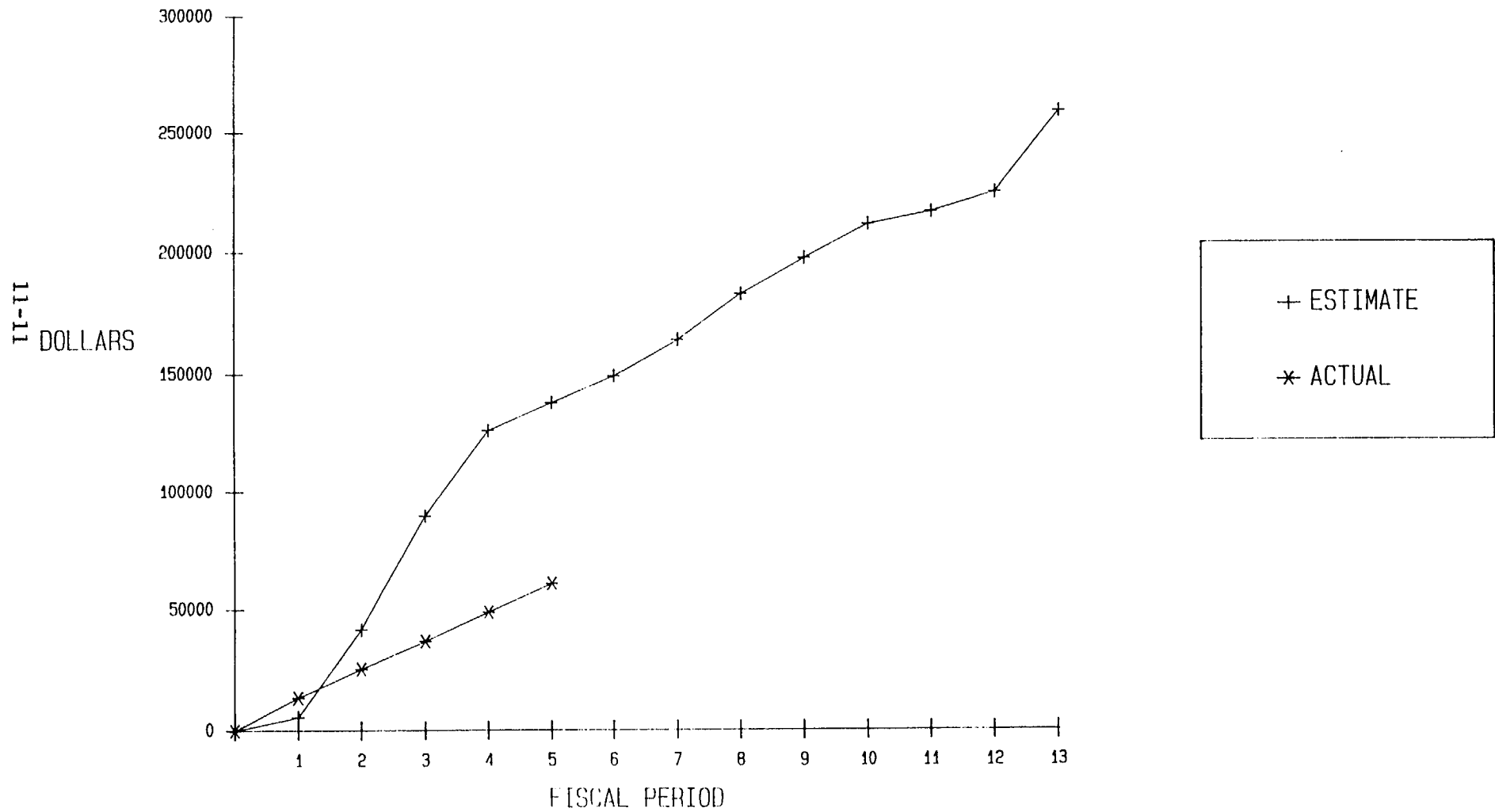
11-11

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3704-000 OVERALL - FY 90

Estimate vs. Actual



3704-010

GEOCHEM

Element Status Cost Report

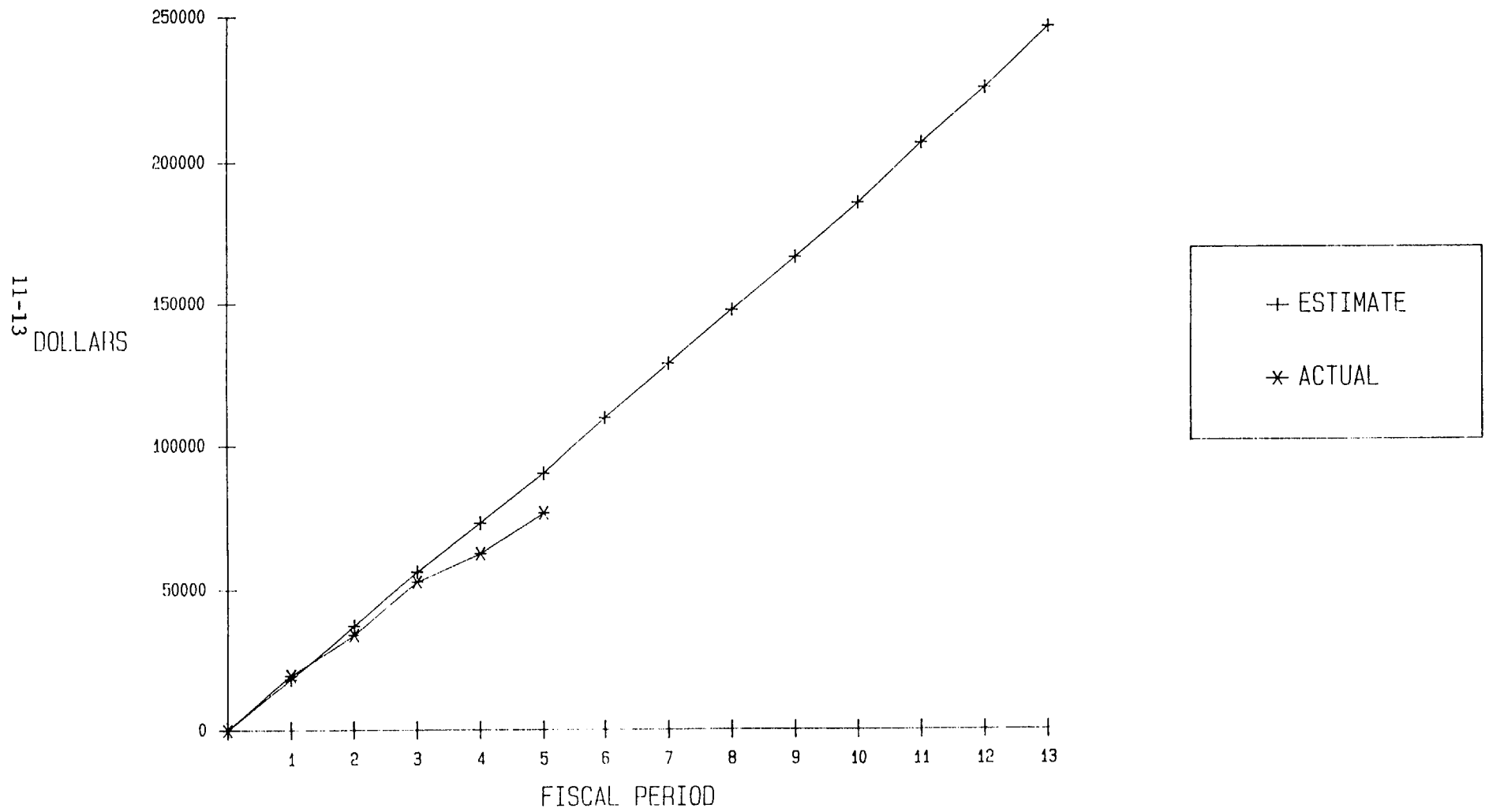
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	18219	19041	19041	17041	17041	19041	19041	18928	18928	18928	20928	18928	20684	90382
ACTUAL PERIOD COST	19634	14425	18742	9889	14000	0	0	0	0	0	0	0	0	76691
VARIANCE, \$	-1415	4616	299	7152	3040	0	0	0	0	0	0	0	0	13691
VARIANCE, %	-7.8	24.2	1.6	42.0	17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.1
EST. FY CUMUL COST	18219	37260	56301	73341	90382	109423	128464	147392	166320	185249	206177	225105	245789	
ACTUAL FY CUMUL COST	19634	34060	52802	62691	76691	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.217	0.377	0.584	0.694	0.849	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-1415	3200	3499	10651	13691	0	0	0	0	0	0	0	0	
VARIANCE, %	-7.8	8.6	6.2	14.5	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3704-010 GEOCHEM - FY 90

Estimate vs. Actual



3704-020

THERMO

Element Status Cost Report

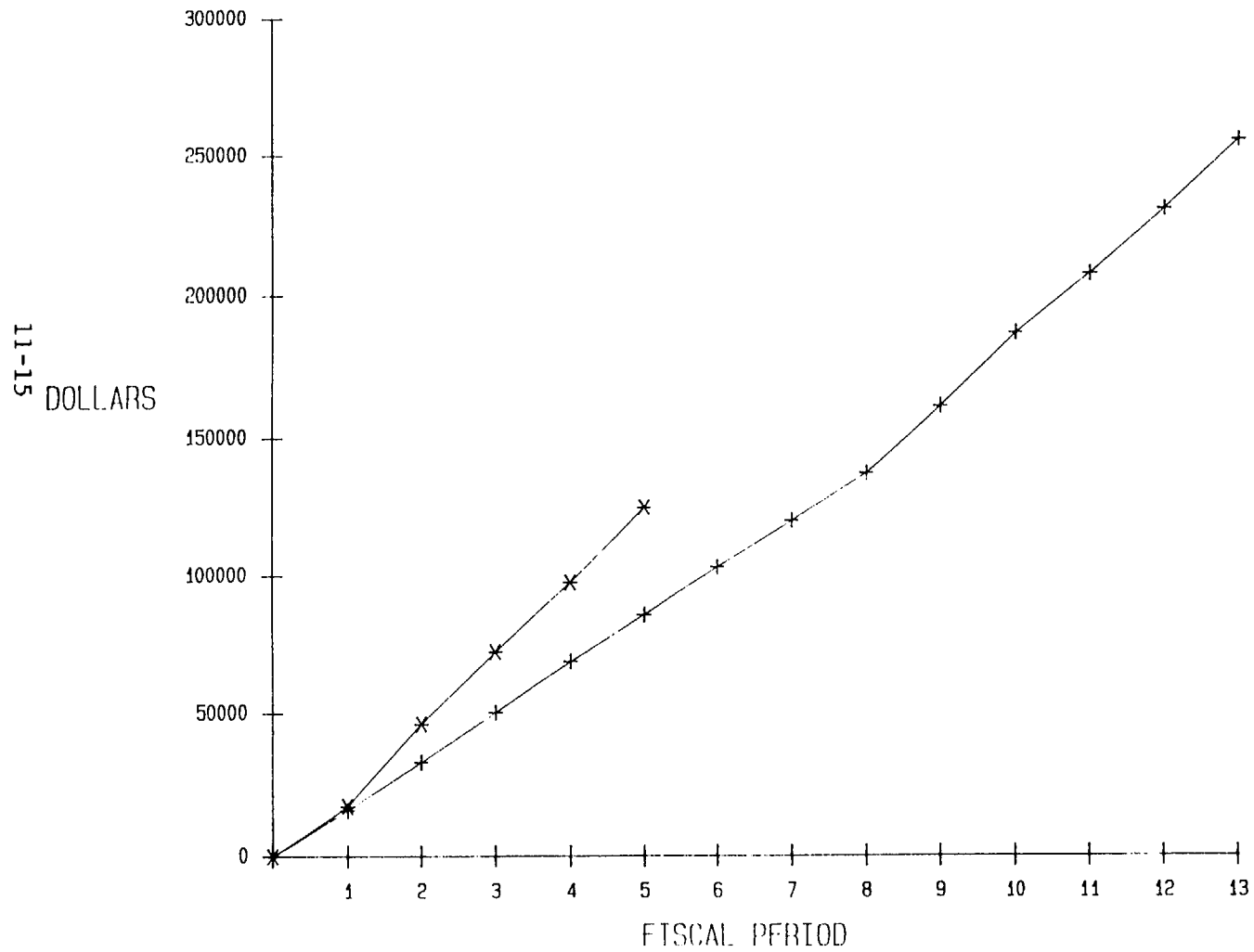
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	15938	16795	17511	18272	17067	17442	16982	17020	23977	25583	20807	22964	24971	85582
ACTUAL PERIOD COST	17324	28853	25863	25372	27433	0	0	0	0	0	0	0	0	124845
VARIANCE, \$	-1386	-12058	-8352	-7100	-10366	0	0	0	0	0	0	0	0	-39262
VARIANCE, %	-8.7	-71.8	-47.7	-38.9	-60.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-45.9
EST. FY CUMUL COST	15938	32733	50243	68516	85582	103024	120006	137026	161003	186586	207394	230357	255328	
ACTUAL FY CUMUL COST	17324	46177	72040	97412	124845	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.202	0.540	0.842	1.138	1.459	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-1386	-13445	-21797	-28896	-39262	0	0	0	0	0	0	0	0	
VARIANCE, %	-8.7	-41.1	-43.4	-42.2	-45.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3704-020 THERMO - FY 90

Estimate vs. Actual



+ ESTIMATE

* ACTUAL

3704-030

SEISMIC

Element Status Cost Report

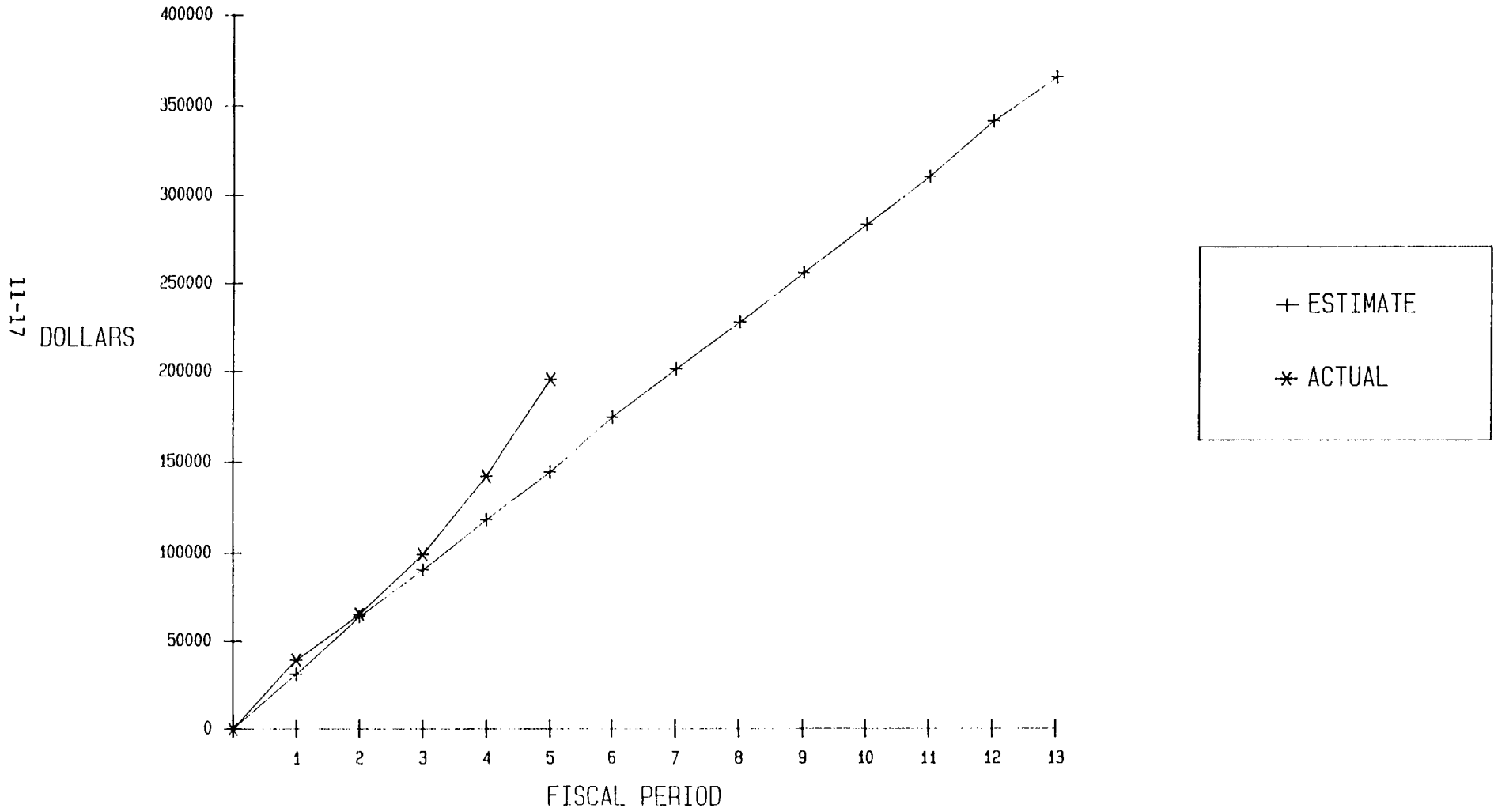
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	31113	32745	26748	27748	25973	30038	26860	26172	28516	27376	26860	30995	23984	144326
ACTUAL PERIOD COST	39249	26008	34001	42840	53407	0	0	0	0	0	0	0	0	195505
VARIANCE, \$	-8136	6737	-7254	-15093	-27434	0	0	0	0	0	0	0	0	-51178
VARIANCE, %	-26.1	20.6	-27.1	-54.4	-105.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-35.5
EST. FY CUMUL COST	31113	63858	90606	118353	144326	174365	201225	227396	255912	283289	310149	341144	365127	
ACTUAL FY CUMUL COST	39249	65257	99258	142098	195505	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.272	0.452	0.688	0.985	1.355	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	-8136	-1398	-8652	-23745	-51178	0	0	0	0	0	0	0	0	
VARIANCE, %	-26.1	-2.2	-9.5	-20.1	-35.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3704-030 SEISMIC - FY 90

Estimate vs. Actual



3704-040

WASTE PACKAGE

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	32092	36030	36030	37030	34030	37030	35143	36143	36143	35143	35143	37143	42401	175214
ACTUAL PERIOD COST	7456	7996	29768	30925	43071	0	0	0	0	0	0	0	0	119217
VARIANCE, \$	24636	28034	6263	6105	-9041	0	0	0	0	0	0	0	0	55997
VARIANCE, %	76.8	77.8	17.4	16.5	-26.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0
EST. FY CUMUL COST	32092	68122	104153	141183	175214	212244	247387	283530	319673	354816	389959	427102	469503	
ACTUAL FY CUMUL COST	7456	15453	45220	76146	119217	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.043	0.088	0.258	0.435	0.680	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	24636	52670	58933	65038	55997	0	0	0	0	0	0	0	0	
VARIANCE, %	76.8	77.3	56.6	46.1	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

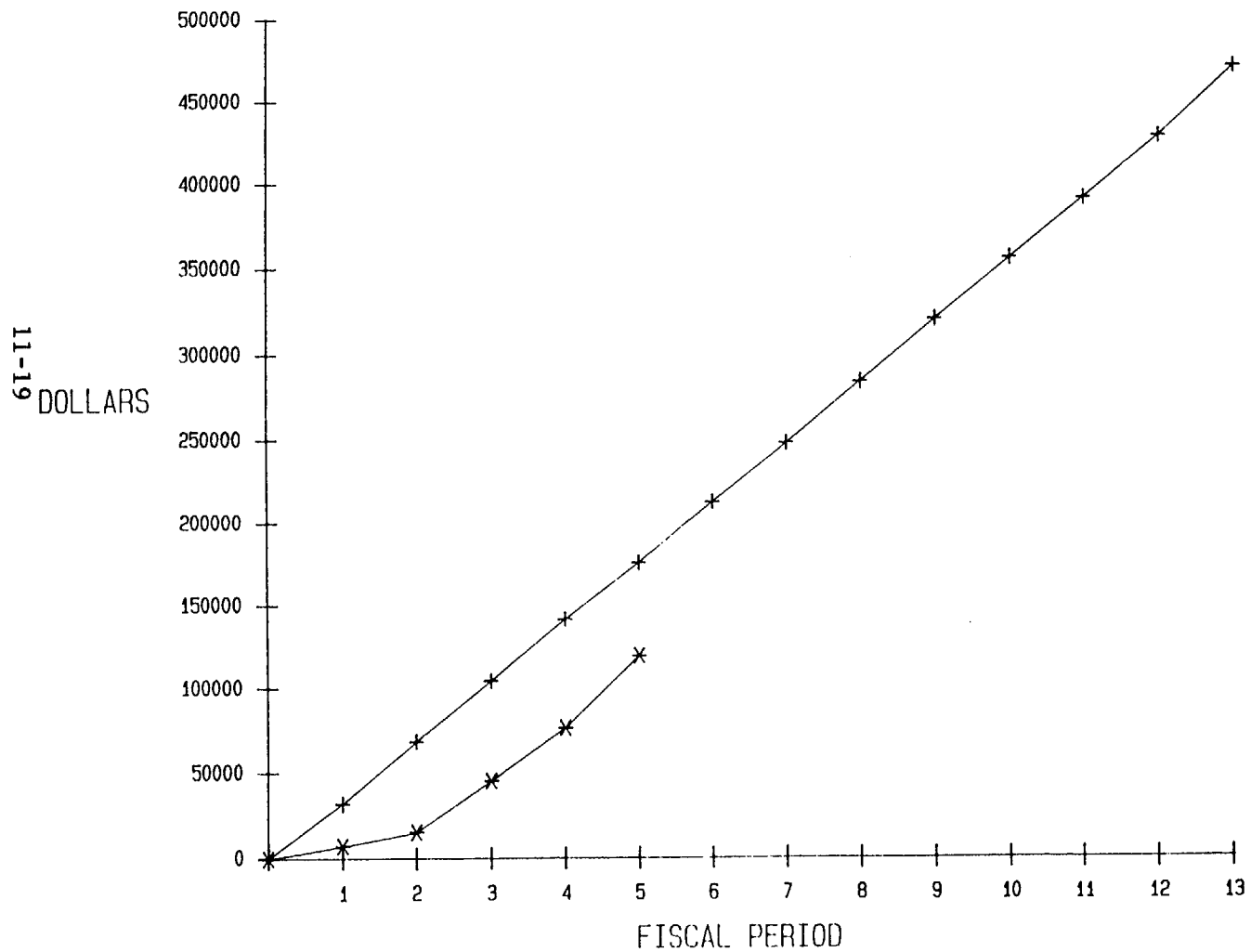
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NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3704-040 WASTE PACKAGE - FY 90

Estimate vs. Actual



+ ESTIMATE

* ACTUAL

3704-050

STOCH MODELING

Element Status Cost Report

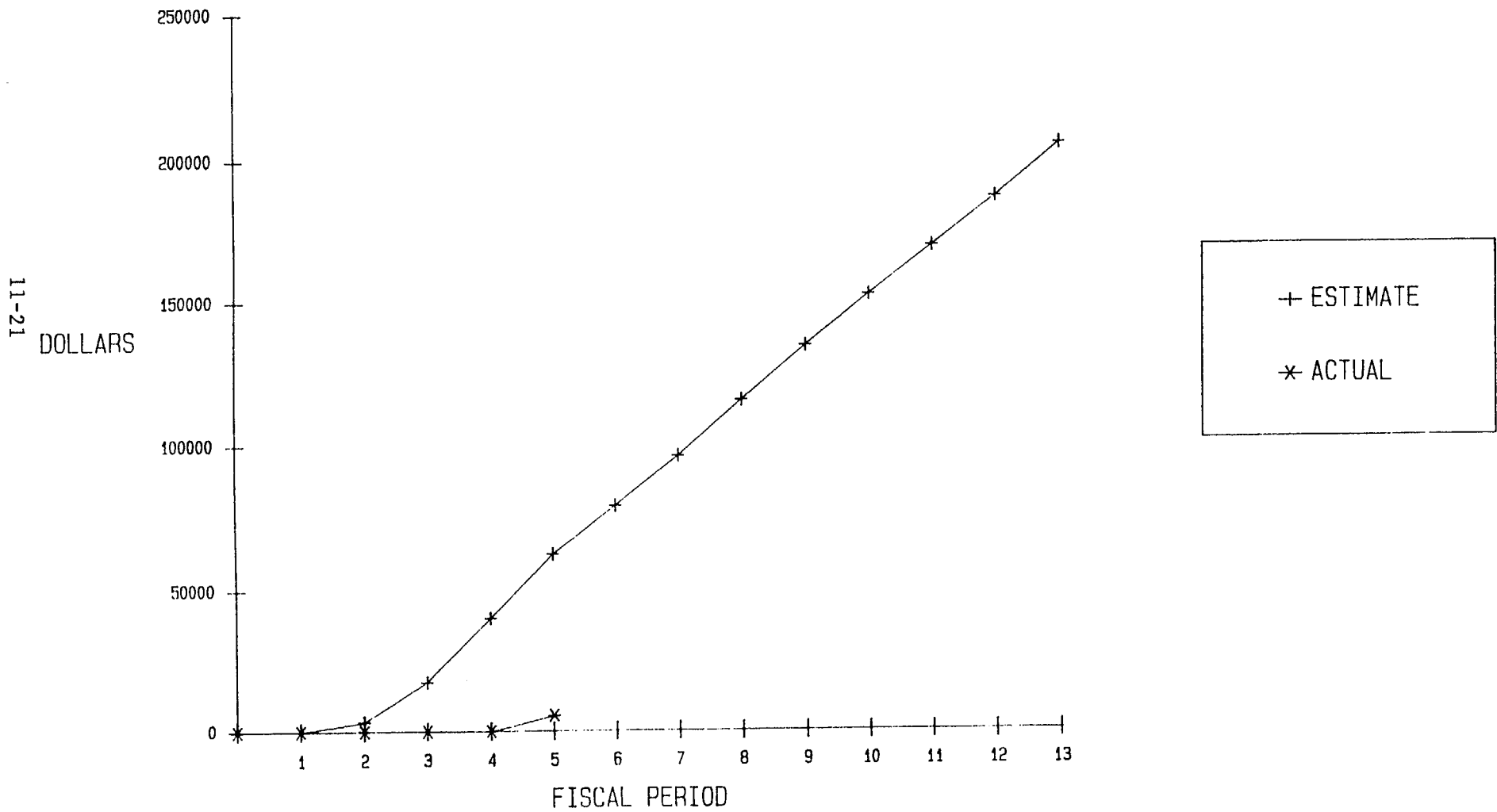
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	0	3375	14235	22585	22507	16499	16948	19056	18919	17960	17415	17067	18322	62703
ACTUAL PERIOD COST	0	0	0	0	5590	0	0	0	0	0	0	0	0	5590
VARIANCE, \$	0	3375	14235	22585	16917	0	0	0	0	0	0	0	0	57114
VARIANCE, %	0.0	100.0	100.0	100.0	75.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91.1
EST. FY CUMUL COST	0	3375	17611	40196	62703	79202	96150	115206	134125	152086	169501	186568	204890	
ACTUAL FY CUMUL COST	0	0	0	0	5590	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.000	0.000	0.000	0.000	0.089	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	0	3375	17611	40196	57114	0	0	0	0	0	0	0	0	
VARIANCE, %	0.0	100.0	100.0	100.0	91.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

3704-050 STOCH MODELING - FY 90

Estimate vs. Actual



3704-060

GEOCHEMICAL ANALOGS

Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	9569	20321	25049	25072	24717	24941	25050	24873	38671	44913	31597	30224	25612	104728
ACTUAL PERIOD COST	0	0	1167	0	338	0	0	0	0	0	0	0	0	1505
VARIANCE, \$	9569	20321	23882	25072	24379	0	0	0	0	0	0	0	0	103223
VARIANCE, %	100.0	100.0	95.3	100.0	98.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.6
EST. FY CUMUL COST	9569	29890	54939	80011	104728	129669	154719	179592	218263	263176	294773	324997	350609	
ACTUAL FY CUMUL COST	0	0	1167	1167	1505	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.000	0.000	0.011	0.011	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, \$	9569	29890	53772	78844	103223	0	0	0	0	0	0	0	0	
VARIANCE, %	100.0	100.0	97.9	98.5	98.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NOTES:

1. All Estimated and actual costs exclude award fee.
2. Estimates are taken from September 1989 Draft Operations Plan.
3. TOTAL column reflects YTD total.

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3704-060 GEOCHEMICAL ANALOGS - FY 90

Estimate vs. Actual

