University of California

LOS ALAMOS SCIENTIFIC LABORATORY

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In reply refer to: LS6-80-410
Mail stop: 495

September 12, 1980

1539 General

Dr. George Levin
EG & G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415

Dear George:

In accordance with your instructions of August 11, 1980, the attached "Current Year Work Plans" are submitted in support of the Field Task Proposals/Authorizations for the Low-Level Waste Programs at LASL (AL 3.5.1, AL 3.5.4, AL 3.10.1). Since this is the first time current year work plans have been required, we are not certain that we have provided you with all of the information that you want. If additions or modifications are desired, we will be most pleased to respond.

Sincerely yours,

Jim

James G. Steger
LS-6 Alternate Group Leader
Environmental Science, MS-495

JGS:em

Enc: a/s

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3. MODEL SLB SITE

Objective

The purpose of this task is to provide the experimental facilities to carry out the engineering testing studies for the LASL part of the Low-Level Waste Management Program. This task includes site preparation, site planning and development, and emplacement of the actual experiments in the facility.

The LASL Experimental Engineered Waste Burial Facility is being developed to assess, on an appropriate scale, the effectiveness of some of the suggested solutions to problems of radionuclide migration that have been associated with shallow-land burial. The experiments in this facility will provide a collection of data for construction of waste disposal facilities in a completely engineered environment. In this test facility, data on mobilization of contaminants, migration of contaminants, interaction of the contaminants with the fill material, water infiltration through the cap system, water infiltration through the disposal facility walls or liner systems, leakage rates from engineered containers, and the general chemistry and hydrology of the system will be obtained. This information will be used to design waste disposal facilities so that liquid movement can be controlled, and so that the amount and composition of any leachate or liquid in the system can be predicted.

This facility will provide the basic test environment in which we will conduct a large part of our LLW studies. These include assessment of materials and strategies for closure and remedial action for arid SLB sites, and the evaluation of cover and barrier materials to reduce migration of moisture and waste components into and out of SLB sites. Two important objectives of these experiments are: to determine the scaling factors relative to small, intermediate, and full scale plots to facilitate extrapolation to real shallow-land burial facilities; and, to develop methods to accelerate the weathering and aging processes to obtain results useable as quickly as possible.

After site preparation is complete, experiments will be emplaced on two scales: isolated variable experiments, and intermediate scale experiments. The isolated variable experiments will be performed in experiment groups which consists of several caissons clustered around a central access and instrument caisson. The instrument and access caissons should be about 9 to 10 feet in diameter. The experiment caissons can be any size up to the same size as the central caisson or can be larger if used in place of two smaller caissons. The access caisson will allow samples to be taken in a horizontal direction, and will allow the emplacement of sample access ports for in situ measurements of moisture and the recovery of solid and liquid samples. These ports can be at any elevation in the caissons and will allow sampling without disturbing the surface of the caisson or allowing vertical channeling by water

through the packing material along vertical sampling or access tubes. The intermediate scale experiments will be done in small burial pits, about 15 feet square and varying in depth from very shallow to about 10 feet deep. In these experimental units, measurements will be made to determine water content and movement, contaminant movement, temperature, bulk density, and other parameters.

Experiments to test barriers to control moisture and radionuclides migration will be done in the experiment clusters. Intrusion barriers, arid site closure concepts, and the remedial action testing will be done in the intermediate scale experiments. Some of the experiments on intrusion barriers will be done in small lysimeters located in the facility.

The small lysimeters, the experiment cluster, and a few of the intermediate scale experiments will be emplaced in the Fall of 1980. The remainder of the intermediate scale experiments and possibly another experiment cluster will be emplaced in the spring of 1981.

This experimental facility is large enough so that many more experiments can be done in the future.

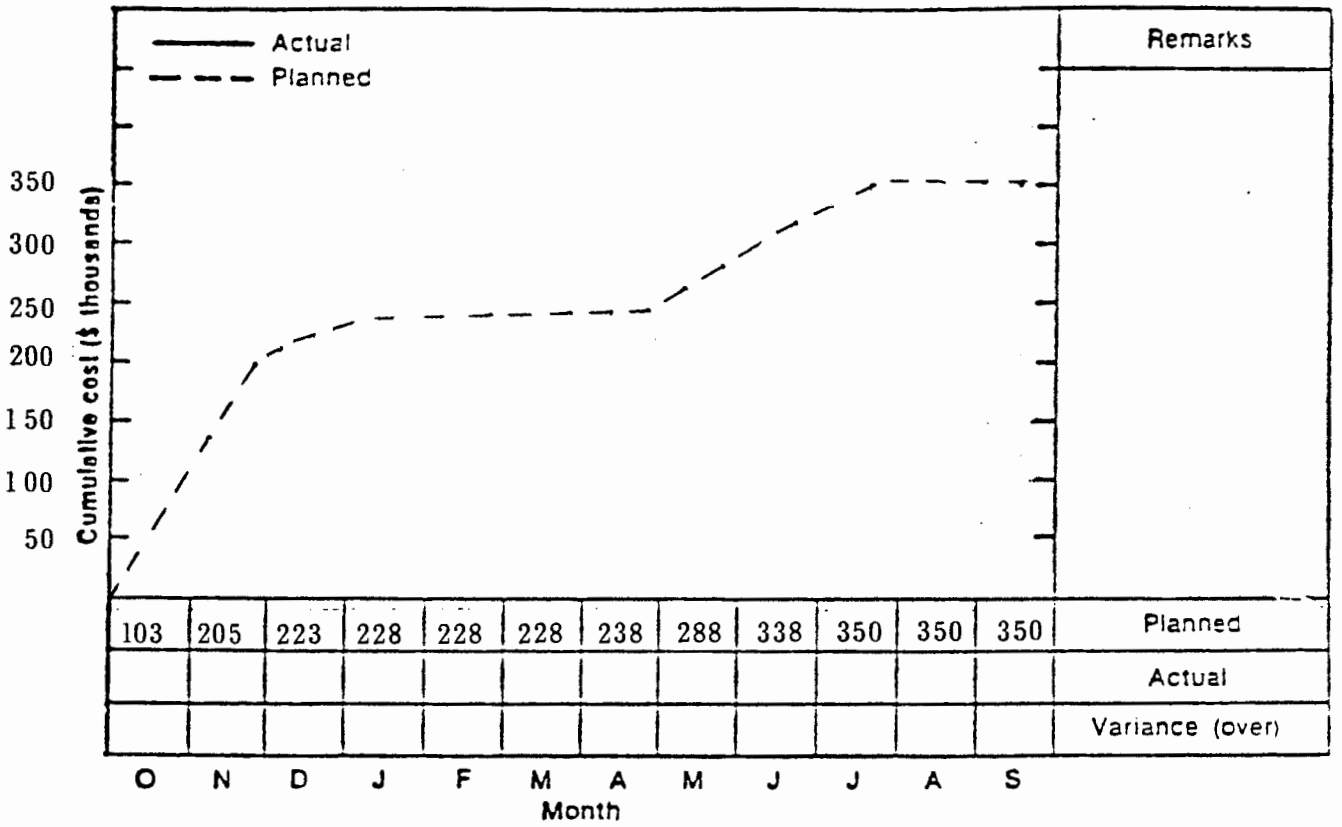
MILESTONES

1. Site preparation and fencing, 12/80
2. Emplace experiment cluster, 12/80
3. Fill cluster, emplace experiments, 2/81
4. Put in first intermediate scale experiments, 1/81
5. Put in second group of intermediate scale experiments, 8/81
6. Emplace second experiment cluster, 7/81
7. Fill second cluster, 8/81

Title D3 Model SLB Site B&FC No. AL 3.5.4 AR

FO/Contractor AL/LASL FY 81 WEP No.

Operating Dollars in Thousands (BO)



	O	N	D	J	F	M	A	M	J	J	A	S
Planned	103	205	223	228	228	228	238	288	338	350	350	350
Actual												
Variance (over)												

13. REMEDIAL ACTION TESTING

Objective

The purpose of this task is to field test methods that could be used to correct actual or anticipated problems with a closed SLB site in an arid environment. These problems might include surface water infiltration, surface erosion by wind or water, contaminant uptake by plants and animals, and the upward migration of radionuclides due to moisture cycling. The results of these field tests will provide input for milestone D.4 - Provide Reports on All (Remedial) Tests and for milestone C.4 - Provide Updated Handbook to Reflect Developed Technology.

Experiments to support this task will be mostly performed on the intermediate scale in the Experimental Engineered Test Facility and will emphasize application to and compatability with existing waste disposal facilities. Based on earlier work in this program, a few configurations of integrated cap systems will be constructed and tested. These integrated cap systems will be multifunctional and will be designed to prevent water infiltration, plant infiltration, and wind and water erosion. Measurements will be made on the experiments so that the reasons for the success or failure of an integrated cap system will be known and documented.

The upward migration experiments will be performed in a smaller individual caisson. Tracer materials will be placed in typical fill materials at a depth determined to be in the region of moisture cycling. The system will be monitored to determine if tracer material is brought to or near the surface of the caisson due to moisture cycling.

The moisture cycling experiments will be started in the Fall of 1980 while the integrated cap experiments will be started in the Spring of 1981.

The experimental data obtained in this work task, combined with the data obtained in the work tasks on barriers for both migration and intrusion, will be a large input to the task on arid site closure. By obtaining information on remedial action for problems associated with previously closed sites, the source of the problems may be eliminated in the future as arid sites for SLB are closed.

MILESTONES

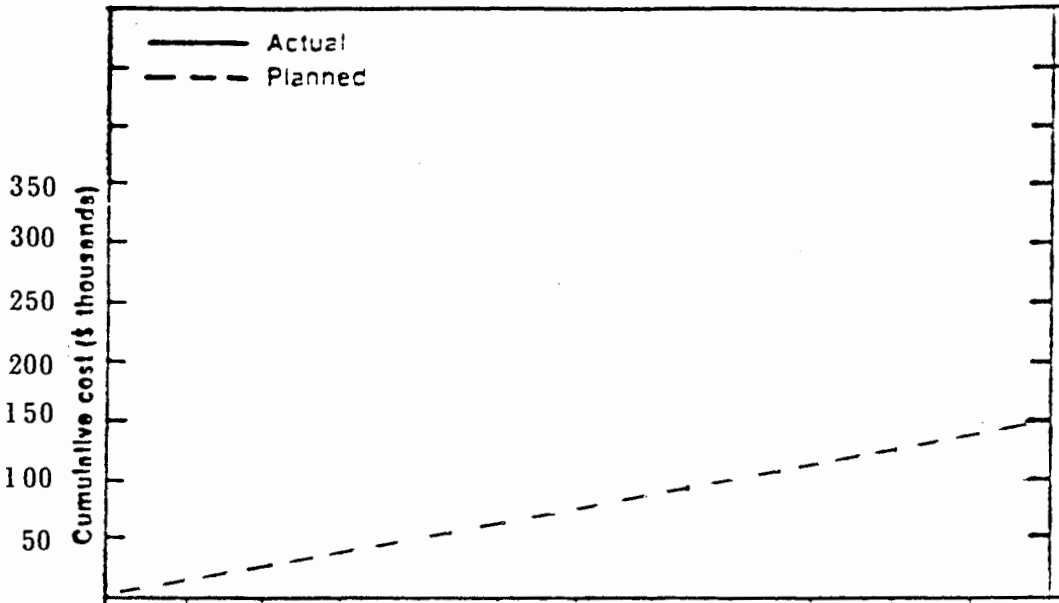
1. Design moisture cycling experiment, 10/80
2. Construct moisture cycling experiment, 12/80
3. Conduct experiments (moisture cycling), 6/81
4. Write report on results of moisture cycling experiment to date, 8/81
5. Design integrated cap systems, 3/81
6. Construct integrated cap systems, 6/81

7. Monitor performance of integrated cap systems, 9/81
8. Write report on performance of integrated cap system to date, 9/81

Title D13 Remedial Action Testing B&FC No. AL 3.5.4 AR

FO/Contractor AL/LASL FY 81 WEF No.

Operating Dollars in Thousands (BO)



Remarks

	O	N	D	J	F	M	A	M	J	J	A	S
Planned	8	17	25	33	42	50	58	67	75	83	92	100
Actual												
Variance (over)												

Month

28. SHALLOW-LAND BURIAL BARRIERS - MIGRATION

Objective

One of the major objectives of the LLW Program is to prepare an updated handbook to reflect developed technology by March 1984. This task is to study, design, and field test engineered barriers to reduce the potential migration of chemicals and control the flow of water in the shallow-land burial environment. This field research will be performed in caissons at the LASL Experimental Engineered Waste Burial Facility, the construction of which is supported by the "Model SLB Site" project. This task will provide the "LASL-Remedial Action Testing", the "SLB Barriers-Intrusion", and the "Arid Site Closure" programs with information concerning migration of water and chemicals in controlled field geometries. These three programs will allow some of the concepts and experimental findings of the "SLB Barrier-Migration" program to be field tested at a larger scale and to be evaluated in the presence of several additional variables.

During the past several years, LASL and its contractors have been evaluating the performance of barrier material, the impact of different waste properties on them, unsaturated transport and improved geometries for barriers. The most promising combinations will be selected for the field experiments. One of the more difficult aspects of this experiment will be selecting an instrumentation methodology which will provide reliable information quickly about the barriers' ability to prevent transport.

Several tangible end products will be produced by this work. The reliability and effectiveness of several engineered barriers will be field tested on a small scale under defined hydrologic conditions. Field estimates of the migration rates of water and chemicals in and around the engineered barriers will be measured and will be available for hydrologic-chemical transport modeling efforts. Several SLB trench sampling schemes and monitoring instruments will be field tested and correlations made between destructive and nondestructive sampling techniques.

MILESTONES

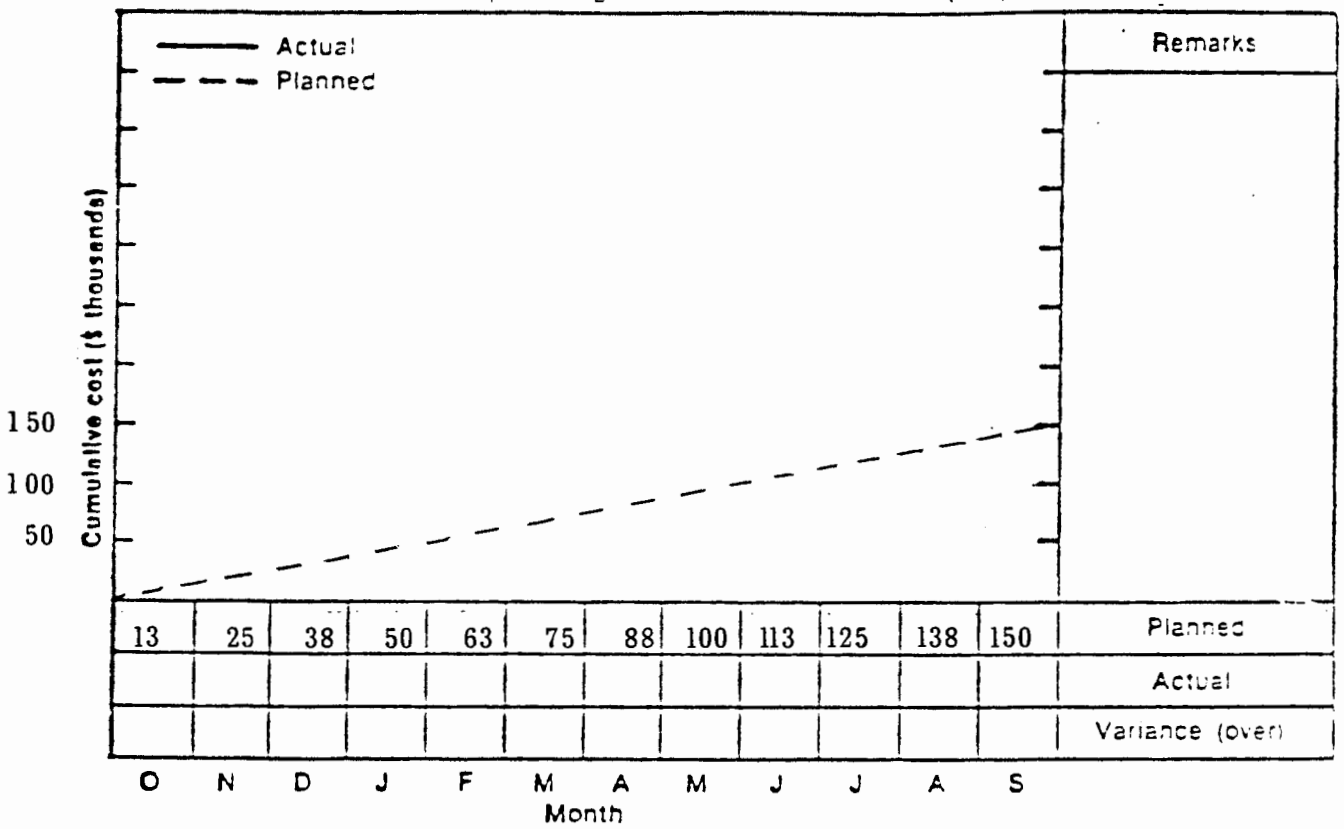
1. Estimate hydraulic conductivities of porous materials to be used as engineered barriers, 10/80
2. Construct and emplace first experimental cluster in field 10-12/80
3. Evaluate water and chemical transport and barrier performance in first experimental cluster, 1-10/81
4. Construct and emplace second experimental cluster in field, 5-7/81

5. Evaluate water and chemical transport and barrier performance in second experimental cluster, 7-9/81

Title D28 Shallow Land Barriers-Migration B&PC No. AL 3.5.4 AR

FO/Contractor AL/LASL FY 81 WEF No.

Operating Dollars in Thousands (BO)



13	25	38	50	63	75	88	100	113	125	138	150	Planned
												Actual
												Variance (over)

29. BIOLOGICAL INTRUSION BARRIERS FOR SLB SITES

Objective

Experience at decommissioned and current sites for radioactive and chemical wastes has demonstrated the need for biological criteria to select trench cover configurations that limit biological interaction with buried waste. Cases exist at SLB sites at PNL, INEL, and LASL where shallow, poorly designed overburden configurations have encouraged growth of deep rooted plants and burrowing animals resulting in the transport of radioactive and chemical waste materials to the ground surface. Physical (wind and water erosion of soil) and biological processes can transport these waste radionuclides into ecological and human food webs.

This study will utilize experimental field plots in the Experimental Engineered Test Facility at two different scales to measure the effectiveness of a variety of cover configuration in limiting plant and animal intrusion into waste trenches. Cover configurations to be tested will consist of various combinations and depths of soil, biobarrier (i.e., cobble, clay, and backfill) subjected to perturbations by several vegetation and animal species.

Intensive screening of the effect of cover configuration on plant rooting depths will be conducted in 288 small (700 cm^2) plots to select design criteria for testing the effect of cover configuration on both plant and animal intrusion potential in intermediate scale (9 m^2) plots.

The results of these studies will provide documentation of biological criteria that can be used in selecting and applying trench cover configurations that minimize biological transport of low-level waste to the ground surface. Results available in FY81 will consist of the complete evaluation of the small plot experiment and the construction and initiation of the intermediate scale study.

Human intrusion prevention is an interesting dilemma. The harder past civilizations tried to prevent intrusion into burial chambers, the harder subsequent generations worked to penetrate them - with success in all cases. At this time, the approach which seems to offer the most practical solution is in the field of land use planning. Techniques may be available to bias future uses of closed burial grounds towards predetermined applications and indirect control of human intrusion.

This study in combination with those emphasizing barriers to limit physical and chemical transport of low-level waste (Items 13 and 28), will be used to develop experimental designs for intermediate scale field tests of methods for SLB arid-site closure (Item 47).

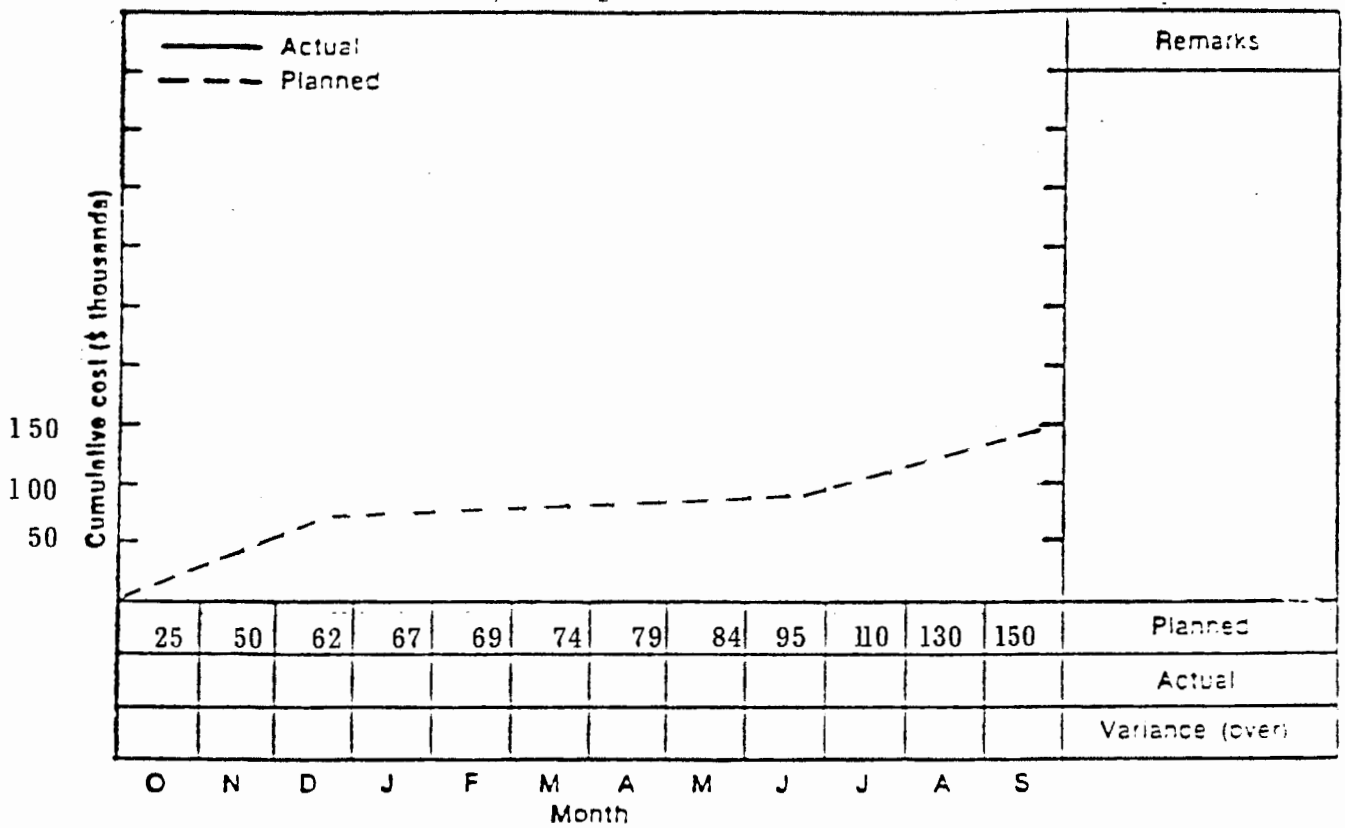
MILESTONES

1. Small plot construction and emplacement, 1/81
2. Seeding of small plots, 2/81
3. Evaluation of barriers to plants intrusion, 7/81
4. Construction of intermediate scale plots, 8/81
5. Preliminary report on intermediate scale plots, 9/81

Title D29 Shallow-Land Barriers-Intrusion B&F C No. AL 3.5.4 AR

FO/Contractor AL/LASL FY 81 WBS No.

Operating Dollars in Thousands (BO)



	O	N	D	J	F	M	A	M	J	J	A	S
Planned	25	50	62	67	69	74	79	84	95	110	130	150
Actual												
Variance (over)												

41. LASL DISPOSAL SITE STUDIES

Objective

The basic objectives of this task are to understand the mechanisms controlling radionuclide transport from a shallow-land burial facility in an arid environment, and to use this information to validate transport models for use in estimating the impact of buried radionuclides. The models involved are BIOTRAN/ARM/SERATRA covering biological uptake and surface erosion and runoff. An unsaturated flow model will be added in the near future.

In the past, this task was directed at site specific goals with some potential generic applications. This year, the site specific work will be finished and closed out, and the remaining work will be redirected to only generic applications. The results of this project will be useful in assessing the results of the other LASL low-level waste tasks on barriers and site closure, as well as similiar work at other labs.

Work efforts can be divided into three sub-tasks:

1. Geological. Some effort will be expended on completing the description and mapping of the geology at LASL. Since this is site specific, it is not expected that this work will continue past mid-year.

2. Hydrology. A small effort will be spent on completing the descriptive report on the hydrology at LASL. Emphasis will then be shifted to radionuclide transport in unsaturated environments. The movement of moisture and related radionuclide transport in arid environments is dominated by strong interactions of the liquid and vapor phases of the soil water. This subtask will test our knowledge of those interactions and apply that knowledge to the control and monitoring of radionuclides in arid locations.

Field and laboratory experiments will be conducted to determine the extent to which moisture movement relates to transport of soluble materials. Experimental results will be interpreted through the use of a partially saturated flow model, but emphasis will be placed upon the development of simplified methods for measurement and description of moisture flow.

Tritrium, a dominant radionuclide in most low-level waste, is particularly mobile in hydrologic and biologic systems, and as tritiated water vapor provides an opportunity to identify mechanisms governing gaseous transport. Field and lab experiments will be conducted to quantify these mechanisms and to identify possible techniques for controlling tritium releases from arid burial sites.

3. Evaluation Methodology. This subtask is to develop a methodology to evaluate

the impact of buried LLW based upon an analysis of future potential land use, release/containment conditions, and environmental transport. For the past two years, LASL has been working with PNL to combine the biological, surface runoff and stream transport models. A substantial amount of funding for this effort was expected to be provided by the TRU program, but the FY81 budget was zeroed. This funding loss will mean that the results will take longer to achieve than what had been expected.

The evaluation methodology will be based upon: a technique to determine most likely land use in the future: radionuclide release mechanisms and rates: and computer simulation of pathways in an arid environment (biological, wind, and water erosion, runoff, stream transport, and unsaturated transport). Test runs of the models made to date are very encouraging.

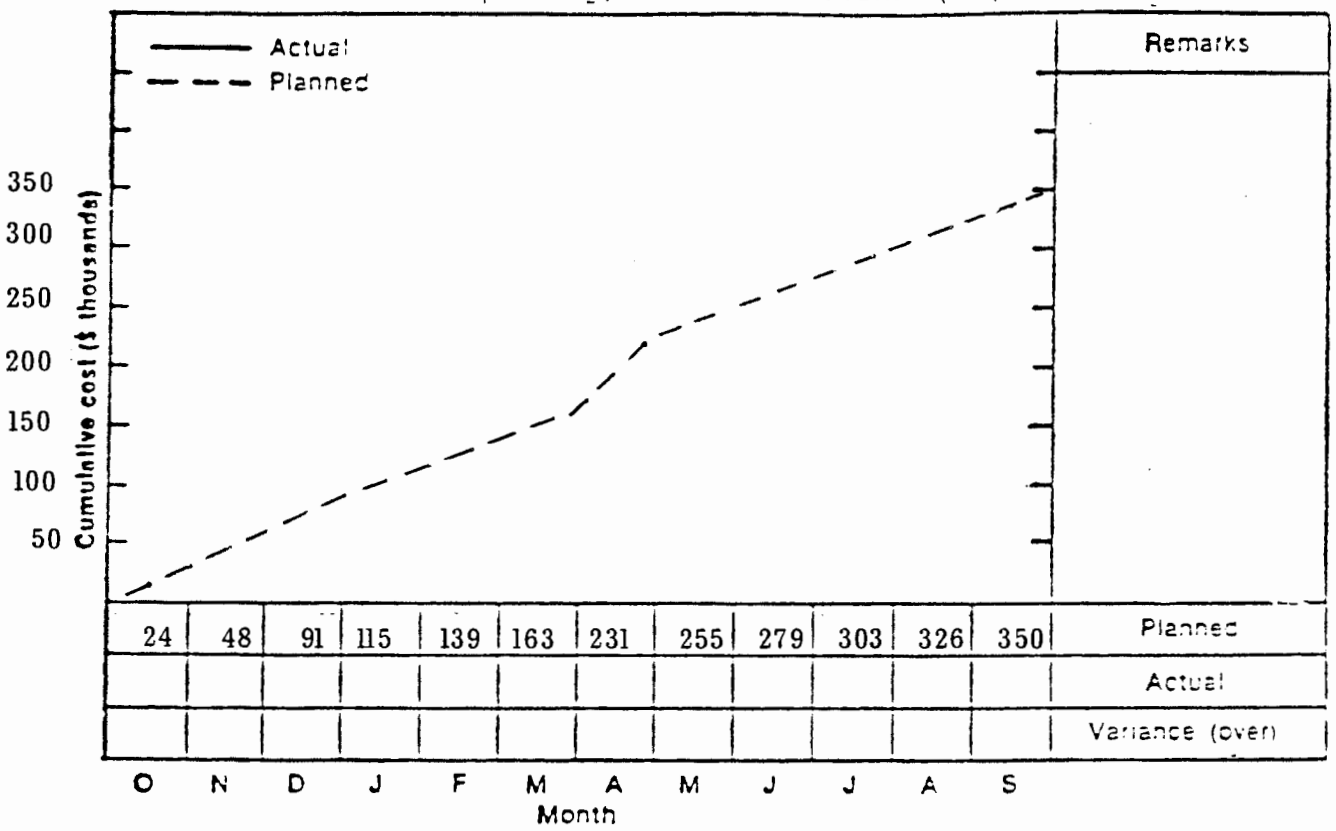
MILESTONES

1. Issue LASL Hydrological Report, 11/80
2. Issue LASL Geological Report, 2/81
3. Descriptive Report on Unsaturated Transport, 9/81
4. Incorporate Selected Fission Product into BIOTRAN, 9/81
5. Validate Airshed Meteorology Model, 8/81
6. Complete Testing of Unsaturated Flow Model, 9/81
7. Develop Basic Land Use Evaluation System, 4/81
8. Compare BIOTRAN Climatology Predictions With Tree Ring Data, 5/81

Title D41 LASL Disposal Site Studies B&P C No. AL 3.5.4 AR

FO/Contractor AL/LASL FY 81 WEP No.

Operating Dollars in Thousands (BO)



	O	N	D	J	F	M	A	M	J	J	A	S	
Planned	24	48	91	115	139	163	231	255	279	303	326	350	
Actual													
Variance (over)													

47. ARID SITE CLOSURE

Objective

A major objective of the LLW Program is to provide documentation of technology developed for shallow-land bural of wastes by March 1984. In the process, all procedures necessary for site closure will be demonstrated and documented to support the licensing of a new SLB site. This task will evaluate shallow-land burial practices at the LASL experimental Engineered Waste Burial Facility, which is supported by the "Model SLB Site" project. Experiments will be performed in intermediate scale burial pits containing engineered caps, liners, biobarriers, and monitoring systems that anticipate site closure in their design. This program will rely on the detailed information collected in the "SLB Barrier-Migration" project on potential migration in and around engineered barriers, the data on pit caps generated in the "LASL Remedial Action Testing" program, and the biobarrier field test results from the "SLB Barrier-Intrusion" project. The latter three programs test individual components while this task combines components as well as including physical factors such as erosion and subsidence.

This project will produce several tangible end products. The effectiveness of several different engineered caps, liners, and biobarriers will be field tested on an intermediate pit scale. Field measurements of the vertical components of burial pit subsidence will be obtained, as well as rates of soil loss from the burial pits due to erosion processes. Several trench monitoring techniques and sampling schemes directed at measuring chemical and water transport will be field tested.

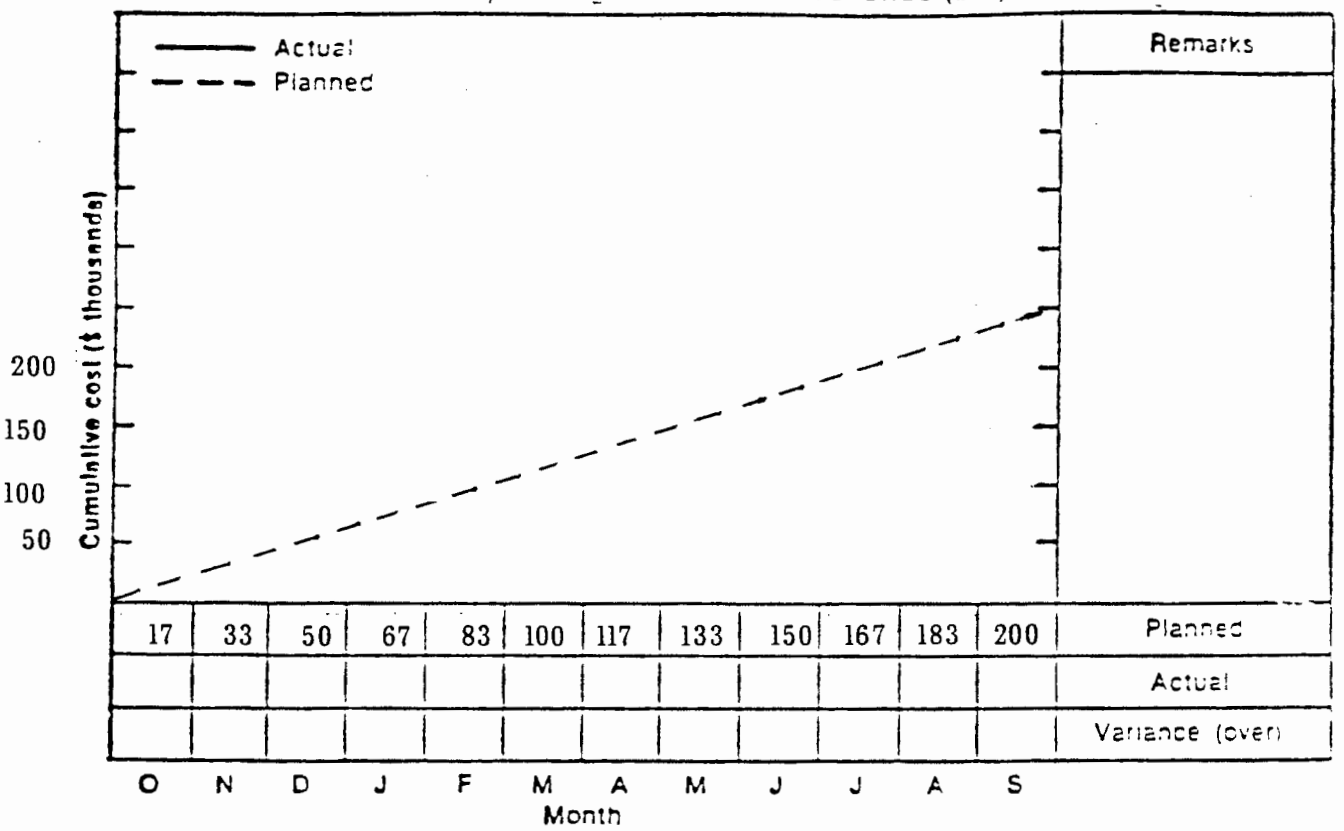
MILESTONES

1. Calibrate hardware systems for soil water, bulk density and soil temperature determinations, 10-11/80
2. Construct and emplace first intermediate scale experiments, 11/80-1/81
3. Evaluate intact intermediate-scale burial pits for design effectiveness, 1-10/81
4. Construct and emplace second intermediate scale burial pit experiment, 4-8/81.
5. Evaluate second experiment, 8-10/81

Title D47 Arid Site Closure BEC No. AL 3.5.4 AR

FO/Contractor AL/LASL FY 81 WEF No.

Operating Dollars in Thousands (EO)



17	33	50	67	83	100	117	133	150	167	183	200	Planned
												Actual
												Variance (over)

50. ALTERNATIVES TO SHALLOW-LAND BURIAL

Objective

The Department of Energy is currently evaluating the role of both shallow-land burial and alternative techniques in the disposal of low-level radioactive waste. This project is performing an analysis of selected alternative disposal methods to evaluate their advantages and disadvantages, to identify any existing technological limitations on their application, and to recommend possible pairings of waste types and disposal methods.

During FY80, a report was prepared that described characteristics of low-level waste, environmental processes affecting disposed radionuclides, and the possible advantages of selected alternatives. Conceptual descriptions were prepared of deeper burial, mined cavity disposal, engineered storage and ocean disposal. Detailed reports were also prepared on mined cavity disposal and deeper burial.

During FY81, detailed reports will be prepared covering engineered storage, seabed disposal, and injection into wells or shafts. A summary report will be prepared which identifies any technical limitations on the implementation of all alternatives evaluated. The summary report will also suggest the general character of research or development work needed to remove these limitations.

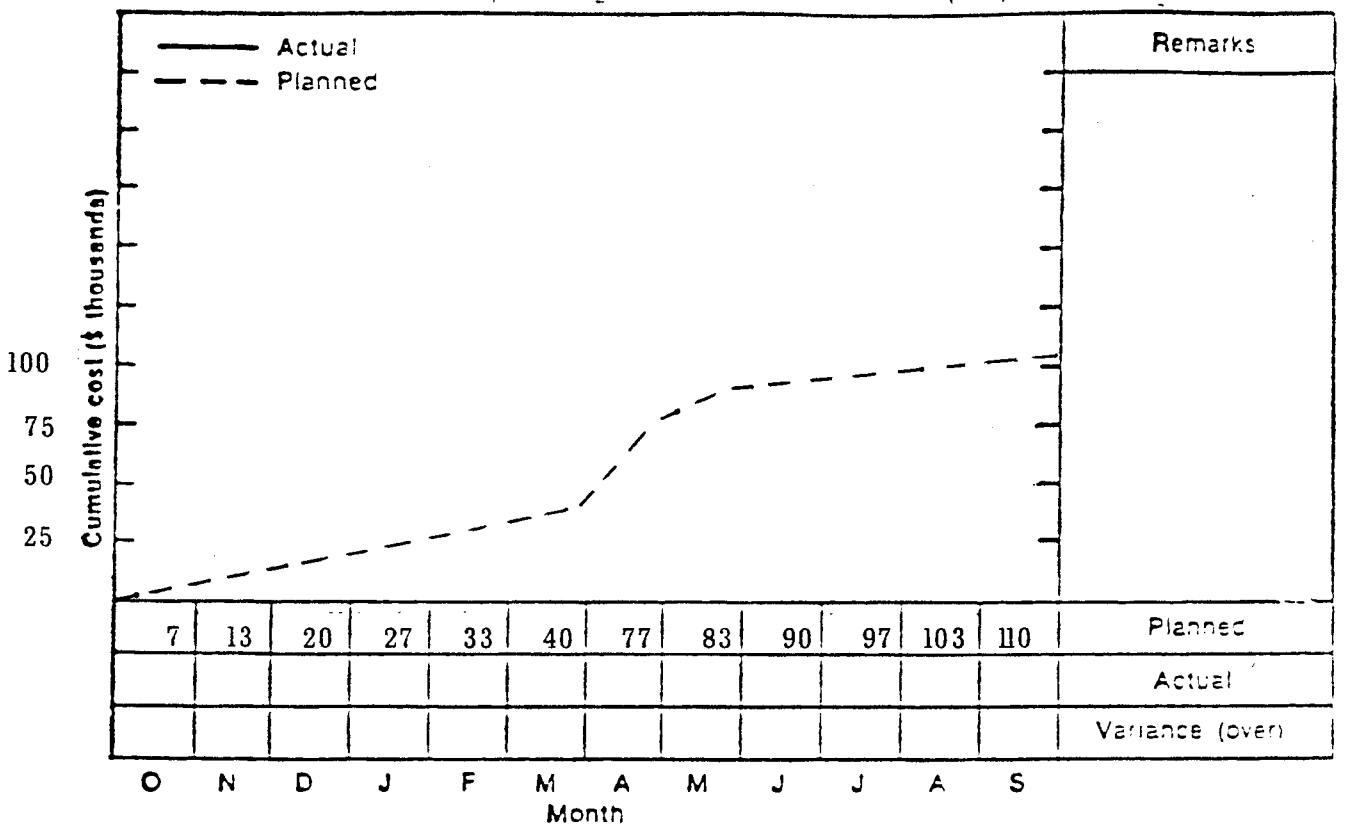
MILESTONES

1. Overview Report 10/80
2. Deeper Burial, 10/80
3. Mined Cavities 9/80
4. Engineered Storage, 11/80
5. Ocean Disposal, 12/80
6. Sea Bed Disposal, 1/81
7. Summary Report, 4/81

Title D50 Alternatives to SLB B&P C No. AL 3.5.5 AR

FO/Contractor AL/LASL FY 81 WEP No.

Operating Dollars in Thousands (EO)



7	13	20	27	33	40	77	83	90	97	103	110	Planned
												Actual
												Variance (over)