CNWRA PROGRAM MANAGER'S PERIODIC REPORT

ON ACTIVITIES OF THE

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

FOR THE FISCAL REPORTING PERIOD

December 23, 1989 - January 19, 1990

PMPR No. 90-04

February 2, 1990

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ON ACTIVITIES OF THE
CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TITLE: Center for Nuclear Waste Regulatory Analyses

FIN: D1035-8

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

CONTRACTOR: SwRI

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

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

CONTRACT NO: NRC-02-88-005

ESTIMATED BUDGET: $42,550,000

SITE: 6220 Culebra Road
San Antonio, Texas

PERIOD OF PERFORMANCE: 10/26/87 - 10/26/92
PERIOD OF THIS REPORT: 12/23/89 - 01/19/90

1. SUMMARY

1.1 Technical Status

NMSS Element 1 - CNWRA Operations

The preliminary draft Center Management Plan was completed and transmitted to the NRC January 4, 1990. The informal comment resolution process commenced.

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. Drs. Gustavo Cragnolino, Principal Scientist in electrochemistry and corrosion, and Budhi Sagar, Manager of Performance Assessment and senior hydrogeologist, joined the staff this period. Intensive interviewing and recruitment efforts continued for positions in the geosciences, rock mechanics, and performance assessment. Interviews were conducted for one geoscientist and one rock mechanic (mining engineer).

Comments are awaited on the revised Division of High Level Waste Operations Plans and Overall Research Project Plan for FY90-91. These documents were transmitted to the NRC for approval December 1, 1989, and November 30, 1989, respectively. An internal "lessons learned" session was held January 12, 1990, to evaluate the Operations Plan preparation process. Preparation of the Center Five Year 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 particular emphasis on analysis of regulatory and institutional uncertainties, (b) review of several technical products within the Elements (see accomplishments of those Elements), and (c) revisions to the CQAM.

NMSS Element 2 - Waste Systems Engineering and Integration

Identification of Regulatory and Institutional Uncertainties in the remainder of 10 CFR Part 60 was completed (Section 3). An annotated outline prescribing the format and content for the deliverable "Identification and Evaluation of Regulatory and Institutional Uncertainties in 10 CFR Part 60" was completed and subsequently concurred in by the NRC. These activities supported preparation and transmittal of the draft Milestone 110 report (CNWRA 90-003) on January 5, 1990. Meetings were held January 11 and 18, 1990, to discuss preliminary staff comments on the report.

Discussions were held on the requirements document for Version 2.0 of PASS which was transmitted to NRC November 30, 1989. Formal comments are awaited. Development of a user's manual for Version 1.0 continued this period.

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--Geochemical Processes", 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

Staff input to the report on the Los Alamos National Laboratory Observation Audit was completed and the NRC report on this audit was reviewed (Section 4).

NMSS Element 4 - Geologic Setting

Staff participated in the January 9, 1990, DOE/NRC/NV Technical Exchange Meeting on Data Management (Section 5). The DOE Study Plan on Characterization of the Yucca Mountain Quaternary Regional Hydrology was reviewed and point papers were drafted.

Geologic Setting Element activities included work on Steps 1, 3, 4, and 7 of the Natural Resources technical position. The GS Element Manager and the NRC Program Element Manager discussed work plan preparation for the various technical positions in meetings on January 8 and 10, 1990.

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.

NMSS Element 5 - Engineered Barrier Systems

Activities related to the potential rulemaking on "Substantially Complete Containment" continued (Section 6). A progress review meeting was held January 11-12, 1990, in San Antonio to discuss progress to date and to reschedule the Workshop. The two reports that form the technical basis for the potential rulemaking were being peer reviewed and revised this period.

A paper titled "Technical Considerations and Approach for Evaluating Substantially Complete Containment of High Level Nuclear Waste" was submitted for presentation at the First International High Level Radioactive Waste Management Conference and Exposition, which will be held in Las Vegas, NV, April 8-12, 1990.

Computer tapes and associated documentation for the heat transfer code TOPAZ3D were received and evaluation of the code structures began.

Center staff attended the Nuclear Waste Technical Review Board meeting on Canister Materials in Pleasanton, CA, January 18-19, 1990.

NMSS Element 6 - Special Projects

Work focused on (a) development of the outline for the License Application Review Strategy (LARS), (b) the statutory, regulatory, and policy bases and constraints on the LA review, and (c) the Environmental Impact Statement (EIS) review strategy continued (Section 7). An analysis of interfaces between environmental statutes and the EIS review, and an 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 will be held with the cognizant NRC staff January 22, 1990. 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

Work continued on the Performance Assessment Review Strategy (PARS) tasks (Section 9). Review of Sandia National Laboratory documents related to Task 2 continued, with comments being provided on the SNL report on formal use of expert judgment. Comments were also

provided on the revised scope of the Technical Position on methods for scenario identification and evaluation.

Development of the work plan for the proposed rulemaking on the design basis accident dose limit. Comments on a revised draft of this proposed rulemaking were prepared and discussed with the cognizant NRC staff.

NRC comments were incorporated in the report "Statutory Basis for Performance Assessment Review and Identification of Requirements for Performance Assessment in 10 CFR Part 60" and the final document was transmitted to NRC.

Plans for the first Performance Assessment Workshop, to be held February 15-16, 1990, were completed. Several meetings were conducted among CNWRA and NRC staff regarding performance assessment activities in support of NMSS and RES. A joint meeting on technology transfer will be held with NRC and SNL early in Period 5.

NMSS Element 9 - Transportation Risk Study

Discussions were held regarding curtailment of TRS activities as a result of the DOE program stretch out. The CNWRA prepared an options paper regarding this matter and awaits formal direction on the plan of action to be pursued (Section 10).

Shipment data continued to be extracted from the entries to SAND84-7174. The transition to RADTRAN 4.0 is complete and analyses of normal (incident-free) transportation continue with the revised code.

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.

Responses to comments and revisions to the Stochastic Analysis Project Plan were underway and the Geochemical Analog Project Plan was revised and transmitted for approval.

Research Project 2 - Geochemistry

Revisions and additions were made to the annual milestone report for the experimental task which is titled "Progress in Experimental Studies on the Thermodynamic and Ion Exchange Properties of Clinoptilolite".

Characterization of specimens of clinoptilolite from the Succor Creek, Oregon, area was completed. If separation of other specimens from the same area is successful, this material will be use in the geochemical experiments.

W. Murphy participated in a Nuclear Waste Technical Review Board Meeting on the DOE Container Materials program at Lawrence Livermore National Laboratory on January 18-19, 1990.

Research Project 3 - Thermohydrology

Development, assembly, and adaptation of the gamma-ray densitometer traversing system was essentially continued this period. The traversing/tracking and data acquisition system was assembled and successfully tested. Preparations were completed for calibration of the initial tensiometer, including installation in the Tempe pressure cell.

The TOUGH code, for modeling unsaturated flow, was installed and is now operational on the SwRI VAX 8700.

Research Project 4 - Seismic Rock Mechanics

A technical report on the qualification study of the two-dimensional distinct element code UDEC against closed-form solutions was completed and transmitted to the NRC January 4, 1990. Qualification study of the two-dimensional finite element code HONDO was completed during this period and preparation of the report is underway.

A proposal to conduct instrumented field studies at the Lucky Friday Mine in Idaho met with provisional approval. Negotiations continue and a meeting with the mine management and other pertinent parties is planned for February 6 and 7, 1990. The proposal calls for field studies of (a) dynamic effects on underground openings and (b) seismic effects on the hydrologic regime.

Large-diameter core drilling for acquisition of jointed welded tuff specimens from the Apache Leap Site, Arizona, continued. About 70% of the required number of specimens have been obtained.

Preparation of a report on the custom-made rock joint dynamic shear test apparatus continued, as did preparation of a detailed technical operating procedure for its use.

A letter was prepared at NRC request to provide an assessment of the progress and expenditures to date on this project.

Research Project 5 - Integrated Waste Package Experiments

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

Staff attended the Nuclear Waste Technical Review Board Meeting on the DOE Container Materials program on January 18-19, 1990. The visit included a tour of laboratory facilities at the Lawrence Livermore National Laboratory.

1.2 Major Problems

None to report.

1.3 Forecast for Next Period

Approvals of the Division of High Level Waste Operations Plans and the Overall Research Project Plan are expected during the next period. It may be necessary to rerun the budgets and schedules to (a) reflect experience to date (i.e. the first four fiscal periods have elapsed since the Plans were drafted) and (b) address the impacts of the DOE program stretch-out and attendant budget reductions.

Comments on the preliminary draft of the Center Management Plan should be received, allowing completion of this document. 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 report on Regulatory and Institutional Uncertainties in 10 CFR Part 60 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 continue.

Center and SwRI quality assurance professionals will participate in audit observation and other quality assurance activities, as requested. The possibility of the NRC staff conducting a "training audit" at the CNWRA offices in San Antonio is being contemplated.

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 will be made and a final schedule will be established for the workshop on SCC. Activities will continue regarding EBS performance assessment. Staff will participate in the ASTM C-26 Subcommittee Meeting in Las Vegas.

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.

Work on the Performance Assessment Review Strategy will continue. The scope of the scenario identification and evaluation technical position will be finalized. The first Performance Assessment Workshop involving NRC-NMSS, NRC-RES, SNL, and CNWRA technical staff will be conducted. Review of SNL documents and preparation of work plans for Task 2 and Task 5 activities will continue. The work plan for the design basis accident dose limit rulemaking should be completed.

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. A decision regarding the curtailment of TRS activities will be made by NRC and the program of work will be revised accordingly.

Work will continue in the Geochemistry, Thermohydrology, Seismic Rock Mechanics, and Integrated Waste Package Experiments Projects in accordance with approved plans. Work will commence on approved portions of the Stochastic Modeling and Geochemical Natural Analog Projects, and the Plans for these projects will be revised to reflect NRC comments. Recommended revisions to the IWPE Project Plan will be prepared and discussed with the NRC.

1.4 Summary Financial Status

Table 1, below, indicates the financial status of the overall Center program in the context of "ceiling" and "allotted" 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 $465,097. 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 results 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 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	$ 114,815
b) FY90 Funds Allocated	$3,130,383
c) Total FY90 Funds Available	$3,245,198
Funds Costed to Date	$2,105,381
Funds Uncosted	$1,139,817
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) (a)				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) (a)				1	1	1	1	1	1	1
MINING ENGINEERING	1	1	1	1	1	1	1	1	1	0
NUMERICAL MODELING (b)			1	1	1	1	1	1	1	1
PERFORMANCE ASSESSMENT (b) (a)		1	2	3	3	4	4	4	4	2
QUALITY ASSURANCE	1	2	2	2	2	2	2	2	2	0
RADIOCHEMISTRY (b)				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)		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	16

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.

Staffing Summary

	Professional	Support	Total
Current	34	10	44
Planned This Date	38	9	47
Planned End of FY90	51	9	60

CENTER CORE STAFF -- CURRENT PROFILE (01/19/90)

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. Cragnolino
ENGINEERING GEOLOGY/GEOLOGICAL ENGINEERING	
GEOCHEMISTRY	W. Murphy, R. Pabalan, E. Pearcy
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	

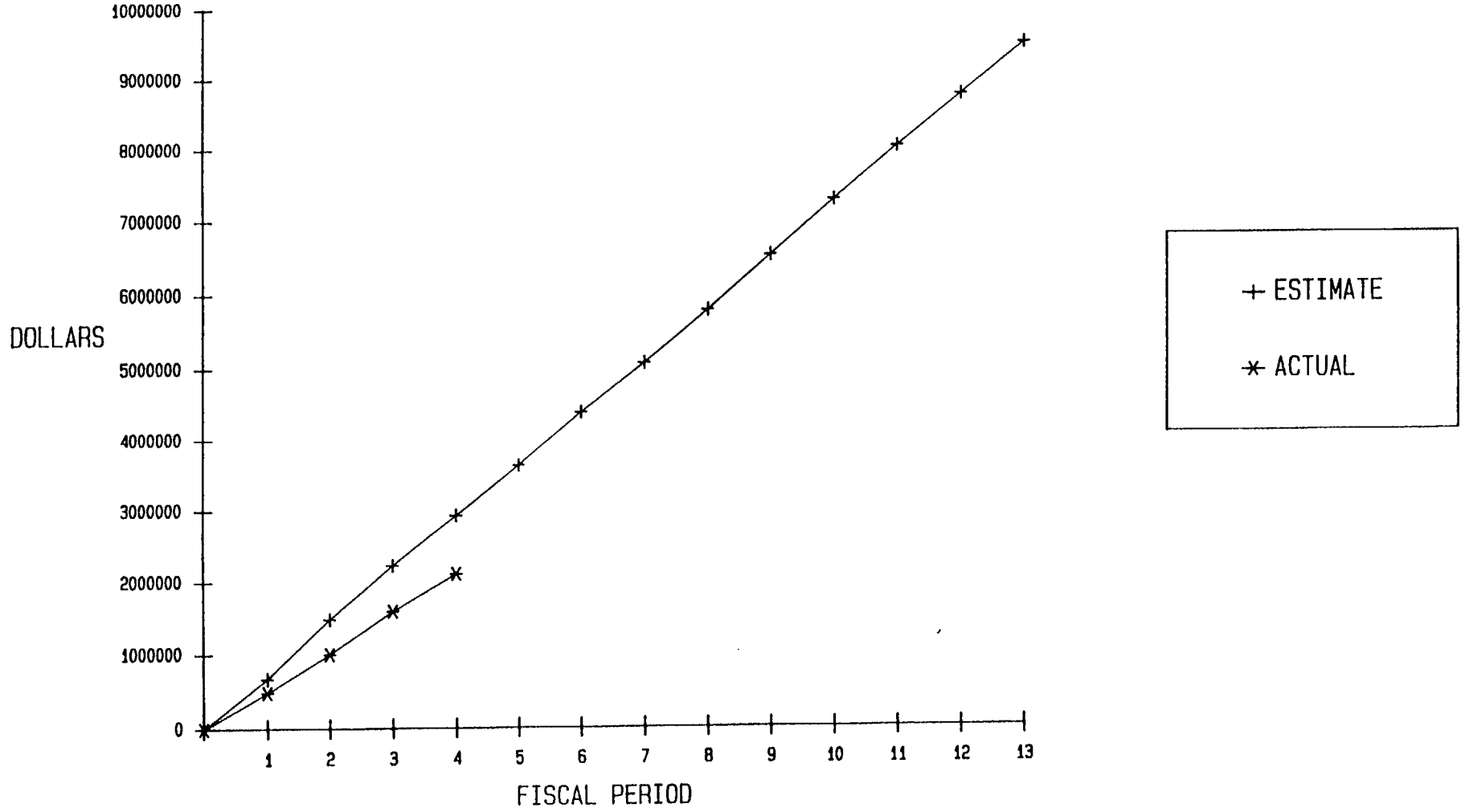
3700-000 Center Composite Element Status Cost Report

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
ESTIMATED PERIOD COST	667121	811124	749914	694409	704267	751470	690528	708138	739691	754144	750448	729855	727930	2922567
ACTUAL PERIOD COST	481422	515564	593272	515124	0	0	0	0	0	0	0	0	0	2105381
VARIANCE, $	185699	295560	156642	179285	0	0	0	0	0	0	0	0	0	817186
VARIANCE, %	27.8	36.4	20.9	25.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.0
EST. FY CUMUL COST	667121	1478244	2228158	2922567	3626835	4378305	5068833	5776972	6516662	7270806	8021253	8751108	9479038	
ACTUAL FY CUMUL COST	481422	996986	1590257	2105381	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.165	0.341	0.544	0.720	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	185699	481259	637901	817186	0	0	0	0	0	0	0	0	0	
VARIANCE, %	27.8	32.6	28.6	28.0	0.0	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.
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 corresponding 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

The Periodic Management Meeting between NRC and Center, which covered various issues and concerns, was held at the NRC's White Flint offices, and effective coordination of work activities continued during this period. The Center Management Plan was delivered in preliminary draft form. Personnel from the NRC's IRM Group met with the Center's IMS Group to review this Group's current work on all the IMS-related activities. Administrative and fiscal matters which affect the management of the Center, e.g., communications, contract modifications and budgets, were reviewed with both the Program Management and Contracts Administration staff to effect the necessary changes, pursuant to the delivery of the final Operations Plans.

Task 2 - Develop and Sustain Technical and Analytical Capabilities

The Center is maintaining its input of various documents into the Technical Document Index.

Task 3 - Staffing Activities

The Center's recruitment efforts continued with Drs. Asad Chowdhury, John Russell, and Budhi Sagar reviewing numerous applications and arranging for interviews for promising applicants in rock mechanics, the geosciences, and performance assessment. A number of contacts

were made with potential applicants for other positions, especially for senior technical staff. Both Drs. Budhi Sagar and Gustavo Cragnolino began their employment with the Center on January 2, 1990. Drs. E. Pearcy and G. Stirewalt, and Mr. S. Young will join the Center next period.

National advertisements for employment opportunities at the Center were coordinated with SwRI's Personnel Department.

Task 4 - Operations Plans and Five Year Plan Development

The completed Division of High Level Waste Operations Plans and the Overall Research Operations Plan were scrutinized further in anticipation of necessary modifications. A sustained level of activity characterizes the development of the Center Five-Year Plan.

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 in the Center Quality Assurance Manual for Revision 2, and preparation for a quality survey to be conducted at the University of Arizona. Center 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 QA staff is developing a standard set of quality requirements for organizations performing experimental research laboratory and data collection activities for the Center.

2.2 Major Problems

None to report.

2.3 Forecast for Next Period

The final version of the above mentioned Operations and Research Project Plans will be prepared. The PMPR will be produced for the fifth period. Attendance at professional development events will be encouraged. A sustained, heightened level of focused activity will characterize the Center's recruitment efforts, especially in the geosciences and rock mechanics disciplines. 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/ Subelement program in the context of "ceiling" and "allotted" 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 $8,350. Spending is on target for the established budgets. No changes to budget or schedule are recommended at this time.

Prior Year Unfunded Cost	$ -0-
FY90 Funds Allocated	$628,144
Total FY90 Funds Available	$628,144
Funds Costed to Date	$633,398
Funds Uncosted	$(5,254)
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.

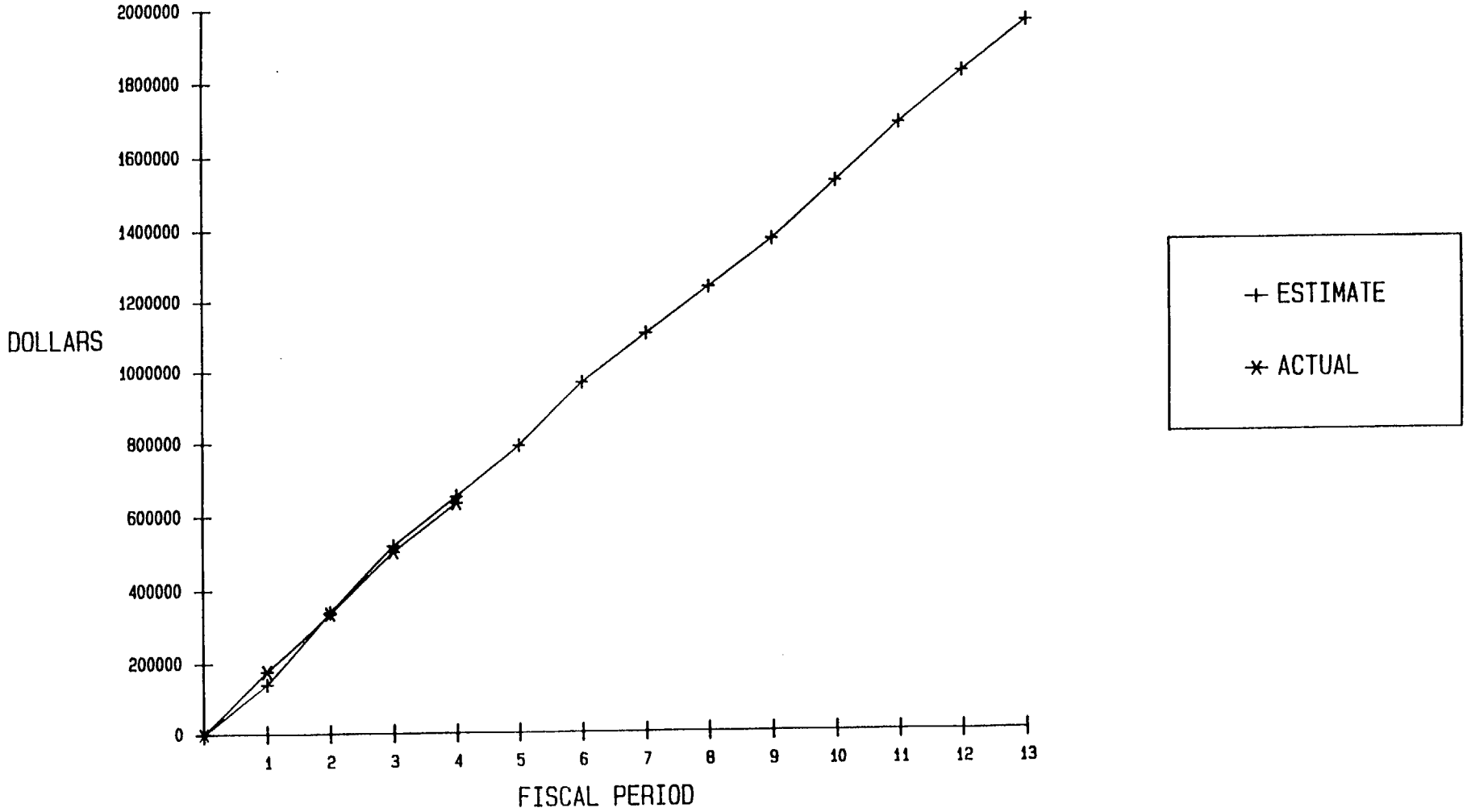
3702-070 CNWRA OPS Element Status Cost Report

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	651189
ACTUAL PERIOD COST	176916	158050	166556	131875	0	0	0	0	0	0	0	0	0	633398
VARIANCE, $	-36203	40071	12156	1767	0	0	0	0	0	0	0	0	0	17791
VARIANCE, %	-25.7	20.2	6.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.272	0.514	0.770	0.973	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	-36203	3868	16024	17791	0	0	0	0	0	0	0	0	0	
VARIANCE, %	-25.7	1.1	3.1	2.7	0.0	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.

3702-070 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 resulting draft report CNWRA 90-003 being delivered to the NRC on January 5, 1990.

Task 1 - Statutory and Regulatory Analysis

Major emphasis this period included finalizing and submitting the draft report of the Major Milestone 110 (Reference January 4, 1990, letter from J. Latz to M. Mace). NRC comments received on both the December 21, 1989, CNWRA preliminary submittal, and the January 4, 1990, Milestone 110 (CNWRA 90-003 Report) were discussed with the NRC staff in meetings held at White Flint on January 11 and 18, 1990, respectively (Reference W. Patrick's meeting minutes for each meeting).

The NRC internal technical review continues on the CNWRA's January 5 Milestone 110 draft document, with the anticipation that final comments will be available at a meeting set for January 30, 1990, at White Flint to discuss and finalize the Center's position on the relationship of sections 112 and 122 in 10 CFR Part 60. It is anticipated that a schedule can be finalized for close-out of the CNWRA 90-003 Report at that meeting.

Throughout this period, the Center has been addressing comments that have been received to date on "Erosion" and "Substantially Complete Containment" submitted earlier by the Center and used to baseline the Program Architecture. NRC review of TOP-001-02 continued, producing comments which were received by the Center during this period. Additional comments are anticipated from the NRC reviewers during the next reporting period. 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 is awaiting response to a formal written request of January 1, 1990, to WESTLAW before downloading other regulations and statutes for use in the PA Database. The design of Version 2.0 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.

Continuing discussions were held with NRC staff regarding the OS/2 and the PASS development for Versions 2.0 and 3.0. A meeting has been set for January 22 to discuss the CNWRA and NRC status and current thoughts on IMS activities. This meeting will take place at the CNWRA offices in San Antonio, with representatives from the NRC NMSS and IRM Offices to be present.

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, 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. It is anticipated that these items will be discussed during a meeting scheduled for January 24 at the San Antonio offices of the CNWRA with P. Altomare in attendance.

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 and S. Hsiung of the Center, and T. Brandshaug and L. Lorig of Itasca performed these activities. Identification of Regulatory and Institutional Uncertainties of 10 CFR Part 60 relevant to RDCO continued during this reporting period.

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

Activity continued this period in conjunction with the SCC Regulatory Requirement.

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:

- Response to comments on the WSE&I Major Milestone 110 deliverable (CNWRA 90-003 Report).
- Continuing development of the Technical Operating Procedure TOP-001-05 "Procedure for Attribute Analysis."
- Preparation of a revised schedule for the delivery of Version 2.0 of the PASS consistent with the results from the meeting scheduled to be held January 22-23 at the CNWRA.
- Continued PADB training of Center and contractor staff on Version 2.0 and preparation of PASS Users Manual for Version 1.0.
- Continued loading of 1989 revisions of regulations and acquiring official approval for downloading from WESTLAW.
- Continued evaluation of the statutory and regulatory basis for the Rulemakings and Technical Positions being worked by RDCO, GS, EBS, and PA Elements, consistent with the established schedules. (Note that 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, will also have to be considered).
- Continue to develop the AS/PMC programs to include expanded capabilities for commitment control, as well as support for 5-Year Plans for the Center and interface to other scheduling levels.

3.4 Element Financial Status

Table 1, below, indicates the financial status of the Element/ Subelement program in the context of "ceiling" and "allotted" 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 $108,614. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Spending is on target; no changes in budget are recommended at this time.

Table 1. Financial Status

a) Prior Year Funds Uncosted	$ 330
b) FY90 Funds Allocated	$616,922
c) Total FY90 Funds Available	$617,252
Funds Costed to Date	$548,828
Funds Uncosted	$ 68,424
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

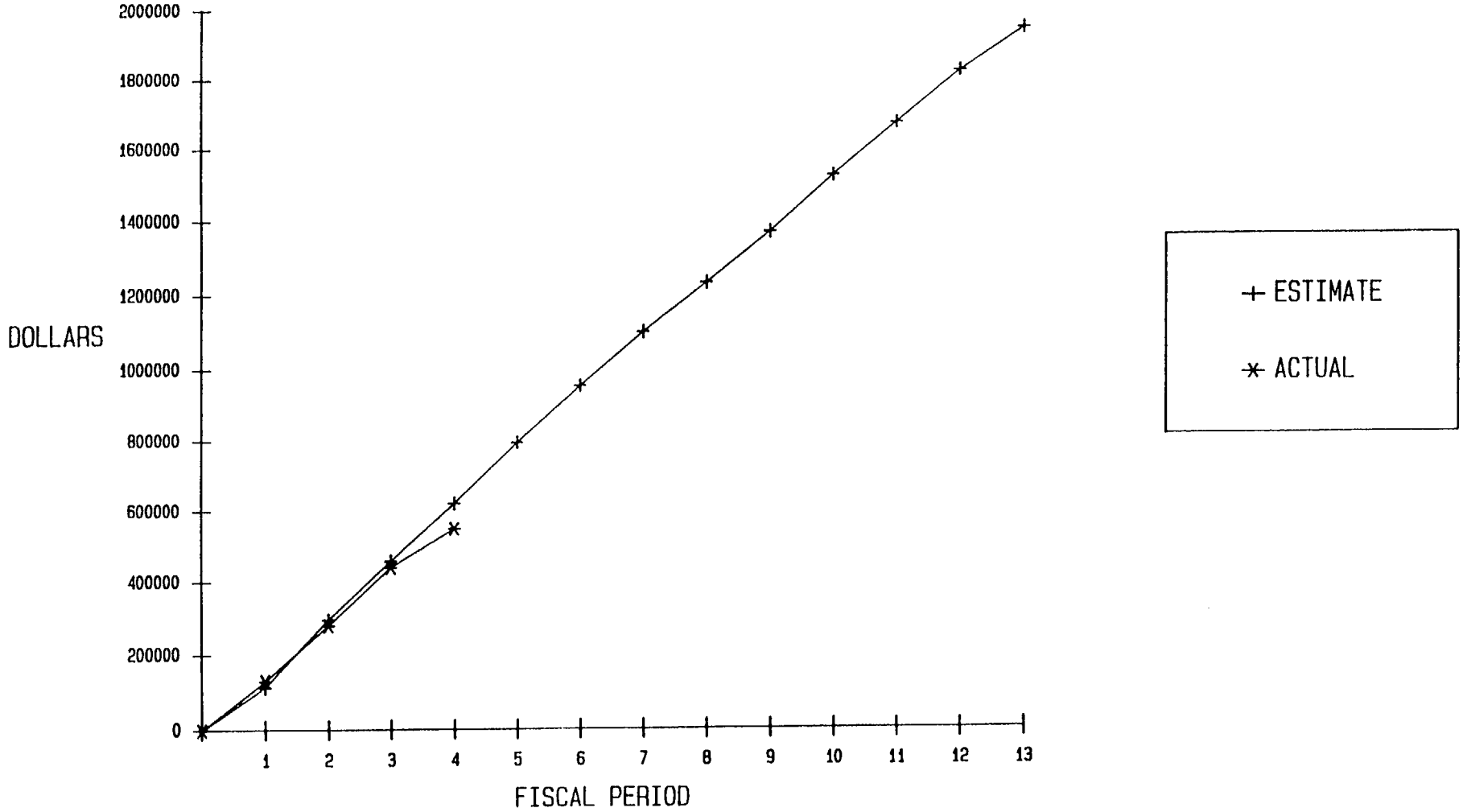
Element Status Cost Report

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	620904
ACTUAL PERIOD COST	129467	148656	161537	109168	0	0	0	0	0	0	0	0	0	548828
VARIANCE, $	-16602	32945	1053	54681	0	0	0	0	0	0	0	0	0	72076
VARIANCE, %	-14.7	18.1	0.6	33.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.6
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.209	0.448	0.708	0.884	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	-16602	16343	17396	72076	0	0	0	0	0	0	0	0	0	
VARIANCE, %	-14.7	5.5	3.8	11.6	0.0	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.

3702-030 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 major activity during this period was the review of the NRC draft of the Audit Observation Team work at Los Alamos National Laboratory.

Task 1 - Audit DOE QA Program for Site Characterization

During this period the Center Director of Quality Assurance continued oversight of this phase of this Element, reviewing draft NRC Audit Observation Reports, participating in two NRC QA staff meetings by teleconferencing (other QA staff resources were also included in this important communications activity), and worked with the SwRI QA Manager to ensure resource availability when required for NRC site characterization work.

The input to the NRC on the Los Alamos Audit Observation Team work was integrated into the NRC report and it was reviewed by Center QA staff at the request of Ken Hooks of the NRC.

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 have taken place during visits to the White Flint NRC office and the periodic teleconferencing meetings amongst the NRC QA staff and Center QA personnel.

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.

It is still expected that an on-site visit by the NRC will take place in the second quarter of FY90, and Center QA personnel may be involved with that task.

Discussion has taken place regarding a "training audit" for NRC QA personnel, and Center Research activities have been identified as a possible area where such an audit could be conducted. The benefits of such a training audit for the NRC have been discussed with Messrs. Delligatti, Kennedy, and Hooks, and information has been provided directly to Ken Hooks for his use.

4.4 Element Financial Status

Table 1 below, indicates the financial status of this Element in the context of "ceiling" and "allotted" 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. 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	$ 42,773
c) Total FY90 Funds Available	$ 42,773
Funds Costed to Date	$ 13,014
Funds Uncosted	$ 29,759
Recommended Adjustment to Complete (+/-)	$ -0-

See the enclosed Element Status Cost Report.

Notes:

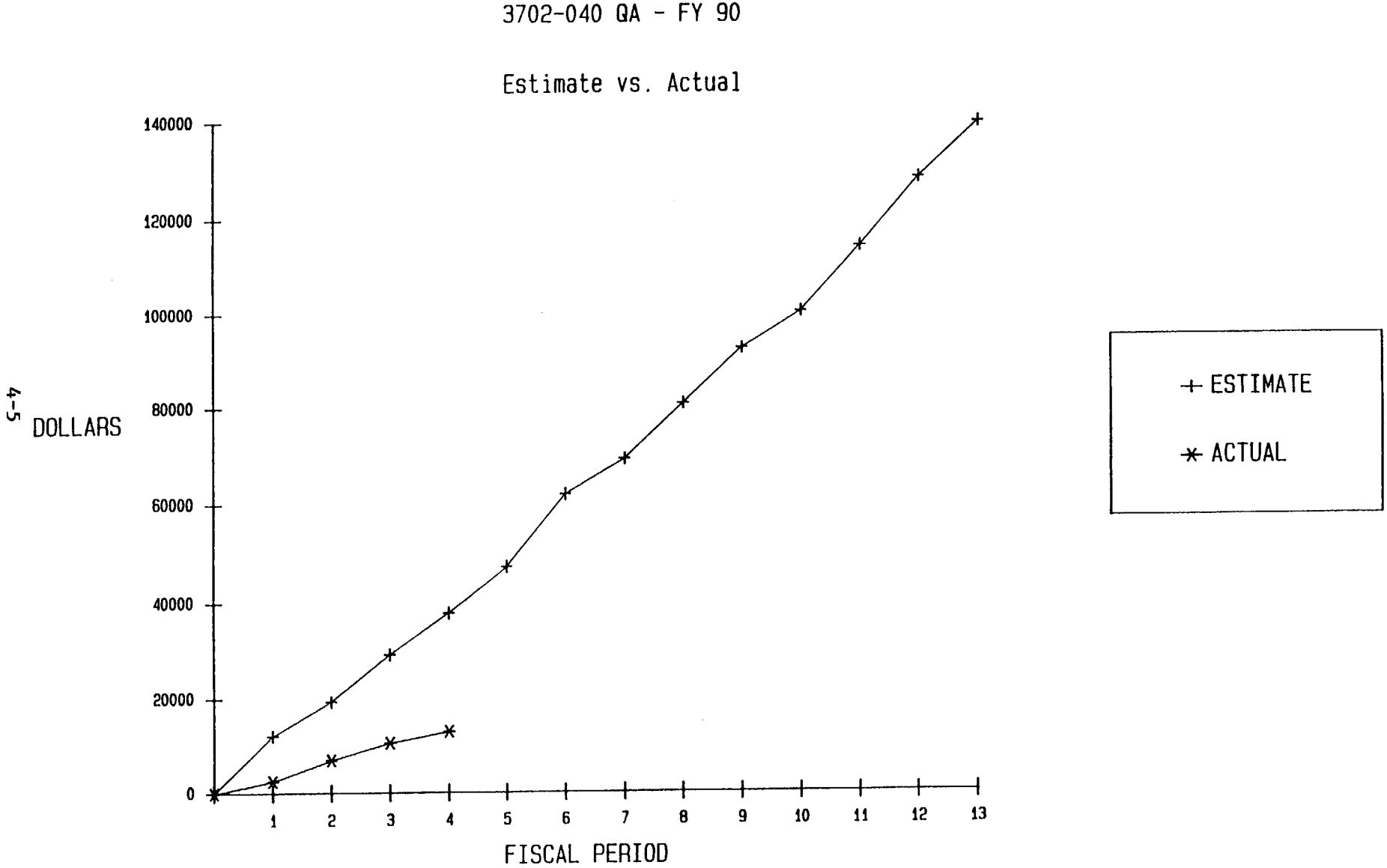
a) The current unspent amount from previous portions of each FIN.
b) See "Total Contract Amount" in the corresponding Element page of the "Project Status Report."
c) Sum of (a) and (b)
d) Prior Year Funds Uncosted, stated in the PMPR for Period 1 as "(a) Prior Year Funds Uncosted" reflects the expenditure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

3702-040 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	37908
ACTUAL PERIOD COST	2549	4472	3627	2366	0	0	0	0	0	0	0	0	0	13014
VARIANCE, $	9589	2791	6264	6249	0	0	0	0	0	0	0	0	0	24894
VARIANCE, %	79.0	38.4	63.3	72.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.7
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.067	0.185	0.281	0.343	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	9589	12381	18645	24894	0	0	0	0	0	0	0	0	0	
VARIANCE, %	79.0	63.8	63.6	65.7	0.0	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
140000
120000
100000
80000
60000
40000
20000
0
DOLLARS
1
2
3
4
5
6
7
8
9
10
11
12
13
FISCAL PERIOD
ESTIMATE
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.

Task 1 - Prelicensing Activity

During Period 4, J. Russell and R. Marshall represented the Center at the January 9, NRC-DOE Technical Exchange Meeting conducted at Rockville, Maryland, on Data Management.

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. Drafts of the point papers were delivered to the NRC.

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. J. Russell discussed the Center's technical assistance support for the development of technical positions with D. Brooks, the NRC technical "leads" for each technical position, and the NRC Section Leader responsible for generation of each technical position on January 8 and 10, at Rockville, MD. The strategy and personnel

required to perform the Center's technical assistance support was discussed, particularly in regard to the development of detailed plans required in the Center's Operation Plans.

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/ Subelement program in the context of "ceiling" and "allotted" 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 $41,363. 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	$ 37,225
b) FY90 Funds Allocated	$386,657
c) Total FY90 Funds Available	$423,882
Funds Costed to Date	$113,686
Funds Uncosted	$310,196
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

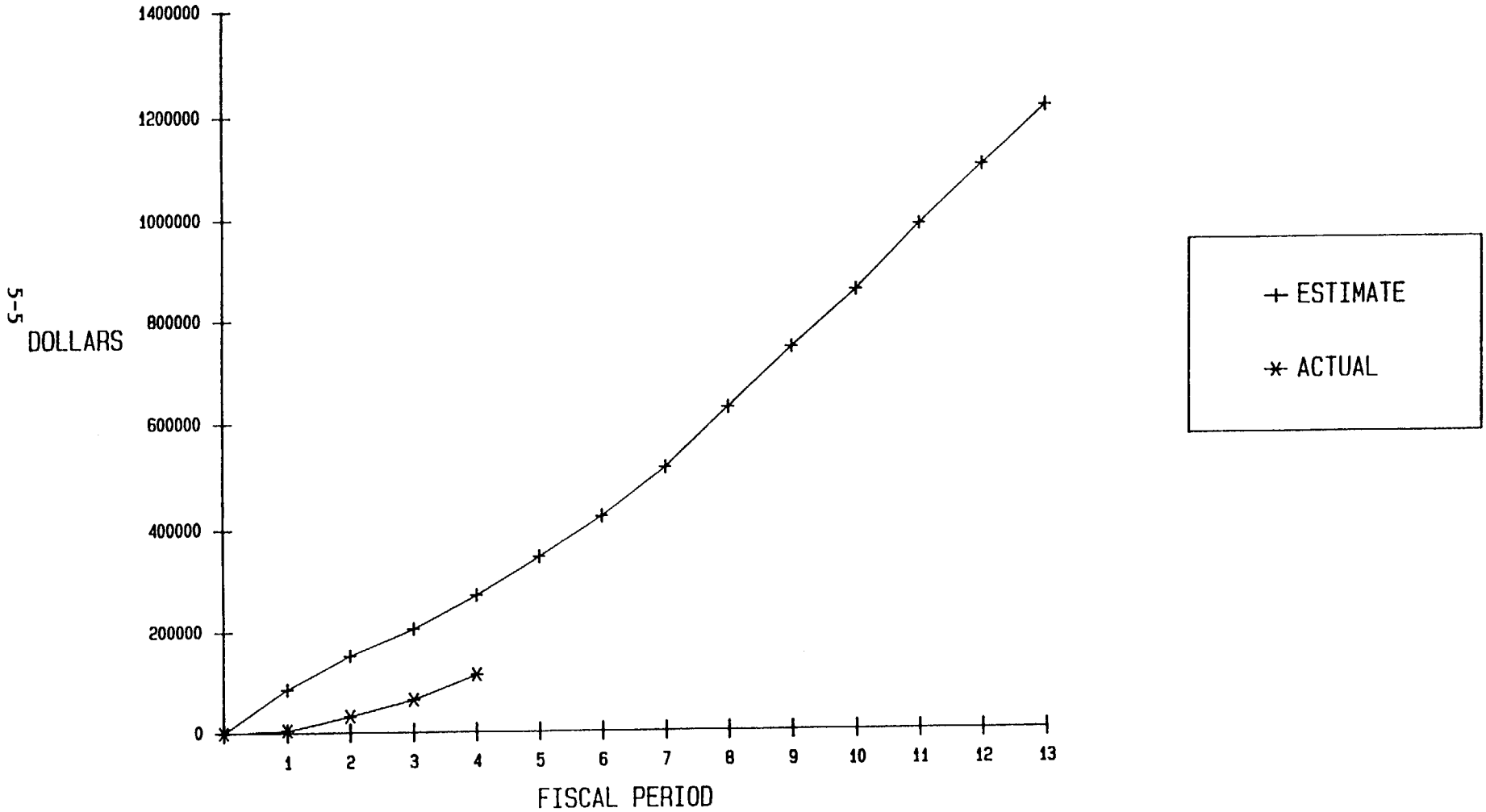
Element Status Cost Report

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	271231
ACTUAL PERIOD COST	4921	27704	32741	48320	0	0	0	0	0	0	0	0	0	113686
VARIANCE, $	82035	37893	19486	18130	0	0	0	0	0	0	0	0	0	157545
VARIANCE, %	94.3	57.8	37.3	27.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.1
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.018	0.120	0.241	0.419	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	82035	119928	139414	157545	0	0	0	0	0	0	0	0	0	
VARIANCE, %	94.3	78.6	68.1	58.1	0.0	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.

3702-000 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 Dr. Gustavo Cragnolino joined the EBS Program Element staff. Dr. Cragnolino will also support the materials related research projects.

Task 1 - Prelicensing Activities

No significant activities

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). A progress review meeting on SCC was held on January 11-12, 1990 at the CNWRA San Antonio Offices. The meeting was attended by J. Bunting, R. Weller, J. Pearring, and C. Interrante from the NRC and P. Nair, H. Manaktala, Y.-T Wu, and C. Tschoepe from the CNWRA. The development of the two SCC related technical reports was discussed. Based on the discussions at the meeting, several suggestions were developed to be incorporated into the reports. The planned seminar/workshop on the reports, scheduled for the end of January 1990, will require additional time to setup. A delay in the schedule will be requested. Plans are for a total of nine peers to participate in the seminar/workshop.

A technical paper on the subject of SCC entitled, "Technical Considerations and Approach for Evaluating Substantially Complete Containment of High Level Nuclear Waste," authored by H. Manaktala (CNWRA), Y. Wu (CNWRA/SwRI), P. Nair (CNWRA), C. Interrante (NIST/NRC), and J. Bunting (NRC) was submitted for presentation at the First International High Level Radioactive Waste Management Conference and Exposition, Las Vegas, Nevada, April 8-12, 1990.

(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 of the CNWRA and C.

Interrante of the NRC was reviewed by J. Bunting, J. Pearring, and R. Weller of the NRC in a meeting at San Antonio, Texas, January 11-12, 1990. It was agreed to revise the introduction to the report to better define the scope of the document and make it compatible with the second report on the subject of treatment of uncertainty in the technical data and information. A section on earth-movement (tectonics, volcanism, seismicity, etc.) is planned to be added. The section dealing with geology, geochemistry, and hydrology will be updated/revised. Comments from the three independent external reviewers were received in early January. The comments will be incorporated in the February 23, 1990, draft. The three external reviewers for this report, who have provided formal written comments, are Professor Robert Stout of Lehigh University, Dr. John Weeks of Brookhaven National Laboratory, and Dr. Michael Streicher-an independent consultant. Scheduled dates for the SCC workshop, which will be held in San Antonio, Texas, are April 4-6, 1990.

(B) Uncertainty Evaluation Methodology Report

The first level external peer reviews on the preliminary draft report, "Uncertainty Evaluation Methods for Waste Package Performance Assessments" were received and report modifications are underway. The report is co-authored by Y.-T. Wu, A. Journel (Stanford University), L. Abramson (NRC), and P. Nair. The draft report was also reviewed by the NRC staff. The approaches presented in the report were discussed at the progress review meeting on January 11-12, 1990, at the Center.

Task 3 - Analysis Codes and Methods

The tapes containing the thermal model TOPAZ3D have been received, along with the documentation, from the National Energy Software Center. A portion of the codes have been examined for content. Results to date indicate that the code structures are as expected. The documentation is current and complete, though not greatly detailed.

The SSI subcontract expired in December 1989. It is the Center's intent to extend the subcontract to complete an example for a heat transfer model for a waste package using the TOPAZ3D code.

N. Sridhar, W. Murphy and P. Nair attended the Nuclear Waste Technical Review Board meeting on Canister Materials held in Pleasanton, California, on January 18-19, 1990. The presentations were made by LLNL staff. On January 18, 1990, the Center staff visited LLNL facilities where corrosion and other materials related studies are being undertaken. A detailed letter report is under preparation.

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. H. Manaktala plans to participate in the ASTM C-26 sub-committee meetings at Las Vegas on January 22-25, 1990.

A revised schedule for the SCC related reports and the planned workshop will be determined. The draft reports are expected to be completed in the next period.

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/ Subelement program in the context of "ceiling" and "allotted" 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 $12,774. The attached figure displays the estimated cumulative spending plan and the actual cumulative costs to date.

Current allocations and expenditure rates are appropriate. Recent increases in activities in the Element have nearly 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	$ 10,919
b) FY90 Funds Allocated	$171,543
c) Total FY90 Funds Available	$182,462
Funds Costed to Date	$146,909
Funds Uncosted	$ 35,553
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

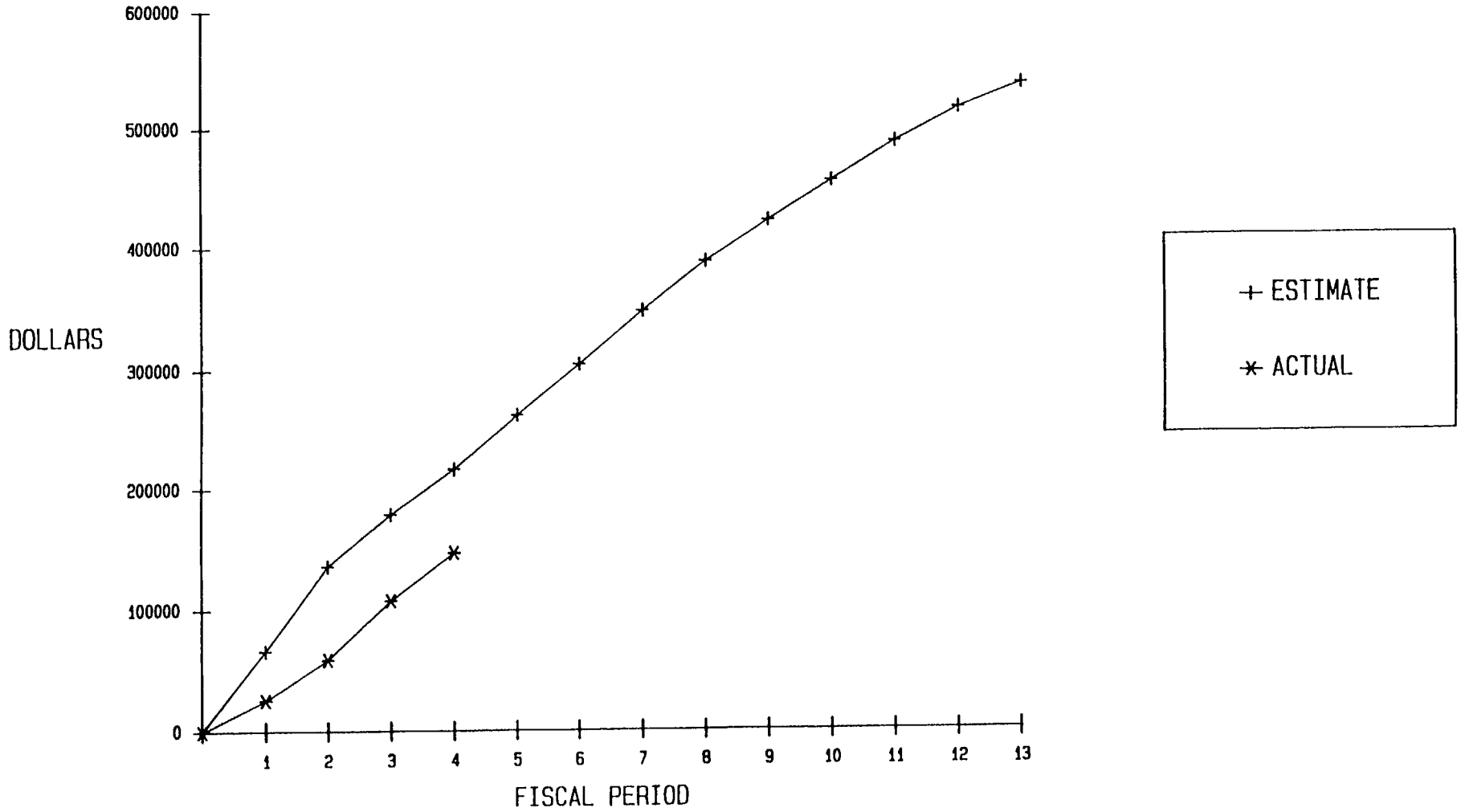
Element Status Cost Report

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	216052
ACTUAL PERIOD COST	25455	33175	49114	39165	0	0	0	0	0	0	0	0	0	146909
VARIANCE, $	40460	36962	-6154	-2126	0	0	0	0	0	0	0	0	0	69143
VARIANCE, %	61.4	52.7	-14.3	-5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.118	0.271	0.499	0.680	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	40460	77422	71268	69143	0	0	0	0	0	0	0	0	0	
VARIANCE, %	61.4	56.9	39.8	32.0	0.0	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.

3702-010 EBS - 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

Work on the License Application Review Strategy (LARS) has been concentrating on specific areas of the preliminary draft outline of the LARS. A meeting on January 17, 1990 in White Flint was held among J. Hageman, R. Weiner (Center), Robert Johnson and Mark Delligatti (NRC) to discuss the contents of the LARS and the statutory, regulatory, and policy requirements and constraints that will apply to license application review. NRC and CNWRA teaming was also discussed to help ensure a consensus of other sections within the NRC on the LARS approach.

At the January 17 meeting, aspects of the Environmental Impact Statement (EIS) review strategy were discussed and it was concluded that specific questions should be addressed to James (Jim) Wolf (NRC). S. Spector is progressing with an analysis of other non-NEPA statutes that may be incorporated within EIS Review Strategy. The potential NRC role in EIS review from the proposed and final rule changes to 10 CFR Parts 2, 51, and 60 is being reviewed and summarized to present the NRC role and the rationale for an environmental impact review strategy. The National Environmental Policy Act (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

More strategy meetings and teleconferences on the LARS outline and agenda items are planned. A teleconference with Jim Wolf and Robert Johnson is planned to discuss NEPA requirements on EIS review and the interface and requirements of other environmental related statutes. A brief synopsis of this teleconference and a previous one with Jim Wolf will be informally forwarded to the Project Officer, Robert Johnson and Program Element Manager, Mark Delligatti.

7.4 Element Financial Status

Table 1, below, indicates the financial status of the Element/Subelement program in the context of "ceiling" and "allotted" 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 $400. 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	$113,622
c) Total FY90 Funds Available	$113,622
Funds Costed to Date	$ 57,535
Funds Uncosted	$ 56,087
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

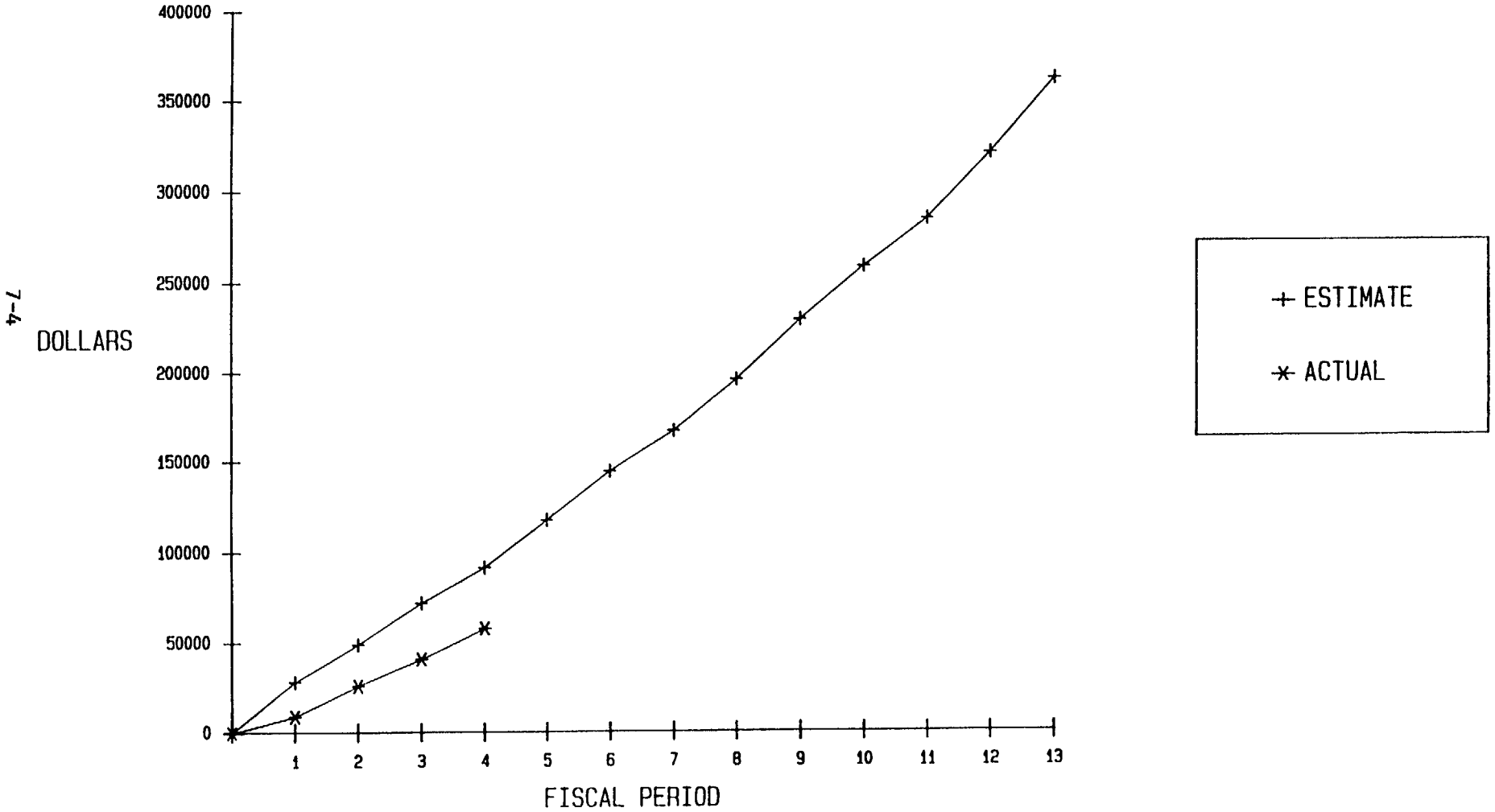
Element Status Cost Report

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	91415
ACTUAL PERIOD COST	9087	16951	14712	16785	0	0	0	0	0	0	0	0	0	57535
VARIANCE, $	19165	3634	8293	2788	0	0	0	0	0	0	0	0	0	33880
VARIANCE, %	67.8	17.7	36.0	14.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.1
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.099	0.285	0.446	0.629	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	19165	22799	31093	33880	0	0	0	0	0	0	0	0	0	
VARIANCE, %	67.8	46.7	43.3	37.1	0.0	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.

3702-050 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

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), T. Brandshaug (Itasca), and L. Lorig (Itasca) performed these activities. A. Chowdhury and T. Brandshaug will attend 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.

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 (CNWRA), S. Hsiung (CNWRA), T. Brandshaug (Itasca), and L. Lorig (Itasca), will perform these activities.

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/ Subelement program in the context of "ceiling" and "allotted" 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	$ 33,664
b) FY90 Funds Allocated	$131,963
c) Total FY90 Funds Available	$165,627
Funds Costed to Date	$ 26,091
Funds Uncosted	$139,536
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

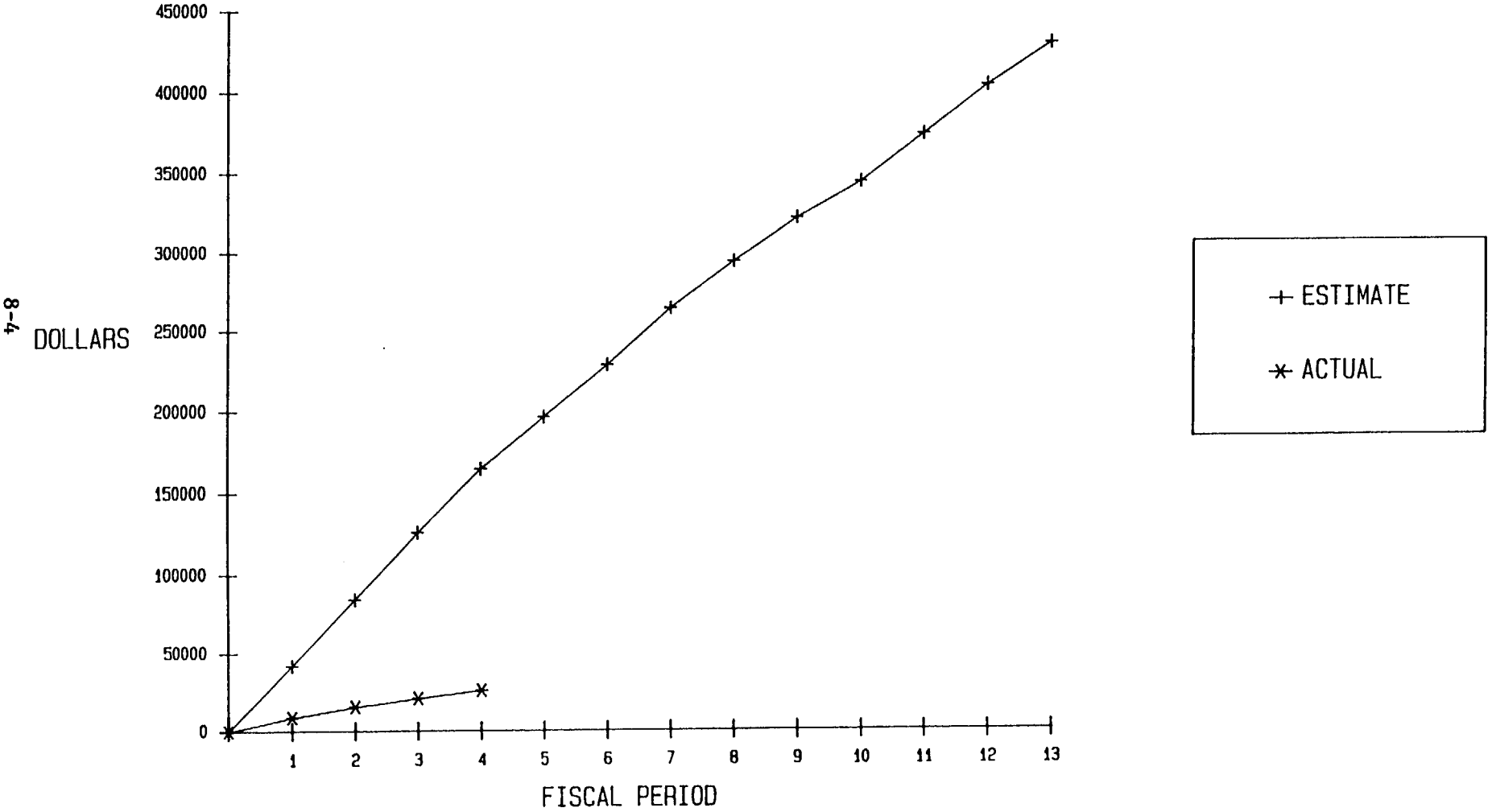
Element Status Cost Report

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	164465
ACTUAL PERIOD COST	8976	6710	5385	5019	0	0	0	0	0	0	0	0	0	26091
VARIANCE, $	32974	35549	36575	33275	0	0	0	0	0	0	0	0	0	138374
VARIANCE, %	78.6	84.1	87.2	86.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84.1
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.055	0.095	0.128	0.159	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	32974	68524	105099	138374	0	0	0	0	0	0	0	0	0	
VARIANCE, %	78.6	81.4	83.3	84.1	0.0	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.

3702-020 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. Weiner, R. Green, J. Hageman

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

The SNL report on formal use of expert judgment was received and comments were submitted to NRC.

Subtask 2.8 - Design Basis Accident Dose Limit Rulemaking

J. Hageman, and R. Field met with R. Neel, P. Brooks, B. Thomas, and S. Coplan to discuss this Subtask's Work Plan. We also discussed the scope of an implementation procedure for this rulemaking that includes the aspects of "Important to Safety" and radiation dose criteria for a "Limited Access Area." A second preliminary draft of the Proposed Rulemaking was received by the Center and comments discussed at a January 16, 1990, meeting with several members of the rulemaking team.

Task 4 - Review Plan Preparation

Subtask 4.2 - Performance Assessment Review Strategy

NRC comments were incorporated in the letter report, "Statutory Basis for Performance Assessment Review and Identification of Requirements for Performance Assessment in 10 CFR Part 60" and the final copy was submitted to the NRC.

Task 5 - Iterative Performance Assessment

B. Sagar visited the NRC offices and held discussions with the Performance Assessment Group members on future iterations of the MOU.

Plans for a Performance Assessment Workshop were finalized. The first PA Workshop should be held on February 15-16, 1990, at White Flint in Rockville, Maryland.

9.2 Major Problems

We expect to do work on PARS (Subtask 4.2) which has no funding. Discussions are underway to transfer $150,000 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 A1165 on techniques for determining probabilities and of evaluating scenarios will continue.

The first workshop on Performance Assessment will be held on February 15-16, 1990, at White Flint in Washington. R. Weiner will participate in a working group on scoping PARS. J. Hageman will finalize the Work Plan on Subtask 2.8, and complete the references for the implementation procedure.

B. Sagar and R. Johnson will hold a meeting with NRC and SNL on technology transfer. The scope of work for technology transfer will be defined in this meeting.

9.4 Element Financial Status

Table 1 below, indicates the financial status of this Element in the context of "ceiling" and "allotted" 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 $1,300. 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 should be rectified in the coming periods as activities in Tasks 4 and 5 intensify.

Table 1. Financial Status

a) Prior Year Funds Uncosted	$ -0-
b) FY90 Funds Allocated	$209,218
c) Total FY90 Funds Available	$209,218
Funds Costed to Date	$ 88,462
Funds Uncosted	$120,756
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.

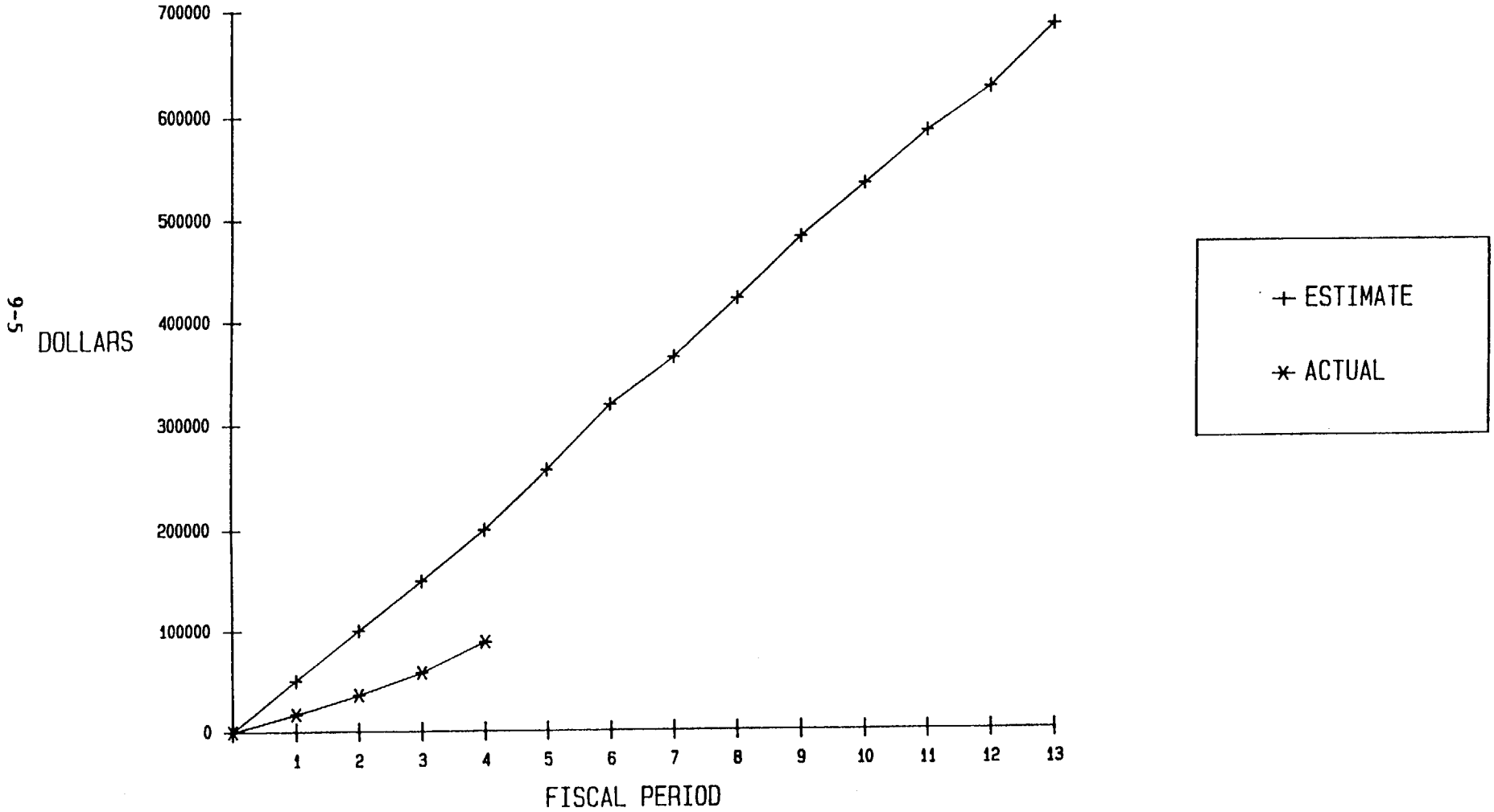
3702-060 PA Element Status Cost Report

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	199728
ACTUAL PERIOD COST	17497	18629	21922	30415	0	0	0	0	0	0	0	0	0	88462
VARIANCE, $	33176	30899	27783	19408	0	0	0	0	0	0	0	0	0	111266
VARIANCE, %	65.5	62.4	55.9	39.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.7
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.088	0.181	0.291	0.443	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	33176	64075	91858	111266	0	0	0	0	0	0	0	0	0	
VARIANCE, %	65.5	63.9	61.3	55.7	0.0	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.

3702-060 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 activity this period.

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 is extracting shipment-based and package-based data from the original entries to the SAND84-7174 database.

Subtask 2.2 - Evaluation of Models and Codes

The changeover to RADTRAN 4.0 is complete, but the link was essentially out of service for two weeks during this period. RADTRAN analysis continues.

Subtask 2.3 - Uncertainty and Sensitivity Analysis

No activity this period.

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) are awaiting Center internal review.

Task 4 - Discussion and Analysis of Transportation Alternatives

A list of credible alternative modal scenarios was drawn up.

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 analogous tables in NUREG-0170 is being made. Comparison Tables 4-18 and 4-19 are being formulated.

Subtask 5.2 - Radiological Effects and Risk Analysis of Transportation Accidents

R. Weiner has begun to scope the material for Chapter 5. This item may be deleted pending an NRC decision regarding curtailment of transportation-related activities.

Subtask 5.3 - Security and Safeguards Considerations

No activity this period. This item may be deleted pending an NRC decision regarding curtailment of transportation-related activities.

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 action to date. Consideration of Human Factors is unfunded.

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. J. Buckingham will continue the sensitivity analysis during the coming periods. Response to NRC comments on Chapter 2 will be completed during the coming period.

10.4 Subelement Financial Status

Table 1, below, indicates the financial status of this Element in the context of "ceiling" and "allotted" 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 $400.

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

Table 1. Financial Status

a) Prior Year Funds Uncosted	$ -0-
b) FY90 Funds Allocated	$ 96,173
c) Total FY90 Funds Available	$ 96,173
Funds Costed to Date	$ 49,218
Funds Uncosted	$ 46,955
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

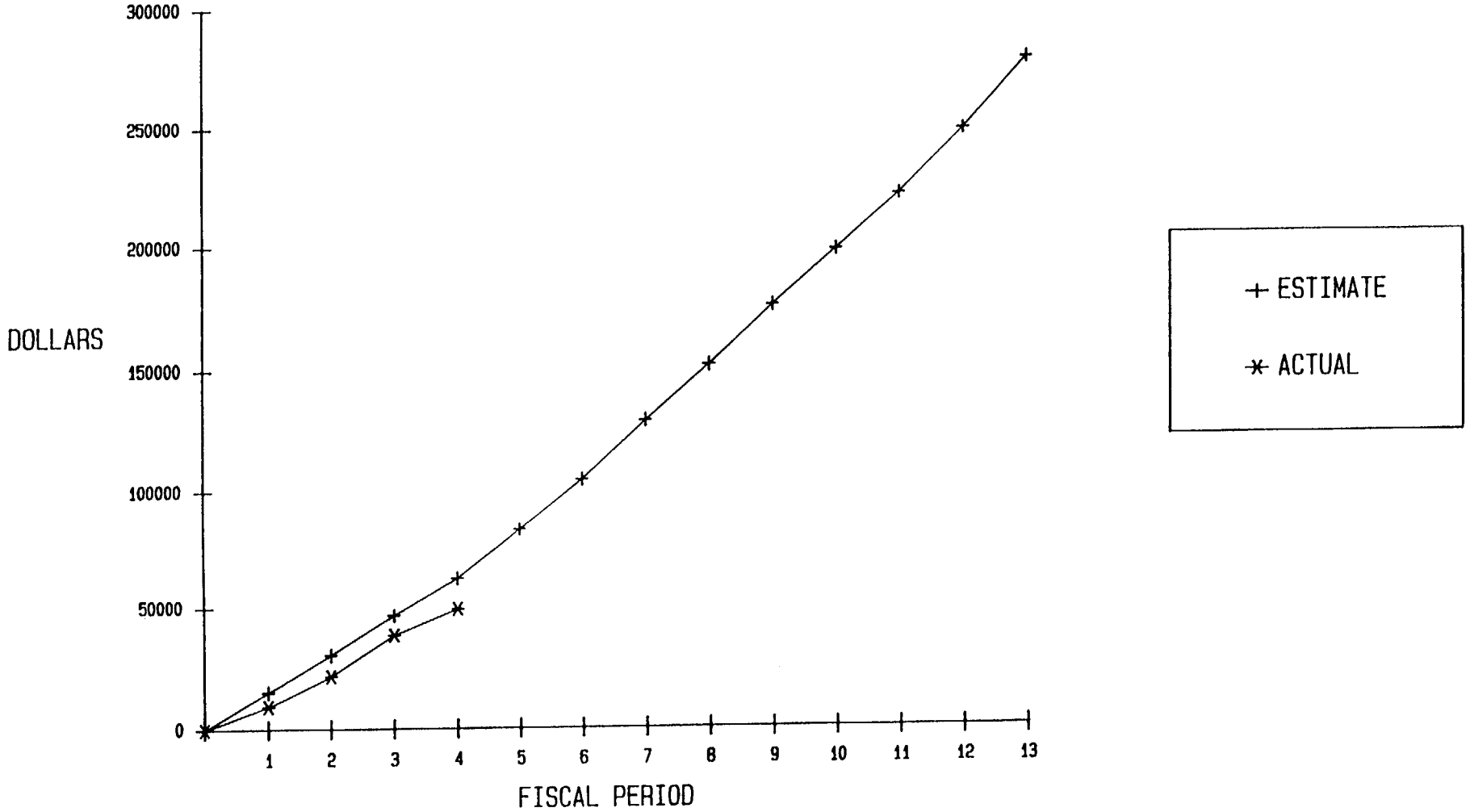
Element Status Cost Report

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	62240
ACTUAL PERIOD COST	9382	12154	16785	10897	0	0	0	0	0	0	0	0	0	49218
VARIANCE, $	5853	2881	-416	4704	0	0	0	0	0	0	0	0	0	13022
VARIANCE, %	38.4	19.2	-2.5	30.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.151	0.346	0.616	0.791	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	5853	8735	8319	13022	0	0	0	0	0	0	0	0	0	
VARIANCE, %	38.4	28.9	17.8	20.9	0.0	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.
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. Cragnolino, 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.

Project Title	Revised Plan Completion Date	Approval Status
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	Pending Approval
Res. 5-Integrated Waste Package	12/30/88	Revision planned
Res. 6-Stochastic Analysis of Unsaturated Flow and Transport	10/26/89	Draft Plan submitted
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

W. Murphy attended a Nuclear Waste Technical Review Board meeting at Lawrence Livermore National Laboratory on January 18 and 19, 1990. J. Russell and R. Pabalan participated in an internal QA audit conducted by Bob Englehardt (from SwRI QA, Division 30) of the Geochemistry Research Project.

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 and were submitted for Center management review. The report summarizes the theoretical background for the experimental studies, the data generated in sample characterization, and procedures for experimental work.

Characterization of zeolite specimens from Succor Creek, Oregon was completed. X-ray diffraction and scanning electron microscopy of the samples have been used to identify the zeolite as

clinoptilolite. Other minor phases present in the specimens include quartz and mordenite. In contrast to the microcrystalline variety of clinoptilolite commonly present in zeolitized tuffs, the Succor Creek clinoptilolite occurs in 1mm diameter euhedral crystals in vugs and coating fractures in the volcanic (?) matrix. Sample purification techniques, including gentle crushing, picking by hand, and heavy liquid separation, appear to be successful in obtaining relatively pure clinoptilolite samples. Additional specimens from the same locality are being ordered from the mineral dealer and, if similar success in isolating clinoptilolite from the bulk samples occurs, the clinoptilolite will be used for the geochemistry experiments.

R. Pabalan reviewed a paper by Alekhin, Y.V. et al., entitled "Study of Hydration and Associated Processes in Dry Steam Mixtures as Applied to Sodium and Potassium Chlorides" for the journal Geochemica et Cosmochimica Acta.

Research Project 3 - Thermohydrology

Additional work on adapting a traversing system has been performed during this period. The traversing/tracking and data acquisition system, which has been assembled in a SwRI electronics lab, has performed as designed. The tracking and acquisition system will be incorporated onto the planar table with a gamma-ray densitometer. A gamma-ray densitometer from previous SwRI experiments for another project at SwRI will be adapted to fit with the traversing table. Calibration experiments with the densitometer will commence upon completion of the traversing system. The initial tensiometer for the thermohydrology experimental apparatus has been constructed and installed in a Tempe pressure cell for calibration.

The thermohydrology project was subjected to an internal QA audit January 24, 1990. Participating in the internal audit were S. Svedman, M. Lewis, R. Green, R. Brient (CNWRA Quality Assurance) and R. Englehardt (SwRI Quality Assurance). The status of deliverable reports and documents were examined as were the programmatic elements of the research project. The experimental portions of the project performed to date have been designed to provide scoping data and information necessary for the successful performance and design of the separate effects experiments and the coupled effects experiments (to be determined in Task 3). Therefore, the experiments accomplished to date were audited for their programmatic relevance. No quality assurance deficiencies were identified during the internal audit.

The TOUGH code has been installed on both a VAX 8700 (a SwRI based computer) and a Silicon Graphics work station (on loan to the CNWRA). The program performs as intended when run using the VAX 8700. However, the TOUGH code is not yet operational on the Silicon Graphics work station. Additional adaptation and verification of the program will be required to use the work station to run the program.

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 study of computer codes, (ii) instrumented field study effort, (iii) the tuff specimens acquisition effort, (iv) seismic rock mechanics experimental apparatus and instrumentation development and calibration, and (v) response of letter to John E. Latz (CNWRA) from Mary H. Mace (NRC), dated December 22, 1989, concerning status of Seismic Rock Mechanics Research Project.

A draft technical report for the completed qualification study of the two-dimensional distinct element code UDEC against some benchmark analytical problems was prepared during this reporting period and was submitted to NRC on January 4, 1990. Qualification study of the two-dimensional finite element code HONDO was completed during this period. A draft technical report on the qualification study of HONDO is under preparation and will be submitted to NRC during the next reporting period.

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. The Lucky Friday Mine has tentatively agreed to allow the Center to go ahead with the seismic field study program. An initial meeting has been arranged to take place at the Lucky Friday Mine, Idaho on February 6 and 7, 1990 to discuss the project planning and instrumentation location selection in detail. This meeting will be attended by A. Chowdhury of CNWRA, B. Brady, M. Board and W. Blake (on-site consultant) of Itasca, and S. Lautenschlager and R. Appling of Lucky Friday Mine.

Drilling for collection of jointed tuff specimens from the Apache Leap Site, Arizona continued during this reporting period. S. Hsiung (CNWRA) supervised the rock specimen collection activities at the site. By the end of this reporting period, about 70% of the needed rock specimens have been collected. The collection of the tuff rock specimens will resume on February 1, 1990.

Preparation of a draft report for the custom-made rock joint dynamic shear test apparatus continued during this period. This report will be submitted to NRC on January 31, 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 letter to Mary H. Mace (NRC) from John E. Latz (CNWRA) describing the status of seismic rock mechanics research project was submitted to NRC on January 5, 1990. The purpose of this letter is to respond to the letter to John E. Latz from Mary H. Mace, dated December 22, 1989.

Research Project 5 - Integrated Waste Package Experiments

During this reporting period Dr. Gustavo Cragnolino joined the Center staff. Dr. Cragnolino will be a key member of the IWPE project team.

Investigations of the statistical variation in the pitting parameters using the potentiodynamic test method (ASTM G-61 procedure) are underway. Initial tests are being conducted on type 304L stainless steel as baseline material. Three concentrations of chloride are being examined. Simulated J-13 water with 6 ppm chloride is being studied first. A modified J-13 water chemistry with 20 ppm chloride concentration will be studied next since this corresponds to the simulated J-13 water prepared by Cortest Inc. Finally, a 1000 ppm chloride solution will be examined. Seven samples are being tested under each conditions. Other factors being examined include procedural differences between the various laboratories such as cathodic pre-polarization.

N. Sridhar, W. Murphy and P. Nair visited Lawrence Livermore National Laboratory to attend the Nuclear Waste Technical Review Board meeting on DOE's Container Materials program on January 18-19, 1990. As part of this meeting, a tour of the labs was arranged. The IWPE staff had an opportunity to review part of the LLNL laboratory studies on material degradation. Most of the recent effort of the LLNL staff (40%-50%) has been directed toward the preparation of procedures and setting up a quality assurance program. A trip report is under preparation.

Research Project 6 - 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 Element/ Subelement program in the context of "ceiling" and "allotted" 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 $251,096 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 is essentially on target at this time. Although the Thermohydrology and Seismic Rock Mechanics Projects indicate 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 reducted, 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	$ 48,726
Funds Uncosted	$ 62,139
Recommended Adjustment to Complete (+/-)	$ -0-
Geochemistry	
a) Prior Year Funds Uncosted	$ 958
b) FY90 Funds Allocated	$105,461
c) Total FY90 Funds Available	$106,419
Funds Costed to Date	$ 62,691
Funds Uncosted	$ 43,728
Recommended Adjustment to Complete (+/-)	$ -0-
Thermohydrology	
a) Prior Year Funds Uncosted	$ -0-
b) FY90 Funds Allocated	$109,484
c) Total FY90 Funds Available	$109,484
Funds Costed to Date	$ 97,412
Funds Uncosted	$ 12,072
Recommended Adjustment to Complete (+/-)	$ -0-

Seismic Rock Mechanics	
a) Prior Year Funds Uncosted	$ 31,719
b) FY90 Funds Allocated	$169,036
c) Total FY90 Funds Available	$200,755
Funds Costed to Date	$142,098
Funds Uncosted	$ 58,657
Recommended Adjustment to Complete (+/-)	$ -0-
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	$ 76,146
Funds Uncosted	$125,376
Recommended Adjustment to Complete (+/-)	$ -0-
Stochastic Analysis	
a) Prior Year Funds Uncosted	$ -0-
b) FY90 Funds Allocated	$ 7,000
c) Total FY90 Funds Available	$ 7,000
Funds Costed to Date	$ -0-
Funds Uncosted	$ 7,000
Recommended Adjustment to Complete (+/-)	$ -0-
Geochemical Analogs	
a) Prior Year Funds Uncosted	$ -0-
b) FY90 Funds Allocated	$ 30,000
c) Total FY90 Funds Available	$ 30,000
Funds Costed to Date	$ 1,167
Funds Uncosted	$ 28,833
Recommended Adjustment to Complete (+/-)	$ -0-

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

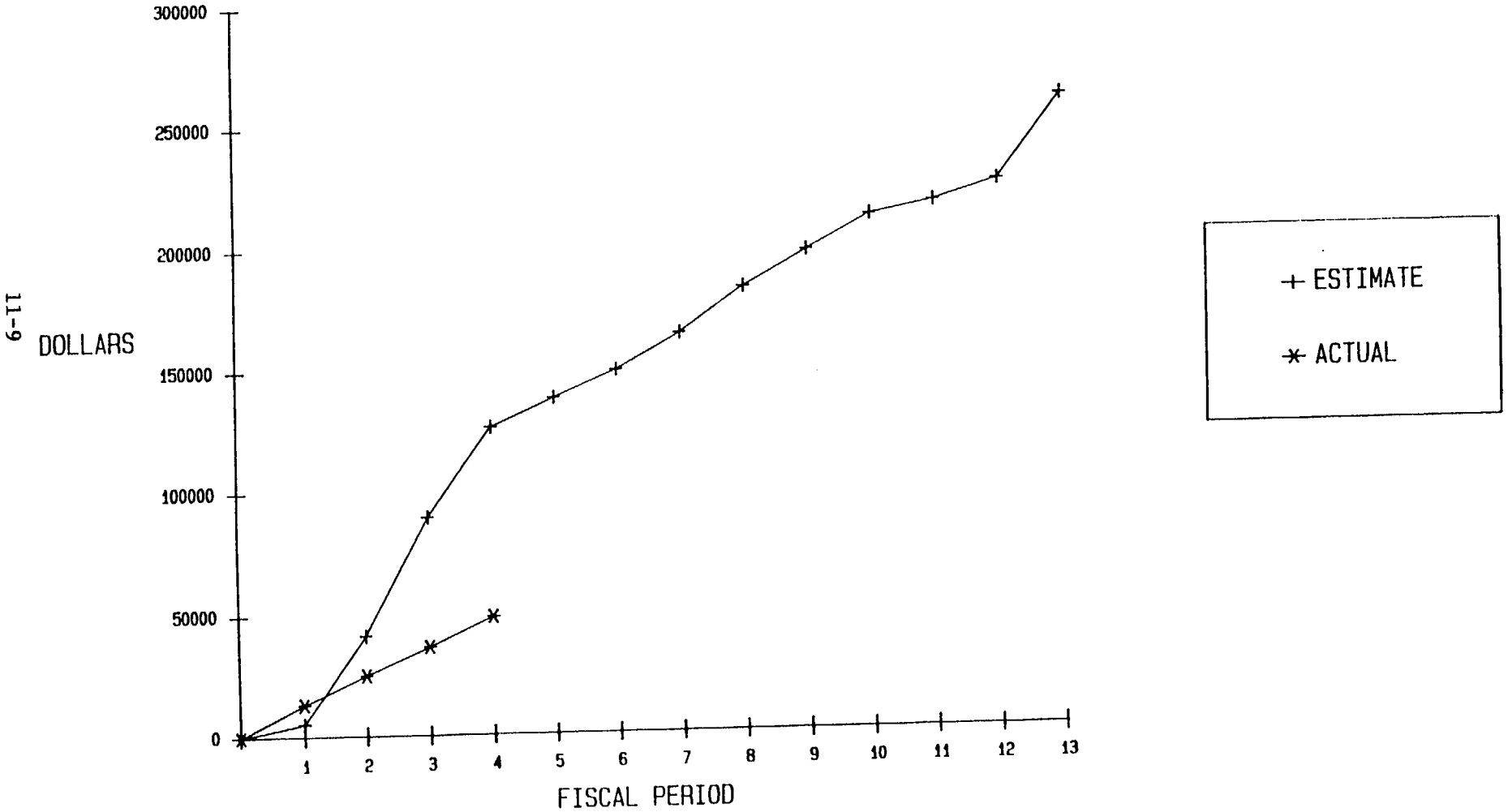
Element Status Cost Report

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	126030
ACTUAL PERIOD COST	13507	11781	11352	12086	0	0	0	0	0	0	0	0	0	48726
VARIANCE, $	-8016	24285	36762	24273	0	0	0	0	0	0	0	0	0	77304
VARIANCE, %	-146.0	67.3	76.4	66.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.3
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.107	0.201	0.291	0.387	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	-8016	16268	53030	77304	0	0	0	0	0	0	0	0	0	
VARIANCE, %	-146.0	39.1	59.1	61.3	0.0	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.

3704-000 OVERALL - FY 90

Estimate vs. Actual



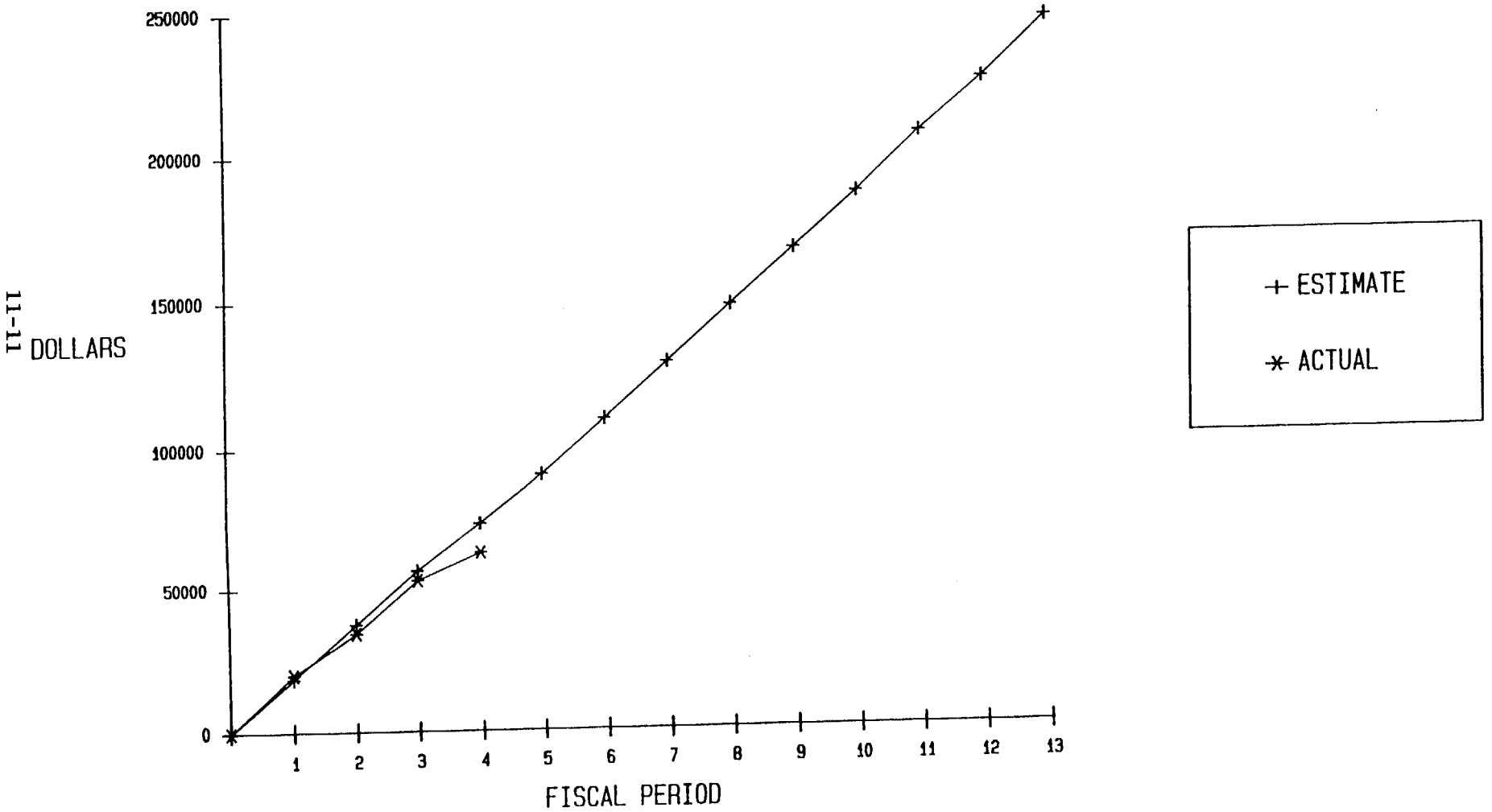
3704-010 GEOCHEM Element Status Cost Report

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	73341
ACTUAL PERIOD COST	19634	14425	18742	9889	0	0	0	0	0	0	0	0	0	62691
VARIANCE, $	-1415	4616	299	7152	0	0	0	0	0	0	0	0	0	10651
VARIANCE, %	-7.8	24.2	1.6	42.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.268	0.464	0.720	0.855	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	-1415	3200	3499	10651	0	0	0	0	0	0	0	0	0	
VARIANCE, %	-7.8	8.6	6.2	14.5	0.0	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



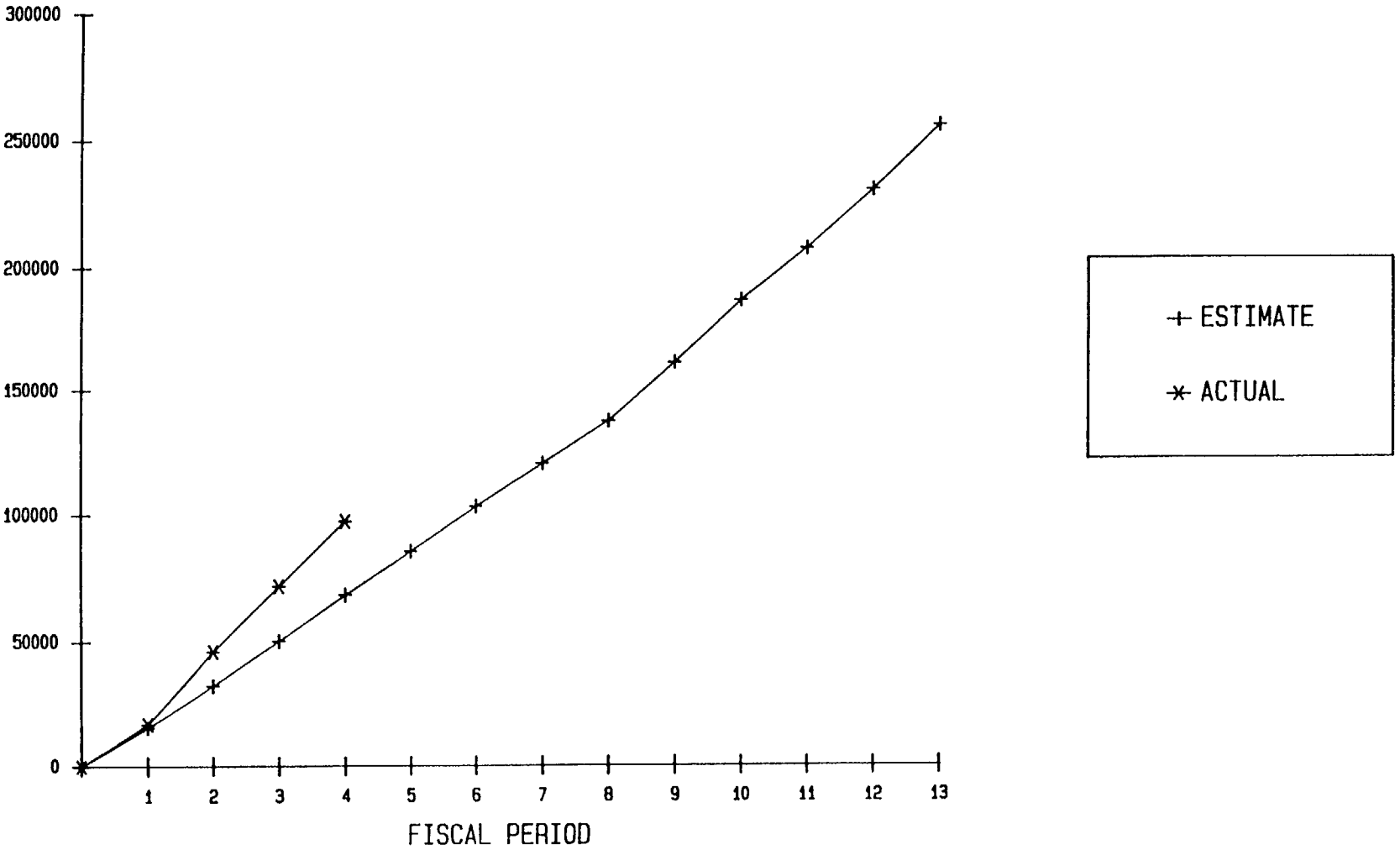
3704-020 THERMO Element Status Cost Report

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	68516
ACTUAL PERIOD COST	17324	28853	25863	25372	0	0	0	0	0	0	0	0	0	97412
VARIANCE, $	-1386	-12058	-8352	-7100	0	0	0	0	0	0	0	0	0	-28896
VARIANCE, %	-8.7	-71.8	-47.7	-38.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-42.2
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.253	0.674	1.051	1.422	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	-1386	-13445	-21797	-28896	0	0	0	0	0	0	0	0	0	
VARIANCE, %	-8.7	-41.1	-43.4	-42.2	0.0	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



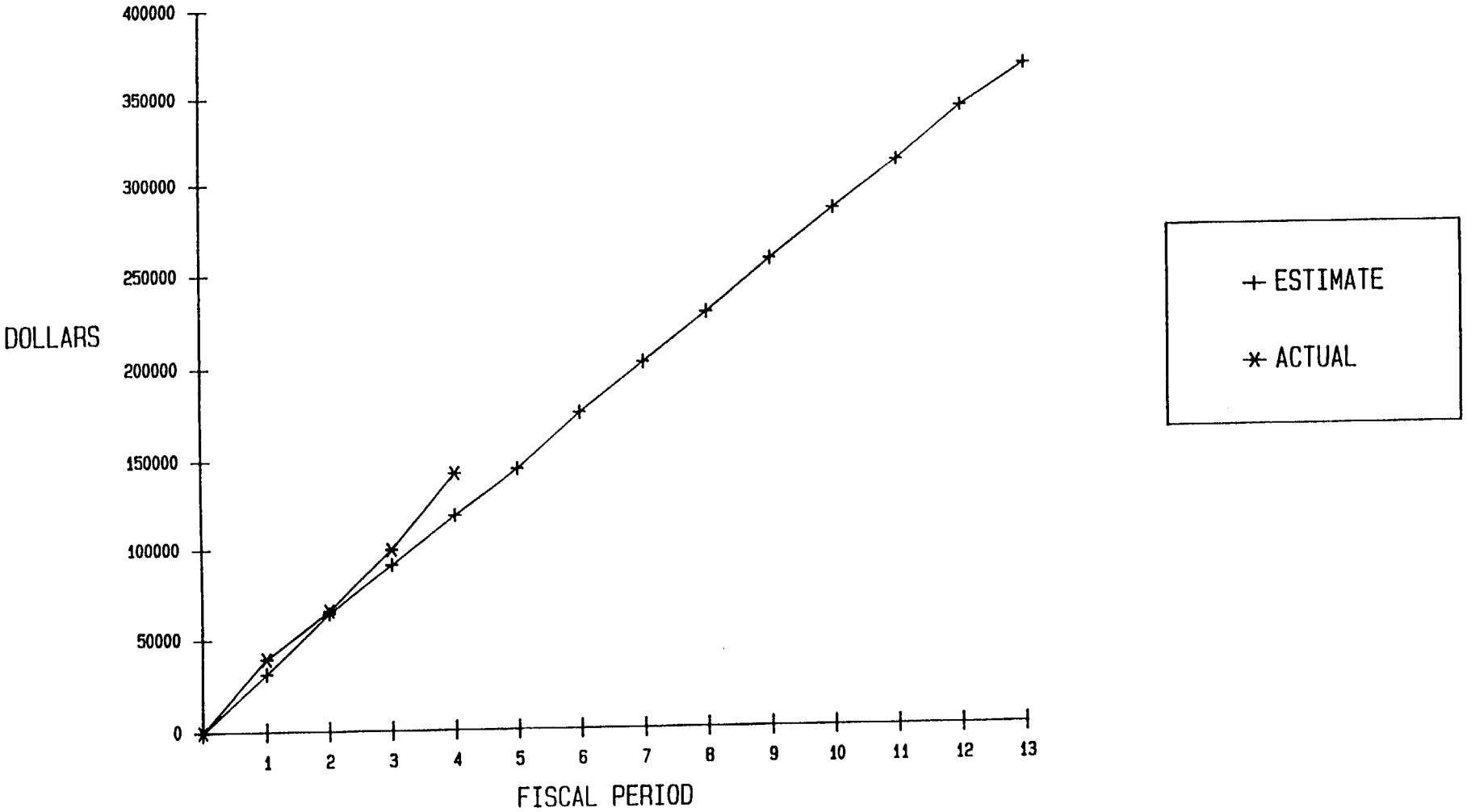
3704-030 SEISMIC Element Status Cost Report

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	118353
ACTUAL PERIOD COST	39249	26008	34001	42840	0	0	0	0	0	0	0	0	0	142098
VARIANCE, $	-8136	6737	-7254	-15093	0	0	0	0	0	0	0	0	0	-23745
VARIANCE, %	-26.1	20.6	-27.1	-54.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-20.1
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.332	0.551	0.839	1.201	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	-8136	-1398	-8652	-23745	0	0	0	0	0	0	0	0	0	
VARIANCE, %	-26.1	-2.2	-9.5	-20.1	0.0	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



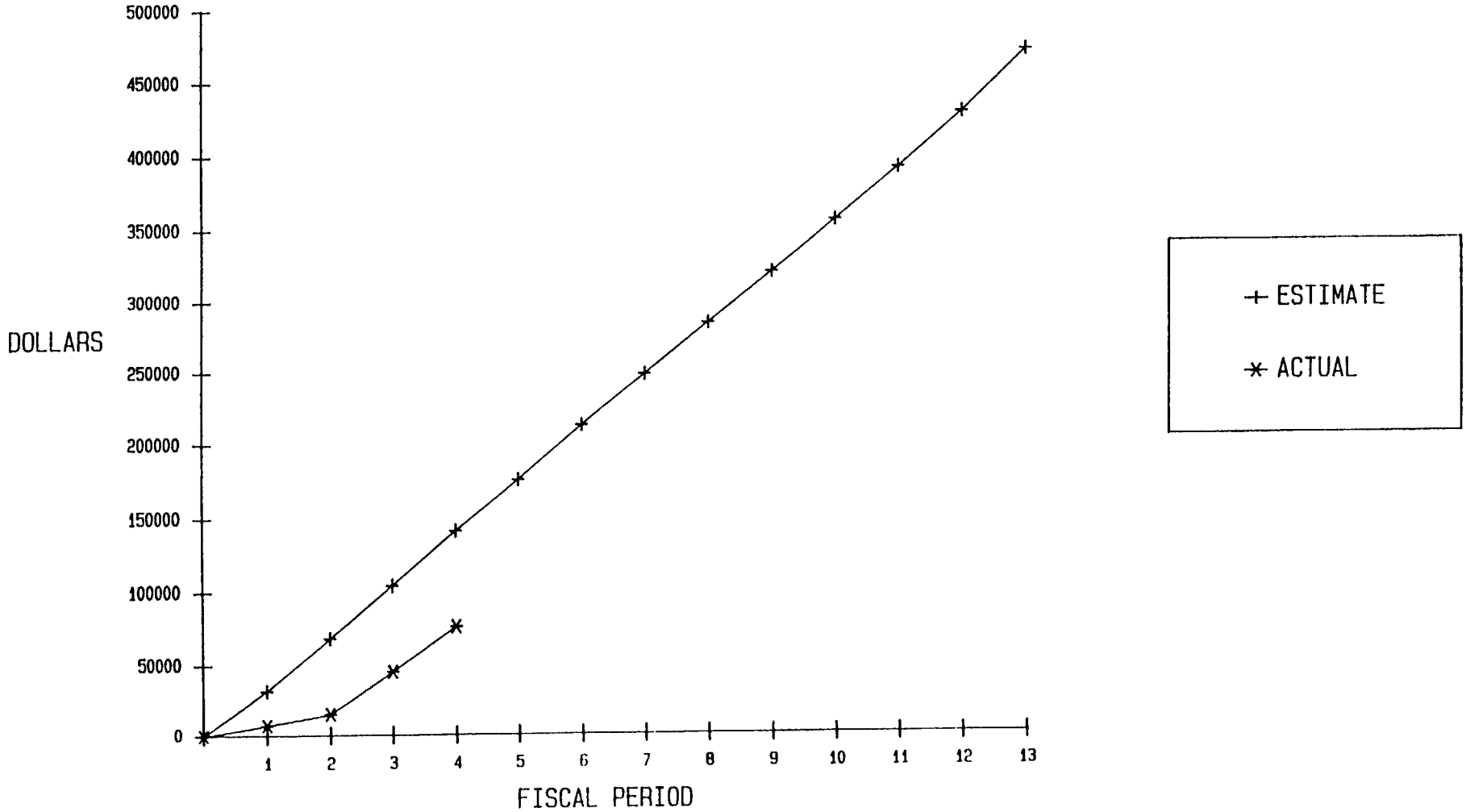
3704-040 WASTE PACKAGE Element Status Cost Report

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	141183
ACTUAL PERIOD COST	7456	7996	29768	30925	0	0	0	0	0	0	0	0	0	76146
VARIANCE, $	24636	28034	6263	6105	0	0	0	0	0	0	0	0	0	65038
VARIANCE, %	76.8	77.8	17.4	16.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.1
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.053	0.109	0.320	0.539	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	24636	52670	58933	65038	0	0	0	0	0	0	0	0	0	
VARIANCE, %	76.8	77.3	56.6	46.1	0.0	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.

3704-040 WASTE PACKAGE - 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	80011
ACTUAL PERIOD COST	0	0	1167	0	0	0	0	0	0	0	0	0	0	1167
VARIANCE, $	9569	20321	23882	25072	0	0	0	0	0	0	0	0	0	78844
VARIANCE, %	100.0	100.0	95.3	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.5
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	0	0	0	0	0	0	0	0	0	
PERCENT COMPLETE, %	0.000	0.000	0.015	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
VARIANCE, $	9569	29890	53772	78844	0	0	0	0	0	0	0	0	0	
VARIANCE, %	100.0	100.0	97.9	98.5	0.0	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.

3704-060 GEOCHEMICAL ANALOGS - FY 90

Estimate vs. Actual