

Multiyear Work Element Plan

AL 3.10.1 Alternative Disposal Methods

(LS-2010A)

National Low - Level Waste Program

University of California

Los Alamos Scientific Laboratory

Life Sciences Division

Environmental Sciences Group, LS-6

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General

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1. SUMMARY

The DOE Low Level Waste Management Program has identified a need to investigate and develop suitable alternatives to shallow land burial for the disposal of low level waste. The work proposed in this Plan will develop a multi-year management plan to perform the required research and demonstrate selected alternatives. Low level waste will be characterized in sufficient detail to identify the type of waste treatment required for a particular alternative. Prior work on descriptions of alternatives will be surveyed, and improved as required, to describe a range of alternatives, and identify the key technical issues controlling development and use of each. The research work required to develop necessary technology will be scoped, and current or planned efforts in those areas will be identified. In particular, research work coordinated by ONWI will be assessed to determine possible applications to low level waste disposal alternatives. Opportunities for cooperative research work with ONWI will be highlighted. Finally, a development plan will be generated, identifying those alternatives which appear to show greatest promise of early development with minimum expenditures, and detailing the scope and objectives of necessary research.

2. INTRODUCTION

Low level radioactive waste, from both DOE and commercial sources, is currently being disposed of by shallow land burial at three commercial sites, and five major DOE sites. However, environmental problems at several sites, as well as recent analyses sponsored by both DOE and NRC suggest that this mode of disposal may not be adequate for much of the present low level waste. Some of the current problems may be alleviated by substantial modifications to current shallow land burial practice. Some of the current objections to shallow burial, such as the proximity of the waste to surface or a need to isolate the waste from the zone of circulating ground water, can only be satisfied by use of substantial alternatives

to current practice.

Alternative disposal technologies must satisfy a number of constraints related to the waste material, availability of sites, transportation requirements, technology availability, cost effectiveness, etc. While preliminary surveys of possible alternatives have been performed, and work is underway on investigating or developing some specific alternatives, no overall plan exists for the systematic and timely development of commercially viable methodologies.

3. GOALS AND OBJECTIVES

The overall goals of the proposed work are to gather information pertinent to analyzing Alternative Disposal Methods (3-10-1) and to generate a management plan for a program to evaluate selected alternatives to shallow land burial for the disposal of low level radioactive waste (3-10-2). The work will be structured so as to take maximum advantage of all applicable ongoing and proposed work within DOE and other organizations. In particular, close cooperation will be sought between this work and the High Level Waste disposal work coordinated by ONWI.

The program goal will be satisfied through a number of specific objectives. Current characteristics of low level waste will be evaluated, with an eye towards compatibility with disposal modes or treatment requirements to meet disposal criteria. Conceptual descriptions of disposal alternatives will be developed, relying heavily on previous work. The alternatives will include a range from ocean burial/dumping, through geologic disposal, to deep burial and engineered storage. The key technical issues controlling the development of various alternatives will be detailed, and the purpose and scope of experimental programs to resolve these issues will be developed. Ongoing or planned research coordinated by ONWI will be assessed for application to the Alternatives program, and possible cooperative efforts delineated. Applicable work in other areas, such as the TRU-waste programs will be assessed for applicability. These tasks, when completed, will provide the basis for

a plan to develop alternative disposal methods.

4. SUB TASKS

a. Work Breakdown Structures

The major tasks and subtasks required to satisfy the specific objectives are outlined in Table I. Each of these is described in detail in the following sections.

b. Discription of Tasks

1. Waste Characterization

Numerous studies have been performed of the characteristics of low level waste, and this section will draw heavily on that work. The characterization of the waste will be at a level of detail sufficient to assess the suitability of a particular disposal alternative. Further, it is important to understand those properties of the waste which can best be changed by process alteration, those which can be altered by an applied treatment and those which are fundamental and are essentially unalterable by treatment or process modification.

1.1. Waste Sources

A perspective on the characteristics of low level waste must include the sources of the waste. Information on regional volumes will be developed, so as to interact with regional availability of particular disposal options and transportation requirements. Each major waste source will be characterized regarding the uniformity (or heterogeneity) of the waste and anticipated changes in waste characteristics (including volumes).

1.2. Fundamental Characteristics

The physical, chemical and radiological properties of untreated waste will be described for each major waste source. Areas of

substantially inadequate knowledge will be identified. Emphasis will be placed on those properties which might effect disposal options. The dependency of the waste properties on the generating process will be identified wherever possible.

1.3. Post-treatment Characteristics

The characteristics of waste received at current disposal sites are frequently different than the as-generated waste, due to waste treatment and packaging. This section will deal primarily with the characteristics of waste received at the burial site, including package types, radiation levels, special handling problems, etc. Those waste materials which have proven difficult to handle with existing technology will be identified.

1.4. Significant Constraints

The previous sections will provide a basis for establishing a match between disposal criteria and current waste types. While many of the waste characteristics are subjectable to change by treatment or process alteration, many may not be, or may require treatment technology not readily available. Licensing restrictions may prevent process alteration, and transportation regulations may impose further limitations. This section will delineate those factors which will place major constraints on disposal technology.

2. Conceptual Descriptions of Disposal Alternatives

Previous work by DOE, NRC, and other federal agencies have developed various descriptions of possible alternatives. These studies will serve as a starting point, and will be critiqued and improved as necessary. Current work on development or application of particular disposal alternatives will be utilized, as well as any historical information (such as that on US ocean dumping). This section will be

focused on describing the technical and environmental factors controlling the use of a particular disposal alternative.

2.1. Catalog of Disposal Options.

The various options will be described at the generic level, in sufficient detail to determine the technical and environmental feasibility of each. Specific examples will be cited as possible, particularly when such examples provide working knowledge of the advantages and disadvantages of a particular alternative.

2.2. Critical Factors Controlling Viability

Each disposal alternative is expected to have a set of critical factors governing its application. These may include site availability, waste acceptance criteria, legal considerations and technology requirements. These critical factors may serve as initial screening criteria to rank the various disposal alternatives for further considerations.

3. Technical Issues

This task will describe the technology required for development and implementation of the various disposal alternatives, with an emphasis on that technology which is currently unavailable. Programs which are currently developing the required technology will be identified, with particular emphasis on other DOE sponsored work, including ONWI. Whenever possible, a time scale will be identified, so as to assess the feasibility of developing a particular technology in a given time frame.

3.1. Technology Requirements

The technology required for development and implementation of the various disposal alternatives will be described. This will include an analysis of that technology which is not currently available in any form, that which is pilot or benchscale work, and that which is in

actual use. Specific examples will be provided whenever possible.

3.2. Assessment of ONWI Program

It is expected that many of the technology requirements for low level disposal alternatives are currently being addressed by the high level disposal program, as coordinated by ONWI. An in-depth analysis will be made of the ongoing and planned ONWI programs (including its research cooperation agreements) to identify that work which is applicable to low level waste disposal alternatives. Issues left unaddressed, or only partially dealt with by ONWI will be highlighted. This assessment will insure minimum overlap between the high and low level disposal research efforts.

3.3. Assessment of Other Programs

EPA, NRC, USGS, and other federal and state agencies are conducting research programs aimed at filling particular gaps in disposal technology. This work will be surveyed to establish its applicability. Work aimed at filling non-technological gaps, such as NRC licensing criteria development, will be included in the analysis where such was identified as a constraint on a particular disposal alternative.

3.4. Feasibility Assessment

This section will provide an overview of the feasibility of developing required technology in a particular time frame. The feasibility analysis will in effect, show the value of investing in a particular research effort. It will provide a method of ranking various research and development programs against an overall goal of demonstrating realistic alternatives to shallow land burial.

4. Development Plan

This section will integrate the previous three sections to outline a multi-year research and development plan for alternative

disposal technologies. Candidate alternatives will be selected which appear to promise a high degree of success with minimum technology development. The candidate alternatives may address a wide variety of existing waste forms, or be focused on specialized but problematical wastes. The general characterizing of experimental programs to develop the technology will be described. Opportunities for cooperative efforts between the Low Level program and ONWI will be identified.

4.1. Selection of Candidate Disposal Alternatives

The information on waste characteristics, disposal alternatives and technology requirements will be integrated to select areas for research and development. The candidate alternatives will represent a range of possibilities, but will include those alternatives which appear to promise the greatest likely-hood of near term success. This section will also identify those alternatives which may be of a second or third generation character, requiring a gradual evolution in disposal technology. Requirements such as a major change in process equipment, for example, may require a substantial waiting time before implementation of a particular alternative. Such an alternative, while perhaps more suitable in the long run, would not prove a worthwhile near term investment.

4.2. Experimental Program Objectives

This section will outline the necessary objectives of research and development programs required to resolve the uncertainties in the candidate disposal alternatives. While, in general, experimental designs will not be developed, suggestions will be made for work which might profitably combine several objectives. Modifications to existing research programs within ONWI or other DOE agencies will be suggested, particularly where such modifications are minor and have a high return.

Table II. Milestone Schedule

Work Activity	FY-79				FY-80				FY-81	FY-82
	1	2	3	4	1	2	3	4		
1. Waste Characterization					_____ ▽					
2. Conceptual Discriptions of Disposal Alternatives					_____ ▽					
3. Technical Issues									_____ ▽	
4. Development Plan									_____ ▽	

Table I

Work Breakdown Structure

1. Waste Characterization
 - 1.1 Waste Sources
 - 1.2 Fundamental Characteristics
 - 1.3 Post-treatment Characteristics
 - 1.4 Significant Constraints
2. Conceptual Descriptions of Disposal Alternatives
 - 2.1 Catalog of Disposal Options
 - 2.2 Critical Factors Controlling Viability
3. Technical Issues
 - 3.1 Technology Requirements
 - 3.2 Assessment of ONWI Program
 - 3.3 Assessment of Other Programs
 - 3.4 Feasibility Assessment
4. Development Plan
 - 4.1 Selection of Candidate Disposal Alternatives
 - 4.2 Experimental Program Objectives

Table III
Explanation of Milestones

Milestone Number	Milestone	Date
1	Complete subtask	3-15-1980
2	Disposal Alternatives Summary Report	5-25-1980
3	Report on Technical Issues	9-30-1980
4	Preliminary Management Plan Issued	3-29-1981

Table IV. Program Manpower Requirements

Research Activity	Fiscal Year (Manyears)			
	1980 S O	1981 S O	1982 S O	1983 S O
Waste Characterization	.25	.2		
Conceptual Descriptions	.5	.2		
Technical Issues	.5	.2		
Development Plan	<u>.25</u>	<u>.2</u>	<u>.75</u>	<u>.2</u>
	1.5	.8	.75	.2
	2.3		.95	

Table V. Program Costs According to Work Breakdown Structure

Research Activity	Fiscal Year (\$.000)			
	1979	1980	1981	1982
1. Waste Characterization		55		
2. Conceptual Description		95		
3. Technical Issues		95		
4. Development Plan		<u>55</u>	<u>110</u>	
		300	110	

Table VI
Capital Equipment Requirements

Work Breakdown	Equipment Item	Cost
Structure		(\$,000)
Number	NONE	

Table VII
Subcontracts

Work Breakdown Structure Number	Purpose	Cost (\$,000)
	<u>FY-1980</u>	
2,3	U. of Arizona Assessment of ONWI Program Application	100
1	Unselected, Development of Baseline Data	50
	<u>FY-1981</u>	
4	Unselected. Generation of Develop- ment Plan	45

Table VIII
**TASK REQUIREMENTS FOR OPERATING/EQUIPMENT
COSTS AND OBLIGATIONS**

CONTRACTOR NAME					
Los Alamos Scientific Laboratory					
BIN NUMBER	TASK NO.	REV. NO.	DATE PREPARED		CONTRACTOR NUMBER
			9/79		
20. STAFFING (in staff years)	BY-2		BY-1		AUTHORIZED
			PRESIDENT'S	REVISED	BY FY 1981
A. SCIENTIFIC	0.1			1.5	0.75
B. OTHER DIRECT	0			0.8	0.20
C. TOTAL DIRECT	0.1			2.3	0.95
21. OBLIGATIONS AND COSTS (in Thousands)					
A. TOTAL COSTS	7			140	65
B. TOTAL OBLIGATIONS	7			140	65
22. EQUIPMENT (in Thousands)					
A. EQUIPMENT COSTS					
B. EQUIPMENT OBLIGATIONS					
23. OTHER COSTS (specify)					
A. Subcontracts	100			150	45
B.					
C.					
D.					
24. OPTIONAL FIVE-YEAR PLAN (in Thousands) Constant BY dollars			BY +1	BY +2	BY +3
A. TOTAL OPERATING COSTS			0	0	0
B. TOTAL OPERATING OBLIGATIONS					
C. TOTAL EQUIPMENT COSTS					
D. TOTAL EQUIPMENT OBLIGATIONS					
25. MILESTONE SCHEDULE	PROPOSED SCHEDULE			AUTHORIZED SCHEDULE	

ZBB Impact Statement

This Task will end in FY-81 and is funded at a level substantially less than FY-80. Because of this and the completion of this Task is important to 3.10.3, the funding level requested is considered to be below all the levels of ZBB and essential for program maintenance.

Table IX

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**TASK REQUIREMENTS FOR OPERATING/EQUIPMENT
COSTS AND OBLIGATIONS**

CONTRACTOR NAME Los Alamos Scientific Laboratory						
SIN NUMBER		TASK NO.	REV. NO.	DATE PREPARED 9/79	CONTRACTOR NUMBER	
20. STAFFING (in staff years)	BY-2 FY 1979	BY-1 BY 1980		BY FY 1981		
		PRESIDENTS	REVISED	Minimum	Current	Enhanced
A. SCIENTIFIC	0.1		1.5	0.75	0.75	0.75
B. OTHER DIRECT	0		0.8	0.20	0.20	0.20
C. TOTAL DIRECT	0.1		2.3	0.95	0.95	0.95
21. OBLIGATIONS AND COSTS (in Thousands)						
a. TOTAL COSTS	7		140			65
b. TOTAL OBLIGATIONS	7		140			65
22. EQUIPMENT (in Thousands)						
a. EQUIPMENT COSTS						
b. EQUIPMENT OBLIGATIONS						
23. OTHER COSTS (specify)						
a. Subcontracts	100		150			45
b.						
c.						
d.						
24. OPTIONAL FIVE-YEAR PLAN (in Thousands) Constant BY dollars		BY +1	BY +2	BY +3	BY +4	
a. TOTAL OPERATING COSTS		0	0	0	0	
b. TOTAL OPERATING OBLIGATIONS						
c. TOTAL EQUIPMENT COSTS						
d. TOTAL EQUIPMENT OBLIGATIONS						
25. MILESTONE SCHEDULE	PROPOSED SCHEDULE			AUTHORIZED SCHEDULE		