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A Preliminary Evaluation of Alternatives for Treatment of INEL Low-Level Waste and Low-Level Mixed Waste

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Published June 1992

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**Prepared for the
U.S. Department of Energy
Office of Environmental Restoration and Waste Management
Under DOE Idaho Field Office
Contract DE-AC07-76ID01570**

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ABSTRACT

The Mixed and Low-Level Waste Treatment Facility (MLLWTF) project was established in 1991 by the U.S. Department of Energy Idaho Field Office to provide treatment capabilities for Idaho National Engineering Laboratory (INEL) low-level mixed waste and low-level waste. This *Preliminary Evaluation of Alternatives for Treatment of INEL Low-Level Waste and Low-Level Mixed Waste* identifies and evaluates—on a preliminary, overview basis—the alternatives for treating that waste. Twelve treatment alternatives, ranging from "no-action" to constructing and operating the MLLWTF, are identified and evaluated. Evaluations include facility performance, environmental, safety, institutional, schedule, and rough order-of-magnitude cost comparisons. The performance of each alternative is evaluated against lists of "musts" and "wants." Also included is a discussion of other key considerations for decision making. Analysis of results indicated further study is necessary to obtain the best estimate of future waste volumes and characteristics from the expanded INEL Decontamination and Decommissioning Program. It is also recommended that conceptual design begin as scheduled on the MLLWTF, maximum treatment alternative while re-evaluating the waste volume projections. This approach will allow management of these wastes in accordance with Federal and State regulations and Department of Energy Orders as soon as feasible.

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SUMMARY

S-1 Background

The Idaho National Engineering Laboratory (INEL) was established in southeastern Idaho in 1949 as a site where nuclear reactors, support facilities, and equipment could be built, tested, and operated. Today, the INEL is one of the Department of Energy's (DOE's) principal centers for nuclear energy research and development.

Environmental restoration and waste management technology have also been a major thrust of INEL activities.

There are four broad categories of waste at the INEL: hazardous, radioactive, mixed, and nonhazardous nonradioactive. Management of low-level mixed waste and low-level radioactive waste (LLW) is addressed in this study. High-level waste, transuranic waste, hazardous waste, and nonhazardous nonradioactive waste are not addressed here. (Hereafter, the term "mixed waste" refers only to low-level mixed waste.)

The Waste Experimental Reduction Facility (WERF) and the Idaho Chemical Processing Plant (ICPP) are the principal facilities for treating mixed waste and LLW generated by INEL operations. The ICPP treats aqueous waste streams and will continue to process these wastes in the future. WERF treats most of the solid LLW generated at the INEL. WERF treatment operations involve incineration, compaction, cutting, and stabilization. WERF has limited incineration capabilities for mixed waste. Mixed waste is being stored at the INEL until treatment capability becomes available. The generation of mixed waste without available treatment is considered a de facto violation of the Land Disposal Restriction (LDR) storage prohibition under the Resource Conservation and Recovery Act (RCRA). Storage of mixed waste without available treatment is also considered a violation of the LDR storage prohibition.

WERF is currently shut down for operational upgrades. Restart is planned for July 1993. The facility is planned to be closed around the year 2000.

The Mixed and Low-Level Waste Treatment Facility (MLLWTF) project was established in 1991. The objective is to provide enhanced treatment capabilities for INEL mixed waste and LLW. Early studies conducted to date on the MLLWTF project include characterization of waste streams from ongoing operations at the INEL, identification of candidate treatment technologies, environmental compliance plans, facility siting studies, and development of functional and operational requirements and design criteria. The present study continues the preconceptual design activities in support of the proposed MLLWTF.

S-2 Purpose and Scope

The objective of this study was to identify and evaluate, on a preliminary and overview basis, the alternatives for treating INEL mixed waste and LLW. The results of the study were intended to provide useful information on which to base a decision on whether to proceed with the conceptual design of the MLLWTF. The results can also be used later as input to the alternatives evaluation

required as part of the National Environmental Policy Act documentation to support selection of a waste treatment alternative.

The alternatives evaluated cover the full range from "no-action" to constructing and operating the MLLWTF.

The evaluations involved overview comparisons of the capabilities of treatment alternatives, based on a set of assumptions. The evaluations included facility performance, safety, environmental, institutional, schedule, and rough order-of-magnitude (ROM) cost comparisons.

Detailed, engineering-level evaluations of the alternatives were outside the scope of this study. Except for cost and logistical considerations, the comparisons were performed on a qualitative basis. Evaluations were performed using data available at the time of analysis and are subject to change in the near future.

Figure S-1 is a flowchart that illustrates the sequence and logic for the various activities that constituted this study.

S-3 Waste Streams and Required Waste Products

To enable development and comparison of alternatives, both the given waste inputs and the required product characteristics were evaluated if known, or assumed if unknown. Waste streams considered in this study included those generated by ongoing INEL operations, those generated by the Decontamination and Decommissioning (D&D) Program, and those generated by INEL environmental remedial actions. Because the alternatives evaluated in this study would begin operations about the year 2000 or soon thereafter, the waste streams had to be considered relative to that time period.

Mixed waste streams and LLW streams currently generated by INEL facilities were characterized in another MLLWTF task. Analysis of the Engineering Design Files (EDFs) determined that 4266 m³/yr of mixed waste and LLW is currently generated at the INEL. The categorization scheme for the waste is shown schematically in Figure S-2. This total volume consists of 82.7 m³/yr of mixed waste and 4183.3 m³/yr of LLW.

No reliable projections are available of waste from ongoing INEL operations in the post-2000 time period. An assumption is made that the future waste from ongoing operations will not change from the current waste.

No comprehensive projections are available of the waste to be generated by the D&D Program and INEL remedial actions.

Based on input from remedial action managers, no waste to be generated by INEL remedial actions is assumed to require treatment in the INEL LLW and mixed waste treatment facilities in the time period covered in this study (approximately 2003-2028). The waste to be generated will have

Figure S-1. Logic flowchart for alternatives study.

Figure S-2. Distribution of waste from ongoing operations.

been dispositioned before the treatment facilities evaluated here begin operations. Therefore, such waste was not addressed in this study.

The volumes and characteristics of the D&D Program waste streams were estimated using information provided by those working in the Program and based on engineering judgment. A major increase in D&D activities is expected to occur about the time that the treatment alternative would begin operations. Preliminary D&D projections are that 3776 m³/yr of D&D waste will be produced. The categorization scheme is shown in Figure S-3. This total volume consists of 442 m³/yr of mixed waste and 3334 m³/yr of LLW.

The total waste stream volume (ongoing waste plus D&D waste projected for the time period of this study) is 8042 m³/yr (4266 + 3776). The total LLW volume is 7517.3 m³/yr (4183.3 + 3334), and the low-level mixed waste volume is 524.7 m³/yr (82.7 + 442).

The required characteristics of the waste products of treatment are stipulated by disposal regulations. The required product characteristics for the disposal of the mixed waste and LLW at the proposed Mixed and Low-Level Waste Disposal Facility (MLLWDF) have not been established yet. Therefore, a list of guiding assumptions was developed to reflect the requirements of DOE Order 5820.2A, RCRA, the technical requirements of 10 CFR 61, and the current waste acceptance criteria of the Radioactive Waste Management Complex (RWMC).

S-4 Assumptions and Uncertainties

Many items of information necessary to perform detailed comparisons of the alternatives were not available. For example, the treatment processes that will be used in the MLLWTF have not been selected yet by the engineering and design team. Therefore, numerous assumptions were made about the missing items of information. To allow equitable comparisons between alternatives, assumptions were made in the following categories:

- Programmatic or general assumptions
- Waste assumptions
- Treatment facility assumptions
- Assumptions concerning auxiliary functions
- General regulatory assumptions
- Environmental regulatory assumptions
- Assumptions concerning interfaces with other facilities
- Schedule assumptions
- Cost assumptions.

Figure S-3. Distribution of waste from ongoing operations and from the expanded P&D Program

Several of the assumptions made are not only uncertain, but are also important enough to potentially affect the conclusions of the study. For this reason, "key uncertainties," which could change between now and the date of facility startup, were identified.

The key uncertainties fell into the following categories:

- Regulations
- DOE policies, philosophies, and programs
- Waste volumes and characteristics
- Status and missions of various waste management facilities
- Performance of waste management technologies
- Other.

S-5 Treatment Alternatives

Several conceptual alternatives for treating INEL mixed waste and LLW were formulated for evaluation and comparison. The alternatives form a relatively complete set of reasonable, upper-level options. A list of the alternatives considered in this study is shown below in Table S-1.

Highly simplified flow diagrams were prepared for all alternatives. Figure S-4 presents the flow diagram for the MLLWTF alternative, as an example.

Table S-1. Treatment alternatives.

Alternative 1	Construct and operate the MLLWTF
Alternative 2	Modify and operate Waste Experimental Reduction Facility (WERF)
Alternative 3	Modify and operate Process Experimental Pilot Plant (PREPP)
Alternative 4	Generator treatment
Alternative 5	Offsite treatment
Alternative 6	Treat waste in Idaho Waste Processing Facility (IWPF)
Alternative 7	Combinations of alternatives
Alternative 8	No action

ALTERNATIVE 1: CONSTRUCT AND OPERATE MLLWTF (TWO CASES - MAXIMUM AND MINIMUM TREATMENT AT MLLWTF)

Figure S-4. Highly simplified flow diagram for the MLLWTF alternative.

Argonne National Laboratory-West (ANL-W) plans to construct and operate a small facility to treat INEL sodium-contaminated waste and cadmium- or barium-contaminated waste. ANL-W is the only INEL generator of such waste at present. In a different program, EG&G Idaho plans to construct and operate a lead recycling process to decontaminate and recover lead. The lead process equipment, initially, will be skid-mounted or housed in trailers. Ultimately, the process will be relocated to one of the stationary treatment facilities. Therefore, in all alternatives, the sodium treatment facility and the lead recovery process were assumed to treat the respective types of waste they can accommodate.

Below is a brief summary of each treatment alternative that was evaluated.

Alternative 1: Construct and Operate MLLWTF

In this alternative, the proposed MLLWTF will be constructed and operated at the INEL. The MLLWTF will provide a wide range of waste treatment capabilities: size-reduction, incineration, and one or more immobilization processes. A schematic of the process is shown in Figure S-5. Except for the sodium treatment facility and lead recovery process discussed above, the MLLWTF will treat all INEL mixed waste and the LLW for which treatment is either required or cost effective. LLW for which treatment is neither required to meet the waste acceptance criteria of the MLLWDF nor cost effective will be disposed of without treatment. Waste volumes treated and final volumes to be disposed of at the MLLWDF are summarized in Table S-2.

Two options were developed for this treatment alternative. The maximum-treatment option was based on treatment of the maximum amount of waste prior to disposal. The minimum-treatment option was based on treatment of the minimum amount of waste required to meet the waste acceptance criteria of the MLLWDF. These options provided upper and lower bounds on the capabilities of the MLLWTF.

Alternative 2: Modify and Operate WERF

In this alternative, new waste-processing capabilities will be added to the existing capabilities at WERF, which will themselves be upgraded as necessary. WERF will thereby accommodate more of the INEL waste than is currently the case.

However, the modified WERF will still not have the capability to treat some waste streams. Such streams will be placed into storage indefinitely, and storage facilities will be constructed for that purpose. The modifications required to treat those streams would require a facility of the same order of magnitude as the MLLWTF. As discussed for the MLLWTF, the sodium treatment facility and lead recovery process were assumed to operate. The LLW for which treatment is neither required nor cost effective will be disposed of without treatment.

Alternative 3: Modify and Operate the Process Experimental Pilot Plant (PREPP)

PREPP is a full-scale, waste-treatment facility located at the Test Area North of the INEL. PREPP was constructed in the mid-1980s as a pilot testing facility for the treatment of transuranic waste. Testing was conducted in PREPP. However, major difficulties were encountered, and a large number of design noncompliances were identified, some of which were due to changes in the

Figure S-5. Simplified schematic of treatment processes in MLLWTF.

Table S-2. Summary by alternative of annual volumes of waste treated and disposed of at the MLLWDF.

Alternative	LLW				Mixed waste (MW)				Final disposition			
	Incineration	Mechanical volume-reduction	Direct disposal	Lead recovery	Sodium treatment	Incineration	Stabilization ^a	Storage	Contact-handled	Remote-handled	Contact-handled	Remote-handled
MLLWTF												
Maximum	2474	3915.8	1127.5	52.6	0.6	27.2	444.3	0	2555.7	132.7	1498.1	0
Minimum	0	0	7517.3	52.6	0.6	27.2	444.3	0	8137.6	132.7	1498.1	0
WERF	2474	3915.8	1127.5	52.6	0.6	27.2	58.3	386	2075.5	130.7	50.3	0
PREPP	2474	3915.8	1127.5	52.6	0.6	27.2	444.3	0	2555.7	132.7	1498.1	0
Generator	0	2642	4875.3	52.6	0.6	0	48.3	423.2	5543.8	130.7	0	423.2
Offsite	0	0	7517.3	52.6	0.6	27.2	444.3	0	8137.6	132.7	1498.1	0
IWPF	0	0	7517.3	52.6	0.6	27.2	444.3	0	8137.6	132.7	1498.1	0
Combinations												
WERF/Offsite	2474	3915.8	1127.5	52.6	0.6	27.2	444.3	0	2555.7	132.7	1498.10	0
WERF/IWPF	2474	3915.8	1127.5	52.6	0.6	27.2	444.3	0	2555.7	132.7	1498.1	0
Generator/Offsite	0	2642	4875.3	52.6	0.6	27.2	444.3	0	6024.0	132.7	1498.1	0
Generator/IWPF	0	2642	4875.3	52.6	0.6	27.2	444.3	0	6024.0	132.7	1498.1	0
No action	0	0	7517.3	52.6	0.6	0	0	471.5	7415.9	130.7	0	471.5

a. 422.8 m³/yr of the mixed waste needs to be incinerated, but only 27.2 m³/yr will burn to an ash. The remaining 395.6 m³/yr will incur a factor of 5 increase in volume when it is solidified. This later waste is included in the stabilization column for the purposes of accounting for the volume increase.

requirements. No radioactive operations were conducted, and the project was terminated. PREPP remains shut down.

Restart of PREPP will involve making major modifications to the facility. Modifications to PREPP include those intended to correct the problems experienced during testing. In addition, a small building will be required to provide feed stock surge storage, feed stock verification capabilities, and additional size-reduction capabilities.

Except for the sodium treatment facility and lead recovery process discussed above, PREPP will treat all INEL mixed waste and the LLW for which treatment is either required or cost effective. LLW waste for which treatment is neither required to meet the waste acceptance criteria of the MLLWDF nor cost effective will be disposed of without treatment.

Alternative 4: Generator Treatment

In this alternative, there will be no central location for treatment of INEL waste. Instead, the waste will be treated by the individual facilities that generate the waste.

The major waste-generating areas at the INEL were assumed to construct and operate small treatment facilities. Treatment capabilities will include volume-reduction and immobilization. The small generators will generally dispose of LLW at the MLLWDF without treatment. If treatment is required, the waste will be transported to the treatment facilities of the major generators.

The generator-treatment alternative will not have the capability to treat some mixed waste streams. Such streams will be placed into storage indefinitely, and storage facilities will be constructed for that purpose.

Alternative 5: Offsite Treatment

In this alternative, with the exception of the waste destined for the lead recovery process or the sodium treatment facility, the INEL mixed waste will be shipped offsite for treatment. The treated waste will be shipped back to the INEL for disposal. The MLLWDF will be responsible for disposing of the treated waste. The treated waste will comply with the waste acceptance criteria of the MLLWDF and with the LDRs of RCRA.

Comprehensive mixed waste treatment is not yet available at offsite commercial facilities. This study assumed that such treatment will be available by the future time period of interest.

Alternative 6: Treat Waste at the Idaho Waste Processing Facility (IWPF)

In this alternative, the proposed IWPF will be used to treat the mixed waste streams. The IWPF is a proposed facility, currently in the preconceptual design stage, whose mission is to treat transuranic waste, transuranic mixed waste, and LLW (whether mixed or not) that is contaminated with transuranic radionuclides.

In this alternative, except for the sodium treatment facility and lead recovery process discussed above, IWPF will treat all INEL mixed waste. LLW for which treatment is neither required to meet the waste acceptance criteria of the MLLWDF nor cost effective will be disposed of without treatment.

Alternative 7: Combinations of Alternatives

Combinations of the above alternatives were considered for evaluation. In each combination, some waste streams will be treated using one of the above alternatives, and the other waste streams will be treated by another alternative.

The matrix in Table S-3 indicates the four pairs of alternatives that were selected for consideration as combinations, marked with an "X." Pairs that were not selected are marked with a "0." Only the upper right half of the matrix was addressed because of symmetry. Also, the diagonal represents the combination of an alternative with itself, so it was not considered.

The descriptions and assumptions concerning the combinations of alternatives are generally the same as those for the individual alternatives comprising the combination. However, only part of the waste streams will be treated by each alternative.

Alternative 8: No Action

In this alternative, no new action will be taken concerning treatment of INEL mixed waste and LLW. The MLLWTF will not be constructed. No other alternative will be implemented. The activities already in effect or planned for other waste management operations will go forward as planned, however.

The sodium treatment facility and lead recovery process discussed above will treat the respective types of waste they can accommodate. LLW will be disposed of without treatment. All other mixed waste will be placed into storage indefinitely, and storage facilities will be constructed for that purpose.

Table S-3. Combinations of alternative selected for evaluation.

	MLLWTF	Modify WERF	Modify PREPP	Generators	Offsite	IWPF
MLLWTF		0	0	0	0	0
Modify WERF			0	0	X	X
Modify PREPP				0	0	0
Generators					X	X
Offsite						0
IWPF						

S-6 Evaluations

Seven areas were selected for evaluating the suitability of the alternatives on a preliminary overview basis. Each alternative was evaluated against the requirements and criteria established under each area. The following areas of comparison were selected:

- **Process and facility evaluations**
 - These evaluations compared the alternatives on (a) the ability to treat all waste such that regulatory requirements are met, (b) the availability of the technology chosen for treatment, including an assessment of developmental risks, and (c) operability, reliability, and maintainability.
- **Evaluation of relationship to other INEL waste management facilities**
 - These evaluations compared the alternatives on the interfaces of the treatment alternatives with other major INEL waste management facilities and identified any potential interface problems that could have major programmatic or operational consequences.
- **Environmental evaluations**
 - These evaluations identified the major bodies of environmental regulation affecting the selection and implementation of an alternative and assessed the difficulties expected for each alternative to comply with those regulations.
- **Safety, health, and risk evaluations**
 - These evaluations qualitatively compared the alternatives on (a) the degree to which they will comply with safety and health requirements, and (b) the risk they will present to the workers, the public, and the environment.
- **Institutional Evaluations**
 - These evaluations identified institutional issues that could negatively impact implementation and compared each treatment alternative on the basis of potential institutional problems.
- **Schedule Evaluations**
 - These evaluations compared alternatives on the basis of the date when operations are expected to start, as well as uncertainties in those dates. Schedules were prepared for each alternative. As an example, the schedule prepared for the MLLWTF is shown in Figure S-6. Table S-4 summarizes the expected operational dates for each alternative.

Table S-4. Start of facility operations for treatment alternatives.

Alternatives	Start of facility operations
MLLWTF (maximum and minimum treatment)	FY 2003
Modify WERF	FY 2001
Modify PREPP	FY 2002
Generator treatment	FY 2001
Offsite treatment	FY 2003
IWPF	FY 2005
Combinations	
WERF/offsite	FY 2003
WERF/IWPF	FY 2005
Generator/offsite	FY 2003
Generator/IWPF	FY 2005
No action ^a	FY 2000

a. Requires construction of RCRA-permitted waste-storage buildings for which the schedule was developed.

- **Cost Evaluations**

- These evaluations compared the ROM life-cycle costs of the treatment alternatives. Table S-5 summarizes the life-cycle costs for each alternative.

In addition to discussing the performance of each alternative in the areas listed above, the performance was specifically evaluated against a list of "musts" and "wants."

The list of "musts" comprised the mandatory criteria for recommendation of a treatment alternative. To be considered viable, an alternative must comply with every listed "must."

Alternatives were evaluated on the extent to which they satisfied the "wants." The list of "wants" represents criteria that will affect the recommendation of an alternative, but are not strict requirements. Each alternative was scored on each "want." Each "want" was assigned an importance weight. For each alternative, the scores on the various "wants" were multiplied by the importance weights of the respective "wants," then summed.

Table S-5. Present worth life-cycle costs for the treatment alternatives, M\$.

Alternatives	Life-cycle costs
MLLWTF	
Maximum treatment	470
Minimum treatment	497
Modify WERF	450
Modify PREPP	422
Generator treatment	410
Offsite treatment	370
IWPF	270
Combinations	
WERF/offsite	530
WERF/IWPF	428
Generator/offsite	470
Generator/IWPF	370
No action ^a	330

a. Requires construction of RCRA-permitted waste-storage buildings for which the cost estimate was developed.

S-7 Analysis of Results

The results of the evaluations were analyzed, and other decision-making considerations were identified.

Table S-6 summarizes the "musts" and states whether each alternative passed or failed each criterion.

The modify WERF, generator treatment, and no-action alternatives require indefinite waste storage because some mixed waste cannot be treated to meet disposal requirements. Therefore, these three alternatives failed the following "must" criteria and were not considered viable:

- Comply with all environmental and waste management regulations
- Perform all required treatment of mixed waste and LLW generated at the INEL over a period of 25 yr

Table S-6. Summary of performance of alternatives against "musts."

Musts									
Alternative	Comply with all environmental and waste management regulations	Present acceptable risk to the workers, the public, and the environment	Perform all required treatment of mixed waste and LLW generated at the INEL over a period of 25 yr	All waste forms that are produced must be acceptable for disposal at the proposed MLLWDF	Have acceptable development risk, as measured by a requirement to use only proven technology	Present no potential major conflicts with the missions or operations of other existing or planned INEL waste management facilities	Present no insurmountable institutional problems		
MLLWTF (maximum treatment)	P	P	P	P	P	P	P		P
MLLWTF (minimum treatment)	P	P	P	P	P	P	P		P
* Modify WERF	F	P	F	F	P	P	P		P
Modify PREPP	P	P	P	P	P	P	P		P
* Generator treatment	F	P	F	F	P	P	P		P
Offsite	P	P	P	P	P	P	P		P
IWPF	P	P	P	P	P	P	P		P
WERF/offsite	P	P	P	P	P	P	P		P
WERF/IWPF	P	P	P	P	P	P	P		P
Generator/offsite	P	P	P	P	P	P	P		P
Generator/IWPF	P	P	P	P	P	P	P		P
* No action	F	P	F	F	P	P	F		F

P = Passed the "must" criterion.

F = Failed the "must" criterion.

* Alternatives that are no longer considered viable treatment options.

- All waste forms that are produced must be acceptable for disposal at the proposed MLLWDF.

The no-action alternative also failed the following "must" criterion:

- Present no insurmountable institutional problems.

The MLLWTF, PREPP, offsite treatment, IWPF, and all four combinations of alternatives satisfied all "must" criteria and were considered to be viable alternatives.

The top row of Table S-7 summarizes the "wants;" the importance weights appear in parentheses. The remainder of Table S-7 presents the weighted scores. The viable treatment alternatives were ranked as follows:

1. MLLWTF—Maximum treatment
2. MLLWTF—Minimum treatment
3. IWPF
4. Generator/IWPF
5. Modify PREPP
6. WERF/IWPF
7. Offsite
8. Generator/Offsite
9. WERF/Offsite

If the recommendation were based strictly on the "musts" and "wants," the preferred alternative for treatment of INEL mixed waste and LLW would be the MLLWTF maximum treatment option. However, selecting an alternative is extremely complex and involves many factors; some do not readily lend themselves to lists of "musts" and "wants." The decision is not completely determined by any evaluation of numbers. Several major factors that the decision-maker needs to consider, in addition to the results of the "musts" and "wants," were identified and are listed below.

- Should a decision be made now or delayed?
 - Other than gaining additional information on the D&D waste, no gain from delay was identified. (In fact, additional waste information can be obtained while implementation proceeds.) The current issues associated with the LDRs will not be resolved by delaying a decision.

Table S-7. Summary of performance of alternatives against "wants."

Alternative	Minimize risk to workers, the public, and the environment. (5)	Wants						Sum
		Minimize noncompliance with safety-related criteria of DOE Order 6430.1A **	Minimize problems in operability, reliability, and maintainability. (3)	Minimize use of technologies proven only under nonradio-logical conditions or only by the vendor. (3)	Minimize the schedule for beginning radioactive operations. (2)	Minimize the life-cycle cost. (2)	Minimize potential interface problems with other INEL waste management facilities. (1)	Minimize potential institutional problems. (1)
MLL WTF (maximum treatment)	50	**	15	18	14	12	9	9
MLL WTF (minimum treatment)	35	**	24	18	14	10	7	8
* Modify WERF	15	**	12	27	18	12	10	5
Modify PREPP	30	**	6	18	16	12	9	10
* Generator treatment	15	**	24	30	18	14	7	5
Offsite	20	**	15	18	14	14	6	7
IWPF	35	**	12	18	12	20	7	8
WERF/offsite	15	**	9	24	14	10	9	6
WERF/IWPF	30	**	6	24	12	12	9	7
Generator/offsite	20	**	15	18	14	12	7	6
Generator/IWPF	35	**	12	18	12	14	7	7
* No action	10	**	30	30	20	16	6	0
								112

() = Importance weight.

* Alternatives that failed a "must" and are not considered viable.

** Performance on this "want" is also a factor in the performance on the "want" related to risk. To avoid double counting of compliance with safety-related criteria, the scoring on this "want" is deleted.

- Will the waste management philosophy of the future reflect maximum treatment or minimum required treatment?
 - DOE Order 5820.2A requires treatment of LLW only if cost effective or if needed to enable the disposal facility to meet its performance criteria. However, DOE Order 6430.1A and the INEL Site-Specific Plan imply that all LLW must be treated to reduce volume and increase stability.
- Uncertainty of waste volume projections
 - The major uncertainty involves the mixed waste soil, sludge, and rubble from D&D activities. If that waste were not generated, a rotary kiln incinerator might not be needed.
- Technology risk
 - A risk is that technologies not yet proven in radioactive operations will encounter significant implementation problems.
- Will other facilities be available?
 - There is no assurance that several of the waste treatment facilities addressed in this study (offsite treatment of mixed waste, IWPF, etc.) will exist.

S-8 Recommendations

Based on analysis of the results, the following recommendations were made:

1. It is recommended that a detailed building-by-building study be performed as soon as possible to obtain the best estimate of future D&D waste volumes and characteristics.
2. Based on the milestones in the final INEL Action Plan for Implementation of the Federal Facility Agreement and Consent Order, it is recommended that INEL remedial action managers re-evaluate periodically the projected timing and volume of waste from remedial actions (including self-generated waste) and the need for waste treatment at the INEL centralized treatment facility.
3. The MLLWTF maximum treatment alternative is the conditionally recommended alternative for the following reasons:
 - It satisfies all "must" criteria
 - It ranks first against the "wants" criteria
 - It satisfies all DOE requirements and commitments as stated in DOE Order 6430.1A and the INEL Environmental Restoration and Waste Management Site-Specific Plan

- It offers assurance that long-term treatment capability will be available for treatment of INEL mixed waste and LLW.

The recommended alternative is conditional on the results of waste volume and characteristic projections, which will be confirmed in the studies discussed under recommendations 1 and 2.

4. It is recommended that conceptual design and all other supporting activities begin on the recommended alternative as scheduled in the BUD, while re-evaluating the waste volume projections, so that additional time is not lost. This approach will help the INEL to manage the mixed waste and LLW in accordance with Federal, State, and DOE requirements as soon as feasible.

ACRONYMS

ACGIH	American Conference of Government and Industrial Hygienists
ADS	activity data sheet
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
ANL	Argonne National Laboratory
ANL-W	Argonne National Laboratory-West
BDAT	best demonstrated available technologies
BUD	backup documentation
CAA	Clean Air Act
CDAS	Control and Data Acquisition System
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
D&D	decontamination and decommissioning
DBA	design basis accident
DBE	design basis earthquake
DOE	Department of Energy
DOE-HQ	Department of Energy Headquarters
DOE-ID	Department of Energy Idaho Field Office
DOT	Department of Transportation
EA	environmental assessment
EBR	Experimental Breeder Reactor

EDE	effective dose equivalent
EDF	Engineering Design File
EE	environmental evaluation
EG&G	EG&G Idaho, Inc.
EIS	environmental impact statement
EO	Executive Order
EPA	Environmental Protection Agency
ER&WM	Environmental Restoration and Waste Management
FONSI	finding of no significant impact
FSAR	final safety analysis report
FY	fiscal year
HEPA	high efficiency particulate air
HIC	high-integrity container
HP	Health Physicist
HSWA	Hazardous and Solid Waste Amendments
IAQB	Idaho Air Quality Bureau
ICPP	Idaho Chemical Processing Plant
IDAPA	Idaho Administrative Procedures Act
IFR	Integral Fast Reactor
INEL	Idaho National Engineering Laboratory
IWPF	Idaho Waste Processing Facility
LDR	Land Disposal Restrictions
LLW	low-level radioactive waste
M&LLW	mixed and low-level radioactive waste

MLLWDF	Mixed and Low-Level Waste Disposal Facility
MLLWTF	Mixed and Low-Level Waste Treatment Facility
MW	mixed waste
MWSF	Mixed Waste Storage Facility
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRF	Naval Reactor Facility
NRF/ECF	Naval Reactor Facility/Expendable Core Facility
O&M	operations and maintenance
OBA	operational basis accident
OSHA	Occupational Safety and Health Act (or Administration)
PBF	Power Burst Facility
PCBs	polychlorinated biphenyls
PREPP	Process Experimental Pilot Plant
PSAR	preliminary safety analysis report
PSD	prevention of significant deterioration
PTC	permit to construct
PSD	prevention of significant deterioration
PVC	polyvinyl chloride
R&D	research and development
RAM	reliability, availability, and maintainability

RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROM	rough order-of-magnitude
RWMC	Radioactive Waste Management Complex
SAR	safety analysis report
SCC	secondary combustion chamber
SEG	Scientific Ecology Group
SMC	Specific Manufacturing Capability
SPERT	Special Power Excursion Reactor Test
SWEPP	Stored Waste Examination Pilot Plant
TAN	Test Area North
TMI-2	Three Mile Island (reactor), Unit 2
TOC	total organic carbon
TRA	Test Reactor Area
TRU	transuranic
TSA	Transuranic Storage Area
TSCA	Toxic Substances Control Act
TSD	treatment, storage, and disposal
UBC	Uniform Building Code
WAC	waste acceptance criteria
WERF	Waste Experimental Reduction Facility
WINCO	Westinghouse Idaho Nuclear Company

REGULATORY SOURCES CITED

All Federal and State statutes and regulations, Department of Energy (DOE) Orders, and Department of Energy Idaho Field Office (DOE-ID) Orders and Supplemental Directives cited herein are listed below. Other references cited are listed at the end of the section where cited.

DOE Orders, DOE-ID Orders, DOE-ID Supplemental Directives, and Secretary of Energy Notices

- a. DOE Order 4700.1, "Project Management System," March 6, 1987
- b. DOE Order 5400.3, "Hazardous and Radioactive Mixed Waste Program," February 22, 1989
- c. DOE Order 5400.5, "Radiation Protection of the Public and the Environment," February 8, 1990
- d. DOE Order 5440.1D, "National Environmental Policy Act Compliance Program," February 22, 1991
- e. DOE Order 5480.3, "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes," July 9, 1985
- f. Idaho Field Office, DOE-ID Order 5480.3, "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes," March 14, 1991
- g. DOE Order 5480.4, "Environmental Protection, Safety, and Health Protection Standards," May 15, 1984
- h. DOE Order 5480.5, "Safety of Nuclear Facilities," September 23, 1986
- i. DOE Order 5480.10, "Contractor Industrial Hygiene Program," June 26, 1985
- j. DOE Order 5480.11, "Radiation Protection for Occupational Workers," December 21, 1988
- k. DOE Order 5481.1B, "Safety Analysis and Review System," September 23, 1986
- l. DOE Order 5820.2A, "Radioactive Waste Management," September 26, 1988
- m. Idaho Field Office, DOE-ID SD 5820.2A, "Radioactive Waste Management (DRAFT)," June 27, 1991
- n. DOE Order 6430.1A, "General Design Criteria," April 6, 1989

- o. SEN-27-90, "Strengthening the Department of Energy Project Management System," August 15, 1990

Code of Federal Regulations

- a. Code of Federal Regulations, 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste"
- b. Code of Federal Regulations, 29 CFR 1910, "Operational Safety and Health Standards"
- c. Code of Federal Regulations, 29 CFR 1926, "Safety and Health Regulations for Construction"
- d. Code of Federal Regulations, 40 CFR 60, "New Source Performance Standards"
- e. Code of Federal Regulations, 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants"
- f. Code of Federal Regulations, 40 CFR 122, "National Pollutant Discharge Elimination System"
- g. Code of Federal Regulations, 40 CFR 261, "Identification and Listing of Hazardous Waste"
- h. Code of Federal Regulations, 40 CFR 263, "Standards Applicable to Transporters of Hazardous Waste"
- i. Code of Federal Regulations, 40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities"
- j. Code of Federal Regulations, 40 CFR 268, "Land Disposal Restrictions"
- k. Code of Federal Regulations, 40 CFR 270, "EPA-Administered Permit Programs—The Hazardous Waste Permit Program"
- l. Code of Federal Regulations, 49 CFR 173, "Shippers—General Requirements for Shipments and Packagings"
- m. Code of Federal Regulations, 49 CFR 271, "Performance-Oriented Packaging Standards; Changes to Classification, Hazard Communication, Packaging and Handling Requirements Based on UN Standards and Agency Initiative; Final Rule"
- n. Code of Federal Regulations, 40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Distribution in Commerce, and Use Prohibitions"
- o. Code of Federal Regulations, 10 CFR 1021, "DOE Regulations for NEPA Compliance"

- p. Code of Federal Regulations, 40 CFR 1500-1508, "National Environmental Policy Act Regulations"
- q. Executive Order (EO) 12088 [Federal Compliance with Pollution Control Standards (October 13, 1978), as amended by EO 12580 (January 23, 1987)]
- r. Idaho Administrative Procedures Act, Title 1, Chapter 1, "Rules and Regulations for the Control of Air Pollution in Idaho," Department of Health and Welfare, January, 1992

National Standards

- a. National Electrical Code, NFPA 70-1990, National Fire Protection Association
- b. Uniform Building Code (UBC), 1991 edition

Statutes

- a. National Historic Preservation Act of 1966 (16 U.S.C. 470 et seq.)
- b. Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.)
- c. Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.)
- d. Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.)
- e. Hazardous and Solid Waste Amendments (HSWA) (1984) to the Resource Conservation and Recovery Act (RCRA)
- f. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- g. Clean Air Act (CAA)
- h. National Emission Standards for Hazardous Air Pollutants (NESHAP)
- i. Idaho Administrative Procedures Act (IDAPA) 16.01.1012, Procedures and Requirements for Permits to Construct and Operation Permits

A Preliminary Evaluation of Alternatives for Treatment of INEL Low-Level Waste and Low-Level Mixed Waste

1. INTRODUCTION

1.1 Purpose

This study identifies and evaluates, on a preliminary and overview basis, the alternatives for treating low-level radioactive waste (LLW)^a and low-level mixed waste^b generated at the Idaho National Engineering Laboratory (INEL).^c The study is one of several preconceptual design activities in support of the proposed Mixed^d and Low-Level Waste Treatment Facility (MLLWTF).

The results of the study are intended to provide useful information on which to base a decision on whether to proceed with the conceptual design of the MLLWTF. The results can also be used later as input to the alternatives evaluation of the National Environmental Policy Act (NEPA) documentation to support selection of a waste treatment alternative.

1.2 Background

Since the early 1980s, part of the INEL-generated LLW has been treated by the Waste Experimental Reduction Facility (WERF). The facility has been instrumental in reducing the volume of LLW to be disposed. WERF has also treated a small volume of mixed waste.

Several factors, discussed below, have brought about the need for advanced treatment of the INEL waste.

First, WERF was built in an existing decommissioned reactor facility, dating from the late 1950s. The facility has certain hardware and operational deficiencies. The operational deficiencies and some hardware deficiencies are being remedied. The upgrade program is now underway, while WERF is

a. Low-level radioactive waste is waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel or 11e(2) byproduct material, as defined by DOE Order 5820.2A. Treatment of waste that has measurable concentrations of transuranic (TRU) radionuclides or that is suspected to have originated in a TRU-contaminated environment (e.g., the Rocky Flats Plant) is excluded from the scope of this study.

b. Mixed waste is waste that contains both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act, respectively.

c. The alternatives addressed herein are not to be confused with activities currently under way in other programs to restart WERF and to work off the backlog of mixed waste and LLW requiring treatment.

d. Hereafter, for brevity, the term "mixed waste" will be used without the modifier "low-level." It should be remembered, however, that the term applies only to the mixed waste that is low-level.

shut down for approximately 2.5 yr. However, other hardware deficiencies, such as possible structural inadequacies and some utility nonconformances with national codes and standards, will still exist.

Second, WERF is scheduled for closure about the year 2000.

Third, increasing regulatory requirements have brought about the need for advanced treatment of INEL waste. Department of Energy (DOE) Order 5820.2A requires that "DOE low-level waste shall be managed on a systematic basis, using the most appropriate combination of waste generation reduction, segregation, treatment, and disposal practices so that the radioactive components are contained and the overall system cost-effectiveness is maximized." The Order also requires that "DOE low-level waste operations shall be managed to . . . ensure that no legacy requiring remedial action remains after operations have been terminated." Appropriate treatment methods are needed (a) to comply with current and pending regulatory requirements, (b) to ensure that no future remediation will be required, and (c) to maximize the life of disposal facilities.

Fourth, current mixed-waste treatment capability and capacity at the INEL is not adequate to meet the Land Disposal Restrictions (LDRs) promulgated by the 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA). INEL mixed waste is being stored while awaiting the development of treatment capability. The generation of mixed waste without available treatment is considered a de facto violation of the LDR storage prohibition. Storage of mixed waste without available treatment is also considered a violation of the LDR storage prohibition.

All of the above driving forces have led to the need to develop improved treatment capability for INEL LLW and mixed waste. The treatment capability must comply fully with all applicable regulations, and the waste products for disposal will be required to meet the acceptance criteria of the proposed Mixed and Low-Level Waste Disposal Facility (MLLWDF).

The MLLWTF has been proposed to provide the necessary treatment capability discussed above. Several preconceptual design studies are under way to provide the basis for conceptual design of the MLLWTF. The studies include characterization of waste streams, identification of candidate treatment technologies, environmental compliance plans, facility siting studies, development of functional and operational requirements and design criteria, and the present study of alternatives.

Alternatives to proceeding with the MLLWTF are evaluated here to arrive at a preliminary recommendation on whether the MLLWTF is the preferred alternative. Not only is the comparison a NEPA requirement, but it is also good project management practice; hence, the need for this overview study of the alternatives for treating INEL LLW and mixed waste. (However, the current document is not a NEPA document.)

1.3 Scope

The scope of this study is to identify and evaluate, on a preliminary and overview basis, the alternatives for treating INEL-generated LLW and mixed waste.

The alternatives evaluated are to cover the full range from "no action" to constructing and operating the MLLWTF.

The evaluations are to include comparisons of the capabilities of treatment alternatives at the facility level, rather than on the level of one treatment process versus another. The evaluations are also to include safety, environmental, institutional, schedule, and rough order-of-magnitude (ROM) cost comparisons.

Many items of information necessary to perform detailed, final comparisons of the alternatives are not available at this early date. For example, the treatment processes that would be used in the MLLWTF have not been selected yet by the engineering and design team. Therefore, numerous assumptions were made about the missing items of information in order for this study to proceed.

Many items of information obtained for use in this study are subject to change at any time. For example, the waste stream characterization studies are subject to revision. Information used in this study reflects the data available at the time of analysis and may change significantly in the future.

Detailed, engineering-level evaluations of the alternatives are outside the scope of this study. The present evaluations will be performed at the overview level. Furthermore, except for cost and logistical considerations, quantitative comparisons of the alternatives are generally outside the scope of this study.

1.4 Flowchart for Study

Figure 1-1 is a flowchart that illustrates the sequence and logic for the various activities in this study.

Figure 1-1. Logic flowchart for alternatives study.

2. DESCRIPTION OF WASTE STREAMS AND REQUIRED WASTE TREATMENT PRODUCTS

Two key considerations affect the treatment of waste. The first is the characteristics of the waste to be treated. The second, and ultimately controlling, is the required characteristics of the waste products of the treatment process, as stipulated by disposal requirements.

If the input waste characteristics and the required output product characteristics are the same, then no treatment is required. However, if the input waste characteristics do not comply with the disposal requirements, as is often the case, then the waste must be treated to produce a disposable form.

To enable development and comparison of alternatives, both the given waste inputs and the required product characteristics must be known or assumed. Unfortunately, these characteristics change with time. Changes in the processes creating waste, as well as more complete understanding of the processes already operating, contribute to changes in waste inputs. Changes in environmental policy and treatment technology both contribute to changes in product requirements. Although these changes will occur, the assumed input and product characteristics must be fixed in order to perform comparisons of alternatives. The input and product characteristics to be used in this study are defined in this section.

2.1 Description of Waste To Be Treated

In support of the design of the MLLWTF, information on the characteristics of the mixed waste and LLW to be treated has already been gathered in another task. That task addressed waste that is currently being generated, or waste from ongoing INEL operations. The information gathered for each waste stream includes a description, radiation level, volume, and hazardous constituents. The information has been organized into a published report.¹ Tables 2-1 and 2-2 summarize the information of that report. Table 2-1 is for LLW and Table 2-2 is for mixed waste.

The cited report and this study both use the current data for waste from ongoing operations. Waste generator or projections of future volumes have proven not to be particularly accurate.

Two major future generators of waste were not included in the studies that led to Tables 2-1 and 2-2. Those two generators are the INEL environmental remedial actions and the INEL Decontamination and Decommissioning (D&D) Program. As used in this document, the remedial actions deal principally with the remediation of areas outside of buildings, and the D&D Program deals principally with the buildings themselves.

No comprehensive projections have been made of the waste to be generated by these two programs.

As discussed in Section 3, based on the input from remedial action managers, the waste to be generated by those activities is assumed not to require treatment in the INEL LLW and mixed waste

Table 2-1. Summary of LLW from ongoing operations.

No.	Waste stream ID	Description	Annual volume (m ³)	Current practice	Percent bypassing treatment	Likely future practice	Annual curies
1.	X21	Any combination of cloth, paper, plastic (nonhalo) and wood	1640	75% incineration 12% compaction 9% disposal 4% sizing	8.8	Incineration	1.2 E 2
2.	X41	Any comb. glass, halo. plastic, lag., liq. abs., met chips, wire, etc.	577 (11.5 remote-handled)	69% compaction 26% disposal-contact 2% sizing 2% disposal-remote 1% incineration	27.3	Sizing/Compaction	1.1 E 4
3.	M41	Metal combination-assemblies	455 (9.1 remote-handled)	66% disposal-contact 23% sizing 9% compaction 2% disposal-remote	67.5	Sizing/Compaction	1.9 E 3
4.	P21	Paper and/or cloth	236	97% incineration 3% disposal	2.8	Incineration	2.27 E 0
5.	S71	Soil/gravel/brick/concrete rubble	218	100% disposal	100	Packaging	6.1 E 1
6.	M31	Metal-steel, carbon	153	68% sizing 30% disposal 2% compaction	29.8	Sizing/Compaction	9.4 E 1
7.	M33	Metal-steel, stainless	140	84% sizing 13% disposal 3% incineration	13	Sizing/Compaction	1.6 E 1
8.	R50	HFEF-south facility modification waste stream	122	100% disposal	100	Packaging	1.7 E 1
9.	X80	NRF/ECF/WERF only-mix.std.cc: M31-20%, M33-30%, M41-10%, X41-40%	79	100% compaction	0.3	Sizing/Compaction	2.6 E 0
10.	X22	NRF/ECF only-mix.std.cc: P21-60%, P41-30%, W31-10%	75	100% incineration	0	Incineration	8.0 E-2
11.	X61	Any combination of filters	62	62% compaction 26% disposal 12% incineration	25.8	in incineration	5.6 E 0

Table 2-1. (continued).

No.	Waste stream ID	Description	Annual volume (m ³)	Current practice	Percent bypassing treatment	Likely future practice	Annual curies
12.	I21	Ion exchange resin in metal containment	57 (1.7 remote-handled)	97% disposal-contact 3% disposal-remote	100	Incineration	1.1 E 2
13.	M83	NRF/ECF only—mix.sld.cc M31-20%, M33-30%, M41-10%, X41-40%	56	100% disposal	100	Sizing/Compaction	1.9 E 0
14.	X31	Any combination of ferrous and nonferrous metal articles	39	58% disposal 31% sizing 7% compaction 4% incineration	58	Sizing/Compaction	1.1 E-2
15.	S72	Concrete structural components	34	100% disposal	100	Packaging	3.7 E-3
16.	M84	NRF/ECF/WERF only—mix.sld.cc M31-30%, M33-50%, M41-20%	28	98% sizing 2% disposal	1.8	Sizing/Compaction	5.2 E-3
17.	C61	Core structural parts	25 (All remote-handled)	100% disposal	100	Packaging	4.2 E 4
18.	F21	Filter—HEPA	18	67% sizing 33% disposal	32.6	Sizing/Compaction	1.9 E 0
19.	M61	Metal chips or miscellaneous small metal objects	19	63% disposal 37% compaction	63	Sizing/Compaction	2.4 E-1
20.	W31	Wood	17	83% incineration 11% sizing 6% disposal	5.9	Incineration	9.6 E-3
21.	F22	Filter—other than HEPA	14	100% compaction	0	Sizing/Compaction	8.4 E-2
22.	B22	Biological waste—feces, vegetation	13	100% disposal	100	Incineration	2.3 E-4
23.	A61	Radioactive contaminated asbestos	12	100% disposal	100	Packaging	3.6 E-1
24.	C75	NRF/ECF only—mix.sld.cc C61-70%, C51-10%, X41-20%, S5-ton cask 1	11 (All remote-handled)	100% disposal	100	Packaging	2.0 E 4
25.	M21	Metal—aluminum	11	55% disposal 45% sizing	55	Sizing/Compaction	2.0 E-1

Table 2-1. (continued).

No.	Waste stream ID	Description	Annual volume (m ³)	Current practice	Percent bypassing treatment	Likely future practice	Annual curies
26.	I22	Ion exchange resin in concrete containment	8 (4 remote-handled)	52% disposal-remote 48% disposal-contact	100	Packaging	6.8 E-2
27.	S41	Sludge	8	100% disposal	100	Incineration	2.1 E-3
28.	X51	Any combination paving, roofing, soil/gravel, brick and concrete rubble	6	100% disposal	100	Sizing/Compaction	4.5 E-1
29.	P31	Paving (e.g., asphalt and concrete)	6	100% disposal	100	Sizing/Compaction	5.0 E-4
30.	R21	Roofing (e.g., asphalt shingles)	6	100% disposal	100	Sizing/Compaction	3.1 E-2
31.	C62	Core subassembly parts	6 (5.6 remote-handled)	93% disposal-remote 7% disposal-contact	100	Packaging	2.3 E-5
32.	E21	Evaporation drum (e.g., shade)	5	100% disposal	100	Packaging	1.6 E-1
33.	A24	Absorbed liquids, noncombustible-diatomaceous earth (e.g., kitty litter)	5	100% disposal	100	Packaging	2.7 E-1
34.	X81	NRF/ECF only—mix.sld.cc X71-90%, M33-10% RWDS resin module	5	100% disposal	100	Packaging	3.2 E-1
35.	S51	HFEF/north process and maintenance waste stream, bldg 785	4	100% disposal	100	Packaging	1.2 E-0
36.	L20	L&O Laboratory bldg 752 analytical laboratory waste stream	4	100% disposal	100	Packaging	1.1 E-1
37.	F31	Filter—liquid	3	100% disposal	100	Packaging	1.4 E-1
38.	P41	Plastic—nonhalogenated	3	88% incineration 12% disposal	10.4	Incineration	1.2 E-2
39.	P42	Plastic—halogenated	1	100% compaction	0	Incineration	5.4 E-4
40.	W21	Wiring and wiring devices	1	100% disposal	100	Sizing/Compaction	4.8 E-2
41.	M43	Metal—cut up glove boxes	0.4	100% disposal	100	Sizing/Compaction	6.3 E-5
42.	A21	Absorbed liquids, combustible	0.4	100% disposal	100	Incineration	7.8 E-4
43.	X71	Any combination of resin containers	0.3	100% disposal	100	Packaging	1.1 E-2

Table 2-1. (continued).

No.	Waste stream ID	Description	Annual volume (m ³)	Current practice	Percent bypassing treatment	Likely future practice	Annual curies
44.	A22	Absorbed liquids, noncombustible—cement (e.g., Portland Cement)	0.1	100% disposal	100	Packaging	2.5 E-4
45.	M23	Metal—copper	0.02	100% compaction	0	Sizing/Compaction	3.2 E-7
46.	S21	Slag—unsolidified	0.02	100% disposal	100	Packaging	4.6 E-5
47.	CS1	Core instrumentation	0.01	100% disposal	100	Packaging	3.4 E-6
48.	A25	Absorbed liquids, noncombustible—fillers earth (e.g. soil—dirt)	0.01	100% disposal	100	Packaging	4.1 E-3
49.	S83	Source alpha	.001	100% disposal	100	Packaging	7.4 E-7

Table 2-2. Summary of mixed streams from ongoing operations.

No.	Waste stream ID	Radiation level	Name	Likely future treatment	Annual volume	Environmental Protection Agency (EPA) codes
1.	ID-WIN-143	Contact-handled	Radioactive contaminated lead	Lead recovery	25.20 m ³	D008 radioactive lead solids
2.	ID-EGG-117-MWF	Unknown	Cadmium solids, radioactive sheets	Lead recovery	10.00 m ³	D006 cadmium
3.	ID-EGG-143-TSA	Contact-handled	Radioactively contaminated lead	Lead recovery	9.54 m ³	D008 radioactive lead solids
4.	ID-SMC-136	Contact-handled	Nonacidic waste solid	Stabilization	4.00 m ³	D008 lead D010 selenium
5.	ID-SMC-149A	Contact-handled	Spent GM 141 SAPC solvent	Incineration	2.00 m ³	D006 cadmium D007 chromium D008 lead
6.	ID-WIN-130-1617	Contact-handled	Mercury contaminated solids shielded with lead	Incineration	1.83 m ³	D009 high-mercury > = 240 mg/kg
7.	ID-WIN-131-MWF	Contact-handled	Mercury contaminated solids	Incineration	1.40 m ³	D009 high-mercury > = 240 mg/kg
8.	ID-EGG-166-MWF	Contact-handled	WERF HEPA filters and lead	Incineration	0.90 m ³	D006 cadmium D008 radioactive lead solids
9.	ID-SMC-101B	Contact-handled	Spent 1,1,1-TCA degreaser solvent	Incineration	0.40 m ³	F001 1,1,1-trichloroethane
10.	ID-SMC-149B	Contact-handled	Spent Stoddard solvent	Incineration	0.40 m ³	D001 ignitable TOC > 10% D006 cadmium D007 chromium D008 lead
11.	ID-WIN-111-1619	Contact-handled	Cadmium contaminated solids	Incineration	0.34 m ³	D006 cadmium
12.	ID-WIN-198-HCR	Contact-handled	Lead acid batteries, radioactive	Lead recovery	0.33 m ³	D008 lead-acid batteries
13.	CH-ANL-180-771	Contact-handled Remote-handled	Sodium—LLW	Sodium treatment	0.23 m ³	D001 ignitable reactive D003 reactive water reactive
14.	CH-ANL-111	Contact-handled	Cadmium uranium sample waste—Integral Fast Reactor (IFR) experiment	Stabilization	0.21 m ³	D006 cadmium
15.	ID-SMC-101A	Contact-handled	1,1,1-TCA and alcohol lab waste	Incineration	0.20 m ³	F001 1,1,1-trichloroethane
16.	ID-SMC-101E	Unknown	TCA waste	Incineration	0.20 m ³	F001 1,1,1-trichloroethane
17.	ID-WIN-217	Contact-handled	Heavy metal, radioactive oil	Incineration	0.20 m ³	D007 chromium D008 lead

Table 2-2. (continued).

No.	Waste stream ID	Radiation level	Name	Likely future treatment	Annual volume	Environmental Protection Agency (EPA) codes
18.	CH-ANL-179-797	Contact-handled	Sodium (contaminated) tin bismuth alloy	Sodium treatment	0.17 m ³	D001 ignitable reactive D003 reactive water reactive
19.	ID-WIN-201-HCR	Unknown	F002 contaminated solids	Incineration	0.16 m ³	F002 methylene chloride
20.	CH-ANL-218-IFR	Remote-handled	Electrorefiner stripped salt—BA and CD	Stabilization	0.11 m ³	D005 barium D006 cadmium
21.	CH-ANL-183-765	Contact-handled	Paint-stripping waste	Incineration	0.1 m ³	F002 methylene chloride F003 methanol D008 lead D007 chromium
22.	ID-WIN-197-HCR	Contact-handled	Chromium and lead contaminated solids	Incineration	0.08 m ³	D007 chromium D008 lead
23.	CH-ANL-142-MWF	Contact-handled	Lead contaminated solids—IFR experiment	Lead treatment	0.07 m ³	D008 radioactive lead solids
24.	ID-WIN-200-HCR	Contact-handled	Cadmium, mercury, and selenium contaminated solids	Incineration	0.06 m ³	D006 cadmium D009 low mercury <260 mg/kg D010 selenium
25.	ID-WIN-110-1619	Contact-handled	Cadmium and chromium contaminated solids	Incineration	0.04 m ³	D006 cadmium D007 chromium
26.	CH-ANL-182-797	Contact-handled Remote-handled	Sodium potassium	Sodium treatment	0.04 m ³	D001 ignitable reactive D003 reactive water reactive
27.	ID-WIN-129-1619	Contact-handled	Mercury and cadmium contaminated solids	Incineration	0.03 m ³	D006 cadmium D009 high-mercury ≥260 mg/kg
28.	ID-SMC-113A	Contact-handled	Chromium trioxide wastes	Incineration	0.02 m ³	D007 chromium
29.	ID-SMC-133	Contact-handled	Miscellaneous lab wastes	Stabilization	0.02 m ³	D006 cadmium D007 chromium D008 lead D010 selenium

Table 2-2. (continued).

No.	Waste stream ID	Radiation level	Name	Likely future treatment	Annual volume	Environmental Protection Agency (EPA) codes
30.	ID-EGG-138	Contact-handled	Organic lab wastes	Incineration	0.02 m ³	D001 ignitable TOC > 10% F002 methylene chloride F003 acetone F004 nitrobenzene or cresol F005 toluene F002 1,1,1-trichloroethane F002 trichloroethylene F003 xylene
31.	ID-SMC 152	Contact-handled	TAN 629 tank bottoms sludge	Incineration	0.02 m ³	D001 ignitable TOC > 10% D006 cadmium D007 chromium D008 lead
32.	CH-ANL-224	Contact-handled	IBC-cask maintenance—mercury contaminated	Incineration	0.02 m ³	D009 high mercury ≥260 mg/kg
33.			Activated carbon	Incineration	1.0 m ³	D001 ignitable 1% < TOC < 10% D035 methyl ethyl ketone F001 1,1,1-trichloroethane F002 methylene chloride F002 trichloroethylene F003 acetone F003 methanol F003 xylene F004 cresols F005 toluene

Table 2-2. (continued).

No.	Waste stream ID	Radiation level	Name	Likely future treatment	Annual volume	Environmental Protection Agency (EPA) codes
34.			Aqueous	Incineration	10.0 m ³	D004 arsenic D005 barium D006 cadmium D007 chromium D008 lead D009 low-mercury <266 mg/kg D010 selenium D011 silver D001 ignitable 1% < TOC < 10% D035 methyl ethyl ketone F001 1,1,1-trichloroethane F002 methylene chloride F002 trichloroethylene F003 acetone F003 methanol F003 xylene F004 cresols F005 toluene
35.			Clay (zeolites)	Stabilization	0.4 m ³	D005 barium D006 cadmium D007 chromium D008 lead D009 low-mercury <260 mg/kg D010 selenium D011 silver
36.			polychlorinated biphenyls (PCBs)	Incineration	0.2 m ³	n/a
37.			Resin beads	Incineration	0.8 m ³	Same as clay (zeolites)
38.			Soils, etc.	Incineration	12.0 m ³	Same as aqueous except no D001

treatment facilities in the time period covered in this study. The waste to be generated would be dispositioned before the treatment facilities evaluated here would begin operations. Therefore, such waste is not addressed in this study. The results of waste projections now underway may require a reconsideration of this key assumption.

As discussed in Section 3, the waste to be generated by the D&D Program (which is expected to expand greatly in the future) is addressed in this study. Because no detailed comprehensive projections of the D&D waste have been made, the volume and characteristics of the D&D waste were estimated using information provided by those working in the D&D effort, and based on engineering judgment. The D&D waste projections represent the maximum amount of such waste expected to be generated when the new waste-treatment facility would be in operation. The actual amount of D&D-generated waste could be much smaller. Table 2-3 is a summary of the estimated volumes and characteristics of the D&D waste. The table also lists assumptions used. The assumptions are discussed further in Section 2.2.

2.2 Evaluation of Waste To Be Treated

2.2.1 Waste from Ongoing Operations

The information in the Engineering Design Files (EDFs) was analyzed, and the currently generated waste streams were divided into categories that require common treatments. The categorization scheme is shown schematically in Figure 2-1. The volumes of the various divisions are shown to allow an understanding of the relative magnitudes.

The waste streams were first divided into mixed waste and LLW streams. This distinction is based on the additional treatment requirements for mixed wastes because of the LDRs.

As indicated in Tables 2-1 and 2-2, there are 38 individual mixed waste streams and 49 individual LLW streams. As shown in Figure 2-1, there are 82.7 m³/yr of mixed waste to be treated and 4183.3 m³/yr of LLW to be treated. These volumes are equivalent to 2% and 98%, respectively, of the waste volume to be treated.

Both the mixed waste and LLW streams were then divided into remote- and contact-handled streams. For the remote-handled streams, each waste container has a radiation field of greater than 500 mR/hr at 3 ft from the container. For the contact-handled streams, the radiation field is less than 500 mR/hr at 3 ft. This distinction is made to provide a reasonable level of protection from exposure while handling radioactive waste. Treatment of remote-handled waste requires shielding, while treatment of contact-handled waste does not.

There is 0.4 m³/yr of remote-handled mixed waste and 67.9 m³/yr of remote-handled LLW. The remote-handled mixed waste stream is a small-volume (0.01% of the total waste), special-case waste created at Argonne National Laboratory-West (ANL-W). About half consists of sodium-contaminated waste that must be handled in an inert environment. The other half consists of barium and cadmium salts that require stabilization. ANL-W is planning to design and construct a shielded facility to treat the sodium-contaminated waste. An assumption is made that the ANL-W facility will

Table 2-3. Summary of waste assumed to be generated by the expanded D&D Program.

Waste category	Annual volume of mixed and low-level radioactive waste (M&LLW) ^{a,b}	Annual volume of remote-handled LLW ^c	Annual volume of contact-handled/LLW ^d	Annual volume of contact-handled LLW incinerable to an ash ^e	Annual volume of contact-handled LLW that could be mechanically volume-reduced ^f	Annual volume of contact-handled LLW that will not be incinerated or mechanically volume-reduced ^f	Annual volume of remote-handled MW ^d	Annual volume of contact-handled MW that is lead ^g	Annual volume of contact-handled MW that must be incinerated ^h	Annual volume of contact-handled MW that must be stabilized ^h
Concrete	755	740	726.5/13.5	0	581.2	145.3	15/0	0	13.5	1.5
Steel	944	925	908.1/16.9	0	726.5	181.6	19/0	0	17	2
Equipment	755	740	726.5/13.5	0	581.2	145.3	15/0	0	13.5	1.5
Sludge	189	0	0/0	N/A	N/A	N/A	188.8/0.2	0	169.8	19
Rubble	755	740	726.5/13.5	363.3	290.6	72.6	15/0	7.5	6.8	0.7
Soil	378	189	185.6/3.4	0	148.5	37.1	188.8/0.2	0	169.8	19
Totals	3776	3334	3273.2/60.8	363.3	2328.0	581.9	441.6/0.4	7.5	390.4	43.7

a. Based on a total of 3776 m³/yr projected by D&D personnel and on percentage splits derived from past experience and engineering judgment.

b. All volumes in table are in units of m³/yr.

c. Based on the 98:2 ratio found in M&LLW from ongoing operations with the exception that all sludge and half of soil are mixed waste.

d. Based on remote-handled LLW being 1.6% of M&LLW and remote-handled mixed waste being 0.01% of M&LLW as found in M&LLW from ongoing operations.

e. Rubble is the only stream assumed to burn to an ash, and only 50% of it does so.

f. Based on the 80:20 ratio found in nonincinerable LLW from ongoing operations.

g. Based on assumption that only rubble will contain significant lead, and on the 50:50 ratio found in the mixed waste from ongoing operations.

h. Based on the 90:10 ratio found in the mixed waste from ongoing operations.

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Figure 2-1. Distribution of waste from ongoing operations.

also have a small cell in which to treat the barium/cadmium salts. Since the generator already has plans to treat the remote-handled mixed wastes, these streams are removed from further consideration for treatment in this study. (See the assumptions in Section 3.)

The remote-handled LLW stream is primarily nonincinerable, noncompactible wastes that are packaged by the generators into special casks. These wastes represent less than 2% of the total mixed waste and LLW stream. To treat these wastes would result in only a small volume reduction and would not result in a significant improvement in waste form. Therefore, direct disposal of this waste in high-integrity containers is considered to be the optimum treatment. Since the wastes are already packaged at the generator, this practice is assumed to continue. These streams are not considered further for treatment in this study.

The contact-handled stream, at 4197.7 m³/yr, makes up greater than 98% of the mixed waste and LLW. At 82.3 m³/yr, the contact-handled mixed waste is approximately 2% of all waste. The mixed portion can be broken down into four streams, based on required treatment: lead and cadmium shielding and lead batteries (45.1 m³/yr, 1.0%), sodium-contaminated waste (0.2 m³/yr, 0.005%), incinerable waste (32.4 m³/yr, 0.7%), and waste requiring stabilization (4.6 m³/yr, 0.1%).

ANL-W plans to treat the contact-handled, sodium-contaminated waste along with the remote-handled waste; therefore, this waste stream is not considered further for treatment.

A plan already exists to build a lead recovery process at the INEL to treat and recover lead shielding. (See the assumptions in Section 3.) Therefore, the lead shielding stream is also not considered further for treatment. The cadmium shielding is treated in a similar fashion to the lead waste; therefore, an assumption is made that the treatment of cadmium will be performed in the lead recovery process, using essentially the same equipment.

An assumption is made that, with appropriate precautions, procedures, and regulatory approvals, the mixed wastes requiring incineration and/or stabilization can be treated in the same equipment used to incinerate and stabilize LLW. (Issues related to this assumption are discussed in Section 14.)

The contact-handled LLW stream is now the only remaining stream to discuss. This stream has a volume of 4115.4 m³/yr, which is 96.5% of the total waste. It is first divided into incinerable and nonincinerable streams. Incineration is the major method for volume reduction and is therefore a logical division. The incinerable stream (2110.7 m³/yr, 49.5%) requires no further division and may be disposed of in appropriate containers after incineration and ash stabilization. The nonincinerable stream is subdivided into streams that can be mechanically reduced in volume by cutting, sawing, grinding, shredding or compacting (1587.8 m³/yr, 37.2%), and streams that are not amenable to mechanical volume reduction (416.9 m³/yr, 9.8%). The nonincinerable streams may be placed in containers and disposed of following applicable mechanical volume reduction.

2.2.2 Total Waste

The waste from the D&D Program can also be divided into categories that require common treatment. Figure 2-2 is a schematic showing the treatment categorization for the combination of waste generated by ongoing operations and D&D programs.

Figure 2-2. Distribution of waste from ongoing operations and from the expanded D&D Program.

Preliminary D&D projections are that 3776 m³/yr of D&D waste will be produced, predominantly as concrete, steel, equipment, sludge, rubble, and soil. Therefore, the total waste stream volume (ongoing waste plus D&D waste projected for the time period of this study) is 8042 m³/yr (4266 + 3776).

The distribution of D&D waste into six categories, on a volume basis, was estimated, based on knowledge of D&D personnel of the composition of previous D&D wastes (see Table 2-3). The results were 25% for steel (944 m³/yr), 20% each for concrete, equipment, and rubble (755 m³/yr, each), 10% for soil (378 m³/yr), and 5% for sludge (189 m³/yr). Based on the likely source of sludge, an assumption is made that it is all mixed waste. The soil is expected to contain both mixed and low-level contamination in about equal parts; an assumption is made that it is 50% mixed waste. The ratio of LLW to mixed waste in the other four categories is estimated to reflect the 98:2 ratio found in the waste from ongoing operations. Therefore, the total low-level waste volume is 7517.3 m³/yr (4183.3 + 3334), and the mixed waste volume is 524.7 m³/yr (82.7 + 442).

The amount of remote-handled waste in each category is estimated to reflect the 1.6% and 0.01% found in the waste from ongoing operations. Thus, the remote-handled volumes of LLW and mixed waste are 128.7 m³/yr (67.9 + 60.8) and 0.8 m³/yr (0.4 + 0.4), respectively. The remaining contact-handled volumes are 7388.6 m³/yr and 523.9 m³/yr.

An assumption is made that only the rubble stream has a significant incinerable component, and that it is 50% of the stream. Therefore, a total of 2374 m³/yr (2110.7 + 263.3) of contact-handled LLW is considered incinerable. The remaining contact-handled LLW in all categories is then split into a portion that can be mechanically volume-reduced and a portion that cannot be mechanically volume-reduced. The ratio used is 80:20, reflecting that found in the waste from ongoing operations. This breakdown yields 3915.8 m³/yr (1587.8 + 2328) of LLW that can be mechanically volume-reduced and 998.8 m³/yr (416.9 + 581.9) that cannot be volume-reduced.

The contact-handled mixed waste is split into lead, waste that must be incinerated, and waste that must be stabilized. An assumption is made that significant quantities of lead are present only in the rubble stream, and that this lead is 50% of the stream. Thus, there are 52.6 m³/yr (45.1 + 7.5) of lead. The remaining mixed wastes are then divided into incineration and stabilization to reflect the 90:10 ratio found in the waste from ongoing operations, yielding 422.8 m³/yr (32.4 + 390.4) of waste to be incinerated and 48.3 m³/yr (4.6 + 43.7) of waste to be stabilized.

2.3 Description of Expected Disposal Requirements Affecting Waste Treatment

The required characteristics of the waste products of treatment are stipulated by disposal regulations. The required product characteristics for disposal of the mixed waste and LLW at the proposed MLLWDF, however, have not been established yet. The disposal facility project is in the early stage. Nevertheless, a list of guiding assumptions can be developed, based on present and draft policies, regulations, and waste acceptance criteria.² (The assumptions used in this study are discussed in detail in Section 3.)

The disposal of waste is primarily controlled by DOE Order 5820.2A and the associated draft supplemental directive DOE-ID SD 5820.2A. The latter document incorporates requirements that are nearly identical to the technical requirements in 10 Code of Federal Regulations (CFR) 61.

The heart of the Order and Directive is the performance objectives that disposed waste must meet. The performance objectives are promulgated to protect the public from excessive exposure due to releases from the disposed waste, to protect an inadvertent intruder in the future when institutional controls have lapsed, and to protect ground-water resources.

Performance objectives can be expressed as a set of volumetric or mass-based curie concentration limits for radionuclides of concern. These concentration limits are affected by the stability of the waste, by the disposal method, and by the radiological characteristics of the waste, with radioactive half-life being of critical importance. As a result, the concentration limits are usually divided into numerous sets or classes. At present, the Nuclear Regulatory Commission (NRC) concentration limits for LLW found in 10 CFR 61 are used as a guide for the limits to be expected for most disposal facilities. These limits are incorporated into Appendix A of Department of Energy Idaho Field Office (DOE-ID) SD 5820.2A with two changes. The first change is minor and consists of the renaming of Class A, B, and C waste (NRC system) as Class 1, 2, and 3 waste (DOE-ID system). The second is more important and consists of lowering the transuranic (TRU) limits for Class 3 waste by a factor of 10, from 100 nCi/g to 10 nCi/g.

In summary, a simplistic interpretation of the concentration limits is as follows. Waste within the limits of a class may be disposed of as long as it meets the waste acceptance criteria (WAC) associated with the class and is disposed of in a prescribed manner. One must understand what the WAC and the prescribed manner of disposal will likely be for each class of waste.

According to DOE-ID SD 5820.2A, which is closely based on 10 CFR 61 technical requirements, all classes of waste must meet the following general requirements:

- (a) Waste must not be packaged for disposal in cardboard or fiberboard boxes. For all types of containers, void spaces within the waste and between the waste and its packaging shall be reduced as much as practical.
- (b) Liquid wastes, or wastes containing free liquid, must be converted into a form that contains as little freestanding and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume of the waste when the waste is in a disposal container, or 0.5% of the volume of the waste processed to a stable form.
- (c) Waste must not be readily capable of detonation, or of explosive decomposition, or reaction at normal pressures and temperatures, or of explosive reaction with water.
- (d) Waste must not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing the waste. This does not apply to radioactive gaseous waste packaged at a pressure that does not exceed 1.5 atm at 20°C.

- (c) Waste must not be pyrophoric. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable.

Class 1 waste must meet the following additional requirements:

- (a) Site WAC (these criteria tend to be mostly oriented toward procedural aspects, such as standard container sizes, lifting attachments, paperwork, etc.).
- (b) Be covered with at least 2 m of uncontaminated cover material.
- (c) Be segregated from higher classes of waste if not stabilized.

Class 2 waste must meet the following additional requirement:

- (a) Be stabilized in accordance with the NRC Technical Paper on Waste Form, Revision 1, January 1991, by application of stabilization methods which must have received prior DOE-ID approval.

Class 3 waste must meet the following additional requirements:

- (a) Be covered with at least 5 m of uncontaminated cover material, or within an intruder barrier designed to protect against an inadvertent intrusion for at least 500 yr.
- (b) Be stabilized in accordance with the Regulatory Guide on Low-Level Waste Form Stability by application of stabilization methods that must have received prior DOE-ID approval.

Greater than Class 3 waste is not generally acceptable for near-surface disposal.

A few other key points of DOE-ID SD 5820.2A need to be mentioned before the general final waste disposal assumptions are generated. One point is that generators are required to segregate waste into incinerable, volume-reducible metallic, compactible, and other waste streams. Additionally, any other segregation requirements of the disposal facility must be met. This will certainly include segregation of mixed waste from LLW. Segregation is partially enabled by the knowledge of the actual physical and chemical characteristics and major radionuclide content of the waste. Specific waste characterization required by DOE-ID SD 5820.2A includes

- (a) The physical and chemical characteristics of the waste
- (b) Volume of the waste (total waste and any solidification or absorbent media)
- (c) Weight of the waste (total of the waste and any solidification or absorbent media)
- (d) Major radionuclides and their concentrations
- (e) Packaging data, package weight, and internal and external volumes.

In addition, characterization requirements of the specific WAC of the disposal site must be met.

WAC peculiar to the specific disposal facility have been referred to numerous times in the preceding discussion. DOE-ID SD 5820.2A gives some general guidance on the criteria. They must include, in addition to the characterization information, the following items:

- (a) Allowable quantities/concentrations of specific radioisotopes to be handled, processed, stored, or disposed of
- (b) Criticality safety requirements (waste forms and geometries)
- (c) Restrictions regarding LLW classified for security reasons
- (d) External radiation and internal heat generation
- (e) Restrictions on the generation of harmful gases, vapors, or liquids in waste
- (f) Chemical and structural stability of waste packages, radiation effects, microbial activity, chemical reactions, and moisture
- (g) Restriction for chelating and complexing agents having the potential for mobilizing radionuclides
- (h) Quantity of free liquids
- (i) Data quality requirements.

The present INEL low-level radioactive waste acceptance criteria are set forth in DOE-ID-10112.² This document states the requirements that waste generators must satisfy in order to process LLW at WERF and to dispose of LLW at the Radioactive Waste Management Complex (RWMC), the current disposal facility. The basic requirements are similar to those already discussed.

Two additional points are made. First, waste shipments must meet the requirements of DOE-ID Order 5480.3. Second, certain processes require the setting of specific chemical and radiological limits, in addition to those mentioned above. For example, incineration of chloride-containing material may be limited due to a limited offgas treatment capability. Radionuclide limits may be lower than the Class A limits, due to the concentrating effects of incineration and the associated exposure and disposal problems.

For this study, the guiding assumptions for waste-disposal requirements at the INEL, based on the present and projected draft and regulations and on the assumptions of Section 3, are as follows:

- (a) Class 1 waste, which is the bulk of the waste to be treated, can be disposed of after cost-effective volume reduction in simple lined containers.
- (b) Class 2 waste can be disposed of after cost-effective volume reduction in either high-integrity containers or, if the waste form is stabilized, in simple lined containers.

- (c) Class 3 waste can be disposed of after cost-effective volume reduction in either high-integrity containers or, if the waste form is stabilized, in simple lined containers.
- (d) A high-integrity disposal structure will not be incorporated into the disposal facility. Therefore, Class 2 and 3 wastes will need to be stabilized or placed in high integrity containers.
- (e) Stabilization in portland/pozzolonic cements, sulfur-polymer cement, or vitrification into glasses will be acceptable. Some exceptions, based on chemical compatibility, will be noted as applicable for specific streams.
- (f) Mixed waste can be disposed of in accordance with the above guidance, but it will receive additional treatment, as necessary, to meet the requirements of the LDRs of the RCRA. This essentially means that the waste will be treated to RCRA standards using Best Demonstrated Available Technologies (BDAT), as defined by the Environmental Protection Agency (EPA).

2.4 References

1. EG&G Idaho, Inc., *Mixed and Low-Level Waste Treatment Facility Project*, EGG-PD-92-006, April 1992.
2. EG&G Idaho, Inc., *INEL Low-Level Radioactive Waste Acceptance Criteria*, DOE/ID-10112, Rev. 4, October 1991.

3. ASSUMPTIONS FOR STUDY OF ALTERNATIVES

3.1 Background

Many unknowns could impact the suitability of each alternative for treatment of INEL mixed waste and LLW. The unknowns include gaps in today's knowledge, as well as the nature of possible future events, trends, policies, and decisions.

To evaluate the treatment alternatives on a meaningful and equitable basis, many assumptions must be made about these unknowns. The assumptions cover items such as the waste streams to be treated, the regulatory requirements affecting the treatment facility, the timing of various events, etc.

A set of simplifying assumptions was developed as a basis for the evaluations of the treatment alternatives. As events unfold, some assumptions may prove to be accurate. Others may need to be revised. The present assumptions are the best set of guidelines that the study team could assemble to allow the evaluations to proceed with equitable comparisons between alternatives.

3.2 Assumptions

A. Programmatic or General Assumptions

1. In July 1992, the DOE will decide which long-term treatment alternative to pursue. The decision will be implemented immediately thereafter. Efforts will essentially cease on the other long-term alternatives for waste treatment. However, no matter which long-term alternative is selected, interim restart and operation of WERF will continue (as described in Section 4), until overridden by the operations of the selected alternative.

B. Waste Assumptions

1. The MLLWTF EDFs¹ on waste characteristics and quantities and suitable treatment technologies accurately and completely represent both current waste streams and future extrapolations of *waste streams from ongoing operations*.

NOTE: Some waste-generating activities at the INEL may terminate before the future time period addressed in this study. On the other hand, new waste-generating activities may start. No attempt is made to predict which projects or facilities may startup or shutdown. An assumption is made that the waste streams of the ongoing operations of the future are adequately represented by the waste streams of the current ongoing operations.

2. Some small waste streams generated by INEL environmental remedial actions are included in the ongoing waste streams discussed in item B.1 above. (As used in this report, the remedial actions refer to cleanup conducted principally outside of buildings.) Future remedial action activities can be expected to result in large waste

streams. However, those waste streams are not addressed for treatment in this study for the following reasons:

- Remedial action managers indicate that nearly all their activities are to be completed and the waste dispositioned several years before a long-term waste treatment facility will be operating.
- Remedial action managers indicate that the waste generated in the remediation activities will not be stored to await the development of a long-term treatment facility.
- The remaining remedial action waste streams, such as the possibly large amounts of waste from remediation of the RWMC, will be treated by means other than the treatment facility addressed in this study. For example, a special waste treatment facility will be operated for the RWMC waste, or the waste will be treated in the Idaho Waste Processing Facility (IWPF).

NOTE: If the assumption on remedial action waste proves incorrect, and such waste must be treated in the treatment facility, a major impact could result.

3. Some small waste streams generated by the activities of the INEL D&D Program are included in the ongoing waste streams discussed in item B.1 above. (As used in this report, INEL D&D refers to remediation activities conducted principally inside buildings.) A major increase in INEL D&D activities is expected to begin in approximately 10 yr and last approximately 25 yr. The quantity of D&D waste is expected to increase significantly. The expected increase in D&D waste generation will match closely the future time period for operation of the treatment facility. Accurate estimates of the nature and volume of D&D-generated waste in that time period are not available. Nevertheless, a rough estimate of the upper limit of the increased D&D waste is included in the waste streams addressed in this study. This was done because of the potentially large magnitude of the streams and the advisability of the treatment facility being able to accommodate the maximum waste flow projected in the time period of interest. The detailed assumptions are listed in Section 2.

NOTE: The uncertainties in D&D waste may have a major impact on the volumes of INEL mixed waste and LLW requiring treatment. Therefore, the uncertainties in this item are a major uncertainty for this study.

4. No waste from offsite will be received for treatment.
5. Waste generators will be required to do a reasonable amount of segregation of waste streams before transporting them to the treatment facility.

C. Treatment Facility Assumptions

1. Processes to be used will have been proved full-scale (e.g., by the vendor), although possibly under nonradiological conditions only.
2. Hazardous (nonmixed) waste is excluded from the scope of this study.
3. Treatment of waste that has measurable concentrations of TRU radionuclides or that is suspected to have originated in a TRU-contaminated environment (e.g., the Rocky Flats Plant) is excluded from the scope of this study.
4. The waste product will comply with the WAC of the MLLWDF, whether or not the latter is operational by that time. If a waste stream cannot be treated to produce a fully compliant product, then the stream will not be treated.
5. At least one offsite facility for commercial treatment of mixed waste and LLW will be available in the future timeframe modeled by this study.
6. The backlog of stored waste will have been treated when a new or modified waste-treatment facility begins radioactive and hazardous operations.
7. Unless indicated to the contrary, the current (February 7, 1992) draft of the Functional/Operational Requirements for the MLLWTF will be used.
8. Facilities shall be designed to limit maximum radiation exposure to an individual worker to less than one fifth of the annual occupational external dose-equivalent limits ($1/5$ of 5 rem).
9. ANL-W will, as currently planned, construct and operate a facility to treat sodium-contaminated waste and cadmium- or barium-contaminated waste. ANL-W is the only INEL generator of such waste at present.
10. In a different program from the MLLWTF, EG&G Idaho will, as currently planned, construct and operate a process to decontaminate and recover lead. The lead process equipment will initially be skid mounted or housed in trailers. Ultimately, the process will be relocated to one of the stationary treatment facilities.
11. The INEL mixed waste and LLW discussed in this document will not be treated in the IWPF, except that, in the IWPF alternative and in combinations of that alternative with other alternatives, INEL mixed waste will be treated in the IWPF.

D. Assumptions Concerning Auxiliary Functions

1. All onsite treatment alternatives will include storage space (in a separate, auxiliary facility as required by DOE Order 6430.1A) for 1 month throughput of incoming, untreated waste and for 1 month throughput of treated waste.

2. All long-term onsite treatment alternatives (except generator treatment) will include a waste-analysis laboratory capability on premises. Use of a centralized waste-analysis laboratory will be allowed for the generator treatment alternative.

E. General Regulatory Assumptions

1. Unless indicated to the contrary, the regulatory environment of the future will include the current requirements and all proposed requirements as currently drafted.
2. Regulatory restrictions will not preclude the shipment and treatment of LLW or mixed waste offsite.

F. Environmental Regulatory Assumptions

1. The waste management facilities and operations will be required to comply with all environmental requirements.
2. In particular, the waste treatment facilities will comply with all emissions standards of Federal, State of Idaho, and DOE regulations. If a waste stream cannot be treated without violating an emissions standard, then the stream will not be treated.
3. An environmental impact statement (EIS) will be required for the MLLWTF, assuming an incinerator is included in the facility.
4. No "Below Regulatory Concern" provisions concerning radioactive or mixed waste will be in effect.

G. Assumptions Concerning Interfaces with Other Facilities

1. The MLLWDF will be a RCRA-permitted disposal facility.
2. Either the MLLWDF or the RWMC will be operational at all times during the future time period studied (FY-2003 through 2028 for the operations phase) so that storage of no more than the 1 month throughput, listed in an above assumption, is required at the treatment facility.
3. The WAC of the MLLWDF will reflect the requirements of DOE Order 5820.2A, RCRA, and the technical requirements of 10 CFR 61. The WAC will also incorporate any other pertinent requirements from the current WAC of the RWMC.
4. Characteristic waste that is treated (so it is no longer characteristic waste) can be disposed of as LLW, assuming it complies with all other WAC.
5. The ICPP will accept aqueous LLW for treatment during the future operations time period (typically FY-2003 through 2028) modeled in this study.

6. The mixed waste storage building adjacent to WERF will be available for lag storage exceeding the 1-month capability provided at the treatment facility.

H. Schedule Assumptions

1. The facility operating lifetime for all alternatives will be 25 yr.

I. Cost Assumptions

1. Cost estimates will be life-cycle costs. They will include design and construction costs, program costs, operations and maintenance (O&M) costs, costs of shipping waste, disposal costs, and D&D costs for the treatment facility and any required ancillary facilities.
2. For purposes of estimating shipping costs, the offsite waste treatment facility is assumed to be located 1000 mi away.
3. Costs will be presented (a) as approximate present worth (constant FY-1992) dollars and (b) as escalated dollars to the years of expenditure.

3.3 References

1. EG&G Idaho, Inc., *Mixed and Low-Level Waste Treatment Facility Project, Appendix B, Parts 1 and 2 - Waste Stream Engineering Files, (DRAFT)* EGG-PD-92-006, April 1992.

4. OVERVIEW OF ALTERNATIVES

Several conceptual alternatives for treating INEL mixed waste and LLW were formulated for evaluation and comparison. The alternatives form a relatively complete set of reasonable, upper-level options.

The alternatives have not been defined yet in detail in separate engineering studies. Also, in-depth tradeoffs of one specific treatment process against another are yet to be performed.

This section provides an overview description of each alternative. The description is aimed at the concepts embodied in the alternative, rather than at the details of the particular facility or the particular treatment processes. A more detailed description of each alternative is presented in Section 5.

Numerous assumptions were made about the alternatives so the evaluations could proceed. Top-level assumptions unique to a particular alternative are generally discussed here. Assumptions that apply to more than one alternative are generally listed in Section 3.

Figure 4-1 presents a highly simplified flow diagram for each waste-treatment alternative.

4.1 Alternative 1: Construct and Operate MLLWTF

In this alternative, the MLLWTF project will proceed essentially as planned in the backup documentation (BUD), dated 1-31-92.

The facility will provide a wide range of waste treatment capabilities: size-reduction, incineration, and immobilization processes. With the two exceptions shown in Figure 4-1, the MLLWTF will treat all INEL mixed waste and the LLW for which treatment is either required or cost effective. (The two exceptions relate to small waste-treatment processes already planned at the INEL. These include the ANL-W sodium treatment facility and the EG&G Idaho lead recovery process.) LLW for which treatment is neither required to meet the WAC of the MLLWDF nor cost effective will be disposed of without treatment.

In Section 5, two subalternatives, or options, are developed for the MLLWTF alternative. The maximum-treatment option is based on treatment of the maximum amount of waste prior to disposal. The minimum-treatment option is based on treatment of the minimum amount of waste required to meet the WAC of the MLLWDF. These options provide upper and lower bounds on the capabilities of the MLLWTF.

The design and operations of the MLLWTF will comply with all DOE Orders, including the safety design criteria in DOE Order 6430.1A and in guidance documents cited therein.

ALTERNATIVE 1: CONSTRUCT AND OPERATE MLLWTF (TWO CASES - MAXIMUM AND MINIMUM TREATMENT AT MLLWTF)

Figure 4-1. Highly simplified flow diagrams for the waste-treatment alternatives evaluated.

ALTERNATIVE 2: MODIFY AND OPERATE WERF

Figure 4-1. (continued).

ALTERNATIVE 3: MODIFY AND OPERATE PREPP

Figure 4-1. (continued).

ALTERNATIVE 4: GENERATOR TREATMENT

Figure 4-1. (continued).

ALTERNATIVE 5: OFFSITE TREATMENT

Figure 4-1. (continued).

ALTERNATIVE 6: IWPF

Figure 4-1. (continued).

ALTERNATIVE 7: COMBINATIONS

1. WERF AND OFFSITE TREATMENT

Figure 4-1. (continued).

ALTERNATIVE 7: COMBINATIONS

2. WERF AND MPF TREATMENT

Figure 4-1. (continued).

ALTERNATIVE 7: COMBINATIONS

3. GENERATOR AND OFFSITE TREATMENT

Figure 4-1. (continued).

ALTERNATIVE 7: COMBINATIONS

4. GENERATOR AND IWPF TREATMENT

Figure 4-1. (continued).

ALTERNATIVE 8: NO ACTION

Figure 4-1. (continued).

Siting studies for the proposed MLLWTF are under way. For cost or other evaluations in the current study, the location at the INEL is assumed to be away from existing facilities, so the full range of siting activities will be required.

The assumed schedule for the construction and operation of the MLLWTF generally follows that indicated in the BUD. However, this study assumes that the beginning of radioactive operations is delayed from the BUD schedule by 2 yr. Part of the delay is due to NEPA and permitting requirements, based on a more recent regulatory compliance plan for the MLLWTF. The remainder of the delay is due to allowing more time for facility startup activities. The hot operations start date for the MLLWTF is assumed to be at the end of fiscal year (FY)-2003.

The draft Functional and Operational Requirements for the MLLWTF require a minimum facility design life of 25 yr. The operating life of the facility is assumed to be 25 yr. Thus, the MLLWTF will operate until the end of FY-2028.

An assumption is made that the deactivation, decontamination, and decommissioning activities for the facility will be completed at the end of FY-2032.

4.2 Alternative 2: Modify and Operate WERF

In this alternative, major modifications will be made to the WERF.

By way of background information, WERF is located at the Power Burst Facility (PBF) area of the INEL in the former SPERT III reactor building. WERF treated LLW by incineration, compaction, size reduction, solidification, and melting from the early 1980s through 1990. Limited treatment of mixed waste was performed.

WERF is currently shut down to upgrade the rigor of operations and to complete minor modifications; primarily, replacement of the exhaust stack and upgrade of the offgas and stack-monitoring equipment. The restarted WERF will include the processes of incineration, immobilization, size reduction, and compaction.

Upon restart of WERF about July 1993, the newly generated and stored waste that is treatable in WERF will be worked off. Newly-generated, nontreatable waste will either be disposed of at the RWMC or (later) the MLLWDF, or be stored if restricted from land disposal. WERF is assumed to continue operations until the selected alternative is fully operational.

In this long-term alternative, new waste-processing capabilities will be added to the existing capabilities at WERF, which will themselves be upgraded as necessary. WERF will thereby accommodate somewhat more of the INEL waste than is currently the case.

As shown in Figure 4-1, however, the modified WERF will still not have the capability to treat some waste streams. Such streams will be placed into storage indefinitely, and a storage facility will be constructed for that purpose. The WERF modifications required to treat those streams will require a facility of the same order-of-magnitude as the MLLWTF.

Figure 4-1 also shows that the sodium treatment facility and lead recovery process are assumed. Finally, the LLW for which treatment is neither required nor cost effective will be disposed of without treatment.

The modified WERF will be operated for 25 yr. It will then undergo deactivation, decontamination, and decommissioning over a period of 4 yr.

The major modifications will bring only partial compliance with the safety design criteria of DOE Order 6430.1A. Certain deficiencies in the basic structure and utilities of the 1960s-era building are not expected to be practical to correct. Therefore, an assumption is made that the major modifications will be performed only insofar as the changes are cost effective to move toward compliance. If this alternative is selected, an assumption is made that DOE will approve the remaining noncompliances. Such approval is required by DOE Order 6430.1A.

4.3 Alternative 3: Modify and Operate Process Experimental Pilot Plant

This alternative will involve making major modifications to another existing waste-treatment facility, the Process Experimental Pilot Plant (PREPP). See Figure 4-1.

PREPP is a full-scale, waste-treatment facility located at the Test Area North (TAN) of the INEL. PREPP was constructed in the mid-1980s as a pilot testing facility for the treatment of TRU waste. Testing was conducted in PREPP. However, major difficulties were encountered, and a large number of design noncompliances were identified,^{1,2} some of which were due to changes in the requirements. No radioactive operations were conducted, and the project was terminated. PREPP remains shut down.

The above discussion for WERF applies identically for PREPP, with the following exceptions:

- No efforts are currently planned to upgrade or operate PREPP in the interim.
- No waste streams will be required to be stored indefinitely, so an indefinite-storage facility will not be required.

PREPP will be operated for 25 yr. Deactivation, decontamination, and decommissioning would take place over a period of 4 yr.

4.4 Alternative 4: Generator Treatment

In this alternative, there will be no central location for treatment of INEL waste. Instead, the waste will be treated by the individual facilities that generate the waste (see Figure 4-1).

The major waste-generating areas at the INEL are assumed to construct and operate small treatment facilities. Such facilities will include compactors, size-reduction equipment, and immobilization capabilities. Incinerators will not be included.

The small generators will generally dispose of waste at the MLLWDF without treatment. If treatment is required, the waste will be transported to the treatment equipment of the major generators.

For some waste streams, suitable treatment capabilities will not be developed in this alternative. Such streams will be placed into storage indefinitely, and a storage facility will be constructed for that purpose.

The generator waste-treatment capabilities are assumed to operate for 25 yr. Deactivation, decontamination, and decommissioning will then take place over a period of 3 yr.

As with the modifications to WERF and PREPP, adding capabilities to the various waste generators will comply only partially with DOE Order 6430.1A if existing buildings are used. Some deficiencies that exist with the basic structure and utilities of certain buildings will not be practical to correct. Therefore, an assumption is made that modifications to comply with DOE Orders will be made only insofar as the changes are cost effective to move toward compliance. If this alternative is selected, an assumption is made that DOE will approve the remaining noncompliances, as required by DOE Order 6430.1A. To the extent that new treatment buildings are constructed by the major generators, those facilities are assumed to comply fully.

4.5 Alternative 5: Offsite Treatment

In this alternative, with the exception of the waste destined for the lead recovery process or the sodium treatment facility, the INEL mixed waste will be shipped offsite for treatment. The treated waste will be shipped back to the INEL for disposal. The MLLWDF will be responsible for disposing of the treated waste. The treated waste will comply with the WAC of the MLLWDF and with the LDRs of the EPA. (See Figure 4-1.)

Comprehensive mixed waste treatment is not available yet at offsite commercial facilities. This study assumes that such treatment will be available by the future time period of interest.

Even if available, offsite treatment may not accommodate certain waste streams. To simplify the evaluations, this possibility is not addressed in the study.

4.6 Alternative 6: Treat Waste in IWPF

In this alternative, use will be made of the proposed IWPF to treat the low-level mixed waste stream. The IWPF is a proposed facility whose mission is to treat TRU waste, mixed TRU waste, and LLW (whether mixed or not) that is contaminated with TRU radionuclides. The IWPF project is in the early stages. Specific designs have not been developed yet. The facility will perform the necessary thermal treatment, immobilization, removal of liquids, neutralization of hazardous components, repackaging, and other processing to fulfill its mission.

The schedule for the IWPF reflects a phased implementation. Phase I operations will address non-TRU waste and will begin in FY-2005. Phase II operations will address TRU waste and are to begin in FY-2007.

In this alternative, the lead recovery process and the sodium treatment facility will operate as planned. Waste for which treatment is neither required nor cost effective will be disposed of in the MLLWDF without treatment. Beginning in FY-2005, all other low-level mixed waste will be treated in the IWPF before disposal.

The same 25-yr campaign is assumed.

4.7 Alternative 7: Combinations of Alternatives

In this subsection, several combinations of the above alternatives are identified for evaluation. In each combination, some waste streams will be treated using one of the above alternatives, and the other waste streams will be treated by another alternative.

The descriptions and assumptions concerning the combinations of alternatives are generally the same as those for the individual alternatives comprising the combination. However, only part of the waste streams will be treated via each alternative.

Some possible combinations of the above six alternatives are attractive and were judged worth considering in this study; some were not. In general, combinations are more attractive if their respective treatment capabilities are complementary, rather than duplicative.

The matrix in Table 4-1 indicates the pairs of alternatives that were selected for consideration as combinations, marked with an "x." Pairs that were not selected are marked with a "0." Only the upper right half of the matrix needs to be addressed because of symmetry. Also, the diagonal represents the combination of an alternative with itself, so it need not be considered.

Thus, four combinations of alternatives were selected for analysis and are addressed later in this report. An overview flow chart for each selected combination appears in Figure 4-1.

The following paragraphs provide a brief rationale for evaluating only the four combinations indicated.

Table 4-1. Combinations of alternatives selected for evaluation.

	MLLWTF	Modify WERF	Modify PREPP	Generators	Offsite	IWPF
MLLWTF		0	0	0	0	0
Mod. WERF			0	0	X	X
Mod. PREPP				0	0	0
Generators					X	X
Offsite						0
IWPF						

No combinations of other alternatives with the "no-action" alternative were selected, for obvious reasons. No combinations with PREPP were selected because PREPP has essentially all necessary treatment capability and is already built. Either PREPP will be modified to be operational, or it will not.

The MLLWTF alternative also will have all necessary treatment capability and is not combined with other alternatives.

The combination of Modify WERF with Generator Treatment would not be attractive because neither alternative will have the capability to treat mixed waste soils and debris.

The combination of offsite treatment with IWPF will not be attractive. Both alternatives are best suited for treating the mixed waste, and neither is well suited for treating large quantities of LLW. Offsite treatment of the LLW involves considerable shipping. IWPF treatment of the LLW could result in creating more TRU waste by cross-contamination of waste streams in the IWPF process equipment, which will considerably increase the disposal cost above that for LLW.

4.8 Alternative 8: No Action

This alternative is basically the same as the "no-action" alternative required by NEPA regulations. In this alternative, no new action will be taken concerning treatment of INEL mixed waste and LLW. The MLLWTF will not be constructed. No other alternative will be implemented.

The activities already in effect or planned for other waste management operations will go forward as planned, however. A preliminary projection of those activities follows. (See Figure 4-1.)

PREPP, which is currently shut down, will remain shut down. There are no approved plans to renovate PREPP.

WERF will be permanently shut down about the year 2000.

In this alternative, the disposition of the waste is as follows. The lead recovery process and the sodium treatment facility will treat the respective types of waste they can accommodate. LLW meeting the WAC of the MLLWDF will be disposed of without treatment. All other mixed waste and LLW will be placed into storage indefinitely, and a storage facility will be constructed for that purpose.

4.9 References

1. C. H. Cargo and D. A. Reny, *Preliminary Safety Analysis for the Process Experimental Pilot Plant (Draft)*, WM-PD-90-013, November 1990.
2. EG&G Idaho, Inc., *Proposal for Reactivation of the PREPP Facility*, December 2, 1991.

5. DESCRIPTION OF ALTERNATIVES

In order to provide a reasonable basis for evaluation of the alternatives, they are described in more detail in this section. For all alternatives, with the exception of no action, specific unit operations were selected to carry out treatment of the waste streams of concern.

The choice of treatment units was made using engineering judgment, based on the inherent restrictions of each alternative and the specific requirements associated with the wastes to be treated. Some alternatives already have several units specified, whereas others require complete definition. For example, in order to treat many mixed wastes, an incineration unit will be required. For the modify WERF alternative, this will mean using the presently installed controlled-air incinerator combined with appropriate offgas treatment. For the MLLWTF alternative, this will mean selecting an incinerator, or set of incinerators, that will achieve the desired treatment most efficiently, considering all wastes that need to be treated.

It is stressed that an in-depth engineering analysis of any alternative will likely result in changes to the treatment units selected. However, for the purpose of this evaluation, an assumption is made that engineering judgment yields an adequate basis for overview comparisons of alternatives.

For brevity, Alternative 1, Construct and Operate MLLWTF, is used as a baseline in the following descriptions. This approach avoids repetitions of treatment descriptions for those cases in which other alternatives will use similar processes to those used in the MLLWTF.

5.1 Alternative 1: Construct and Operate MLLWTF

This alternative involves the treatment of waste at a newly-constructed facility, the MLLWTF. The defining assumptions are

- MLLWTF will be built
- PREPP will not be restarted
- IWPF will not be used for treatment of M&LLW
- WERF will have been shut down permanently
- MLLWDF will be accepting waste
- A process will be available for treating lead and cadmium shielding
- A facility will be available for treating sodium and barium/cadmium salt wastes.

5.1.1 Overview of Waste Stream Disposition

5.1.1.1 Wastes Streams Treated. Based on the waste information in Section 2, the total volume of mixed waste and LLW to be treated by the MLLWTF will be 6861.3 m³/yr. The volume

of lead and cadmium shielding to be treated by the lead recovery process will be 52.6 m³/yr. The volume of sodium and barium/cadmium salt wastes to be treated in the sodium treatment facility will be 0.6 m³/yr.

5.1.1.2 Waste Streams Disposed of Following Packaging at Generator. The volume of LLW to be packaged for direct disposal will be 1127.5 m³/yr.

5.1.1.3 Wastes Streams Stored. No mixed or LLW will be stored.

5.1.2 Description of Treatment Processes and Operations

This alternative requires the most extensive definition. Review of the waste stream data indicates that the required general elements are receiving and storage, container opening and contents sorting, pretreatment, treatment, and immobilization or packaging for disposal. Each area is defined in greater detail below, including specific units chosen to meet the treatment needs. A schematic of the process is shown in Figure 5-1.

5.1.2.1 Receiving and Storage. The waste is assumed to be presorted by the generator into the waste categories summarized above. Contact-handled waste brought to the MLLWTF receiving and storage area will be removed from the transport vehicle and either taken directly to a treatment unit or stored by category. Forklifts will be used to unload and move the waste containers through air locks in the building housing the MLLWTF. Most remote-handled waste will be treated by the generator or disposed directly. A small volume of remote-handled mixed waste may be created by D&D. This waste will be transferred into a small set of "hot-cells" where treatment will be developed on an individual basis. The hot-cells will be sized to allow for minor decontamination and solidification and also to allow for temporary storage of approximately 30 drums. More specific information for the remote-handled waste is not included in this study.

5.1.2.2 Container Opening and Contents Sorting. Transport containers will be moved by fork lift from the receiving and storage area to the container opening and sorting cell (hereafter called the opening cell) air lock. Transport containers that hold preboxed wastes, suitable for contact handling, will be unloaded. All containers to be placed in the opening cell will pass through a radiation monitor and will be x-ray radiographed to check contents. Containers not passing these inspections will be returned to the generators.

The containers that pass the radiation and x-ray screening will move through the air lock into the opening cell. Once inside the opening cell, any reusable container will be opened by removing its lid. A visual inspection will be performed to confirm the contents of the container. In most cases, contents will be confirmed, and the container contents will be routed to the appropriate treatment cells.

On rare occasions, the waste in a container may have to be sorted to identify the different types of waste. In such an event, the contents of the container will be dumped onto a table and sorted remotely. The sorted items and the empty container will be placed in appropriate bins for transport to other treatment cells.

Figure 5-1. Simplified schematic of treatment processes in MLLWTF.

The capability to sample containers of mixed waste will also be available in the opening cell. Samples will be placed in small sample containers and transferred out of the opening cell to an analytical laboratory, within the MLLWTF, equipped to analyze and confirm the waste contents.

5.1.2.3 Pretreatment. There will be three pretreatment units: decontamination, volume reduction, and liquid preparation. Volume reduction will be actually a combination of numerous units, including shredding, grinding, cutting, and compaction.

Decontamination—Large, nonincinerable items, including empty transfer containers, may be moved to the decontamination area. The loose surface contamination will be removed by various chemical and mechanical methods, depending on the waste stream. Decontamination of most streams may not be required to meet disposal requirements; however, at a minimum, reusable containers will probably have to be decontaminated. The containers will be decontaminated in an ultrasonic or vibratory tank. This will allow release and reuse of most containers. The secondary streams from decontamination will require further treatment. The liquid secondary streams will either be treated in the incinerator or be sent to ICPP for evaporation. (See the assumptions in Section 3.2.)

Size Reduction—Shredding, grinding, cutting, and compaction methods will be used to reduce the size of the waste to be processed.

Shredding—A two-shaft shredder will be used as a pretreatment for incineration. Waste to be incinerated will be routed to a feed hopper for the shredder. After passing through the shredder, the waste will be directed to a transfer bin that will serve as a reservoir and feeder for the incinerator. Provision will be made for manually removing large items that will not pass through the shredder.

Grinding—Waste to be ground will be routed to a feed hopper for a grinding unit. The grinder will be specifically required for a mixed LLW stream consisting of dry evaporator concentrates that must be broken up and then stabilized. The output of the grinder will be collected in a transfer bin.

Cutting—Metal-cutting torches and wood-cutting saws will be available in the cutting cell for sizing large pieces. Sizing will be done remotely by personnel using manipulators. Sized items will be placed in a transfer bin.

Compaction—A compaction unit will be used to volume-reduce the nonincinerable, compressible waste. The compaction will be performed by loading and compacting waste into a disposal container. When the container is full, a lid will be installed, the outside will be cleaned, the container will be passed through an air lock, the outside will be rechecked, and then it will be sent to the disposal facility.

Liquid Preparation—Small volumes of liquid mixed wastes may be treated by incineration. These liquids will be absorbed onto combustible material before being introduced into the incinerator.

5.1.2.4 Treatment. An incinerator will be required for treatment of most mixed wastes and can be used for significant volume reduction for about one-third of the LLW. The choice on using an incinerator is based on the solid and heterogeneous character of the waste. Both combustible wastes (paper, rags, plastics, and wood) and noncombustible waste (solvent-contaminated sludges, soils,

concrete, and metals) must be incinerated. The best currently available technology for dealing with this broad spectrum of waste inputs is a rotary-kiln incinerator.

All sorted and shredded combustible LLW and all mixed waste requiring incineration will be fed to a rotary kiln incinerator using a screw feeder. Noncombustible LLWs will bypass the incinerator and go directly to the immobilization cells. The ash and coarse waste from the incinerator will be collected and transported to the immobilization cells. Offgas from the incinerator will be conditioned before release to the atmosphere.

The ash or residue from the incineration process will be cooled in a rotary cooler and transferred to a trommel separator. The trommel will separate the ash into coarse and fine fractions. The coarse fraction (generally, noncombustibles) will be loaded directly into transfer containers by means of a hopper at the discharge of the trommel separator. The fine ash will be collected in a separate hopper/transfer container. The transfer containers will then be transferred to the immobilization cell.

Combustion gases from the kiln will flow into the secondary combustion chamber (SCC) that is fired with a propane burner. The SCC will be designed to destroy expected hazardous organic constituents.

Exhaust gases from the SCC will be treated by the process offgas cleaning system. The offgas cleaning system will consist of a spray dryer absorber, followed by a baghouse, followed in turn by two stages of high efficiency particulate air (HEPA) filtration. The spray dryer absorber will be fed a caustic solution that will help remove HCl created in the burning of chlorinated solvents and polyvinyl chloride (PVC). It also will serve to cool the offgas, remove some particulates, and condense the volatilized metals. Most solids passing through the spray dryer absorber will be removed in the baghouse. Final polishing of the offgas air will occur in the HEPA filters. Particulate falling to the bottom of the spray dryer absorber will be collected and moved to the immobilization room for final treatment. Particulate removed by the bag house filters is periodically collected and pneumatically transferred to the immobilization room for final treatment. Other miscellaneous solid wastes generated by the facility operation, such as loaded HEPA filters, will be fed into the shredder with the incoming waste containers, or will be packaged for disposal. Based on experience and studies at WERF, atmospheric releases from this system will meet regulatory requirements.

5.1.2.5 Immobilization and Packaging for Disposal. There will be four immobilization/packaging units. The unit required will depend on the specific waste stream to be treated. The units will include sulfur-polymer cement, Portland cement, a small joule-heated glass melter, and a packaging unit.

Common to all units in the immobilization room will be the capability to sample waste, both before and after immobilization, to confirm its hazardous characteristics. As was done with the samples taken in the opening cell, samples will be placed in small sample containers and transferred out of the immobilization cell to an analytical laboratory, within the MLLWTF, equipped to analyze and confirm the final characteristics of the waste.

Sulfur-Polymer Cement—Incinerator ash and dust sweepings will be solidified in a sulfur-polymer cement. The ash may be mixed with inert materials.

Portland Cement—Moist waste that is not appropriate for stabilization in sulfur cement will be solidified in Portland cement. A cement mixer, a container for mixing waste and cement, and a transfer system for cement and waste will be the required components.

Joule-Heated Glass Melter—A Joule-heated glass melter will be available to vitrify sludges that do not pass through the furnace and certain hazardous wastes. The volume of these wastes will be small; therefore, the melter will be small. This unit may not be necessary if sulfur-polymer cement or Portland cement becomes an acceptable substitute.

Packaging: Standard and High-Integrity Containers—Waste streams that are not solidified in sulfur-polymer cement (e.g., waste that is mechanically volume-reduced) will be placed in either standard or high-integrity containers. Standard containers are drums or boxes. Most waste sent to the disposal facility will be Class 1 waste (see Section 2.3); therefore, most waste will be packaged in standard containers. The small amount of Class 2 and 3 waste will be placed in high-integrity containers (HICs) that are designed to last longer than a standard drum or box. The longer-life HIC means that more decay of radioactive elements will occur before exposure of the waste to the leaching environment of the waste disposal site. HIC designs will range from simple, high-density plastic 55-gal drums to large-volume cement and steel containers designed for nested disposal.

5.1.2.6 Final Disposal. After wastes are cured in their final waste containers, the containers will be sealed, decontaminated, transferred out of the process cells through an air lock, rechecked for contamination, transferred out of the building housing the process equipment through an air lock, and sent to the disposal facility.

5.1.2.7 Effluents. The only effluents crossing the boundaries of the MLLWTF will be the treated and packaged solid wastes and the air emissions from the offgas and ventilation systems. The facility will probably have two main stacks, one to handle the primary confinement exhaust, including the offgas from the rotary kiln, and one to handle the secondary confinement exhaust. Liquid waste from the decontamination cell may be sent to ICPP if it is not fed into the incinerator.

5.1.3 Description of Buildings

The entire treatment process will be located within a structure meeting the requirements of DOE Order 6430.1A for the treatment of LLW. There are numerous requirements in 6430.1A. The most important requirement is providing confinement of radioactive material. Basically, wherever exposed waste can exist, two confinement barriers must be provided between the waste and the environment.

The primary confinement system will be the first barrier used to prevent direct release of the hazardous material. The primary confinement system for the MLLWTF will include the treatment cells, conveyor tunnels, waste containers, and properly designed process equipment. The associated ventilation system will also be part of the boundary. The exhaust from the primary system will pass through a HEPA filter bank at a minimum. The incinerator will also require a spray dryer and a baghouse, as mentioned in Section 5.1.2. The integrity of the primary confinement must be ensured for all normal operations and anticipated operational basis incidents (OABIs). The primary confinement will also isolate exposed waste from operations personnel.

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The secondary confinement will enclose the primary confinement systems and serve to contain any release of hazardous material from the primary confinement. The secondary confinement and the associated ventilation system will be capable of performing their function following any design basis accident (DBA). The secondary confinement for the MLLWTF will likely be a pre-engineered metal building, sealed to its foundation, and designed to withstand the DBA. The building will have a 35,000 ft² footprint and will be three stories high. The ventilation system on the secondary confinement will be sufficient to maintain a negative pressure relative to the environment during the DBA. The exhaust from the secondary confinement will pass through a bank of HEPA filters.

For both primary and secondary confinement, special consideration will be given to the access paths through confinement barriers. This will minimize the impact of access on the ventilation system and help prevent the release of radioactive airborne materials.

Lag storage capability will be provided for 1 month throughput of incoming, untreated waste and for 1 month throughput of treated waste (see assumptions in Section 3). In a 1-month period, there will be 532.5 m³ of incoming LLW and 39.3 m³ of incoming mixed waste. The treated waste volume will be calculated assuming a 100:1 volume-reduction for incineration, a 5:1 volume-reduction for compaction and cutting, and a 1:5 volume-increase for stabilization. Therefore, 129 m³ of treated LLW and 123.4 m³ of treated mixed waste will be produced in a 1-month period.

Storage area will be calculated using the same value of the area-to-volume ratios as for proposed storage of TRU waste at the RWMC and for storage of mixed waste at WERF. The area-to-volume ratio for LLW of 1:1, that is, will require 1 m² of floor space to store 1 m³ of waste. The ratio for mixed waste will be 4.5:1. Therefore, the total area required for the lag storage facility will be 1400 m².

The storage buildings used will likely be similar to the Mixed Waste Storage Facility (MWSF) at WERF, which is a single story, pre-engineered metal structure. The storage building will not serve as a confinement structure, but instead as a weather cover for the containerized waste.

5.1.4 Minimum-Treatment Option for MLLWTF Alternative

The above description represents a "maximum-treatment" option for the MLLWTF alternative. "Maximum-treatment" means that volume-reduction is used for all applicable streams. In order to bound the range of designs for the MLLWTF, a "minimum-treatment" option was also developed. Minimum-treatment means that streams are treated only when required, and not for the sake of volume-reduction. There are 2474 m³/yr of incinerable LLW and 3915.8 m³/yr of mechanically volume-reducible LLW that will be sent directly to disposal in the minimum-treatment option. This represents 92% of the waste that is to be treated in the maximum-option, leaving only 471.5 m³/yr to be treated in the MLLWTF.

Use of the minimum-treatment option means that the MLLWTF process can be significantly smaller in size. However, it does not remove the need for any processes except the compactor and the cutting unit. All remaining process units are necessary for treatment of mixed waste.

Another major effect of using the minimum-treatment option is that it requires more disposal area. Using the volume-reduction (increase) factors noted above, the minimum-treatment option will require 5582 m³/yr more disposal volume than the maximum-treatment option.

The volume of lag storage will also change. Using the same approach as before, the area required for lag storage is 800 m².

5.2 Alternative 2: Modify and Operate WERF

WERF is a full-scale facility for radioactive waste handling, decontamination, and volume-reduction techniques. The radioactive waste handled by WERF consists primarily of solid, low-level, beta-gamma contaminated waste. Another function of WERF is the incineration of hazardous and mixed waste.

This alternative involves the treatment of waste at a modified WERF. The defining assumptions are

- MLLWTF will not be built
- PREPP will not be restarted
- IWPF will not be used for treatment of M&LLW
- WERF will be modified for extended operation past its shutdown date
- MLLWDF will be accepting waste
- A process will be available for treating lead and cadmium shielding
- A facility will be available for treating sodium and barium/cadmium salt wastes.

5.2.1 Overview of Waste Stream Disposition

In this alternative, treatment, disposal, and storage are all used for some wastes generated by ongoing operations and created by D&D efforts. Most waste is treated before disposal; some for which treatment is not cost effective is disposed of directly.

5.2.1.1 Wastes Streams Treated. Based on the waste information in Section 2, the volume of mixed waste and LLW to be treated by the modified WERF is 6475.3 m³/yr. The volume of lead and cadmium shielding to be treated by the lead recovery process is 52.6 m³/yr. The volume of sodium and barium/cadmium salt wastes to be treated in the sodium treatment facility is 0.6 m³/yr.

5.2.1.2 Waste Streams Disposed of Following Packaging at Generator. The volume of LLW to be packaged for direct disposal is 1127.5 m³/yr.

5.2.1.3 Waste Streams Stored. There are 386 m³/yr of sludge, dirt, and debris, mostly from D&D operations, which cannot be treated by WERF, and it will have to be stored in a mixed waste storage facility.

5.2.2 Overview of Treatment Capabilities Before and After Modifications

The processing methods currently in use at WERF include mechanical sizing, compaction, incineration, and immobilizations, which will treat the bulk of the waste. In addition, an assumption is made that 386 m³/yr of D&D-generated mixed waste, made up of soil, rubble, sludge, and debris, will have to be stored. Thus, this alternative will require the construction of a mixed waste storage facility because of the limited capability of the controlled-air incinerator to process soil and rubble.

No detailed listing of the operational deficiencies at WERF has been compiled. Some deficiencies are discussed below. There are probably others similar to those listed later under PREPP.

As part of the current upgrades to WERF, the scrubber system will be routinely used to remove acid gases (HCl) and volatile metals from the offgas system; thus, the system will already be in place and operating when this alternative becomes functional.

The only treatment modifications called for under this alternative are to improve the ash-handling capability for the incinerator discharge, and to add redundancy to the incinerator offgas system. The ash handling will be changed to allow remote operation and to allow stabilization of the 119 m³/yr of mixed waste requiring stabilization.

In addition, significant modifications to the building and the utilities will be performed to eliminate many noncompliances with codes and standards, as required by DOE Order 6430.1A. This subject is addressed at greater length in Section 10. As part of the current upgrade at WERF, some of these noncompliances will be corrected before the long-term modifications are made.

To maintain WERF as a viable alternative past the date scheduled for permanent shutdown will require replacement of the incinerator, which has been assumed herein to be with one of the same type (i.e., a controlled air incinerator). The offgas system will also be completely replaced with one of the same type but with redundancy as mentioned above.

5.2.3 Description of Treatment Processes and Operations

Contact-handled waste brought to the WERF receiving and storage area will be removed from the transport vehicle and either taken directly to a treatment unit or stored by category.

5.2.3.1 Container Opening and Contents Sorting. Containers in which waste is received at WERF will be assayed and inspected to verify that the contents are accurately described in the shipping documents. If discrepancies are detected, the container will be returned to the generator. The sorted items and the empty container will be placed in appropriate bins for transport to treatment area.

5.2.3.2 Size Reduction. After transfer to the size-reduction area, the waste will be sorted into several categories. After preparation, which may include stripping of insulation and dismantling of plumbing, the waste will be sized using metal-cutting torches or wood-cutting saws.

5.2.3.3 Compaction. Compactible waste will be received wrapped in plastic or in polyethylene bags in metal refuse containers. The compaction will be done similarly to the compaction step described in Alternative 1 (above). The waste will be loaded by hand in the compactor where it will be reduced in volume. It will be compacted into 4 × 4 × 6-ft metal disposal containers, which will be shipped to the MLLWDF for disposal.

5.2.3.4 Incineration. The WERF incinerator is a two-stage, controlled air incinerator permitted to burn low-level and mixed contaminated wastes such as paper, rags, wood, organic liquids, and certain plastics at a rate of up to 400 lb/hr. The solid waste will be segregated as to combustible contents and prepackaged in corrugated cardboard boxes with polyethylene liners. The liquid wastes processed are combustible LLW or mixed wastes that are compatible with the WERF system. These wastes will be brought to the WERF in drums and fed to the incinerator through the liquid waste feed system. Wastes that are difficult to process through the liquid waste feed system (because of their physical properties, such as solids content or viscosity, or because the quantities are too small to be practical) may be incinerated by mixing with a combustible absorbent material, which is then boxed and processed as solid waste.

Although the type of incinerator used at WERF is different from the type described for the MLLWTF, they perform the same function, and the offgases and ash are handled similarly. The only functional difference is that the rotary kiln specified for the MLLWTF can handle large volumes of soils, rubble, and sludge; the controlled-air incinerator at WERF cannot.

5.2.3.5 Immobilization. The primary purpose of the waste immobilization activity is to solidify drummed WERF baghouse flyash, incinerator bottom ash, and dust from the sizing operations. The secondary purpose is to stabilize heavy metals so the waste will not be characterized as hazardous. The addition of a binder to the waste acts to immobilize the hazardous constituents so they do not leach out in toxic form. The binder could be Portland cement, sulfur polymer concrete, or epoxy. This step is virtually identical to the solidification step for Alternative 1 (above).

5.2.3.6 Packaging in High Integrity Containers. LLW streams that require containment but which cannot be treated by any of the above processes (e.g., remote-handled waste) will be packaged in HICs and disposed directly at the MLLWDF.

5.2.3.7 Effluents. The only effluents crossing the boundaries of WERF are the treated and packaged solid wastes and air emissions from the offgas system. The facility has two outlets for all air and combustion gases leaving the area: the south stack and north stack. The south stack discharges incinerator room ventilation air and cooling air from the incinerator heat exchanger. The north stack discharges air and combustion gases from the incinerator, the furnace rooms, the cleaning room, the contaminated work rooms, and the ash cooling system. Before discharge, the air and offgases to the north stack pass through a baghouse and a bank of HEPA filters.

5.2.4 Description of Buildings

WERF is located in the former Special Power Excursion Reactor Test (SPERT) III reactor building, which was built in the late 1950s. The reactor building is a two-story structure with masonry exterior walls and a concrete and steel frame. The facility includes a high bay area and a basement.

The physical layout of WERF is depicted in Figure 5-2. Waste to be incinerated is fed to the incinerator from the high bay area through an air lock. Offgases are routed through an air-to-air heat exchanger, back out into the high bay, through a baghouse and the main HEPA filters, and out the north exhaust stack. Ash is removed from the incinerator from beneath and taken to the stabilization area. Sorting, sizing, and compaction are done in a separate building.

Problem areas include the manual handling of the incinerator ash, the location of the baghouse and HEPA filters close to the high bay wall, and the need for redundancy in the scrubber system.

No change in the layout is envisioned to accommodate the remote ash-handling system; it will occupy the same space (underneath the incinerator) as the current system. The baghouse and HEPA filter bank for the backup offgas system can be located inside the high bay west of the existing baghouse and HEPA filters. The backup scrubber will require a weather shield as near as practical to the existing scrubber silo.

Indefinite storage is required for 386 m³/yr of mixed waste. Using the 4.5:1 area-to-volume ratio, 1700 m² of storage facility area will be required each year. Using a storage period of 25 yr, 42,500 m² of storage area will be needed.

Lag storage will also be required. Using the same approach as before, the area required for lag storage is 700 m². The mixed waste storage facility adjacent to WERF has adequate capacity to serve as the lag storage building.

The indefinite storage buildings used will be similar to those used for the MLLWTF.

5.3 Alternative 3: Modify and Operate PREPP

This alternative involves the treatment of waste at the PREPP facility. The defining assumptions are

- MLLWTF will not be built
- PREPP will be modified and restarted
- IWPF will not be used for treatment of M&LLW
- WERF will have been shutdown permanently
- MLLWDF will be open and accepting waste

Figure 5-2. Layout of WERF (main floor).

- A process will be available for treating lead and cadmium shielding
- A facility will be available for treating sodium and barium/cadmium salt wastes.

5.3.1 Overview of Waste Stream Disposition

5.3.1.1 Wastes Streams Treated. Based on the waste information in Section 2, the total volume of mixed waste and LLW treated by PREPP is 6861.3 m³/yr. The volume of lead and cadmium shielding treated by the lead recovery process is 52.6 m³/yr. The volume of sodium and barium/cadmium salt wastes treated in the sodium treatment facility is 0.6 m³/yr.

5.3.1.2 Waste Streams Disposed Following Packaging at Generator. The volume of LLW to be packaged for direct disposal is 1127.5 m³/yr.

5.3.1.3 Wastes Streams Stored. No mixed waste or LLW will be stored.

5.3.2 Overview of Facility Capabilities and Problems Before Modifications

PREPP is an existing rotary-kiln thermal treatment facility originally built as a full-scale pilot plant for the treatment of TRU waste. The incinerator is located within a two-story framed building which, in-turn, is located within the TAN-607 facility. The interior of the building is separated into compartments by concrete floors, internal walls, and air locks which, along with the ventilation system, provide positive control of radioactive contamination and hazardous fugitive emissions.

Following construction, the plant underwent an extensive testing program, and subsequent modifications were initiated to correct problems identified during testing. The facility was placed in "standby" status by DOE in early 1991, with the modifications incomplete. The principal reason for ending the modification and testing of PREPP was the high costs associated with upgrading the facility to meet TRU waste processing requirements specified in DOE Order 6430.1A.

While operation as a treatment facility for TRU waste is not perceived to be practical, operation to treat mixed waste and LLW has been proposed.¹ This is thought to be practical because processing requirements for LLW are less rigorous than for TRU; therefore, the associated cost to upgrade the facility is not prohibitive.

The major problems with the facility can be broken down into two categories: those associated with process operability, reliability, and maintainability; and those associated with 6430.1A compliance. The great majority of the problems listed below will be remedied as a result of the upgrades. Only a few noncompliance areas will remain.

Major process problems include the following:

- Lack of simple screening monitors
- Lack of equipment in verification enclosure for performing inspection and sampling
- Lack of analytical facility for verification of incoming and treated wastes

- Seal leaks in the verification enclosure windows, light fixtures, and doors
- Kiln feed system deficiencies
- Kiln seal leaks
- Kiln monitor failures
- Damage to the refractory in the transition from the kiln to the secondary chamber
- Nonfunctional waste conveyor from kiln discharge to waste-collection chamber
- Nonfunctional ash handling/solidification unit
- Numerous offgas inadequacies including poor piping layout, plugging of pipelines and scrubbing tanks, incorrect pump application, high solids carryover and HEPA filter loading, and fan failure
- Inadequate process controls
- Lack of appropriate offgas monitors
- Lack of adequate storage
- General lack of room in which to perform maintenance, especially critical in the kiln feed, kiln, and waste discharge areas.

Major DOE Order 6430.1A noncompliances are listed in Section 10 and are not repeated here. Generally, there are numerous problems related to confinement, safety system redundancy, and the ability to withstand design accidents. Many deficiencies will need to be brought into compliance before PREPP can be operated safely.

5.3.3 Overview of Modifications Envisioned

The needed modifications to the facility are discussed in this section. Modifications can be placed into two major categories: those needed to upgrade process operability, reliability, and maintainability; and those needed to improve compliance with DOE Order 6430.1A. Many needed process-related modifications were identified during testing. Much modified equipment had been designed, and some equipment was on hand when the facility was placed in standby. Most of the modifications below follow those outlined in the proposal to convert PREPP to a LLW treatment facility.¹ A few exceptions where changes were made and the reasons for the changes are noted.

5.3.3.1 Kiln Seal System. The Vulcan-engineered kiln seals delivered with the kiln did not compensate for differential kiln/seal movement, and allowed unacceptably high air in-leakage to the kiln. The seals were also extremely difficult to maintain. The original seals have been removed to prepare the kiln for installation of an enhanced seal system.

The seals were redesigned by EG&G Idaho (patent approved), and a quarter-scale seal successfully passed ambient-temperature testing in the PREPP mockup area. Installation of the redesigned seals and subsequent testing will ensure minimum air in-leakage and prevent the spread of contamination during upset conditions.

5.3.3.2 Kiln Feed System. Design is in progress to install a shredder/auger system in place of the existing batch-feed system. A unit was purchased from Komar Industries, Inc., delivered, and successfully tested in the PREPP mockup area. Engineering for the shredder/auger installation will be completed, and the unit will be installed. The present system is unreliable, and its operation is labor-intensive.

5.3.3.3 Discharge Conveyor System. The existing PREPP inertial horizontal-stroke discharge conveyor is difficult to operate and maintain, has limited cooling capacity, and is subject to frequent bellows failure. A rotary-discharge conveyor of simplified design, including the quarter-scale kiln seals discussed above, has been designed fabricated, and successfully tested at ambient temperatures in the PREPP mockup area. The new conveyor will replace the existing conveyor and trommel to both improve the PREPP throughput and obtain additional operating information on the seal system.

5.3.3.4 Ash Grouting System. In the PREPP proposal, the ash-grouting system is to be re-evaluated and upgraded as required. To facilitate this evaluation, it is assumed that the system will be completely replaced. The new system will include a collection hopper at the discharge of the rotary-discharge conveyor, a set of reusable transfer containers that mate one at a time to the bottom of the collection hopper, a transfer system to move the containers, and a solidification room containing both Portland cement equipment and modified sulfur cement equipment. The solidification room will replace the storage room that is adjacent to the feed collection room. Product waste container storage will be moved to an exterior storage pad and/or a pre-engineered Butler-type building.

5.3.3.5 Kiln Upgrade. Several additional modifications will be made to the PREPP kiln system based upon functional and integrated testing. The modifications will

- (a) Provide observation of the SCC burner by means of a camera similar to the kiln viewing camera
- (b) Improve reliability of the SCC thermocouple that failed during testing
- (c) Improve reliability and reduce maintenance of the kiln temperature-monitoring system
- (d) Provide a safe, efficient method to collect waste from the kiln firing hood waste cleanout located beneath the firing hood.

5.3.3.6 Offgas System. The original PREPP offgas system had many deficiencies. Testing of the offgas system before placing PREPP in standby indicated that modifications could be made to remedy the deficiencies. Since the modifications were extensive, it was decided for the convenience of this study to replace the offgas system with a new system that was similar to that proposed for the

MLLWTF. In one concept, the new system will include a spray dryer absorber, a baghouse, a bank of HEPA filters, and an exhaust fan. The system will have a complete backup. There may be difficulties in fitting the conceptual system into the available space at PREPP. For overview comparisons and ROM cost evaluations, the conceptual system is considered a satisfactory assumption.

5.3.3.7 Miscellaneous Safety Systems. A study has been performed on eliminating or mitigating the consequences of a potential explosion due to incineration pyrolysis gases. However, additional analyses will be required to substantiate the need for a pyrolysis gas control system. Also, collection and treatment of fugitive emissions from the shredder room and feed conveyor enclosure needs further evaluation. Both activities were scheduled, but were not initiated when PREPP was inactivated. Both activities will be reinitiated.

5.3.3.8 Radiological and Effluent Monitoring. Carbon monoxide and oxygen monitors presently provided for the offgas system will be relocated as part of the effluent monitoring system. Carbon dioxide monitors and radiological and particulate monitors will also be installed as part of this system. Monitoring for both the offgas stack and the HVAC stack will be considered, as will type, number, and placement of radiological detection instruments throughout the facility.

5.3.3.9 Control and Data Acquisition System. Work was in progress to upgrade the present Control and Data Acquisition System (CDAS), but was canceled when PREPP was inactivated. Installation of the upgrade will be completed.

5.3.3.10 Feed Stock Surge Storage. Adequate surge-storage facilities do not exist at PREPP for incoming feed stocks. This function is necessary to provide safe, economical storage to optimize scheduling and handling, to allow some selectivity of waste material, and to provide an operating buffer against delivery delays. Exterior storage pads and/or a pre-engineered Butler-type building will be required.

5.3.3.11 Feed Stock Verification. Capabilities must be added to PREPP to allow inspection and verification of incoming waste packages for quality and safety reasons. Space is available in the present plant for installation of a package radiation monitor and a package x-ray monitor. There is also space available for opening packages. Packages failing verification will be sent back to the generator for resolution.

Capability to sample and analyze waste must also be added. The sampling can be performed in the opening and verification enclosure. Analysis of the samples will require an analytical laboratory. PREPP does not have enough room for the laboratory. It will have to be placed adjacent to PREPP, either within TAN-607, or in a new small building adjacent to TAN-607. The addition of an analytical laboratory is beyond that proposed previously.¹

5.3.3.12 SSC Arch Rebricking. Significant quantities of dust built up on the shelf created by the arch in the SCC during previous testing. This modification will fill the shelf with refractory so dust cannot accumulate.

5.3.3.13 Size Reduction. A large amount of nonincinerable waste is unsuitable for treatment by the shredder and must be compacted or cut. There is not enough room within PREPP to handle

size-reduction of waste. To accommodate the large amount of waste that requires this treatment, a small building will be placed adjacent to PREPP. The new facility will house a compactor, metal cutting torches, and wood-cutting saws. This modification is in addition to those made in the PREPP proposal.¹

5.3.4 Description of Treatment Processes and Operations

Figure 5-3 is a simplified process diagram of PREPP as it will appear after completion of the modifications required to make possible the treatment of LLW. Waste containers are unloaded in the shipping, receiving, and storage area. The containers are screened using a radiation monitor and an x-ray monitor. The containers are then moved through an air lock and lifted by elevator into the process area. The containers are either transferred by monorail crane directly to the shredder enclosure or undergo further examination in the opening and verification enclosure.

The capability to sample containers of mixed waste will be available in the opening and verification enclosure. Samples will be placed in small sample containers and transferred out of the opening cell to an analytical laboratory, adjacent to PREPP, equipped to analyze and confirm the contents of the waste.

The containerized waste is fed into a two-shaft, low-speed shredder that shreds the waste and containers (wood boxes or steel drums) and reduces the size of the waste. The shredded material drops to an inertial-drive, vibratory conveyor that transfers it to the feed hopper supplying the incinerator feeder. The waste will be, after modifications, metered into the incinerator by a variable-speed screw feeder.

The incinerator is a rotary kiln, 5.75-ft inside diameter by 25 ft long, and is heated by a 3.5 million Btu/hr propane heater. The kiln is sloped approximately one degree, and variable rotation up to 0.33 rpm provides a retention time for the waste of approximately 30 to 90 min. The kiln operating temperature is typically between 1600 and 1800°F. Ash is discharged from the kiln to the rotary cooler discharge system, and combustion gases are routed to the secondary combustion chamber.

The ash or residue from the incineration process is cooled in a rotary cooler and transferred to a trommel separator. The trommel separates the ash into coarse and fine fractions. The coarse fraction (generally, noncombustibles) is loaded directly into transfer containers by means of a hopper at the discharge of the trommel separator. The fine ash is collected in a separate hopper/transfer container. The transfer containers are then transferred by rail and elevator to the immobilization room. In the immobilization room, the contents of the transfer containers are placed into either Portland cement or modified sulfur cement. The transfer containers are returned for additional waste collection. The cemented wastes are cured in final waste containers, the containers are sealed, decontaminated (if necessary), and transferred to the exterior storage area.

Common to all units in the immobilization room is the capability to sample waste, both before and after immobilization, to confirm its hazardous characteristics. As was done with the samples taken in the opening and verification enclosure, samples will be placed in small sample containers and transferred out of the immobilization room to an analytical laboratory equipped to analyze and confirm the final characteristics of the waste.

Figure 5-3. Simplified schematic of treatment processes in modified PREPP.

Combustion gases from the kiln flow into the SCC and are heated to between 1800 and 2000°F. The SCC is fired with a 5 million Btu/hr propane burner. Additional air is supplied to the SCC and, with a residence time exceeding 2 s, any hazardous organic constituents are expected to be destroyed. (Tests with simulated hazardous organics demonstrated a destruction efficiency exceeding 99.99%.)

Exhaust gases from the SCC are treated by the process offgas cleaning system. The offgas cleaning system consists of a spray dryer absorber, followed by a baghouse, followed then by two stages of HEPA filtration. The spray dryer absorber is fed a caustic solution that helps to remove HCl created in the burning of chlorinated solvents and PVC. It also serves to cool the offgas, removes some particulates, and condenses much of the volatilized metals. Most solids passing through the spray dryer absorber are removed in the baghouse. Final polishing of the offgas air occurs in the HEPA filters. Particulate collected at the bottom of the spray dryer absorber is collected and moved to the immobilization room for final treatment. Other miscellaneous solid wastes generated by the facility operation, such as loaded HEPA filters, are fed into the shredder with the incoming waste containers or are packaged for disposal.

The only effluents crossing the boundaries of PREPP will be treated and packaged solid wastes and the air emissions from the offgas and ventilation systems.

Expected performance characteristics of the PREPP facility are briefly summarized in Table 5-1.

Figure 5-3 also includes a separate line for the size-reduction of LLW. Size-reduction will occur in a small facility adjacent to the building that houses PREPP. Waste containers will pass through the PREPP receiving area and radiation and x-ray screening processes, and then be transferred to the size-reduction facility.

Cutting will be performed by an operator using remote equipment. Besides the appropriate manipulator arms, the operator will use torches for metal and saws for wood. Attention to spark control and fire hazard will be required in facility design. Airborne radioactivity in the fumes and particulate created by size reduction will need to be collected and filtered before exhausting them. Sized waste will be loaded into waste containers inside the size-reduction cell.

Compaction will be performed by loading and compacting waste into a disposal container. When the container is full, a lid will be installed, the outside will be cleaned, and it will be sent to the disposal facility. A filtered exhaust will be needed to collect airborne radioactive particulates.

The only effluents from the volume reduction process are exhausted air and packaged solid wastes.

5.3.5 Description of New Buildings

A new storage and analytical facility will be built adjacent to TAN-607. The facility will serve as surge/lag storage capacity for incoming waste and for treated waste bound for the MLLWDF. The facility will also house an analytical laboratory for the analysis of both incoming and treated waste. The facility will likely be a pre-engineered metal structure, similar to the storage facility described for the MLLWTF, except the analytical laboratory will require climate control. The facility will cover

Table 5-1. PREPP performance summary.

Characteristic	Value
Physical description of waste feed material	Solid with limited quantities of liquids 0 to 100% inert, including metal, concrete, soil, glass, etc. 0 to 100% combustible, including PVC plastic, polyethylene, wood, paper, etc. Small quantities of liquids typically associated with "empty containers" and "wet" sludge
Waste material feed rate	350 lb/hr for high-combustible waste stream 665 lb/hr for low-combustible waste stream Up to 100 lb/hr PVC or equivalent chlorinated plastics
Retention time for solids in the kiln	30 to 90 min
Incinerator destruction efficiency	99.99+ % (by test)
Offgas cleaning system HCl removal efficiency	99+ % (by test)
Particulate release to environment	Less than 5.4×10^{-8} lb/hr (estimate based on test results)

an area of about 2000 m². The ventilation for the laboratory will be provided with HEPA filters, and stack monitoring will be required for radionuclides.

A second facility will be built, also adjacent to TAN-607, to house the size-reduction equipment. The size-reduction facility must meet the requirements for confinement described previously for the MLLWTF. The building will likely be a pre-engineered, metal structure with the processes taking place in inner cells. The building will be a single story structure of 200-m² floor area.

5.4 Alternative 4: Generator Treatment

This alternative involves the treatment of waste by the generators at the generators' facilities. The defining assumptions are

- MLLWTF will not be built

- PREPP will not be restarted
- IWPF will not be used for treatment of M&LLW
- WERF will have been shutdown permanently
- MLLWDF will be accepting waste
- A process will be available for treating lead and cadmium shielding
- A facility will be available for treating sodium and barium/cadmium salt wastes.

The boundaries of a single generator, for the purposes of this section, are essentially the fence line of major operations at the site. For example; TRA, ANL-W, ICPP, NRF, and TAN will all be considered separate generators, each needing to process the waste created within its boundaries.

5.4.1 Overview of Waste Stream Disposition

5.4.1.1 Wastes Streams Treated. The volume of mixed waste stabilized by the generators is 48.3 m³/yr. The volume of LLW that will be mechanically volume-reduced is 2642 m³/yr. The volume of lead and cadmium shielding treated by the lead recovery process is 52.6 m³/yr. The volume of sodium and barium/cadmium salt wastes treated in the sodium treatment facility is 0.6 m³/yr.

5.4.1.2 Waste Streams Disposed Following Packaging at Generator. The volume of LLW that will be packaged for direct disposal is 4875.3 m³/yr.

5.4.1.3 Wastes Streams Stored. The volume of mixed waste requiring incineration that will be stored is 423.2 m³/yr.

5.4.2 Description of Treatment Processes and Operations

In order to describe the specific units used by each generator, some assumptions are made with respect to the level of treatment that each facility is capable of achieving. In addition, assumptions are made as to the sophistication of treatment that any generator might install for its own individual use, and not have it be used by others onsite. Specifically, it is probably impractical for any facility to install a thermal treatment unit for sole use. If a generator went to the expense of installing such a unit, it would be made available for all to use, and would thus negate the basic noncentralized nature of this alternative. (The generator's treatment facility will more or less constitute a MLLWTF). On the other hand, small water-treatment units and small mechanical volume-reduction units can conceivably be practical for large-volume generators. Simple stabilization units for mixed wastes are thought to be practical for all generators.

5.4.2.1 Storage and Disposal. Generators presently package and ship wastes for storage or disposal. No changes are required to continue these operations. No changes will be required for transport of waste to the lead recovery or sodium treatment facilities.

5.4.2.2 Mechanical Volume-Reduction. Two facilities, ICPP and NRF, probably generate enough waste to justify the addition of mechanical volume-reduction equipment. ICPP creates 43% of the overall waste, while NRF creates 25%. The total volumes of waste that can be mechanically volume-reduced at ICPP and NRF are 1565 m³/yr and 971 m³/yr, respectively. At ICPP, 1254 m³/yr can be compacted and 311 m³/yr can be size-reduced. At NRF, 572 m³/yr can be compacted, and 399 m³/yr can be size-reduced.

An assumption is made that both ICPP and NRF will construct small buildings to handle the compaction and size-reduction tasks. Size reduction will be performed remotely by an operator using manipulators to operate a plasma arc torch for metal and a saw for wood. Attention to spark control and fire hazard will be required. Airborne radioactivity in the fumes and particulate created by size reduction will need to be collected and filtered before exhausting to the atmosphere. Metal-cutting torches and wood-cutting saws will be needed by each generator.

Compaction will be performed by loading and compacting waste into a disposal container. When the container is full, a lid will be installed, the outside will be cleaned, and it will be sent to the disposal facility. Filtered exhaust will be needed to collect airborne radioactive particulate.

The only effluent from the volume-reduction process is exhausted air. Secondary waste in the form of filters, protective clothing, and cleaning rags will be treated by the system.

5.4.2.3 Stabilization of Mixed Waste. There is 4.7 m³/yr of mixed waste from ongoing operations and 43.7 m³/yr of D&D mixed waste that must be stabilized. There are five currently-generated waste streams and an unknown number of D&D waste streams.

Two of the five mixed waste streams are being generated at TAN. The streams are numbered 4 and 29 in Table 2-2 and are produced at a rate of 4 m³/yr. Stream 4 is an evaporator sludge stream that can be stabilized in Portland cement. Stream 29 is a small-volume stream from a laboratory, that will be mixed with stream 4 and cemented. The equipment required is an in-drum mixing system for mixing prepared cement and the waste. The waste will be loaded directly into drums that serve as mixing containers and as disposal containers. A cement mixing and delivery system is also needed. The cement/waste mixing operation can take place in a dedicated room having a floor space of 100 to 300 ft². An adjacent 100 to 200 ft² room is needed for preparation of cement. Space can probably be made available for this process within the present buildings at TAN. The room in which the waste is to be cemented must meet the DOE Order 6430.1A requirements for the treatment of LLW. A filtered exhaust will be required.

The third mixed waste stream needing stabilization is No. 14, cadmium-uranium ingots and oil-dri. The stream is created at ANL-W at a rate of 0.21 m³/yr. ANL-W is already treating similar waste that must be handled remotely. An assumption is made that treatment of this additional stream will not entail a large change in the generator operation, nor a large change in design or expense for the sodium treatment facility. Therefore, Stream 14 is removed from further consideration in this option.

The fourth mixed waste stream, No. 20, is already being treated at the sodium treatment facility. The final mixed waste stream from ongoing operations is No. 35, clay. This 0.4 m³/yr stream is to be treated in the mobile unit described below for treatment of D&D waste.

The exact characteristics of the D&D waste stream are unknown. Much of the 43.7 m³/yr stream is soil and sludge. An assumption is made that cementing the waste will be acceptable treatment. Therefore, the equipment required will be similar to that used for the currently-generated waste, with the exception that the equipment will be mounted on a portable skid and can be shared by all D&D sites. The portable equipment will need to be self-contained, or it will need to be installed in a small, air-controlled building that meets the DOE Order 6430.1A requirements for treatment of LLW.

5.4.3 Description of Buildings

Two small buildings must be built to house the size-reduction operations at the ICPP and Naval Reactor Facility (NRF). The buildings must meet the requirements for confinement described previously for the MLLWTF. The buildings will likely be pre-engineered, metal structures with the processes taking place in inner cells. The buildings will be single story having a floor area of about 200 m² each.

The new immobilization process to be installed at TAN will likely be installed within the boundaries of existing buildings. These buildings will not meet all requirements of DOE Order 6430.1A, and they will probably not be altered significantly to do so. Instead, some minor modifications will be made, and some noncompliances will be accepted.

Indefinite storage is required for 423.2 m³/yr of mixed waste. Using the 4.5:1 area-to-volume ratio, 1900 m² of storage facility area will be required each year. Using a storage period of 25 yr, 47,500 m² of storage area will be needed.

Lag storage will also be required. Using the same approach as before, the total area required for lag storage is 500 m². The mixed waste storage facility adjacent to WERF has adequate capacity to serve as the lag storage facility.

The indefinite storage buildings used will be similar to those used for the MLLWTF.

5.5 Alternative 5: Offsite Treatment

This alternative involves the treatment of waste at an offsite facility. All residues generated during treatment will be stabilized, if needed, and shipped back to the INEL for final disposal.

During the timeframe necessary to develop other alternatives, at least one offsite treatment facility is assumed to develop the capabilities to treat the INEL mixed waste. Two commercial companies are currently considering building mixed waste treatment facilities at the Hanford Reservation in Hanford, Washington. One facility in Oak Ridge, Tennessee, is already processing LLW and is in the process of obtaining the necessary permits for mixed waste processing. Because the Scientific Ecology Group (SEG) in Oak Ridge is currently processing LLW, the best information exists for this facility. Therefore, information based on this facility will be used as a basis to develop

this alternative. The identity of the facility that might actually treat the INEL waste, should this alternative be selected, is not projected at this time; no assertion is made here that the waste will be treated at SEG.

The defining assumptions are

- MLLWTF will not be built
- PREPP will not be restarted
- IWPF will not be used for treatment of M&LLW
- WERF will have been permanently shutdown
- MLLWDF will be accepting waste
- A process will be available for treating lead and cadmium shielding
- A facility will be available for treating sodium and barium/cadmium salt wastes.

5.5.1 Overview of Waste Stream Disposition

5.5.1.1 Waste Streams Treated Offsite. Only mixed waste, totaling 471.58 m³/yr, will be treated at offsite facilities. Of this volume, 48.3 m³/yr will be treated by stabilization; 422.8 m³/yr will be treated by incineration; 0.4 m³/yr of remote-handled waste will be treated on a case-by-case basis, such as embedding the remote-handled waste in contact-handled waste and then treating in the same manner as the contact-handled mixed waste is treated.

5.5.1.2 Waste Streams Treated at the INEL. The lead recovery process will be used to treat 52.6 m³/yr of lead and cadmium shielding. The sodium treatment facility will be used to treat 0.6 m³/yr of sodium and barium/cadmium salt wastes.

5.5.1.3 Waste Streams Disposed Following Packaging at Generator. Because of the transportation and other costs involved, 7517.3 m³/yr of LLW will be disposed of at the MLLWDF without treatment prior to disposal.

5.5.1.4 Waste Streams Stored. No mixed waste or LLW will be stored.

5.5.2 Description of Treatment Processes and Operations

5.5.2.1 Waste Packaging and Transportation. The simplest method for collecting the waste and shipping it to the processing facility is to use INEL personnel and equipment to gather all mixed waste at one location at the INEL. The INEL already has in place a program to separate waste according to treatment process (e.g., combustion, compaction, direct disposal, etc.). In addition, mixed waste generated at the INEL is segregated from LLW by the generators. Consequently, major changes in these operations are not anticipated. However, this method will require a mixed waste storage facility.

Once the waste is packaged, the waste can be transported using the processor's trucks: flatbeds, trailers, cask trailers, and shielded vans. Many of the trucks and trailers are actually owned and operated by other companies that supply services to the processor. Trucks are currently available with two-way mobile communications and hook ups to a satellite tracking system.

If vendor containers, transportation, or sorting is needed, these services are available. A variety of containers for waste shipment and storage can be leased or bought. These containers include Sea/Lands (cargo containers), various types of bins and boxes, 55-gal drums, 79- and 89-gal overpack drums, various sizes of plastic and steel liners, casks, and high integrity containers. In general, these containers are used multiple times for radioactive waste service and are occasionally reconditioned and painted.

Using a central collection point at the INEL, and then using the processor's equipment for transportation, benefits both the INEL and the processor. This method will allow one cognizant person from the INEL to coordinate waste collection and pickup. This person will then have control over the waste to ensure that proper procedures are followed, that the waste is tracked adequately, and verify that only mixed waste is sent to the processing facility (and not LLW). This method will simplify the process for the INEL by eliminating the long truck hauls, extra training, interstate transportation issues, mixed waste storage facilities at each INEL area, etc. This method will benefit the vendor because only one stop will need to be scheduled (as opposed to going to each facility at the INEL). Having only one stop at one location will simplify the process and minimize the time at the INEL. If the waste were to be picked up at each INEL area, coordinating a schedule to fit each location might be difficult and would likely incur several loading delays as proper manpower, machinery, and paperwork are assembled.

Once waste arrives at the processing facility, it can be temporarily stored either in a large warehouse or in the shipping container located on a large paved area. Once the waste has been treated, the remaining residue can be returned to the INEL for final disposal. Ideally, the return of the residue will be scheduled to coincide with the pickup of waste from the INEL. In this way, one truck could handle both tasks. However, there are limitations to the length of time that certain wastes can be stored before and after processing.

If the INEL were to send mixed waste to a commercial processor, the waste would likely already be sorted and characterized. However, if sorting is desired, or if the processor wanted to verify that the waste is properly sorted and no items are present that could damage their equipment, then the sorting system would be used. In the waste-sorting process, the waste is manually unloaded from the transportation or storage container and conveyed onto a circular, revolving table. Workers located around the table pick out the various types of waste according to the process used to treat the waste, that is generally compaction or incineration. Waste for compaction is placed in metal boxes and precompacted with a small compactor to increase the waste load in each compaction box. Waste for incineration is placed in large, heavy-duty boxes and temporarily stored or placed on a conveyor to be carried to the incinerator.

5.5.2.2 Incineration Services. Because the incinerator and other processes are planned to be used for both LLW and mixed waste, operations will be sequenced (campaigned). Using this method, LLW will be processed through the incinerator until a sufficient volume of mixed waste is

received. At this point, the incinerator will switch to processing mixed waste. After the mixed waste has been processed, operations will switch back to LLW.

A rotary-kiln is the likely technology to be applied to the mixed waste to be treated (e.g., soils, debris). The next generation of offsite treatment will probably include a rotary kiln. The facility will be similar to that described for the MLLWTF. The present generation offsite facility uses a large controlled-air incinerator, and that unit is described below.

The incinerator is a combination of controlled-air and excess-air combustion technology. Waste is added to the primary chamber through an air lock system. The primary chamber is operated in the controlled-air mode, which results in a less turbulent burning environment and reduced particulate and radionuclide carryover. In this chamber, the waste is pyrolyzed at temperatures of approximately 1650 to 1850°F, producing combustible gas and a char-like residue.

The charred residue is pulled into two ash combustion chambers where excess air is added for complete combustion of carbonaceous matter. The ash transport system gently lifts and mixes the ashes so all residue can be contacted by oxygen. The combustible gas produced in the primary chamber flows into secondary and tertiary chambers where excess air is added for complete combustion. These chambers are designed to provide intense mixing of the combustible gas and air so all combustible matter can be consumed. In addition, these chambers provide a gas residence time of approximately 3 s and can operate at temperatures of 1850 to over 2300°F.

The offgas from the incinerator is drawn through a heat-recovery boiler for cooling. From there, the gas flows through a baghouse and HEPA bank for particulate removal. The gas is then cooled in a quencher and scrubbed in a packed tower using a sodium hydroxide solution to remove acid gas. The gas is then pulled through an induced draft fan and mixed with heated building ventilation exhaust to eliminate the steam plume as the gas flow exits the stack.

5.5.2.3 Stabilization Services. Both cement and epoxy resin solidification equipment are available. The epoxy resin solidification system is used to solidify flyash and occasionally hearth ash from the incinerator. The ash is solidified to minimize the leaching of toxic heavy metals, which will render the ash a mixed waste. The cement system is principally used to contain resins or solidified aqueous wastes and fill void space in overpacks. Occasionally, hearth ash is also stabilized in cement. Both solidification systems can be used to treat customer wastes.

Modified sulfur cement capability may be added to the next generation's offsite treatment facility.

5.5.2.4 Laboratory Services. Analysis of the waste before and after processing is an important part of proper waste management. There are a few options in this area. If available, the INEL can use its own laboratory facilities; however, the waste processor will randomly select a certain percentage of waste containers and verify the results from the INEL laboratory. As an alternative, the waste processor will have some laboratory capabilities available that can be used, if desired. Lastly, a second contractor may be used to do laboratory analysis.

5.5.3 Description of Temporary Storage Building

The central collection building used in this option could be the mixed waste storage facility mentioned in Section 5.1. This storage facility has adequate capacity to hold 1 month of collected waste until it can be shipped offsite for treatment and to hold 1 month of returned treated waste, if it cannot be sent directly to the MLLWDF. The total of collected and returned lag storage needed is 800 m².

5.6 Alternative 6: Treat Waste in IWPF

This alternative involves the treatment of waste at the IWPF. The defining assumptions are

- MLLWTF will not be built
- PREPP will not be restarted
- IWPF will be used for treatment of M&LLW, as well as TRU waste
- WERF will have been permanently shutdown
- MLLWDF will be open and accepting waste
- A process will be available for treating lead and cadmium shielding
- A facility will be available for treating sodium and barium/cadmium salt wastes.

5.6.1 Overview of Waste Stream Disposition

In this alternative, most waste will be disposed of at the MLLWDF without treatment. Lead and cadmium shielding, and sodium and barium/cadmium salt wastes are treated at facilities built and operated by others. All other mixed waste is treated at the IWPF.

5.6.1.1 Waste Streams Treated. Based on the waste information in Section 2, the total volume of mixed waste to be treated by the IWPF is 471.5 m³/yr. The volume of lead and cadmium shielding to be treated by the lead recovery process is 52.6 m³/yr. The volume of sodium and barium/cadmium salt wastes to be treated in the sodium treatment facility is 0.6 m³/yr.

5.6.1.2 Waste Streams Disposed Following Packaging at Generator. The volume of LLW to be packaged for direct disposal is 7517.3 m³/yr.

5.6.1.3 Wastes Streams Stored. No mixed waste or LLW will be stored.

5.6.2 Description of Treatment Processes and Operations

The treatment processes in IWPF will be similar to those described in the MLLWTF alternative, including sorting, size reduction, incineration, stabilization, and packaging. The products from the treatment include offgases and ash from the incinerator and packaged compacted or stabilized wastes. The offgas treatment system includes a spray dryer absorber followed by a baghouse and HEPA filter system. The ash and particulates from the offgas treatment system will be stabilized with grout, Portland cement, or sulfur polymer concrete.

The IWPF will be constructed using state-of-the-art emission control systems to comply with all applicable regulations for the treatment of TRU waste. All wastes considered in this study require less stringent controls than does TRU waste; therefore, the emission controls included with the IWPF will be adequate to control any emissions due to M&LLW waste sent to the IWPF for treatment.

The TRU capability of IWPF will generally make the facility more difficult to operate and maintain. There is also the potential for cross-contamination of LLW with TRU. Therefore, only the mixed waste that must be treated will be sent to IWPF.

5.6.3 Description of Buildings

Lag storage will be required. Using the same approach as before, the area required for lag storage is 800 m². The WERF waste storage facility mentioned in Section 5.1 has adequate capacity to serve as the lag storage facility.

5.7 Alternative 7: Combinations

This alternative involves the treatment of waste involving combinations of the previous six facilities. As noted in Section 4, only four combinations are acceptable. They are

- WERF and offsite treatment (Alternative 7.1)
- WERF and IWPF treatment (Alternative 7.2)
- Generator and offsite treatment (Alternative 7.3)
- Generator and IWPF treatment (Alternative 7.4).

The common defining assumptions associated with the above four combinations are

- MLLWTF will not be built
- PREPP will not be restarted
- IWPF will not be used for treating M&LLW for offsite treatment combinations
- WERF will have been permanently shutdown for generator treatment combinations

- MLLWDF will be accepting waste
- A process will be available for treating lead and cadmium shielding
- A facility will be available for treating sodium and barium/cadmium salt wastes.

5.7.1 Overview of Waste Stream Disposition

5.7.1.1 Wastes Streams Treated. For all four combinations, the volume of lead and cadmium shielding treated in the lead recovery facility is 52.6 m³/yr, and the volume of sodium and barium/cadmium salt wastes treated in the sodium treatment facility is 0.6 m³/yr.

The balance of the waste stream treated in both combinations involving WERF is essentially identical to the WERF treatment option alone, with the exception that the waste going to storage is sent instead either offsite or to IWPF. Therefore, 6475.3 m³/yr of waste is treated at WERF, and 386 m³/yr of waste is either shipped offsite or treated at the IWPF.

The balance of the waste stream treated in both combinations involving generator treatment is essentially identical to the generator treatment option alone, with the exception that the waste going to storage is sent instead either offsite or to IWPF. Therefore, 2690.3 m³/yr of waste is treated by the generators, and 423.2 m³/yr of waste is either shipped offsite or treated at the IWPF.

5.7.1.2 Waste Streams Disposed Following Packaging at Generator. The volume of LLW to be packaged for direct disposal is 1127.5 m³/yr for the WERF combinations and 4875.3 for the generator combinations.

5.7.1.3 Wastes Streams Stored. No mixed waste or LLW will be stored.

5.7.2 Logic for Selecting Combinations

The logic for selecting combinations of alternatives for study was summarized in Section 4 and is repeated here in more detail. (Refer to Table 4-1.)

There are seven alternatives available to make combinations. This results in numerous possible combinations; however, the task is not nearly as formidable if a few simplifications are made. First, the no-action option is not a valid alternative for combination since its combination will render it an action option, and thus negate its purpose. Second, any reasonable restart of PREPP will allow treatment of all wastes; therefore, combination with PREPP serves no purpose. These simplifications reduce the field to just five alternatives; WERF, generator treatment, offsite treatment, IWPF, and MLLWTF.

The WERF alternative, if pursued, results in a facility that can treat all waste but the D&D waste that will not incinerate to an ash, and a small volume of remote-handled D&D waste. The generators cannot handle any waste not treated by WERF; therefore, they are not combined with WERF. Either offsite treatment or IWPF can treat the waste not treated by WERF; therefore, these are both reasonable combinations. The MLLWTF could be designed to treat only the waste not treated by a Modified WERF, but this will essentially mean construction of two large treatment

facilities. Building MLLWTF and retiring WERF is more prudent; therefore, MLLWTF is not combined with WERF.

The generator treatment alternative, if pursued, results in a facility that cannot treat the D&D mixed waste that will not incinerate to an ash, a small volume of remote-handled D&D mixed waste, and the mixed waste that requires incineration. Either offsite treatment or IWPF can treat the mixed waste not treated by the generators; therefore, these are both reasonable combinations. The MLLWTF could be designed to treat only the waste not treated by the generators, but such a facility will easily handle the waste treated by the generators. This will be a duplication of effort, and the option is not considered reasonable.

The offsite treatment option, if pursued, results in treatment of all mixed waste. Its combination with IWPF or MLLWTF will be a duplication of effort. Therefore, further combinations of offsite treatment, beyond those with WERF or generator treatment, are not considered reasonable.

The IWPF option, if pursued, results in the treatment of all mixed waste. Its combination with MLLWTF will be a duplication of effort. Therefore, further combinations of IWPF, beyond those with WERF or generator treatment, are not considered reasonable.

In summary, only four combinations are seen as reasonable: WERF combined with either offsite treatment or IWPF, and generator treatment combined with either offsite treatment or IWPF.

5.7.3 Other Considerations Associated with Combinations

All information on the combinations can be obtained by direct combination of the appropriate alternatives with one exception. The exception is that the indefinite waste storage is no longer required.

5.8 Alternative 8: No Action

This alternative involves no action for treatment of waste beyond that currently being conducted. The defining assumptions are

- MLLWTF will not be built
- PREPP will not be restarted
- IWPF will not be used for treatment of M&LLW
- WERF will have been permanently shutdown
- MLLWDF will be accepting waste
- A process will be available for treating lead and cadmium shielding
- A facility will be available for treating sodium and barium/cadmium salt wastes.

5.8.1 Treatment, Storage, and Disposal Methods

WERF will be permanently shut down, and the only treatment other than packaging for disposal will be done at the lead recovery process ($52.6 \text{ m}^3/\text{yr}$), which recovers lead and cadmium, and the sodium treatment facility ($0.6 \text{ m}^3/\text{yr}$), which treats sodium and barium/cadmium. The LLW meeting the MLLWDF WAC is permanently disposed of at the MLLWDF ($7517.3 \text{ m}^3/\text{yr}$). The mixed waste ($471.5 \text{ m}^3/\text{yr}$ of generated waste plus D&D waste) is stored for future treatment. The storage facility must be provided.

Using the 4.5:1 area-to-volume ratio, 2100 m^2 of storage facility area will be required each year. Using a storage period of 25 yr, $52,500 \text{ m}^2$ of storage area will be needed. The storage buildings that are required will be similar to those used for the MLLWTF.

5.9 Summary Charts

The capabilities of each option to treat the various waste streams are summarized in Tables 5-2 to 5-5. Tables 5-2 and 5-3 are for LLW and mixed waste, respectively, from ongoing operations. Tables 5-4 and 5-5 are for D&D-produced LLW and mixed waste, respectively.

A summary of waste volumes treated and final volumes to be disposed of at the MLLWDF is presented in Table 5-6. Assumptions used to determine output volumes were

- Incinerated waste is reduced 100:1
- Mechanically volume-reduced waste is reduced 5:1
- Stabilized waste is conservatively assumed to increase to 1:5
- Sodium waste is increased 1:5
- Lead recovery results in 10% waste that is then stabilized with an increase of 1:5.
- Treated mixed waste that was classified as characteristic (D-listed waste) can be disposed of as LLW. Treated mixed waste that was classified as listed (F-listed waste) must be disposed of as mixed waste.

A summary of the areas required for lag and indefinite storage is presented in Table 5-7. Assumptions used to determine lag storage area were

- Storage was required for 1 month throughput of incoming, untreated waste and for 1 month throughput of treated waste
- The area-to-volume ratio for storage of LLW is 1:1
- The area-to-volume ratio for storage of mixed waste is 4.5:1.

Table 5-2. Summary of treatment of LLW from ongoing operations under each alternative.

No.	Waste stream ID	Description	Annual volume (m ³)	MLLWTF (maximum option)			MLLWTF (minimum option)	
				WERF	PREPP WERF/offsite	Generator Generator/offsite	WERF no action	IWPF
1.	X21	Any combination of cloth, paper, plastic (nonhalo) and wood	1640	Y		M		N
2.	X41	Any combination of glass, halo. plastic, lag., liq. abs., met. chips, wire, etc.	577	Y		M		N
3.	M41	Metal combination-assemblies	455	Y		M		N
4.	P21	Paper and/or cloth	236	Y		Y		N
5.	S71	Soil/gravel/brick/concrete rubble	218	Y		Y		N
6.	M31	Metal-steel, carbon	153	Y		M		N
7.	M33	Metal-steel, stainless	140	Y		M		N
8.	R50	HFEF-South Facility modification waste stream	122	Y		Y		N
9.	X80	NRF/ECF/WERF only - mix. std cc: M31-20%, M33-30%, M41-10%, X41-40%	79	Y		Y		N
10.	X22	NRF/ECF only - mix. std cc: P21-60%, P41-30%, W31-10%.	75	Y		Y		N
11.	X61	Any combination of filters	62	Y		N		N
12.	I21	Ion exchange resin in metal containment	57	Y		Y		N

Table 5-2. (continued).

No.	Waste stream ID	Description	Annual volume (m ³)	MLLWTF (maximum option)			MLLWTF (minimum option)	
				WERF	PREPP	Generator/offsite	Generator/offsite	IWPF
						Generator/IWPF		no action
13.	M83	NRF/ECF only - mix. std cc: M31-20%, M33 30%, M41-10%, X41-40%	56	Y		Y	Y	N
14.	X31	Any combination of ferrous and nonferrous metal articles	39	Y		M	M	N
15.	S72	Concrete structural components	34	Y		Y	Y	N
16.	M84	NRF/ECF/WERF only - mix. std cc: M31-30%, M33-50%, M41-20%	28	Y		Y	Y	N
17.	C61	Core structural parts	25	Y		Y	Y	N
18.	F21	Filter - HEPA	18	Y		M	M	N
19.	M61	Metal chips or miscellaneous small metal objects	19	Y		M	M	N
20.	W31	Wood	17	Y		M	M	N
21.	F22	Filter - other than HEPA	14	Y		M	M	N
22.	B22	Biological waste - feces, vegetation	13	Y		N	N	N
23.	A61	Radioactive contaminated asbestos	12	Y		Y	Y	N
24.	C75	NRF/ECF ONLY - mix. std cc: C61-70%, C51-10%, X41-20% 55-ton cask I	11	Y		Y	Y	N
25.	M21	Metal - aluminum	11	Y		M	M	N

Table 5-2. (continued).

No.	Waste stream ID	Description	Annual volume (m ³)	MLLWTF (maximum option)			MLLWTF (minimum option)	
				WERF	PREPP	Generator Generator/offsite Generator/IWPF	offsite IWPF	no action
26.	I22	Ion exchange resin in concrete containment	8	Y		Y		N
27.	S41	Sludge	8	Y		N		N
28.	X51	Any combination paving, roofing, soil/gravel, brick and concrete rubble	6	Y		N		N
29.	P31	Paving (e.g., Asphalt and concrete)	6	Y		N		N
30.	R21	Roofing (e.g., Asphalt shingles)	6	Y		N		N
31.	C62	Core subassembly parts	6	Y		Y		N
32.	E21	Evaporation drum (e.g., shade)	5	Y		Y		N
33.	A24	Absorbed liquids, noncombustible-diatomaceous earth (e.g., kitty litter)	5	Y		Y		N
34.	X81	NRF/ECF only - mix. std cc: X71-90%, M33-10% RWDS resin module	5	Y		Y		N
35.	S51	HFEF/North process and maintenance waste stream, Building 785	4	Y		Y		N
36.	L20	L&O Laboratory Building 752 analytical laboratory waste stream	4	Y		Y		N
37.	F31	Filter - liquid	3	Y		Y		N
38.	P41	Plastic - nonhalogenated	3	Y		N		N

Table 5-2. (continued).

No.	Waste stream ID	Description	Annual volume (m ³)	MLLWTF (maximum option)			MLLWTF (minimum option)	
				WERF	PREPP	Generator/offsite	Generator/offsite	no action
39.	P42	Plastic - halogenated	1	Y			N	N
40.	W21	Wiring and wiring devices	1	Y			N	N
41.	M43	Metal - cut up glove boxes	0.4	Y			N	N
42.	A21	Absorbed liquids, combustible	0.4	Y			N	N
43.	X71	Any combination of resin containers	0.3	Y			Y	N
44.	A22	Absorbed liquids, noncombustible-cement (e.g., Portland cement)	0.1	Y			Y	N
45.	M23	Metal - copper	0.02	Y			Y	N
46.	S21	Slag - unsolidified	0.02	Y			Y	N
47.	C51	Core instrumentation	0.01	Y			Y	N
48.	A25	Absorbed liquids, noncombustible-fullers earth (e.g., soil-dirt)	0.01	Y			Y	N
49.	S83	Source alpha	0.001	Y			Y	N

Y = Capable of treating indicated stream.

N = Not capable of treating indicated stream

M = Capable of treating a portion of indicated stream.

Table 5-3. Summary of treatment of mixed waste from ongoing operations under each alternative.

No.	Waste stream ID	Name	Annual volume (m ³)	MLLWTF (both options) WERF PREPP WERF/offsite WERF/IWPF Generator/offsite Generator/IWPF				Generator	No action
1.	ID-WIN-143	Radioactive contaminated lead	25.20	Y				Y	N
2.	ID-EGG-117-MWF	Cadmium solids, radioactive sheets	10.00	Y				Y	N
3.	ID-EGG-143-TSA	Radioactively contaminated lead	9.54	Y				Y	N
4.	ID-SMC-136	Nonacidic waste solid	4.00	Y				N	N
5.	ID-SMC-149A	Spent GM 141 SAPC Solvent	2.00	Y				N	N
6.	ID-WIN-130-1617	Mercury contaminated solids shielded with lead	1.83	Y				N	N
7.	ID-WIN-131-MWF	Mercury contaminated solids	1.40	Y				N	N
8.	ID-EGG-166-MWF	WERF HEPA filters and lead	0.90	Y				N	N
9.	ID-SMC-101B	Spent 1,1,1-TCA degreaser solvent	0.40	Y				N	N
10.	ID-SMC-149B	Spent stoddard solvent	0.40	Y				N	N

Table 5-3. (continued).

No.	Waste stream ID	Name	Annual volume (m ³)	MLLWTF (both options)			Generator	No action
				WERF PREPP	WERF/offsite	WERF/IW/PF		
11.	ID-WIN-111-1619	Cadmium contaminated solids	0.34	Y			N	N
12.	ID-WIN-198-HCR	Lead acid batteries, radioactive	0.33	Y			Y	N
13.	CH-ANL-180-771	Sodium - LLW	0.23	Y			Y	N
14.	CH-ANL-111	Cadmium uranium sample WASTE - IFR experiment	0.21	Y			N	N
15.	ID-SMC-101A	1,1,1-TCA and alcohol laboratory waste	0.20	Y			N	N
16.	ID-SMC-101E	TCA waste	0.20	Y			N	N
17.	ID-WIN-217	Heavy metal, radioactive oil	0.20	Y			N	N
18.	CH-ANL-179-797	Sodium (contaminated) tin bismuth alloy	0.17	Y			Y	N
19.	ID-WIN-201-HCR	F002 contaminated solids	0.16	Y			N	N

Table 5-3. (continued).

No.	Waste stream ID	Name	Annual volume (m ³)	MLLWTF (both options) WERF PREPP WERF/offsite WERF/IWPF				Generator	No action
				Generator/offsite	Generator/IWPF	Generator	No action		
20.	CH-ANL-218-IFR	Electrorefiner stripped salt—barium and cadmium	0.11	Y	Y	Y	N		
21.	CH-ANL-183-765	Paintstripping waste	0.1	Y		N	N		
22.	ID-WIN-197-HCR	Chromium and lead contaminated solids	0.08	Y		N	N		
23.	CH-ANL-142-MWF	Lead contaminated solids - IFR experiments	0.07	Y		Y	N		
24.	ID-WIN-200-HCR	Cadmium, mercury and selenium contaminated solids	0.06	Y		N	N		
25.	ID-WIN-110-1619	Cadmium and chromium contaminated solids	0.04	Y		N	N		
26.	CH-ANL-182-797	Sodium potassium	0.04	Y		Y	N		
27.	ID-WIN-129-1619	Mercury and cadmium contaminated solids	0.03	Y		N	N		
28.	ID-SMC-113A	Chromium trioxide wastes	0.02	Y		N	N		

Table 5-3. (continued).

No.	Waste stream ID	Name	Annual volume (m ³)	MLLWTF (both options)				Generator	No action
				WERF	PREPP	WERF/offsite	WERF/WPF		
				Generator/offsite	Generator/offsite	Generator/offsite	Generator/offsite		
No.	Waste stream ID	Name	Annual volume (m ³)	Generator/offsite	Generator/offsite	Generator/offsite	Generator/offsite	Generator	No action
29.	ID-SMC-133	Miscellaneous laboratory wastes	0.02	Y				N	N
30.	ID-EGG-138	Organic laboratory wastes	0.02	Y				N	N
31.	CH-ANL-224	TAN 629 tank bottoms sludge	0.02	Y				N	N
32.	ID-SMC-152	IBC-cask maintenance—mercury contaminated	0.02	Y				N	N
33.		Activated carbon	1.0	Y				N	N
34.		Aqueous	10.0	Y				N	N
35.		Clay (zeolites)	0.4	Y				N	N
36.		PCBs	0.2	Y				N	N
37.		Resin beads	0.8	Y				N	N
38.		Soils	12.0	Y				N	N

Y = Capable of treating indicated stream.

N = Not capable of treating indicated stream.

Table 5-4. Summary of treatment of LLW from the expanded D&D Program under each alternative.

Waste type	Annual volume (m ³)	MLLWTF (maximum option)	Generator Generator/offsite Generator/IWPF	MLLWTF (minimum option)
		WERF PREPP WERF/offsite WERF/IWPF		offsite IWPF no action
Concrete	740	Y	N	N
Steel	925	Y	N	N
Equipment	740	Y	N	N
Sludge	0	N/A	N/A	N/A
Rubble	740	Y	N	N
Soil	189	Y	N	N

Y = Capable of treating indicated stream.

N = Not capable of treating indicated stream.

Table 5-5. Summary of treatment of mixed waste from the expanded D&D Program under each alternative.

Waste type	Annual volume (m ³)	MLLWTF (both options) PREPP offsite IWPF	WERF Generator	No action
		all combinations		
Concrete	15	Y	10%	N
Steel	19	Y	10%	N
Equipment	15	Y	10%	N
Sludge	189	Y	10%	N
Rubble	15	Y	55%	N
Soil	189	Y	10%	N

Y = Capable of treating indicated stream.

N = Not capable of treating indicated stream.

Table 5-6. Summary by alternative of annual volumes of waste treated and disposed of at the MLLWDF.

Alternative	LLW				Mixed waste				Final disposition			
	Incineration	Mechanical volume reduction	Direct disposal	Lead recovery	Sodium treatment	Incineration	Stabilization ^a	Storage	Contact-handled	Remote-handled	Contact-handled	Remote-handled
MLLWTF												
Maximum	2474	3915.8	1127.5	52.6	0.6	27.2	444.3	0	2555.7	132.7	1498.1	0
Minimum	0	0	7517.3	52.6	0.6	27.2	444.3	0	8137.6	132.7	1498.1	0
WERF	2474	3915.8	1127.5	52.6	0.6	27.2	58.3	386	2075.5	130.7	50.3	0
PREPP	2474	3915.8	1127.5	52.6	0.6	27.2	444.3	0	2555.7	132.7	1498.1	0
Generator	0	2642	4875.3	52.6	0.6	0	48.3	423.2	5543.8	130.7	0	423.2
Offsite	0	0	7517.3	52.6	0.6	27.2	444.3	0	8137.6	132.7	1498.1	0
IWPF	0	0	7517.3	52.6	0.6	27.2	444.3	0	8137.6	132.7	1498.1	0
Combinations												
WERF/Offsite	2474	3915.8	1127.5	52.6	0.6	27.2	444.3	0	2555.7	132.7	1498.1	0
WERF/IWPF	2474	3915.8	1127.5	52.6	0.6	27.2	444.3	0	2555.7	132.7	1498.1	0
Generator/Offsite	0	2642	4875.3	52.6	0.6	27.2	444.3	0	6024.0	132.7	1498.1	0
Generator/IWPF	0	2642	4875.3	52.6	0.6	27.2	444.3	0	6024.0	132.7	1498.1	0
No action	0	0	7517.3	52.6	0.6	0	0	471.5	7415.9	130.7	0	471.5

a. 422.8 m³/yr of the mixed waste needs to be incinerated, but only 27.2 m³/yr will burn to an ash. The remaining 395.6 m³/yr will incur a factor of 5 increase in volume when it is solidified. This latter waste is included in the stabilization column for the purposes of accounting for the volume increase.

Table 5-7. Summary by alternative of required lag and indefinite storage areas.

Alternative	Lag storage (m ²)	Indefinite storage (m ²)
MLLWTF		
Maximum	1400	0
Minimum	800	0
WERF	700	42,500
PREPP	2000 ^a	0
Generator	500	47,500
Offsite	800	0
IWPF	800	0
Combinations		
WERF/Offsite	1400	0
WERF/IWPF	1400	0
Generator/Offsite	1100	0
Generator/IWPF	1100	0
No action	0	52,500

a. Includes space for analytical laboratory.

5.10 References

1. EG&G Idaho, Inc., *Proposal for Reactivation of the PREPP Facility*, December 2, 1991.

6. OVERVIEW OF EVALUATIONS

6.1 Objective

The objective of this section is to list the areas in which the alternatives are compared, and to state why these particular areas of comparison were selected.

6.2 Evaluations Selected

Seven areas were selected for evaluation. The characteristics of the ideal alternative are discussed in each area, although no one alternative is expected to be top-rated in all seven areas.

6.2.1 Process and Facility Evaluations

The ideal treatment alternative should accommodate all waste streams and treat the streams in the most effective, efficient, and reliable manner.

For each treatment alternative, the evaluations address the ability to treat all waste streams. The waste-processing evaluations also address the use of proven technology in the treatment alternatives. Finally, the alternatives are evaluated in terms of efficiency of operation (e.g., operability, reliability, and maintainability).

6.2.2 Evaluation of Relationship to Other INEL Waste Management Facilities

The ideal treatment alternative should interface with the other INEL waste management facilities with a minimum of redundancies and interface issues. Several waste management facilities already exist at the INEL. Several major new facilities are projected in the time period of interest (namely, the years 2003 through 2028).

These evaluations examine the relationship of each treatment alternative to the other current and projected INEL facilities. The intent is to identify potential overlaps, redundancies, and interface problem areas.

6.2.3 Environmental Evaluations

The ideal treatment alternative should comply readily with all applicable environmental requirements, presenting as few environmental issues as possible.

These evaluations compare the treatment alternatives on the difficulties expected in achieving compliance with environmental requirements.

6.2.4 Safety, Health, and Risk Evaluations

The ideal treatment alternative should comply with all requirements related to protection of the workers, the public, and the environment.

These evaluations qualitatively compare the treatment alternatives on the basis of compliance with the pertinent safety requirements, as well as expected radiological and nonradiological risk to the workers, the public, and the environment.

6.2.5 Institutional Evaluations

The ideal treatment alternative should be implementable with a minimum of potential disruptions due to institutional problems. Whereas the discussions in Subsection 6.2.2 related to interfaces with other INEL facilities, these discussions relate to interfaces with non-INEL institutions. Examples are the State of Idaho, local labor unions, local citizens' groups, and States through which waste might be shipped for offsite treatment.

These evaluations compare the treatment alternatives on the basis of institutional issues that might arise during implementation.

6.2.6 Schedule Evaluations

The ideal treatment alternative should be implementable with a minimum of delay. The current shutdown of WERF and its uncertain future, as well as the noncompliances related to LDR waste storage, are driving forces for prompt implementation of the preferred alternative.

These evaluations compare the dates by which the treatment alternatives could be expected to achieve operations, as well as uncertainties in those dates.

6.2.7 Cost Evaluations

The ideal treatment alternative should be implementable with a minimum of cost over its entire life cycle.

These evaluations compare the ROM life-cycle costs of the treatment alternatives.

6.3 "Musts" and "Wants"

In addition to discussing the performance of each alternative in the areas listed in Section 6.2, the performance will be specifically evaluated against a list of "musts" and "wants."

To be viable, an alternative must comply with every listed "must."

Alternatives are also evaluated on the extent to which they satisfy the "wants." Each alternative will be scored on each "want." Each "want" will be weighted in importance. For each alternative, the scores on the various "wants" will be multiplied by the importance weights of the respective "wants," then summed.

Table 6-1 lists the "musts" and "wants" used in the study. The section of this report in which each "must" and "want" is addressed is also stated in the table.

Table 6-1. "Musts" and "wants" criteria for recommending an alternative.

"Musts"—To be worthy of recommendation, an alternative must be judged to satisfy all of the following "go/no go" criteria:

1. Comply with all environmental and waste management regulatory requirements. (Sections 7 and 9)
 2. Present acceptable risk to the workers, the public, and the environment (Section 10)
 3. Perform all required treatment of mixed waste and LLW generated at the INEL, over a period of 25 yr (Section 7)
 4. All waste forms that are produced must be acceptable for disposal at the proposed MLLWDF (Section 7)
 5. Have acceptable development risk, as measured by a requirement to use only proven technology (Section 7)
 6. Present no potential major conflicts with the missions or operations of other existing or planned INEL waste management facilities (Section 8)
 7. Present no insurmountable institutional problems (Section 11).
-

"Wants"—Alternatives are also compared on how well they satisfy the following criteria:

1. Minimize risk to the workers, the public, and the environment (Section 10)
 2. Minimize noncompliances with the safety-related criteria of DOE Order 6430.1A and consensus national standards (Section 10)
 3. Minimize problems in operability, reliability, and maintainability (Section 7)
 4. Minimize use of technologies proven only under nonradiological conditions or only by the vendor (Section 7)
 5. Minimize the schedule for beginning radioactive operations. (Section 12)
 6. Minimize the life-cycle cost (Section 13)
 7. Minimize potential interface problems with other INEL waste management facilities (Section 8)
 8. Minimize potential institutional problems (Section 11).
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7. PROCESS AND FACILITY EVALUATIONS

7.1 Introduction

This section evaluates the alternatives on (a) the ability to treat all waste such that regulatory requirements are met, (b) the availability of the technology chosen for treatment, including an assessment of developmental risks, and (c) operability, reliability, and maintainability. The result of the evaluation will be a determination of which alternatives comply with "musts" and, therefore, are viable, and a relative ranking of the alternatives against a list of "wants."

The ability of each alternative to treat all wastes to an acceptable final waste form, based on regulations, is evaluated. This part of the evaluation is based on the assumption that the processes identified in each alternative will perform as expected.

Each alternative is evaluated to determine if all treatment technologies used are proven. A proven process is one that has been operated in production or, at the least, at full-scale by a vendor.

The alternatives will be ranked, relative to each other, on the basis of operability, reliability, and maintainability. The alternatives will also be compared on the basis of relative risk of process failure. Because of the lack of operations data, reliability, availability, and maintainability (RAM) analyses, and the limited use of some chosen technologies in production and/or radiological environments, the ranking of alternatives is limited to relative observations based on facility walk-throughs, limited site- and process-specific information, and engineering judgment.

Facility walk-throughs included WERF, PREPP, the TSCA incinerator (at Oak Ridge National Laboratory), and the SEG radioactive waste facility in Oak Ridge, Tennessee. The SEG facility walk-through included a tour of the operational receipt, sorting, incineration (controlled air), compacting and solidification units and the partially complete foundry for melting large volumes of metals. The TSCA incinerator facility walk-through included a tour of the operational liquid waste receipt, storage, and incineration (rotary kiln) units. The facility is expected to process and burn solids, including drums and soil; however, solids feed equipment was being modified at the time of the walk-through and was not yet operational.

The lead recovery facility and the sodium treatment facility are common to all alternatives and are not evaluated in this section.

7.2 Requirements/Criteria

7.2.1 Treatment Standards

The primary criteria for evaluation of an alternative are that the alternative must be able to treat all waste that needs to be treated, and that it must treat the waste such that it is acceptable for disposal. These criteria are a reflection of DOE and EPA requirements contained in DOE 5820.2A and in RCRA.

DOE Order 5820.2A in combination with the draft Supplemental Directive, DOE-ID SD 5820.2A, requires that each waste generator shall

- Minimize waste retained in storage; convert any stored liquid radioactive waste to a solid form as soon as practical.
- Cause the highest practical proportion of generated waste to be processed for volume reduction and stabilization, using approved methods.
- Ensure all generated waste has the degree of stability required at disposal.

LLW disposal is required to be managed to limit exposure to the public from release into the air, surface water, ground water, soil, plants, and animals and from inadvertent intrusion after the loss of active institutional control.

The methods for meeting the requirements depend on the combined performance of the waste disposal facility and the physical characteristics of the waste at disposal. All requirements can be succinctly stated as

- Waste shall be treated by appropriate methods so the disposal site can meet the performance objectives.
- Use of waste treatment techniques to increase the life of the disposal facility and improve long-term facility performance, by improved site stability and reduction of infiltrating water, is required if it is cost effective.

RCRA discusses the standards for treatment of the hazardous constituents of mixed waste. The LDRs of RCRA prohibit disposal of hazardous and mixed wastes that have not been treated to EPA-required standards. The standards can be either a specific treatment method (BDAT) to be applied to the waste before the treatment residuals may be land-disposed, a concentration level that must be attained before the wastes or treatment residuals may be land-disposed, or both a method and a concentration limit. Regardless of which standard is applied, the intent is that the toxicity or likelihood of migration of the hazardous waste be reduced to minimize the short-term and long-term threats to human health.

The EPA also prohibits the storage of LDR waste, unless the storage is for the sole purpose of accumulating sufficient quantities in a tank or container to facilitate proper recovery, treatment, or disposal of the waste.

7.2.2 Developmental Risk

In order for an alternative to be considered successful, all processes that comprise the alternative must be proven technologies. A proven technology is one that has been used full-scale, either in production or at a vendor laboratory. Either radiological or nonradiological use is considered here as proven.

While both vendor use and production use are acceptable, a production process is considered less of a risk than a vendor process. A process proven under radiological conditions is considered less of a risk than a process proven only under nonradiological conditions. A process proven by a vendor, under nonradiological conditions, is considered to be the highest risk.

7.2.3 Operability, Reliability, and Maintainability

Each alternative is judged relative to the others on its operability, reliability, and maintainability. For this evaluation, operability is defined as the ability to produce a consistent, acceptable product with minimal operator attention. Reliability is defined as the freedom from unscheduled outages. Maintainability is defined by the degree of freedom from, and the relative ease of, maintenance.

7.3 Evaluations of Alternatives Against Requirements/Criteria

7.3.1 Ability to Treat All Wastes

The alternatives were developed based on the assumption that all waste created in the 25-yr period from approximately 2003 to 2028 will have to be treated to meet the performance and treatment requirements of DOE-ID SD 5280.2A and RCRA. The MLLWTF, PREPP, offsite treatment, IWPF, and all four combination alternatives meet the treatment and performance requirements. The three alternatives involving indefinite storage (no action, WERF, and generator treatment) have limited treatment capabilities and do not meet the requirement to treat all mixed waste.

If the treatment and performance requirements were met, the waste is assumed to be acceptable for disposal at the MLLWTF. Thus, all waste that is treated is acceptable for disposal.

An additional requirement is to use treatment techniques for LLW that result in an increase in the life of the disposal facility and in long-term performance, if they are cost effective. For this evaluation, the requirement is interpreted to mean that volume-reduction and any associated stabilization should be maximized to the extent that they are cost effective. The MLLWTF maximum-treatment option, PREPP, and the two combinations involving treatment at WERF, all treat the maximum amount of waste before it is sent to the disposal facility. The WERF alternative (excluding combinations) treats about 95% of the waste that is treated in the maximum-treatment options. Generator treatment and its combinations treat approximately half the maximum amount. The MLLWTF minimum-treatment option, offsite, and IWPF alternatives treat the minimum amount of waste (only the mixed portion that must be treated). The no-action alternative results in no waste treatment. Since, for this case, the acceptability of the minimum or partial treatment options, as compared to the maximum-treatment options, is a matter of cost effectiveness, it will not be considered further here, but instead will be discussed in Section 13.

7.3.2 Use of Proven Technology

All processes in each alternative are proven. However, all processes have not been proven in radiological application, or in a production environment.

Rotary kiln incinerators have not been proven to operate for solid wastes in a radioactive environment. The MLLWTF, PREPP, IWPF, and likely the offsite treatment alternatives, will use a rotary kiln. Rotary kilns have been proven in nonradiological, production-scale waste treatment applications.

The spray dryer absorber component of the offgas systems proposed for the MLLWTF, WERF, PREPP, IWPF, offsite treatment, and combination alternatives also has not been proven for radiological service although it has been proven in production.

The modified sulfur cement process has been proven in numerous full-scale tests, but has not been operated in production. This process is proposed for use in the MLLWTF, PREPP, and IWPF, and might be used for offsite treatment. Thus, only the WERF and generator treatment alternatives are independent of this technology.

7.3.3 Relative Operability, Reliability, and Maintainability

The MLLWTF maximum-treatment alternative is considered to be the standard for comparisons for operability, reliability, and maintainability. The MLLWTF minimum-treatment option should be easier to operate and maintain, and more reliable, because it treats only a portion of the waste. The advantage is limited, however, because the most difficult component to operate and maintain, the incinerator, is still used for the treatment of mixed waste.

IWPF is envisioned to be similar to MLLWTF, with the exception that it will need to treat TRU waste. Therefore, maintenance will be more difficult on IWPF due to radiological concerns.

PREPP is also similar to the MLLWTF, except that it is extremely cramped and is housed in an old facility. The age of the facility is expected to decrease overall reliability, and maintenance is expected to be more frequent. In addition, both facility maintenance and process maintenance are expected to be more difficult to perform.

Offsite treatment is envisioned to be performed in a facility similar to the MLLWTF, with the exception that the transportation step must be considered as one of the processes. Transportation is not considered to be a major impact; therefore, the offsite option is equivalent to the MLLWTF.

WERF is similar to the MLLWTF except that it uses a controlled-air incinerator. The controlled air-incinerator is a disadvantage in that it cannot treat the noncombustible waste that is contaminated with hazardous organics. On the other hand, the exclusion of the noncombustibles means that the feed will be more homogeneous. This, in turn, means that the incineration process is easier to control, and that the final product is more homogeneous. Thus, due to the use of controlled-air incineration and the exclusion of noncombustibles, WERF is easier to operate than the MLLWTF. Exclusion of the noncombustibles also results in a reduction of damage to the incinerator refractory; therefore, it should be easier to maintain because the damage suffered by the incinerator is less than that at the MLLWTF.

The WERF facility is considerably older than the MLLWTF. The decrease in maintenance associated with the decrease in refractory damage is expected to be overshadowed by the increase in facility maintenance. In addition, the overall reliability will decrease because of the age of the facility.

The combination of WERF and offsite treatment results in a small increase in operability due to the specialization of treatment. Overall reliability and maintainability will decrease because of the problems associated with the age of the WERF facility. Maintainability will also decrease because of the need to maintain two large facilities.

The combination of WERF and IWPF treatment results in a small increase in operability due to the specialization of treatment. Overall reliability and maintainability are expected to decrease because of the problems associated with the age of WERF. Maintainability will also decrease because of the need to maintain two large facilities. It will be worse than for WERF and offsite because of the TRU controls at IWPF.

Generator treatment is considerably simpler than treatment at the MLLWTF. This is primarily due to the absence of an incinerator, and also due to the absence of significant treatment of mixed waste. The need to use a mobile solidification unit does introduce some additional complexity, but not enough to offset the gains of avoiding incineration. Therefore, generator treatment is expected to be easier to operate and maintain and to be more reliable.

The combination of generator and offsite treatment results in a small increase in operability, due to the specialization of treatment. Overall reliability is expected to be about the same. Maintainability will decrease because of the need to maintain one large facility and several smaller facilities.

The combination of generator and IWPF treatment results in a small increase in operability due to the specialization of treatment. Overall reliability is expected to be about the same. Maintainability will decrease because of the need to maintain one large facility and several smaller facilities. Maintainability will be worse than for generator and offsite because of the TRU controls at IWPF.

The no-action alternative is considered the easiest to operate and maintain and the most reliable. This is simply because the option involves very little equipment.

7.4 Overall Conclusions

7.4.1 "Musts"

Four of the "musts" listed in Table 6-1 apply to this section. Each must is repeated below, along with a summary of each alternative's ability to satisfy the requirement:

- Comply with all environmental and waste management regulatory requirements
- Perform all required treatment of mixed waste and LLW generated at the INEL, over a period of 25 yr

- All waste forms that are produced must be acceptable for disposal at the proposed MLLWDF
- Have acceptable development risk, as measured by a requirement to use only proven technology.

The MLLWTF, PREPP, offsite treatment, IWPF, and all four combination alternatives satisfy the first three "musts." The WERF, generator treatment, and no-action alternatives all involve indefinite waste storage because some waste cannot be treated to meet disposal requirements. Therefore, WERF, generator treatment, and no-action alternatives do not satisfy the first three "musts."

All processes used to treat waste in each alternative are considered proven. Thus, the last "must" is satisfied for all alternatives.

7.4.2 "Wants"

Two of the "wants" listed in Table 6-1 are applicable to this section:

- Minimize problems in operability, reliability, and maintainability
- Minimize use of technologies proven only under nonradiological conditions or only by the vendor.

The subjective evaluation of performance on these two "wants" is as follows in Table 7-1. (A score of 10 is assigned to the best-performing alternative. Lesser scores as judged appropriate, down to zero, are assigned to the other alternatives.)

No-action and generator treatment use only technologies proven in radiological service and are therefore given top scores. Two points are subtracted from all others for the potential use of modified sulfur cement. One additional point is subtracted for uncertainty in the operation of the spray dryer absorber under radiological conditions. Finally, a point is subtracted from all options expected to use a rotary kiln.

The MLLWTF was set as the operability, reliability, and maintainability standard for comparison and assigned a score of 5. No-action alternative has essentially no operability, reliability, or maintainability problems and is given the top score of ten. The remainder of the scores are based on the discussion in Section 7.3.3. A single point is added for a moderate improvement in any of the three areas as compared to MLLWTF. A large improvement resulted in addition of two points. One point is subtracted if the operability, reliability, or maintainability is diminished relative to MLLWTF. Two points are subtracted for a large decrease in these factors.

Table 7-1. Subjective evaluation of performance based on applicable "wants."

Alternative	Minimize use of technologies proven only under nonradiological conditions or only by vendors	Minimize problems in operability, reliability, and maintainability
MLLWTF		
Maximum treatment	6	5
Minimum treatment	6	8
Modify WERF	9	4
Modify PREPP	6	2
Generator treatment	10	8
Offsite treatment	6	5
IWPF	6	4
Combinations		
WERF/Offsite	8	3
WERF/IWPF	8	2
Generator/Offsite	6	5
Generator/IWPF	6	4
No action	10	10

8. EVALUATION OF INTERFACES WITH OTHER INEL WASTE MANAGEMENT FACILITIES

8.1 Introduction

This section evaluates the interfaces of the treatment alternatives with other major INEL waste management facilities, whether existing or planned. The intent is to identify any potential mismatches or other interface problems that will have major programmatic or operational consequences.

The projected interfaces of the alternatives with the following current or proposed major waste management facilities at the INEL are evaluated: MLLWDF, RWMC, and IWPF.

The MLLWDF and the IWPF, as well as the MLLWTF, are in the early planning stages. Many years are available in which to work the interfaces before operations begin. Therefore, this discussion of interfaces is oriented toward identifying potential problem areas, rather than listing actual incompatibilities in detail.

Interfaces with INEL waste management facilities other than the three cited are of minor impact. These other interfaces are discussed briefly in the following paragraphs and are not pursued further.

Except under the modify-WERF alternative and combinations involving it, WERF is assumed to have terminated operations when the selected treatment alternative begins operations. Therefore, no operational interface with WERF will occur. At the working level, however, there will be an interface with WERF personnel. The interface will be especially intensive as WERF approaches shutdown. The interface will transfer knowledge from the WERF personnel to the personnel implementing the new alternative. The knowledge will cover subjects such as waste characteristics, operating experience, and compliance matters.

Except under the modify-PREPP alternative, PREPP is assumed to remain in standby condition. Therefore, no operational interface with PREPP will occur. The PREPP project has been closed out. Only landlord personnel are stationed at PREPP. A few former PREPP personnel are still available, many are working on the IWPF project. A working-level interface will continue with those personnel during the development of the new alternative. The interface information will be similar to that discussed above for WERF.

The interface with the Hazardous Waste Storage Facility is expected to be minimal for all treatment alternatives. The alternatives are not expected to treat hazardous waste to any great extent. (See the assumptions in Section 3).

The interface with the MWSF that is operational at that time will be extensive. (A storage facility was recently constructed adjacent to WERF.) However, a storage facility is truly minor in terms of cost, complexity, etc. when compared with the treatment facility. A new storage facility might even be constructed adjacent to a new treatment facility. Therefore, the interfaces with the mixed waste storage facility are not addressed here.

Under any treatment alternative except offsite treatment, the interfaces with the waste generators will be similar to the interfaces currently in place involving WERF. No major, top-level differences among those alternatives are expected on this point. Therefore, such interfaces are not pursued.

Under the offsite treatment alternative, however, a significant new interface will exist between the generator/onsite storage facility and the offsite treatment facility. Although no insurmountable problem areas are foreseen, considerable attention to this interface will be required.

8.2 Requirements/Criteria

Few if any regulatory requirements, per se, relate to the interfaces between DOE waste management facilities. Nevertheless, the interfaces can be critical to the overall success of multiple-facility waste management systems.

In the absence of regulatory requirements, potential interface issues between pairs of facilities were identified by the following approach. Flows of waste between the facilities were considered in light of potential mismatches involving "what (waste streams)?," "how much (waste)?," "when (will the flow occur)?," and "where (will the flow occur)?"

Under the category of "what?" and "how much?," the respective issues include (a) the characteristics of the waste leaving one facility versus the WAC of the receiving facility, and (b) the flow rate of waste to the receiving facility and the capacity of the receiving facility.

Under the category of "when?," the issues include the projected dates of startup and shutdown of the interfacing facilities, as well as the effects of interrupted operations.

Under the category of "where?," the issues include the location of the treatment facility in relationship to the generators and the disposal facility.

The "how?" category of interface issues generally cannot be addressed now but will become important as the design of the new facilities progresses. An example of this category of issues is the compatibility of specific types of waste containers with specific types of handling equipment.

Another category of interface issues involves cost impacts of one waste management facility on another. For example, if one treatment alternative achieves less volume-reduction of the waste than another alternative does, the operating cost of the disposal facility will increase to handle the increased volume requiring disposal. This category of impacts is included in the cost evaluations of Section 13. The life-cycle costs estimated there include the impacts of treatment alternatives on other facilities.

8.3 Interface of Treatment Alternatives with MLLWDF

8.3.1 Introduction

The MLLWDF is a proposed facility for disposal of INEL mixed waste and LLW. The waste product from the selected treatment alternative will be disposed of at the MLLWDF. The MLLWDF will replace LLW disposal operations at the RWMC, which are scheduled to cease about the year 2000 to 2002. It will modernize disposal operations and introduce advanced disposal practices.

The MLLWDF will be a RCRA-permitted disposal facility. It will also be designed and operated in accordance with the technical requirements of the NRC regulations in 10 CFR 61, as well as all pertinent DOE Orders (e.g., 5820.2A).

The MLLWDF project is in the early stages, having been started in October 1991. Current activities include identification of siting requirements and preparation of a Technical Program Plan.

A site for the facility has not been selected. If judged advantageous overall, the MLLWDF will be collocated with the MLLWTF and/or the IWPF.

The design concept for the MLLWDF has not been selected. An engineered, aboveground disposal concept (rather than shallow burial) may be used for part or all of the waste.

WAC for the MLLWDF have not been determined. The required waste form, packaging, and other criteria will reflect the regulations cited above and the results of a performance assessment to be completed 9-30-95. The extent of volume reduction to be required by the WAC has not been determined.

The completion-date milestones for the MLLWDF are as follows:

- Site selection — 9-30-94
- Conceptual design — 3-31-95
- Title I design — 7-16-97
- Title II design — 4-30-98
- Construction — 2-28-02
- Operations begin — 9-30-02.

8.3.2 Evaluation of Interfaces

Several interface-related observations can be made, based on the criteria in Section 8.2.

As listed in the assumptions of Section 3, all waste forms to be disposed of will comply with the WAC of the MLLWDF. Preliminary projections of those criteria are made in Section 2. The treatment schemes for all alternatives are designed accordingly, to the extent practical for each alternative. As the actual WAC for the MLLWDF are developed, the treatment concepts will evolve as necessary.

The planned performance assessment for the MLLWDF could affect the MLLWDF WAC and thereby the requirements on the products of the treatment facility. However, based on the results of performance assessments at the RWMC, major impacts on the MLLWDF WAC appear unlikely, unless major changes occur in regulatory limits.

No waste-capacity or waste-throughput problems are expected at the MLLWDF.

The current schedule for the MLLWDF leads to operations about 1 yr before the MLLWTF will begin operations. Some treatment alternatives will begin operations sooner than the MLLWTF. (See the schedules in Section 12.) No schedule-conflict problems are foreseen so long as the RWMC continues in operation until the MLLWDF is available.

The potential for interruptions in shipments to, or from, the treatment facility is covered in this study. The assumption is (Section 3) made that 1-month storage of incoming and outgoing waste will be provided at the treatment facility.

Collocation of the MLLWTF and/or IWPf with the MLLWDF will reduce trans-shipment of waste products. However, no significant interface problems related to location are expected for any onsite treatment alternative. Some locations will be closer to the generators. Other locations will be closer to the disposal facility. Siting studies will determine the optimum locations. Section 8.1 mentioned the close interface required with the offsite treatment facility, but no major problems are foreseen in this regard.

8.4 Interface of Treatment Alternatives with RWMC

8.4.1 Introduction

INEL LLW is currently disposed of at the RWMC. The facility has performed this function since 1952, using shallow land burial. The unused disposal capacity of the RWMC, within its present boundaries, is limited. Furthermore, the RWMC is not in a favorable location with respect to local surface water drainage. Present plans are to stop disposing of waste at the RWMC about the year 2000 to 2002, and to begin disposing of both LLW and mixed waste in the MLLWDF.

8.4.2 Evaluation of Interfaces

If the MLLWDF project proceeds as scheduled, the RWMC will have ceased operation by the time some treatment alternatives begin operation. For those alternatives, there will be little or no operational interface with the RWMC. One possible interface between the then-shutdown RWMC and the treatment alternative is the need for treatment of waste from the decommissioning of surface buildings at the RWMC.

Due to a delay in the MLLWDF, the RWMC could conceivably still be disposing of LLW when the new treatment alternative begins operations. (An assumption is made that the INEL will not be left without an operating LLW disposal facility.) Potential issues associated with the resulting interfaces are addressed in the following paragraphs.

The LLW WAC for the RWMC are currently less stringent than those planned for the MLLWDF, in that the former WAC do not incorporate the technical criteria of 10 CFR 61. If draft DOE-ID 5820.2A is issued, the RWMC WAC may be upgraded to incorporate the new, more rigorous requirements, which are nearly identical to those in 10 CFR 61. In any event, because the treatment alternatives in this study were structured to comply with all identified potential WAC for the MLLWDF, the waste forms will also comply with the current or future WAC for the RWMC.

No throughput issues were identified for treated waste requiring disposal at the RWMC. However, to the extent that treatment alternatives do not achieve the maximum feasible volume reduction, the remaining disposal capacity of the RWMC will correspondingly be consumed at a faster rate.

For the delayed-MLLWDF situation discussed here, a possible RWMC shutdown for more than 1 month will force shutdown of the treatment facility because the 1-month storage capacity for waste product will be exceeded.

No interface issues related to location are foreseen.

8.5 Interface of Treatment Alternatives with IWPF

8.5.1 Introduction

The IWPF is a proposed facility for treating INEL waste contaminated with TRU radionuclides. Included in the potential feed streams are contact-handled and remote-handled stored TRU waste, recovered buried TRU waste, newly-generated TRU waste, and LLW contaminated with TRU radionuclides. All waste streams may or may not be hazardous, per 40 CFR 261.

The final treatment requirements for some waste streams have not been determined. The requirements will depend on the final version of the WAC for the Waste Isolation Pilot Plant, the outcome of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for the RWMC, and other unknowns. For this reason, the current design concept for the IWPF entails phased implementation. Phase I will treat only well-characterized TRU-contaminated LLW. Subsequent expansions or additions to IWPF in Phase II will allow treating the other waste streams when treatment needs and WAC become better-defined.

The IWPF project is in the early stages, having been started in January 1991. Current activities include compiling regulatory requirements, identifying treatment strategies, and preparing site criteria.

The completion-date milestones for the IWPF are as follows:

- Site selection — 9-30-93
- Conceptual design — 9-30-95
- Title I design — 6-30-99
- Title II design — 6-30-01
- Construction — 6-30-04
- Operations begin — 6-30-05.

The above dates are for Phase I treatment capabilities. Phase II capabilities are scheduled to begin operations in 2007.

8.5.2 Evaluation of Interfaces

For all treatment alternatives other than the IWPF alternative, there probably will not be a major operational interface with the IWPF. Exchange of technical information will occur. A TRU-contaminated drum might occasionally be identified in the facility for treating mixed and LLW and require transfer to IWPF for treatment. Some non-TRU-contaminated secondary waste streams from IWPF might be treated at the mixed and LLW treatment facility. An example is decontaminated, empty, TRU-waste drums that retain beta-gamma activation products. Other than these instances, the operational interface will likely be minimal.

If the capability for production-scale assay of TRU content were improved considerably by the time of implementation, however, the interface with IWPF could become major. A modified waste-treatment philosophy could evolve such that waste with up to perhaps 10 nCi/g of TRU radionuclides could be treated in the mixed and LLW treatment facility, rather than in IWPF. The movement of containers of waste from one treatment facility to the other could become significant in this scenario. Reduced costs for treatment and disposal and the avoidance of TRU cross-contamination will be important factors in the treatment philosophy. Further speculation on the details of treatment philosophy is premature.

Under the IWPF alternative, the low-level mixed waste requiring treatment will be treated at IWPF. The treatment capabilities of IWPF are expected to accommodate this waste. (This assumes that the lead and sodium treatment facilities are operated as planned).

One possible problem area is the treatment of large quantities of mixed waste in the form of contaminated soil. No decision has been made yet as to whether such waste will be treatable in Phase I or have to wait until Phase II operations begin.

The throughput capability of IWPF will not be significantly impacted by the mixed waste.

As will be addressed in the schedule discussions of Section 12, the beginning of operations at IWPF is almost 2 yr later than at MLLWTF, which is the treatment alternative with the next longest schedule. If the contaminated soil requiring treatment had to wait until Phase II, treatment could be delayed an additional 2 yr.

No interface issues related to IWPF location are foreseen.

8.6 Overall Conclusions

8.6.1 "Musts"

One of the "musts" listed in Table 6-1 applies to this section:

- Present no major potential conflicts with the missions or operations of other existing or planned INEL waste management facilities.

The conclusion of this overview evaluation is that, for each alternative, the requirement will be satisfied. This conclusion is based on the assumption that the other waste management facilities are developed and operated as discussed above and as delineated in Section 3.

8.6.2 "Wants"

One of the "wants" listed in Table 6-1 applies to this section:

- Minimize potential interface problems with other INEL waste management facilities.

The subjective evaluation of performance on this "want" is as follows in Table 8-1. (A score of 10 is assigned to the best-performing alternative. Lesser scores as appropriate, down to zero, are assigned to the other alternatives.)

Reductions in scores were applied based on the following considerations for the indicated alternatives. The first consideration is the negative impact on the remaining RWMC lifetime (if the RWMC is still operational when treatment operations start), due to lesser volume reduction during treatment. Based on the volumes of LLW and mixed waste requiring disposal, the scores for the no-action, minimum treatment MLLWTF, offsite treatment, and IWPF alternatives were reduced by three points each. Scores were reduced by two points each for the generator treatment alternative and its combinations. Scores were reduced by one point each for the maximum treatment MLLWTF, PREPP, and WERF combinations. These interface impacts are considered separately from the cost impact of lesser volume reduction.

The lack of a facility to treat non-TRU-contaminated waste from IWPF led to reducing the scores of the generator alternative (and its combinations), offsite treatment, and the no-action alternative by one point each.

The impacts of the longer IWPF schedule will be factored into the schedule ratings in Section 12.

Table 8-1. Subjective evaluation of performance on applicable "want."

Alternative	Minimize potential interface problems
MLLWTF	
Maximum treatment	9
Minimum treatment	7
Modify WERF	10
Modify PREPP	9
Generator	7
Offsite	6
IWPF	7
Combinations	
WERF/Offsite	9
WERF/IWPF	9
Generator/Offsite	7
Generator/IWPF	7
No action	6

9. ENVIRONMENTAL EVALUATIONS

9.1 Introduction

The purpose of this section is to identify the major bodies of environmental regulation affecting the selection and implementation of an alternative and to evaluate each alternative against the requirements established by those regulations. The approach is to evaluate and compare, qualitatively, the difficulties expected in achieving compliance with the environmental requirements for the treatment alternatives.

A survey of the applicable Federal, State of Idaho, and DOE environmental protection regulations and standards provides the basis for the requirements and criteria established for environmental comparisons. The topics considered are NEPA, siting requirements, permitting requirements, and LDRs.

These environmental evaluations do not address the requirements and criteria applicable to the lead recovery process, the sodium treatment facility, and the IWPF. They are assumed to be constructed, independent of implementing an alternative, and are outside the scope of this study. However, requirements and criteria are applied to facilities (e.g., mixed waste storage facilities) that will have to be constructed as a result of implementing an alternative.

A survey of facility safety analysis reports, EDFs, draft environmental assessments (EAs), environmental compliance plans, siting studies, and interviews with facility experts provide the basis for the environmental comparisons.

9.2 Requirements/Criteria

9.2.1 Overview of Requirements/Criteria

DOE facilities are required to manage their radioactive wastes in accordance with DOE Orders developed to carry out the authority granted by the Atomic Energy Act (AEA). The treatment of INEL mixed waste and LLW is not subject to NRC regulations. The radioactive component of mixed waste and LLW is subject to the requirements of DOE Order 5820.2A. See Section 7 for a discussion of the requirements of 5820.2A.

Hazardous wastes must be managed in compliance with regulations promulgated by the EPA under RCRA Subtitle C, which sets the requirements for hazardous waste management by regulating generators and transporters of hazardous waste and owners and operators of treatment, storage, and disposal (TSD) facilities. It is the policy of DOE, as stated in DOE Order 5400.3, to manage all departmental hazardous and radioactive mixed wastes according to the requirements of Subtitle C of RCRA, and the AEA, respectively. RCRA applies to the extent that it is not inconsistent with the AEA.

Executive Order (EO) 12088, amended by EO 12580, requires Federal agencies to comply with applicable administrative and procedural pollution control standards established by several Federal laws.

Listed below are the specific sources of requirements and criteria used in this study to evaluate the regulatory implications associated with each alternative.

- NEPA documentation
- Siting
- Permitting
 - RCRA
 - National Emission Standards for Hazardous Air Pollutants (NESHAP)
 - Permit to Construct/Prevention of Significant Deterioration (PTC/PSD)
 - TSCA
 - National Pollutant Discharge Elimination System (NPDES)
- LDRs
- Emission controls.

9.2.2 National Environmental Policy Act Requirements

All potential projects involving any Federal agency must undergo a review pursuant to NEPA to identify and evaluate potential environmental impacts. The Council on Environmental Quality (CEQ) regulations implementing NEPA ensure that Federal agencies consider environmental information before making decisions on proposed actions. The NEPA process includes decision points at which the significance of environmental effects is considered, project alternatives are identified, and appropriate mitigation measures are identified and adopted.

The CEQ regulations recognize four distinct NEPA documents as "environmental documents" in 40 CFR 1508.10:

- EA
- Finding of no significant impact (FONSI)
- Notice of intent (NOI)
- EIS.

The current strategy for NEPA compliance at the INEL includes preparation of a programmatic or dual-purpose programmatic and project-specific EIS to address existing and planned environmental restoration and waste management activities.

DOE NEPA regulations and discussions with coordinators of the current INEL NEPA strategy provided the basis for the NEPA requirements for each alternative. The actual decisions must be made by DOE-HQ, through submitting appropriate information on the proposed action.

9.2.3 Siting Requirements/Criteria

The physical location of a TSD facility directly influences the potential for impacting human health and the environment. Physical locations refer to the geologic, hydrologic, and pedologic characteristics of a site, as well as adjoining lands, surface water, and ground water that may be impacted if hazardous and/or radiological constituents are released from the facility.

RCRA regulations include standards to control the location of TSD facilities in seismic zones and 100-yr floodplains. See 40 CFR 264.18 and 40 CFR 270.14.

The EPA requires that other Federal laws that affect the location and permitting of TSD facilities be followed if applicable. These Federal laws include, but are not limited to

- National Historic Preservation Act of 1966 (16 U.S.C. 470 et seq.)
- Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.)
- Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) etc.

9.2.4 Permitting Requirements

This section describes Federal and State permits and approvals applicable to the treatment of INEL low-level and mixed waste.

9.2.4.1 Resource Conservation and Recovery Act. RCRA, as amended (42 U.S.C. 6901 et seq.) requires any facility that treats, stores (except in satellite and temporary accumulation areas), or disposes hazardous or mixed waste to obtain a RCRA permit. The RCRA permit process consists of two parts: Part A, interim status, and Part B, final permit.

A trial burn is necessary to obtain a RCRA Part B permit to operate an incinerator for treating chemically hazardous and radioactive mixed wastes.

Construction or modification of a TSD facility requires the preparation of a new permit application or modification of the existing permit. No physical construction of a new facility at the INEL will begin without having submitted Parts A and B (together) of the RCRA permit application to the State of Idaho Hazardous Materials Bureau and having received an approved and effective RCRA permit. No modification can be made before the modified permit is approved.

9.2.4.2 National Emission Standards for Hazardous Air Pollutants. Under the Clean Air Act (CAA), the EPA has set national emission standards for certain hazardous air pollutants that have no national ambient standard, but which may cause adverse effects on public health. These standards regulate both new and existing emission sources and limit the amounts of pollutants. The

materials regulated under NESHAP that may be applicable to the INEL include radionuclides, benzene, volatile hazardous air pollutants, radon, mercury, vinyl chloride, beryllium, and asbestos.

The EPA requires a NESHAP document and approval for all new or modified sources of radionuclides from DOE facilities that will cause an effective dose equivalent (EDE) of greater than or equal to 0.1 mrem/yr, measured at the residence of the nearest residing person. All new or modified sources of radionuclide emissions are subject to EPA approval.

9.2.4.3 State of Idaho Permit to Construct/Prevention of Significant Deterioration. The Idaho Administrative Procedures Act (IDAPA) 16.01.1012 establishes uniform procedures for the issuance of PTCs and operating permits. A PTC must be obtained prior to construction or modification of any stationary source, major facility, or major modification, except for listed classes of equipment. An air contaminant is defined to include dust, fume, gas, mist, odor, smoke, vapor, pollen, soot carbon, or particulate matter regulated by the EPA or Federal CAA.

PSD review by the State of Idaho is necessary for any source of radionuclide emissions. The PSD program requires a preconstruction review of all major facilities and major modifications. A major facility is a facility that has actual or allowable air emissions of 100 tons per year or more of any air contaminant. The INEL is considered a major facility.

9.2.4.4 Toxic Substance Control Act. 40 CFR 761 establishes rules on the disposal of PCBs and PCB-contaminated waste. Under these rules, organizations or persons wishing to site or store a facility managing PCBs are subject to Toxic Substances Control Act (TSCA) requirements. In addition, organizations or persons wishing to dispose PCBs are required to use approved methods and must obtain a permit. All PCB incinerators must be identified to the EPA through a permitting/approval process before initiation of any burn.

9.2.4.5 National Pollutant Discharge Elimination System. The Clean Water Act's (CWA) primary mechanism for imposing limitations on pollutant discharges is a nationwide permit program established under Section 402 and referred to as the National Pollutant Discharge Elimination System (NPDES).

Since no discharge to surface waterways or municipal water systems is anticipated, for any alternative, an NPDES permit is not presently required. However, beginning October 1, 1992, storm water discharges (storm water point sources) will be subject to the NPDES program. DOE-ID plans to obtain a general NPDES permit for all existing INEL facilities. Any new facility will require a modification of this NPDES permit. No difficulties are anticipated in achieving environmental compliance with NPDES permit requirements. This discussion of NPDES permits applies to all alternatives requiring construction of a new facility and is therefore not discussed further here.

9.2.5 Land Disposal Restrictions Requirements

The HSWA to RCRA, through the LDRs, prohibit disposal of hazardous and mixed wastes that have not been treated to standards required by EPA in 40 CFR 268. HSWA also prohibits the storage of any LDR waste unless the storage "is for the sole purpose of accumulating sufficient quantities in a tank or container to facilitate proper recovery, treatment, or disposal of that waste."

EPA has set statutory deadlines to meet these prohibitions, and noncompliance with storage or disposal standards after these dates is a direct violation of the law.

Because RCRA does not impose retroactive waste management requirements, wastes that were disposed of in the past need not be exhumed for additional treatment. However, if a waste generated prior to the effective date of the LDRs is removed from a storage or disposal unit, it becomes subject to the LDRs at that time. Similarly, residues generated from such wastes, like leachate or contaminated ground water, are viewed as newly-generated wastes subject to regulation under RCRA and the LDRs.

All mixed waste was subject to the RCRA land disposal restrictions by May 8, 1992, unless

- It was placed into storage prior to the effective date of the LDRs and has not been removed from the storage or disposal unit where it was placed
- Is in a state that is authorized for RCRA's base program, but has not yet received authorization for mixed waste
- Is a newly identified or listed waste after November 8, 1984, for which treatment standards have not been promulgated.

Current mixed waste treatment capability and capacity at the INEL is not adequate to meet RCRA requirements. Without treatment and disposal alternatives for mixed waste, the ability to meet LDRs and storage limitations established by RCRA is a major concern. Without treatment capabilities in place to process mixed waste, the storage of LDR waste for any period of time could be considered a violation of EPA regulations.

9.2.6 Emission Controls

Emissions from INEL facilities must meet all applicable Federal, State, and local regulations as well as DOE Orders. The regulations applicable to the processing of INEL low-level mixed waste and LLW streams include RCRA, TSCA, CAA, State of Idaho, and DOE Order 5400.5.

This study assumes that the waste treatment facilities will be designed to comply with all applicable emission standards (see Section 3). No unusual waste streams are anticipated to be treated at the proposed facilities. All facility offgas systems will be designed using best available control technologies. No unique problems are anticipated in meeting the required standards.

This discussion of emission controls applies to all alternatives with the potential for air emissions and is therefore not discussed further here.

9.3 Evaluations of Alternatives Against Requirements

9.3.1 Construct and Operate MLLWTF

The MLLWTF alternative is used as the baseline case against which the other alternatives are compared. The discussion below applies to both the minimum and maximum treatment options presented for the MLLWTF.

9.3.1.1 NEPA. DOE has determined that the proposed siting, construction, and operation of incinerators, other than research and development incinerators or incinerators for nonhazardous solid waste, requires the preparation of an EIS. A rotary-kiln incinerator is the proposed treatment unit for the MLLWTF, and therefore will require preparation of an EIS.

As of this writing (April 1992), the NEPA strategy for the MLLWTF involves preparing a document tiered off the INEL Environmental Restoration and Waste Management (ER&WM) EIS although the strategy is still evolving. The current schedule (which is also evolving) for the INEL ER&WM EIS calls for completion of the Final EIS on January 1, 1996. The Record of Decision (ROD) is scheduled to be published August 1, 1996. Title II design of the MLLWTF, which should not begin before the ROD is issued, is scheduled to begin October 1, 1996. The history of the production and approval of NEPA documents indicates that schedule slippages have sometimes occurred. Because the MLLWTF EIS will be integrated with the INEL ER&WM EIS, a small slippage in the schedule of the baseline EIS could cause an impact in the schedule of the MLLWTF. See Section 12 for further details.

Construction of a new incineration facility at the INEL may be controversial and may have a high degree of public concern. These issues and concerns will arise throughout the EIS process, and may present some difficulty in finalizing the EIS and issuing a ROD. See Section 11 for further details.

Because NEPA requires evaluating all reasonable alternatives to a proposed action, the alternatives considered in this study will be evaluated in the MLLWTF EIS, providing they remain viable options. For this reason, the NEPA requirements, schedules, and costs for each treatment alternative are assumed to be identical to the MLLWTF. However, should DOE decide not to consider incineration as a viable option, the NEPA requirements and resulting implications may not be the same.

9.3.1.2 Siting. The exact location to be proposed for the MLLWTF is not determined yet. Implementation of the MLLWTF alternative will require siting studies to select possible locations. The EIS process will eventually identify the preferred location for the MLLWTF.

Siting studies require surveys, consultations, and modeling studies to ensure compliance with Federal, State, and DOE criteria. These lengthy studies will not be required for other alternatives where treatment takes place in an existing facility.

Other difficulties associated with siting the MLLWTF include political and regulatory issues related to collocating the facility with the proposed MLLWDF and/or the IWPF. These issues are currently being evaluated.

9.3.1.3 Permitting.

Resource Conservation and Recovery Act—The INEL MLLWTF will be designed for storage and treatment of mixed waste and, therefore, requires a RCRA permit. Difficulties associated with RCRA permitting for the MLLWTF are associated with the cost and schedule impacts, and the potential for controversy and public opposition.

The INEL MLLWTF does not qualify for interim status; therefore, both a Part A and a Part B permit application must be submitted and approved prior to construction. In addition, a trial burn plan must be prepared and executed.

The RCRA permitting process requires public meetings and public comment periods similar to the NEPA process discussed above. Construction of a new incinerator to treat mixed and LLW may create controversy and public opposition, as discussed in Section 9.3.1.1. These issues and potential public opposition will arise throughout the permitting process, and may present some difficulty in issuing a permit.

National Emission Standards for Hazardous Air Pollutants—Analysis is required to determine if NESHAP approval is necessary for the MLLWTF because it has the potential to emit radionuclides and other hazardous material as listed in 40 CFR 61. This documentation preparation could start as soon as the specified Title II design parameters are bounded.

Because of an agreement between the State of Idaho and EPA Region X, a NESHAP approval (if required) must be obtained from the EPA before the Idaho PTC/PSD can be submitted to the State. This means the NESHAP must be approved in time to obtain the Idaho PTC/PSD. This should not present a problem for the MLLWTF project. Because environmental planning has already begun for this facility, adequate time has been scheduled between NESHAP approval and PTC/PSD permitting processes.

State of Idaho Permit to Construct/Prevention of Significant Deterioration—The MLLWTF is required to submit an application for a permit to construct to the Idaho Air Quality Bureau (IAQB). The analysis can be performed as soon as Title II design is approved or as soon as the needed Title II design parameters are bounded.

PSD analysis is required for the MLLWTF because the facility has the potential to emit radionuclides. Studies must be conducted to project likely emissions and assess the impact on the ambient air quality. The objective is to demonstrate that the MLLWTF will not contribute to a violation of the national air quality standards and will not consume an excessive increment of allowable air quality deterioration over the baseline air quality.

As discussed above under the NESHAP evaluation, early environmental planning for the MLLWTF facility will provide sufficient time for permit preparation and approval. The permitting

process is scheduled such that adequate information will be available to prepare permits, and few difficulties should arise.

The PTC/PSD permitting process allows for public comment on the permit application. As discussed above under RCRA, construction of a new incinerator designed to treat mixed and LLW at the INEL has the potential to create controversy and public opposition. However, the MLLWTF will be designed to maximize the efficiency of the offgas system and reduce harmful air emissions. Meeting the EPA and State emission standards should not be a problem. Therefore, no difficulties are expected in achieving compliance with PTC/PSD requirements for the MLLWTF.

Toxic Substance Control Act—The MLLWTF will incinerate PCBs and, therefore, requires a TSCA permit. Difficulties associated with TSCA permitting for the MLLWTF include those discussed above for RCRA permitting. Additional difficulties in achieving environmental compliance with TSCA permit requirements include more stringent design/combustion criteria and requirements.

The EPA will review the TSCA permit application and determine if the operation may proceed, if a test burn is required, or what deficiencies must be addressed.

9.3.1.4 Land Disposal Restrictions. The key to satisfying LDR requirements is appropriate treatment capabilities for mixed waste. Implementation of the MLLWTF alternative will allow mixed wastes to be processed in accordance with RCRA. The MLLWTF will include treatments, such as incineration, necessary to destroy or fix DOE mixed wastes and meet EPA standards. The treatment capabilities included in the MLLWTF will account for INEL mixed waste, thereby eliminating the need for long-term storage of mixed waste.

9.3.1.5 Conclusions. The MLLWTF will comply with all environmental requirements. The difficulty associated with achieving environmental compliance due to this alternative is expected to be among the smallest of the onsite treatment alternatives because the new facility will treat all INEL mixed and LLW in accordance with DOE orders, and State and Federal regulations. The MLLWTF will include new technologies and engineering controls to minimize any releases from the facility, which will facilitate the permitting process.

9.3.2 Modify and Operate WERF

9.3.2.1 NEPA. WERF was constructed as an experimental waste-reduction facility under an environmental evaluation (EE). An EA is being prepared to cover facility upgrades and continued operations.

Modified WERF will be one of the alternatives in the EIS evaluated for the MLLWTF. The schedule difficulties associated with NEPA compliance for WERF will, therefore, be the same as for the MLLWTF. See Section 9.3.1.1 for further details.

The degree of controversy associated with modifying and operating the WERF incinerator for long-term treatment of INEL mixed waste and LLW is difficult to assess. WERF is an existing facility and has successfully treated LLW and some mixed waste, without adverse environmental impact. The alternative therefore may receive less criticism and may be more acceptable to the public than constructing the MLLWTF. On the other hand, a new facility with new technologies and

engineering controls will achieve lower risk levels and may receive less criticism than continued operation of WERF.

Unlike the MLLWTF alternative, implementing the WERF alternative requires that additional MWSFs be constructed at the INEL. This need is depicted in Figure 4-1 and is discussed in Section 5. Activities related to the treatment and storage of mixed waste are dependent upon one another and will be considered part of the same action. Therefore, environmental impacts for both WERF and the storage facilities will be combined under this alternative in the tiered EIS. The difficulties anticipated in achieving environmental compliance with the NEPA requirements for the storage facilities are the same as discussed for WERF.

9.3.2.2 Siting. The WERF is located near the Power Burst Facility at the INEL. As an existing facility, WERF is "grandfathered," exempting the facility from mandatory siting criteria as discussed above for the MLLWTF.

The construction of new storage facilities for the INEL untreatable mixed waste, however, will require compliance with Federal, State, and DOE siting criteria discussed above under the MLLWTF alternative. The studies and difficulties associated with siting a new storage facility will be similar to siting the MLLWTF. This discussion of siting criteria applies to all other alternatives requiring indefinite storage. However, the quantity of waste requiring storage varies among such alternatives.

9.3.2.3 Permitting.

Resource Conservation and Recovery Act—The WERF is designed for treatment of mixed waste and, therefore, requires a RCRA permit. WERF has Interim Status for mixed waste and hazardous waste.

The Part B documentation is being written for WERF and will cover procedural upgrades proposed for the facility. A trial burn plan is being prepared and will be submitted with the Part B application. As of this writing, the permit is scheduled to be submitted to the State for review November 1, 1992, and is estimated to be approved by January 1, 1995.

Additional modifications to WERF under this alternative, discussed in Section 5, will require that Class 3 permit modifications be made. Difficulties associated with RCRA permitting for WERF are the same as those discussed above for the MLLWTF.

The proposed modifications to WERF are such that the permit modifications will be extensive. A new trial burn will be required. Preparation and modification of the permit documentation, negotiations with permitting agencies, and execution of the trial burn will impact the cost and schedule for the WERF alternative.

The permit modifications will require public meetings and public comment periods, as discussed above for the MLLWTF. The potential controversy and public opposition associated with a modified-WERF, as compared with the MLLWTF is, again, difficult to assess. Because WERF is an existing facility and has successfully treated LLW and some mixed waste at the INEL, the public might perceive the activity as routine and necessary. However, the opposite may be true. The public may perceive the activity to be one that will increase the volume of waste disposed at the INEL.

In addition to modifying the RCRA permit for the WERF facility, both a Part A and a Part B permit application must be submitted and approved prior to construction of any new storage facilities. The additional permitting requirements for the modify-WERF alternative further impact the cost and schedule, and the potential for public opposition. The difficulties anticipated in achieving environmental compliance with the RCRA requirements for the modify-WERF alternative are, therefore, greater than for the MLLWTF alternative.

National Emission Standards for Hazardous Air Pollutants—NESHAP standards apply to WERF. The NESHAP regulations provide for continuous monitoring of those sources that have the potential to release, unabated, greater than 0.1 mrem/yr. The WERF incinerator has been identified as a source requiring continuous monitoring.

The level of difficulty in achieving compliance with NESHAP requirements for WERF will be the same as for the MLLWTF.

State of Idaho Permit to Construct/Prevention of Significant Deterioration—WERF is in the process of submitting a new PTC application to the State to cover proposed changes to the incineration system.

Modifications proposed in this study will require a PTC/PSD permit prior to any modification. The difficulties in achieving compliance with PTC/PSD requirements for a modified-WERF are the same as associated with the MLLWTF. The level of difficulty is again difficult to assess, for public opposition reasons discussed above under WERF NEPA and RCRA sections. Although the source term and waste description for the two facilities may differ, the treatment and offgas capabilities of handling the different streams also differ. Major difficulties are not anticipated in achieving environmental compliance for either facility.

Toxic Substance Control Act—The WERF facility will require a TSCA permit to incinerate PCBs. The facility must demonstrate compliance with the incinerator performance standards required in 40 CFR 761. The discussion for the MLLWTF applies identically to WERF.

The new storage facilities proposed under this alternative will be required to comply with the storage and siting requirements under TSCA and listed in 40 CFR 761. Difficulties associated with siting a new storage facility are discussed in Section 9.3.2.1.

9.3.2.4 Land Disposal Restrictions. Unlike the MLLWTF, the modify-WERF alternative will not comply with LDRs.

The modified WERF will be capable of treating some, but not all, INEL mixed waste streams to standards required by the EPA. Because of design-limiting capability, some INEL mixed waste streams will require indefinite storage in a permitted MWSF.

The long-term storage of LDR waste, except for the sole purpose of accumulating sufficient quantities to facilitate proper recovery, treatment, or disposal of waste, is a violation of the environmental requirements. The INEL will be subject to fines and penalties imposed by the EPA and/or the State of Idaho should this alternative be implemented.

9.3.2.5 Conclusions. The modify-WERF alternative will not comply with all environmental requirements; it cannot treat all INEL mixed waste in accordance with EPA and state regulations. The indefinite storage of the untreatable mixed waste will violate the LDRs promulgated under RCRA. The INEL will be subject to fines and penalties.

9.3.3 Modify and Operate PREPP

9.3.3.1 NEPA. PREPP was constructed as an experimental pilot plant facility under an EE. A draft EA was prepared to support startup and evaluate the environmental impacts from proposed modifications to the PREPP facility and subsequent research and processing involving contact-handled TRU waste, LLW, mixed wastes, hazardous, and incidental nonhazardous wastes. The PREPP facility was deactivated prior to approval of the draft EA.

The PREPP facility will be one of the alternatives in the EIS evaluated for the MLLWTF. The schedule difficulties associated with NEPA compliance for PREPP will, therefore, be the same as for the MLLWTF. See Section 9.3.1.1 for further details.

The potential degree of controversy and public opposition associated with modifying and operating the PREPP incinerator for treatment of INEL mixed and LLW is anticipated to be similar to that associated with the MLLWTF. As discussed in Section 5, the PREPP facility underwent an extensive testing program and subsequent modifications. The predominant reason for ending the modification and testing of PREPP was the high cost associated with upgrading the facility to meet new TRU waste processing requirements. Although modification and operation of the facility to treat mixed waste and LLW may be practical, and the degree of environmental impact low, the controversy associated with reactivating the facility may present cause for public opposition.

9.3.3.2 Siting. As an existing facility, PREPP is "grandfathered," exempting the facility from the mandatory siting criteria discussed above for the MLLWTF.

However, construction of a new storage facility would require compliance with the mandatory Federal, State and DOE siting criteria discussed above under the MLLWTF alternative. The studies and difficulties associated with siting a new storage facility would be similar to siting the MLLWTF.

9.3.3.3 Permitting/Approvals.

Resource Conservation and Recovery Act—The INEL PREPP facility is designed for treatment of mixed waste and, therefore, requires a RCRA permit. PREPP has interim status under RCRA.

Although the RCRA Part B permit for PREPP was prepared and submitted prior to shutdown, facility modifications as proposed in this study will require major modification of existing documentation and preparation of new Part B permit documentation. Difficulties associated with RCRA permitting for PREPP are the same as those listed for the MLLWTF.

The Part B permit must be written to include a trial burn plan, and a trial burn will be required. Preparation of the permit documentation, negotiations with permitting agencies, and execution of the trial burn will impact the cost and schedule for the PREPP alternative.

The potential degree of controversy and public opposition associated with permitting PREPP will again, be difficult to assess for the same reasons discussed under the WERF and MLLWTF alternatives. The opposition is not expected to be greater than for the other facilities.

This alternative, like the WERF alternative, will require permitting a waste storage building.

National Emission Standards for Hazardous Air Pollutants—Analysis is required to determine if NESHAP approval will be necessary prior to modifying the PREPP facility because it has the potential to emit radionuclides and other hazardous materials. The discussion for the MLLWTF applies to PREPP. No difficulties are expected in achieving compliance with NESHAP requirements for PREPP.

State of Idaho Permit to Construct/Prevention of Significant Deterioration—The PREPP facility will be required to submit an application for a permit to construct. A PTC must be obtained prior to any modification of the PREPP facility.

A PSD analysis will be required for PREPP because the facility has the potential to emit radionuclides. The PTC/PSD requirements discussed for the MLLWTF apply identically to PREPP.

Modification and operation of the PREPP incinerator has the potential to create some public opposition during the air permit public comment period. However, the proposed modifications to PREPP include an improved offgas system to reduce harmful air emissions. Meeting the EPA and State emission standards should not be difficult for PREPP.

As for the MLLWTF, no difficulties are expected in achieving compliance with PTC/PSD requirements for PREPP.

Toxic Substance Control Act—The PREPP facility will require a TSCA permit to incinerate PCBs. The facility was designed to meet the incinerator performance standards required under TSCA for treatment of PCB wastes. The discussion for the MLLWTF applies identically to PREPP.

9.3.3.4 Land Disposal Restrictions. Implementation of the PREPP alternative will allow mixed wastes to be processed in accordance with environmental regulations. The discussion for the MLLWTF applies identically to PREPP.

9.3.3.5 Conclusions. The modify-PREPP alternative will comply with all environmental requirements. The difficulties associated with achieving environmental compliance due to this alternative are expected to be comparable to the MLLWTF because PREPP will treat all INEL mixed and LLW in accordance with DOE Orders, and State and Federal regulations. PREPP will include treatment technologies similar to those included in the MLLWTF and new engineering controls to control any releases from the facility, which will facilitate the permitting/approval processes.

9.3.4 Generator Treatment

9.3.4.1 NEPA. Generator treatment will be one of the alternatives in the EIS evaluated for the MLLWTF. The schedule difficulties associated with NEPA compliance for the generator

treatment alternative will, therefore, be the same as for the MLLWTF. See Section 9.3.1.1 for further details.

The degree of controversy and public opposition associated with generator treatment is expected to be less than for the MLLWTF because an incinerator is not present in this alternative.

Unlike the MLLWTF alternative, implementing the generator treatment alternative requires that additional MWSFs be constructed at the INEL. The environmental impact statements for both generator treatment and the storage facilities are assumed to be combined under this alternative in the tiered EIS.

9.3.4.2 Siting. Construction of the two size-reduction facilities will most likely occur in previously undisturbed areas. Siting studies will be needed to ensure compliance with DOE orders, and Federal and State regulations. Compliance will require surveys, consultations, and modeling studies.

The discussion of siting the new storage facilities discussed above under the WERF alternative applies identically to generator treatment.

9.3.4.3 Permitting.

Resource Conservation and Recovery Act—Compaction and size-reduction of LLW proposed under this alternative does not require a RCRA permit. However, the applicability of RCRA permitting to generator treatment of mixed waste by immobilization will be based on the State's interpretation of generator treatment as defined under this alternative.

RCRA permits exempting generator treatment of RCRA wastes, in accumulation tanks or containers, for the sole purpose of rendering the waste nonhazardous from the permitting requirements of 40 CFR 270 as long as treatment is conducted in a temporary accumulation area within 90 days and in accordance with all applicable RCRA regulations.

To make a determination in this case, appropriate information on the project will be submitted to the State for evaluation. The State could rule to allow onsite treatment by the generator, exempting the immobilization processes from RCRA permitting requirements. Alternatively, the State could reject onsite treatment by the generator, requiring that the generator find a TSD to treat the waste or become a TSD. Becoming a TSD will subject the generator to all RCRA permitting requirements.

Because a centralized treatment facility will not be available for INEL mixed wastes under this alternative and to remain consistent and conservative throughout these evaluations, the State is assumed to require RCRA Part A and Part B permits for the proposed immobilization units.

Difficulties associated with RCRA permitting for the immobilization units will be less than for the MLLWTF. Because of the simplicity of the treatment unit, the cost required for permitting will be less than for an incineration unit.

The degree of controversy and public opposition associated with permitting immobilization units will again be less than for the MLLWTF because incineration is not proposed under this alternative.

Unlike the MLLWTF alternative, however, implementing the generator treatment alternative requires that additional MWSFs be constructed at the INEL. The additional permitting required for the generator treatment alternative further complicates this alternative. The further impacts to cost, and the potential for public opposition will increase the difficulties in achieving environmental compliance with RCRA permitting requirements, should this alternative be implemented.

National Emission Standards for Hazardous Air Pollutants—Analysis is required to determine if NESHAP approval is necessary for generator treatment of mixed and LLW because there is potential to emit radionuclides.

Because the treatment units involved in this alternative have limited potential to emit radionuclides and a filtered exhaust will be included in the system design, no major difficulties are expected in achieving environmental compliance with NESHAP requirements. However, unlike the MLLWTF, consideration must be given to the number of units requiring analysis under this alternative.

State of Idaho Permit to Construct/Prevention of Significant Deterioration—Construction and operation of the proposed mixed and LLW treatment units will require State review of anticipated air emissions. An application for a permit to construct must be approved prior to construction.

PSD analysis will be required for mixed and LLW treatment units described under this alternative because potential exists to emit radionuclides. The PTC/PSD requirements discussed for the MLLWTF apply identically to generator treatment.

The treatment units involved in this alternative have limited potential for air emissions, and a filtered exhaust will be included in the system design. Thus, no major difficulties are expected in achieving environmental compliance with PTC/PSD permit requirements. The discussion for NESHAP difficulties applies identically to this discussion.

Toxic Substance Control Act—Under this alternative, no treatment capability exists for waste streams contaminated with PCBs. Indefinite storage of these wastes will be required until treatment becomes available. A TSCA permit is therefore not applicable for this alternative.

The discussion for the new storage facilities under the WERF alternative applies identically to generator treatment.

9.3.4.4 Land Disposal Restrictions. Unlike the MLLWTF, the generator treatment alternative will not comply with LDRs.

Generator treatment of mixed waste will be capable of treating some, but not all, mixed waste to standards required by the EPA. Because of a lack of required treatment, mixed waste will require indefinite storage in a permitted storage facility.

The long-term storage of LDR waste, except for the sole purpose of accumulating sufficient quantities to facilitate proper recovery, treatment, or disposal of waste, is a violation of the environmental requirements. The INEL will be subject to fines and penalties imposed by the EPA and/or the State of Idaho

9.3.4.5 Conclusions. The generator treatment alternative will not comply with all environmental requirements. Generator treatment cannot account for all INEL mixed waste in accordance with EPA and State regulations. The indefinite storage of the untreatable mixed waste will violate the LDRs promulgated under RCRA. The INEL will be subject to fines and penalties.

9.3.5 Offsite Treatment

9.3.5.1 NEPA. The offsite treatment alternative will be an alternative evaluated in the EIS for the MLLWTF. The schedule difficulties associated with NEPA compliance for the MLLWTF however, will not apply to the offsite alternative. As shown in Section 12, ample time is available between the ROD and subsequent activities for the offsite treatment alternative.

The potential exists for political controversy and public opposition to arise as a result of shipping radioactive and mixed wastes across several states. Institutional factors associated with this alternative are presented in Section 11, and other issues associated with this alternative are discussed in Section 14.

9.3.5.2 Permitting. All licensing and permitting required for treatment of INEL wastes will be the responsibility of the offsite TSD facility. The involved offsite facility is assumed to be licensed and permitted to handle the INEL wastes described in Section 5.4.1. Difficulties related to licensing and permitting will be addressed by that facility. However, DOE will audit the offsite TSD facility and ensure that the appropriate licenses and permits are in place.

9.3.5.3 Shipping Regulations. Shipping will comply with Department of Transportation (DOT) requirements per 49 CFR 173, 10 CFR 71, RCRA requirements per 40 CFR 263, and the applicable requirements of the State of Idaho and any Tribal parties or states through which the waste must be transported. Compliance with these regulations will not present any insurmountable difficulties.

Recent revisions to the DOT regulations, referred to as HM-181, present performance-based packaging requirements. The new packaging requirements present a potential regulatory difficulty. HM-181 requires all transitional provisions for continued use of pre-181 packaging to expire October 1, 1996.

This alternative will require compliance with these regulations for offsite shipments of mixed waste. Mixed waste will be required to be shipped in a package meeting the performance requirements for both radioactive waste and mixed waste. These packaging requirements are not necessarily compatible. In addition, untreatable mixed wastes generated and packaged prior to 1996 will require repackaging if they are transported offsite. Repackaging mixed wastes will present other difficulties and issues. These issues are discussed in Section 14.

9.3.5.4 Land Disposal Restrictions. Implementation of the offsite alternative will allow mixed wastes to be processed in accordance with environmental regulations. The discussion for the MLLWTF applies identically to the offsite alternative.

9.3.5.5 Conclusions. The offsite alternative will comply with all environmental requirements. The difficulty associated with achieving environmental compliance due to this alternative is expected to be small. This alternative will transfer many regulatory difficulties associated with waste treatment from the operators of the onsite treatment facility to the operators of the offsite treatment facility.

9.3.6 Idaho Waste Processing Facility

Environmental requirements for implementation of the IWPF alternative will be satisfied by the IWPF and the two small treatment facilities mentioned earlier. This alternative has been evaluated to determine any additional requirements that will be necessary to support implementation.

9.3.6.1 NEPA. The NEPA strategy for IWPF, as of this writing, is identical to the MLLWTF. Provided the NEPA documentation prepared for IWPF addresses processing the mixed waste and LLW streams discussed in Section 5.8.1, no additional NEPA requirements will be necessary.

9.3.6.2 Permitting.

Resource Conservation and Recovery Act—The IWPF is intended for treatment of radioactive waste, whether the waste is also hazardous per RCRA, and will have a RCRA permit prior to construction. The IWPF RCRA permit will adequately cover any mixed waste streams discussed in this study. No additional RCRA permit requirements will be necessary for processing the mixed waste proposed under this alternative.

Air Permits—NESHAPS and PTC/PSD permit applications are planned for the IWPF. Because the IWPF will be designed for wastes that contain greater levels of radioactivity and include hazardous constituents per RCRA, treatment of mixed wastes will not adversely impact emissions from the facility. No additional air permit requirements will be necessary for processing the mixed waste proposed under this alternative.

Toxic Substances Control Act—TSCA permitting for incineration of PCB waste is not addressed in the IWPF environmental compliance plan. However, discussion with IWPF representatives indicates PCB waste streams are under consideration. Therefore, an assumption is that the IWPF will have a TSCA permit to cover PCB operations. No additional permits will be necessary for processing PCB waste proposed under this alternative.

9.3.6.3 Land Disposal Restrictions. Implementation of the IWPF alternative will allow mixed wastes to be processed in accordance with environmental regulations. The discussion for the MLLWTF applies identically to IWPF.

9.3.6.4 Conclusions. The IWPF alternative will comply with all environmental requirements. The IWPF project is planning to obtain all necessary environmental approvals and permits. Adding the mixed waste to the IWPF TRU waste streams will have only a minor impact on the IWPF and will essentially eliminate the need for dual regulatory tasks of the waste treatment projects.

9.3.7 Combinations of Alternatives

The environmental requirements and the difficulties expected in complying for the selected combinations of alternatives will generally correspond to the requirements and difficulties associated with the individual contributing alternatives. However, the combined alternatives remove the need for indefinite storage of mixed wastes, as required under the WERF and generator treatment alternatives, and satisfy the LDR requirements.

For brevity, the four combinations selected for study are not evaluated here in detail. The conclusions for the combinations of alternatives are given in Section 9.5.

9.3.8 No Action

9.3.8.1 NEPA and Siting. The no-action alternative will be one of the alternatives in the EIS evaluated for the MLLWTF. Implementing the no-action alternative requires that additional storage facilities be constructed at the INEL. The discussion of NEPA and siting compliance difficulties discussed above under the WERF alternative applies to the no-action alternative.

9.3.8.2 Permitting/Approvals.

Resource Conservation and Recovery Act—Construction of an additional MWSFs will require a Part A and a Part B permit.

Because the indefinite storage of LDR waste will result in noncompliance with RCRA, permitting these facilities will be difficult. Other difficulties associated with RCRA permitting requirements are discussed under the WERF alternative.

National Emission Standards for Hazardous Air Pollutants—The storage facilities proposed in this alternative are assumed to be designed and operated identical to the current MWSF and will not be subject to NESHAP approval.

State of Idaho Permit to Construct/Prevention of Significant Deterioration—The storage facilities proposed in this alternative are assumed to be designed and operated identical to the current mixed waste storage facility and will not be subject to PTC/PSD requirements.

Toxic Substance Control Act—Storage of PCBs and PCB items will comply with the requirements of TSCA. Difficulties associated with siting a new storage facility are discussed in Section 9.3.2.1.

9.3.8.3 Land Disposal Restrictions. Unlike the MLLWTF, the no-action alternative is in direct violation of the LDR regulations. The long-term storage of LDR waste, except for the sole purpose of accumulating sufficient quantities to facilitate proper recovery, treatment, or disposal of waste, is a violation of the environmental requirements. The INEL will be subject to fines and penalties imposed by the EPA and/or the State of Idaho.

9.3.8.4 Conclusions. The no-action alternative will not comply with all environmental requirements. Indefinite storage of mixed waste, with no attempt at treatment, will clearly violate the LDR requirements of RCRA.

9.4 Overall Conclusions

9.4.1 "Musts"

One of the "musts" listed in Table 6-1 applies to this section:

- Comply with all environmental and waste management regulatory requirements.

The conclusion of the overview evaluation is that the WERF alternative, the generator treatment alternative, and the no-action alternative do not comply with all environmental requirements. They require indefinite storage of LDR wastes, in violation of RCRA regulations. These alternatives fail this "must" criterion. All other alternatives will satisfy this requirement.

9.4.2 "Wants"

None of the "wants" listed in Table 6-1 applies to this section.

10. SAFETY, HEALTH, AND RISK EVALUATIONS

10.1 Introduction

This section evaluates the alternatives on (a) the degree to which they will comply with safety and health requirements, and (b) the risk they will present to the workers, the public, and the environment.

Detailed, quantitative comparisons of the safety, health, and risk of the alternatives require that a rigorous safety analysis report (SAR), per DOE Order 5481.1B, be available for each alternative. SARs do not exist for any of the long-term treatment alternatives. For example, the SAR for the MLLWTF is not scheduled for several years. Also, because the conceptual long-term upgrades for WERF and PREPP are not funded projects, SARs covering those upgrades do not exist. Thus, insufficient information exists to allow quantitative evaluations, such as calculated doses.

Because of the lack of safety documentation and of even preconceptual designs, these evaluations are limited to overview observations. The projected, qualitative safety performance of each alternative is compared against the requirements or against other alternatives. The observations are based on implications from current SARs, knowledge of the general hazards of the waste and conceptual treatment processes, results of WERF and PREPP walk-throughs, discussions with facility personnel, facility safety histories, and miscellaneous existing safety evaluations. Because of the incomplete state of knowledge, the observations are subject to later refinement as more detailed designs and safety evaluations are performed.

The scope of these overview evaluations includes both radiological and nonradiological hazards. Impacts on both the workers and the public are included. Impacts on the environment are included in the sense that evaluations of releases to environmental media are needed in order to project the impacts on the public.

10.2 Requirements/Criteria

The major requirements/criteria that relate to safety and health protection in DOE facility operations are found in several DOE Orders and in other standards sources cited therein.

DOE Order 6430.1A governs the design of DOE facilities. Many design criteria in 6430.1A stem from other DOE Orders or national standards. Thousands of the design criteria in 6430.1A are safety-related. The criteria cover everything from the seismic resistance of buildings and the redundancy of utilities, to the adequacy of ventilation systems and the confinement capabilities of process vessels.

DOE Order 5481.1B contains the requirement to prepare an SAR, a comprehensive document that involves considerable time and funding. The required content of an SAR is also found in DOE Order 5481.1B. One requirement is that, for each applicable, safety-related design criterion in DOE Order 6430.1A, the SAR must state that the facility complies with the criterion, or that the criterion is not satisfied and how safety is nonetheless ensured. Noncompliances with 6430.1A must be approved by the DOE Field Office.

DOE Order 5480.5 will govern the operations of all onsite treatment alternatives because all will be formally categorized as "nuclear facilities."

Radiological safety in DOE facilities is governed by DOE Order 5400.5 and by DOE Order 5480.11. Concentration limits and exposure limits are specified.

Nonradiological safety is governed by DOE Order 5480.10 and by DOE Order 5480.4. The latter Order cites the Occupational Safety and Health Act (OSHA) standards listed in 29 CFR 1910 (operations) and 29 CFR 1926 (construction) as mandatory standards. Exposure limits for toxic materials are cited in the OSHA standards and in publications of the American Conference of Government and Industrial Hygienists (ACGIH).

The safety of mixed or LLW treatment at non-DOE sites is regulated by the NRC or by "agreement states." Offsite shipments are governed by the regulations of the NRC, the EPA, and the DOT.

10.3 Hazards Associated with Treating, Shipping, Storing, and Disposing INEL Mixed Waste and LLW

Certain hazards are inherent with constructing and operating facilities to treat, store, or dispose of INEL mixed waste and LLW, as well as shipping the waste offsite for treatment. The hazards result from the radioactive and/or toxic nature of the waste, combined with events internal or external to the facility.

The inherent hazards do not vary markedly from one alternative to another. In most cases, the same waste with the same radiological and nonradiological hazards will be treated or otherwise managed by similar processes. (Some alternatives will treat more waste than will other alternatives, thereby increasing the hazard of treatment activities and reducing the hazard of post-treatment activities.) However, the safety of the operation depends also on the preventive and mitigative steps taken to control the hazards. The alternatives provide different degrees of rigor in controlling the hazards.

The principal hazards were identified, based on the waste stream characterizations and on safety evaluations of existing similar facilities. The principal hazards associated with the waste are expected to be as follows:

- Direct radiation
- Radioactive contamination resulting from accidental loss of confinement, particularly due to the radionuclides Cs-137, Sr-90, Co-60, and the trace amounts of Pu-238
- Toxic chemical fumes, vapors, or fibers (e.g., volatile organics, lead, mercury, asbestos), particularly resulting from accidental loss of confinement during high-temperature operations or as a result of a fire or explosion
- Potentially explosive chemicals, such as sodium and NaK.

The principal types of events by which control of the hazards could be lost include fires, explosions, earthquakes, confinement failures, utility failures, and shipping accidents.

10.4 Evaluations of Alternatives Against Requirements/Criteria

Based on the foregoing discussion of requirements and expected hazards, the alternatives were evaluated in a qualitative, overview sense, on the following points:

- Facility compliance with the safety-related design criteria of DOE Order 6430.1A
- Radiological risk to workers, both chronic (routine) and accidental
- Nonradiological risk to workers, both chronic and accidental
- Radiological risk to the public and the environment, both chronic and accidental
- Nonradiological risk to the public and the environment, both chronic and accidental.

The total (qualitative) risk is the sum of the risks due to (a) treatment, (b) offsite shipment if any, (c) storage, and (d) postdisposal. These risks are discussed in Sections 10.4.1 through 10.4.4, respectively.

The risk discussions deal only with differences among the alternatives. For example, the management activities for the remote-handled waste, sodium waste, and lead waste are the same for all alternatives, so those risks are not discussed here.

10.4.1 Treatment

Treatment risk is influenced by (a) the hazard of the waste treated, which is proportional to the volume treated, (b) the nature of the treatment processes (all alternatives except generator treatment and no action include incineration), and (c) the rigor of the facility in controlling the hazard. Section 5 provides information on the volume of waste treated. Because all but the two indicated alternatives include similar treatment processes, Section 10.4.1 deals primarily with the rigor with which the various treatment facilities will control the hazard.

10.4.1.1 Construct and Operate MLLWTF.

Background—The MLLWTF alternative is used as the baseline case against which the other alternatives are compared.

Need for an SAR—A new SAR will be required for the MLLWTF alternative.

Compliance with Safety-Related Requirements of DOE ORDER 6430.1A—Because it is new, the MLLWTF will be designed to comply fully with the applicable safety-related requirements of DOE Order 6430.1A and other requirement sources.

Other Potential Safety and Health Problem Areas—None.

Risk to Workers and to the Public—The MLLWTF will be designed to comply with the routine occupational radiation dose limits of DOE Order 5480.11 and with the principle of maintaining exposures "as low as reasonably achievable (ALARA)." The facility also will be designed such that routine releases will comply with the public dose limits and other requirements of DOE Order 5400.5.

The MLLWTF will be designed to comply with the accident dose limits of DOE Orders 5480.11, 5400.5, and 6430.1A, and other pertinent sources.

The facility will also be designed so chronic exposures and credible accident exposures to toxic chemicals will be within the limits of OSHA and the ACGIH.

Of the two design options for the MLLWTF alternative, the maximum-treatment options will present a slightly higher operational-phase risk than will the minimum-treatment options. A larger volume of waste will be treated, more containers will be handled, more treatment processes will be operated, etc.

Conclusions—The MLLWTF will comply with all safety and health requirements. The treatment risk due to the minimum-treatment option of this alternative will be expected to be among the smallest of the onsite treatment alternatives because of the fully-compliant safety design of the facility. The maximum-treatment option will present a slightly higher treatment risk than the minimum-treatment option due to treating a larger volume of waste.

10.4.1.2 Modify and Operate WERF.

Background—As discussed in Section 5, WERF was constructed in several phases in the 1980s. The building that houses WERF is the former SPERT III reactor building, which was constructed in the late 1950s and was later decontaminated and decommissioned.

The current WERF SAR¹ does not adequately analyze the safety of the present facility in terms of the probabilities and consequences of accident scenarios. A major upgrade to the SAR (including an evaluation of the facility against the safety-related criteria of DOE Order 6430.1A) is in preparation to bring the document into compliance.

Because of the inadequacy of WERF safety analyses, less detail can be provided on the safety implications of the long-term WERF upgrades than for the long-term PREPP upgrades discussed in Section 10.4.1.3.

Need for an SAR—An assumption is made that the current upgrade will result in a compliant SAR for WERF. Revisions to the SAR will be required, however, to address the long-term modifications that will be made at WERF if that alternative is selected.

Compliance with Safety-Related Criteria of DOE ORDER 6430.1A—Unlike the case with PREPP (see Section 10.4.1.3), the current SAR for WERF does not evaluate the facility against the design safety criteria of DOE Order 6430.1A.

Many of the same types of safety criteria noncompliances, per DOE Order 6430.1A, that exist at PREPP are expected to exist at WERF. DOE Order 6430.1A was not used as a design basis for

WERF. (See Subsection 10.4.1.3, for PREPP examples of the types of noncompliances expected also in WERF.) Both projects were constructed in existing facilities that date from the late 1950s and early 1960s.

Other Potential Safety and Health Problem Areas—Based on a recent visit to WERF, discussions with WERF personnel, recent inspections, and preliminary results of the SAR upgrade effort, some noncompliance areas are listed below:

- The physical condition of WERF systems has generally deteriorated over the years because of an inadequate maintenance program.
- A recent electrical inspection of WERF identified several hundred instances of noncompliance with the National Electrical Code.
- Both the original structure and the new portions of WERF, as well as the equipment, were constructed to the seismic criteria of the Uniform Building Code (UBC), rather than to the criteria cited in DOE Order 6430.1A. Whether all key confinement barriers and safety systems will withstand the design basis earthquake (DBE) appropriate to today's requirements is questionable. Analyses of the seismic resistance of WERF are underway.
- WERF does not have the required redundancies in offgas blowers, HEPA filters, stack monitors, etc.

Many safety-related deficiencies at WERF will be corrected as part of the long-term modifications to the facility. These corrective actions will constitute a significant part of the construction cost of modifying WERF. It will not be practical, however, to correct all noncompliances. Some noncompliances are expected to be intimately related to the building structure and utilities. Major ripouts could be required and would not be an efficient use of funds. Thus, even the Modified WERF will be expected to retain certain noncompliances.

Risk to Workers and to the Public—The current WERF SAR cannot be used with confidence to project radiological and nonradiological doses to the workers and the public from accident scenarios. However, engineering judgment, based on review of the WERF SAR, other INEL SARs, and waste characteristics and treatment processes, can be used to project ROM risks.

Compared with treatment in the MLLWTF maximum-treatment option, treatment in the modify-WERF alternative will require DOE to accept a slightly higher level of risk to workers and to the public. The principal factors tending to increase the risk (relative to that of MLLWTF) are (a) the expectation of more frequent incidents impacting the workers, and (b) operation with known safety-related noncompliances.

The radiological and nonradiological doses to the public, both chronic and accidental, are expected to be within allowable limits. The change in treatment risk to the public, relative to that from MLLWTF, will be small.

For some accident scenarios, the doses to workers could be significant.

Conclusions—The modify-WERF alternative will comply with most, but not all, safety and health requirements. The residual noncompliances will slightly increase the treatment risk to workers and to the public, relative to that for the MLLWTF maximum-treatment option.

10.4.1.3 Modify and Operate PREPP.

Background—As discussed in Section 5, PREPP was constructed in the mid-1980s. PREPP is a building situated inside a larger structure (TAN-607), dating from the early 1960s. The utility supplies for PREPP are part of the TAN-607 utility system. The utilities typically date from the same early time period. In addition, TAN-607 houses several other activities, including water-basin storage of spent nuclear fuel and core debris from the Three Mile Island (reactor), Unit 2 (TMI-2) reactor core.

Need for an SAR—A compliant, draft preliminary SAR² exists for PREPP, based on the previous mission of the facility. Major revisions will be required to the SAR to address the long-term modifications to the facility.

Compliance with DOE Order 6430.1A—Because of (a) the collocation situation in TAN-607 and (b) the lack of strict application of the safety design criteria of DOE Order 6430.1A during design, PREPP has many noncompliances. Some noncompliances are readily correctable and will be addressed during any future PREPP upgrades. Other noncompliances are more difficult to correct. In many cases, the corrective-action trail will lead outside PREPP and into interconnected parts of TAN-607 (by utilities, potential release paths, etc.).

The principal noncompliances of PREPP with the safety-related criteria of DOE Order 6430.1A are discussed briefly below, based on initial evaluations in the unissued preliminary SAR.

- Both TAN-607 and PREPP were designed to the earthquake criteria of the UBC, rather than to the criteria cited in DOE Order 6430.1A. Some PREPP structural components and numerous TAN-607 structural components will be overstressed in the DBE.
- The TAN-607 fire-water system and potable-water systems are the same system.
- PREPP has no fire-rated partitions, so the entire facility is considered as one fire area in accident evaluations.
- No fire-detection system exists in the waste feed enclosure.
- Safety class systems and components in PREPP were not necessarily designed to higher class standards and codes, as required.
- Process system integrity is not maintained for all DBAs.
- The criteria in DOE Order 6430.1A require both primary and secondary confinement barriers for radioactive solid waste facilities. Portions of PREPP do not comply. In addition, portions of PREPP are partially exhausted through the building ventilation system, rather than through the process offgas system as required.

- Primary confinement is not maintained for all DBAs. The secondary confinement cannot withstand, and remain functional for, all DBAs, including a DBE.
- The capability of the primary confinement barrier to provide adequate protection to the workers under accident conditions is not ensured.
- The PREPP offgas system was designed to the seismic criteria of the UBC, rather than to the criteria cited in DOE Order 6430.1A.
- No means currently exist to purge gas to the incinerator in the event of total offgas failure during incineration. Pyrolysis gases could accumulate in the kiln and form an explosive mixture.
- No fire sprinkler coverage exists in the kiln room or the drum fill enclosure. The sprinkler coverage in the feed enclosure is manual.
- Process confinement systems must have automatic and redundant fire-detection systems. PREPP does not comply.
- PREPP does not have the required redundancy in makeup water supply to the surge recycle tank.
- Because of the ventilation system design, a drum breach in the shipping and receiving area could lead to contamination spread throughout the facility by means of the air-supply system.
- Compliance with the requirement for redundant safety-class electrical systems to be physically separated is not practical in parts of the building.
- PREPP does not have safety class protection, instrumentation, and control systems.

Other Potential Safety and Health Problem Areas—Many PREPP components had startup problems that were not resolved before the shutdown of the project. In addition, as PREPP continues to be idle, many components will gradually degrade or become obsolete.

A recent visit to PREPP and a recent electrical safety inspection of TAN indicated numerous other safety concerns.

- Utilities are a general problem at PREPP. Numerous noncompliances exist with the applicable codes and standards. These deficiencies increase the likelihood of incidents and affect the adequacy of emergency utility support.
- The ventilation system and offgas system (including seals) have numerous problems that could affect the capability to adequately maintain confinement in normal and accident situations.

- In several areas, the capability of the fire-protection system to perform as required is questionable.
- The incinerator flameout-protection system has several single-failure mechanisms, which increase the likelihood of an explosion.
- The control room wiring panel is potentially a major single-point failure, impacting all control room safety functions.
- The maintenance access problems at PREPP raise questions as to whether safety systems difficult to access will be adequately maintained.

Many safety-related deficiencies at PREPP will be corrected as part of the long-term modifications to the facility. These corrective actions will constitute a significant part of the construction cost of modifying PREPP. It will not be practical, however, to correct all noncompliances. Many noncompliances are intimately related to the building structure and utilities, even impacting other parts of TAN-607. Major ripouts will be required and will not be an efficient use of funds. Thus, even the modified PREPP will retain certain noncompliances.

Risk to Workers and to the Public—The draft preliminary SAR for PREPP projected radiological and nonradiological doses to the workers and the public from accident scenarios. The calculations were based on treating TRU waste. These results can be qualitatively scaled to give a ROM estimate covering treatment of mixed waste and LLW.

Compared with treatment in the MLLWTF maximum-treatment option, treatment in the modify-PREPP alternative will require DOE to accept a slightly higher level of risk to workers and to the public. The principal factors tending to increase the risk (relative to that of MLLWTF) are (a) the expectation of more frequent incidents impacting workers and (b) operation with known safety-related noncompliances.

For treatment of mixed waste and LLW, the radiological and nonradiological doses to the public, both chronic and accidental, are expected to be within allowable limits. The change in treatment risk to the public, relative to that from MLLWTF, will be small.

For some accident scenarios, the doses to workers could be significant.

Conclusions—The modify-PREPP alternative will comply with most, but not all, safety and health requirements. The residual noncompliances will increase slightly the treatment risk to workers and to the public, relative to that for MLLWTF maximum treatment option.

10.4.1.4 Generator Treatment.

Background—In this alternative, waste treatment capabilities will be added at two or more site facilities.

Two new treatment areas are assumed to be fairly substantial in scope, approaching a smaller version of WERF without an incinerator. The other potential treatment areas are assumed to be minor, involving only waste packaging, plus one small unit process, at the most.

The waste treatment areas will present a diverse picture. Some will be in new facilities or in new additions to existing facilities. Others will be located within existing facilities.

Need for an SAR—Minor SARs, or revisions to existing SARs, will be required for each generator's treatment processes.

Compliance with Safety-Related Criteria of DOE Order 6430.1A—The new treatment facilities are expected to be designed in accordance with the safety-related criteria in DOE Order 6430.1A. Treatment areas established in existing buildings will, in some cases, not comply with some requirements. Compliance with some requirements relating to redundancy of utilities, building structural capabilities, etc., will likely not be feasible.

Other Potential Safety and Health Problem Areas—This alternative will result in the creation of several waste treatment units around the site. The proliferation of treatment units could present some administrative challenges to maintaining a high level of compliance. Ensuring compliance and procedural control at small, dispersed treatment units will be more difficult than at a larger, centralized facility having specialized staff. In some cases, the smaller units will be staffed by operators who deal with waste treatment only part-time and might not be fully informed on the safety requirements.

Another administrative problem (which was mentioned by a waste generator) is that, at the dispersed facilities, other activities can divert treatment operators away from their waste-treatment responsibilities. An example is outage periods at reactors, which may require support from all personnel. In spite of good intentions, the conflict of missions will always exist, and waste treatment will likely be second in priority.

The physical noncompliances expected in the dispersed waste treatment areas relate, in part, to the age of the facilities. Inspections have shown that many older INEL facilities have numerous noncompliances with the National Electrical Code and other standards. The general types of physical problems identified at WERF and PREPP can be expected at the older generator facilities that will become treatment areas in this alternative. The extent of the problem will vary from one generator to another, depending on the age of the facility, the attention paid to compliance in recent years, and the rigor with which the treatment area will be designed.

New waste treatment facilities at generators will comply with all safety requirements.

Many safety-related deficiencies at older waste-generator facilities will be corrected as part of the modifications to the facility. These corrective actions could constitute a significant part of the construction cost of this alternative. It will not be practical, however, to correct all noncompliances. Many noncompliances are intimately related to utilities and building structures and will be difficult and costly to correct.

Risk to Workers and to the Public—The generator facility SARs do not address waste treatment of the type discussed here, nor do the SARs assess facility compliance with DOE Order 6430.1A. Therefore, the SARs could not be used to project with confidence the radiological and nonradiological doses to the workers and the public from waste-treatment accident scenarios. However, engineering judgment, based on review of several other INEL SARs and on the waste characteristics and treatment processes, can be used to project ROM risks from generator treatment.

The risk from generator treatment is expected to be of the same ROM as that from MLLWTF maximum-treatment option. One factor tending to reduce the risk of generator treatment (relative to that of MLLWTF) is the absence of incineration. Another positive factor is the reduced amount of waste that will be treated. Another positive effect is that making the generator responsible for waste treatment can be an extremely effective waste-minimization technique. The volume of waste generated will be expected to decline, compared with that for the other alternatives. The reduction in waste generation, in turn, will tend to further reduce the risk from treating the waste. In addition, the inventory of waste in any one location will be reduced.

On the other hand, the primary factors tending to increase the risk of generator treatment (relative to MLLWTF) are (a) the potential for more frequent incidents (due to numerous small treatment units with less administrative control), and (b) operation with known safety-related noncompliances.

The radiological and nonradiological doses to the public, both chronic and accidental, from generator treatment will be expected to be within allowable limits. The change in risk to the public, relative to that from MLLWTF, will be small.

For some accident scenarios, the doses to workers could be significant.

Conclusions—The generator treatment alternative will be expected to comply with most, but not all, safety and health requirements. The treatment risk to workers and to the public will be expected to be of the same ROM as that for the MLLWTF maximum-treatment option. Several factors will tend to increase the risk, and several will tend to decrease the risk.

10.4.1.5 Off-Site Treatment.

Background—In this alternative, the INEL mixed waste requiring treatment will be shipped offsite for treatment. The treated waste will then be returned to the INEL for disposal.

Need for an SAR—No SAR will be needed for onsite waste treatment facilities, other than for the two small facilities already planned for treating lead and sodium waste. The offsite treatment facility will have prepared an SAR to satisfy NRC requirements.

Compliance with Safety-Related Criteria of DOE Order 6430.1A—Since the offsite treatment facility is assumed to be a non-DOE facility, that facility will not be required to comply with the DOE Orders. The facility will be required to comply with the regulations of the NRC, OSHA, and EPA, or the corresponding State agencies.

Since the waste product will be returned to the INEL for disposal, its management after treatment and reshipment will be subject to the DOE Orders.

Other Potential Safety and Health Problem Areas—Current (onsite) shipments of INEL LLW do not comply with all requirements in DOE-ID Order 5480.3. However, an assumption is made that, by the time period modeled in this study, all shipments will be conducted in accordance with the requirements.

Risk to Workers and to the Public—The treatment risk to the workers and the public from treatment of the waste at an offsite location will be expected to be the same ROM as that from treatment in the MLLWTF minimum-treatment option.

Conclusions—This alternative will transfer the risk associated with waste treatment from the operators of the onsite treatment facility to the operators of the offsite treatment facility (and the transport vehicle drivers and public along the shipping route).

10.4.1.6 IWPF.

Background—In this alternative, the mixed waste requiring treatment will be treated in the proposed IWPF. The IWPF is intended for treatment of waste that is TRU or slightly TRU-contaminated, whether or not the waste is also hazardous per RCRA.

Need for an SAR—This alternative will not require a new SAR. The SAR for the IWPF will be planned to address the mixed waste and the LLW.

Compliance with Safety-Related Criteria of DOE Order 6430.1A—Because it will be a new facility, the IWPF is expected to be designed and constructed in accordance with the requirements of DOE Order 6430.1A.

Other Safety and Health Problems—The IWPF will provide fully adequate protection of the workers and the public during treatment of the waste.

Risk to Workers and to the Public—The risk from treating mixed waste in the IWPF will be the same ROM as that from treating the same waste in the MLLWTF minimum-treatment option. Both facilities will be designed in accordance with all safety requirements applicable to their respective missions.

A factor tending to increase the risk for the mixed waste in the IWPF is the possibility that accident scenarios involving TRU waste could propagate into the mixed waste. That factor will be balanced, however, by the increased waste confinement at the IWPF due to requirements related to processing TRU waste.

Conclusions—The IWPF alternative will comply with all safety and health requirements. The treatment risk due to this alternative will be expected to be approximately the same as that for MLLWTF minimum-treatment option because of the fully compliant safety design of the facility.

10.4.1.7 Combinations of Alternatives. The safety, health, and risk implications of treatment for combinations of alternatives will generally correspond to the safety, health, and risk implications of the individual contributing alternatives.

For brevity, the four combinations selected for study are not evaluated here in detail. The conclusions for the combinations of alternatives are given in the summary charts and discussion in Section 10.5.

10.4.1.8 No-Action Alternative.

Background—If the no-action alternative were implemented, the mixed waste and LLW would not undergo treatment.

LLW satisfying the WAC of the MLLWDF will be disposed of without treatment. Mixed waste will be placed into indefinite storage.

Need for an SAR—Because no waste treatment will take place, no SAR will be prepared covering treatment. An SAR will be needed for the waste storage facility.

Compliance with Safety-Related Criteria of DOE Order 6430.1A—Not applicable for waste treatment in this alternative.

Other Potential Safety and Health Problem Areas—None were identified.

Risk to Workers and to the Public—Not applicable for waste in this alternative.

Conclusions—Since this alternative does not involve waste treatment, there is no treatment risk.

10.4.2 Offsite Shipment

Only the offsite treatment alternative includes offsite shipment of waste.

Shipment of the waste to the treatment facility, and the products back to the INEL, will be conducted in accordance with the packaging and transport regulations of NRC, EPA, and DOT, as well as DOE and DOE-ID Orders 5480.3. Nevertheless, offsite shipment will involve a residual risk of accidental releases during shipment. The risk will be small, but the publicity accompanying even a minor incident would be unfavorable. In addition, the public located along the shipping route and the drivers of vehicles carrying waste shipments will receive small routine exposures to radiation during shipment. The exposures are not expected to exceed the regulatory limits.

10.4.3 Storage

For each treatment alternative, Section 5 gives the waste volume stored.

Some storage space is for the purpose of lag storage before, during, or after treatment operations. All alternatives except the no-action alternative require lag storage. The lag-storage volumes are small, however, compared with the approximately 9600 to 11,800 m³ of mixed waste that

would accumulate in indefinite storage over 25 yr in the modify-WERF, generator treatment, and no-action alternatives. Those three alternatives do not provide sufficient treatment capability to treat all mixed waste. Thus, the major discriminator here is between alternatives that store large volumes of mixed waste indefinitely and alternatives that do not.

All indefinite-storage facilities would be new facilities, designed in accordance with the safety-related criteria in DOE Order 6430.1A. Nevertheless, mixed waste stored indefinitely aboveground at the INEL presents a greater risk to workers and the public than does the same waste after disposal for several reasons. First, the disposed mixed waste will have been treated to destroy the chemical hazards and/or to stabilize it. In potential release scenarios, the stabilization would reduce the release fraction of the radionuclides and any remaining chemically hazardous substances in the waste. Second, waste that has been treated and disposed of is much less vulnerable to fires, explosions, and mechanical accidents than is waste that is stored indefinitely aboveground. Third, stored mixed waste must be inspected weekly, per RCRA regulations. The inspectors and other workers are subject to routine radiation exposure, and these exposures will continue to occur indefinitely.

Some opposing factors would tend to slightly increase the risk from disposed of waste versus stored waste (e.g., the possibility of a container failure/groundwater leaching scenario). However, performance assessments indicate that the increased postdisposal risk from scenarios like this is extremely small. Thus, on balance, the risk is expected to increase as the volume of waste stored increases. The three alternatives requiring indefinite storage of large volumes of mixed waste would present the largest storage/disposal risk.

10.4.4 Postdisposal

The fraction of the disposed waste that will have been treated varies from 0% for the no-action alternative to about 73% for the MLLWTF maximum-treatment option.

Some types of treatment destroy chemical hazards and/or result in less mobility for the disposed of waste. For instance, incineration followed by immobilization of the ash significantly reduces the risk of the postdisposal waste product. Other types of treatment (e.g., size-reduction or compaction) do not significantly affect the postdisposal mobility and risk.

The MLLWTF maximum-treatment option, modify-WERF (and combinations thereof), and modify-PREPP alternatives would treat the highest percentage of waste that is disposed of. The no-action alternative would treat the smallest percentage, followed by the IWPF, offsite treatment, and MLLWTF minimum-treatment alternatives.

10.5 Overall Conclusions

10.5.1 "Musts"

One of the "musts" listed in Table 6-1 applies to this section:

- Present acceptable risk to the workers, the public, and the environment.

The conclusion of this overview evaluation is that, for each of the alternatives, the risk will be within the allowable dose versus frequency guidelines of DOE Order 6430.1A and other documents cited therein. Thus, all alternatives would satisfy this requirement.

The conclusion is based on the assumption that the facilities are designed in accordance with the requirements cited in Section 10.2, with the exceptions for existing facilities as noted in Section 10.4.1. Also, an assumption is made that the facilities are operated in accordance with requirements found in the same requirements sources (e.g., DOE Orders 5481.1B, 5480.5, 5400.5, 5480.11).

10.5.2 "Wants"

Two of the "wants" listed in Table 6-1 apply to this section:

- Minimize risk to the workers, the public, and the environment.
- Minimize noncompliances with the safety-related criteria of DOE Order 6430.1A and consensus national standards.

The subjective evaluation of performance on these two "wants" is as follows in Table 10-1. (A score of 10 is assigned to the best-performing alternative. Lesser scores as judged appropriate, down to zero, are assigned to the other alternatives.)

The rationale for these scores is as follows. Reference is made to the discussion in Section 10.4. Reference is also made to the detailed data in Section 5 on the waste volumes treated, shipped, stored, and disposed of for each alternative, which were used heavily in assigning the scores.

The "minimize risk" scores of the offsite treatment alternative and combinations thereof were reduced by three points because of the shipping risk. The scores of the no-action, generator treatment, and modify-WERF alternatives were reduced by 5, 4, and 3 points, respectively, due to the risks of indefinite storage for their respective volumes of mixed waste. Based on the beneficial effect of waste treatment on postdisposal risk, the scores were increased three points for the modify-WERF (and combinations thereof), modify-PREPP, and MLLWTF maximum-treatment alternatives. Scores were reduced two points for the offsite treatment, IWPF, and MLLWTF minimum-treatment alternatives; three points for the no-action alternative; and not adjusted for the remaining alternatives. For treatment risk, two factors were used: the relative volume of waste processed and the relative safety of the facility itself. Three points were subtracted from the scores of the MLLWTF maximum-treatment, modify-WERF and its combinations, and modify-PREPP alternatives because they treat the most waste. One point was subtracted from the scores of the generator-treatment alternative and its combinations, which treat smaller volumes of waste. One point was also subtracted from the scores of minimum-treatment MLLWTF, offsite treatment, and IWPF. For the facility safety deficiencies, four points were subtracted from the scores of the modify-WERF (and combinations thereof) and modify-PREPP alternatives. Two points were subtracted from the generator treatment alternative and its combinations. The results of all this adding and subtracting to initial scores of 10 for each alternative led to the results in the table.

Table 10-1. Subjective evaluation of performance on applicable "wants."

Alternative	Minimize risk	Minimize noncompliances with safety-related criteria of DOE Order 6430.1A
MLLWTF		
Maximum treatment	10	10
Minimum treatment	7	10
Modify WERF	3	6
Modify PREPP	6	6
Generator	3	8
Offsite	4	10
IWPF	7	10
Combinations		
WERF/offsite	3	6
WERF/IWPF	6	6
Generator/offsite	4	8
Generator/IWPF	7	8
No action	2	10

For the "want" involving noncompliance with safety-related DOE Orders and standards, the scores were reduced to 6 for the modify-PREPP and modify-WERF alternatives because of residual noncompliances of the facility with safety-related requirements of DOE Order 6430.1A. The score of the generator alternative was reduced to 8 because of lesser noncompliances. For the combinations of alternatives, the same noncompliances of the constituent alternatives will remain.

10.6 References

1. A. M. Bochmer, *Safety Analysis for the Waste Experimental Reduction Facility*, WM-F1-81-026, Rev. 7, February 1987.
2. C. H. Cargo and D. A. Reny, *Preliminary Safety Analysis for the Process Experimental Pilot Plant (Draft)*, WM-PD-90-013, November 1990.

11. INSTITUTIONAL EVALUATIONS

11.1 Introduction

Selection and implementation of an alternative for long-term treatment of INEL mixed and LLW would involve interfacing with various high-level institutions. Ideally, the selected alternative would minimize potential interfacing problems. The purpose of this section is to identify institutional issues that could negatively impact the implementation of a treatment alternative and to compare each treatment alternative on the basis of potential institutional problems.

An institution is defined as an organization or an establishment devoted to the promotion of a particular purpose. An institutional issue is defined as a point, matter, or dispute, the outcome of which is of special importance to an institution.

The institutions discussed in these evaluations are considered to be "stakeholders" because they would have an interest in, and would be involved with, the implementation of a particular treatment alternative. The evaluations in this section relate to interfaces with the following high-level institutions:

- EPA Region 10
- State of Idaho
- Local citizen groups
- Indian tribes
- Other states
- Local labor unions
- Environmental groups.

Although the listed institutions include regulatory agencies, the intent of this section is not to discuss regulators and compliance issues. Regulatory compliance issues are addressed in Section 9.

It is difficult to assess all the potential institutional issues that could be a problem in the future. Therefore, these evaluations are only preliminary observations based on engineering judgment and on interviews with experienced individuals, and are not provable conclusions.

11.2 Criteria

Few regulatory requirements relate to the interface between high-level institutions. Nevertheless, potential interfacing problems can significantly impact the implementation of an alternative.

Institutional issues of two types could arise. One type includes the issues of the "mechanics" category. These issues could impact the implementation of an alternative because an institution might not have the ability, procedures, or resources to deal with the potential impacts (e.g., inadequate personnel for reviewing permit applications). No major issues of this type are expected. They are therefore not considered further.

The other type of issues relates to the emotional and political aspects of implementing an alternative. These "acceptance" issues could impact the implementation of an alternative because of an overall dislike of a treatment alternative and the resulting impacts (e.g., opposition to incinerators).

11.3 Evaluations of Alternatives Against Criteria

Table 11-1 summarizes the institutional interface-related observations that can be made, based on the criteria in Section 11.2. The marked interfaces indicate the potential for a negative impact on the implementation of a treatment alternative due to institutional issues related to acceptance. The interfaces not marked indicate no potential negative impact.

11.3.1 Construct and Operate MLLWTF

Potential institutional issues associated with implementation of the MLLWTF, maximum treatment alternative relate to lack of acceptance by several high-level institutions. The State of Idaho, local citizens groups, Indian tribes, and environmental groups may not readily accept construction and operation of a new incinerator designed to treat mixed waste and LLW. All parties might be concerned with the potential environmental impacts due to operating an incinerator. They might also assume that a new facility with excess treatment capacity could be used to treat waste brought in from other DOE sites, making Idaho a "national DOE waste treatment center."

Indian tribes could be concerned with construction in previously undisturbed areas and the potential to disturb sacred lands. This discussion of Indian tribes applies to all other alternatives requiring construction of new facilities in previously undisturbed areas.

Potential issues associated with the MLLWTF, minimum treatment alternative include those discussed for the maximum treatment alternative. However, additional issues can be expected to develop with State, local, tribal, and environmental groups because LLW would be disposed of without treatment. Treatment without disposal could be viewed negatively because it could increase the potential for adverse environmental impacts.

11.3.2 Modify WERF

Potential issues associated with implementation of the modify WERF alternative relate to lack of acceptance by several high-level institutions. The State of Idaho, local citizens groups, Indian tribes, and environmental groups might not accept indefinite storage of radioactive mixed wastes due to potential environmental impacts.

Construction of a new storage facility and indefinite storage of mixed waste might not be acceptable to Indian tribes. The discussion of Indian tribes (under the MLLWTF alternative) applies identically to the WERF alternative.

Table 11-1. Institutional interface-related observations for treatment of INEL mixed waste and LLW.

Alternative	State of Idaho	Local citizens groups	Indian tribes	EPA Region 10	DOT	Other states	Local labor unions	Environmental groups
MLLWTF	X	X	X	—	—	—	—	X
Modify WERF	X	X	X	—	—	—	—	X
Modify PREPP	X	X	X	—	—	—	—	X
Generator treatment	X	X	X	—	—	—	—	X
Offsite treatment	X	X	X	—	X (minor)	X	X	X
IWPF	X	X	X	—	—	—	—	X
WERF and offsite	X	X	X	—	X (minor)	X	X	X
WERF and IWPF	X	X	X	—	—	—	—	X
Generator and offsite	X	X	X	—	X (minor)	X	X	X
Generator and IWPF	X	X	X	—	—	—	—	X
No action	X	X	X	X	—	—	—	X

X = Institutional issues negatively impacting an alternative due to potential difficulties with "acceptance."

11.3.3 Modify PREPP

Modification and restart of PREPP could raise issues with State, local, tribal, and environmental groups primarily concerned with protection of the environment. Issues associated with restart of PREPP would be similar to those associated with the MLLWTF.

Issues pertaining to new construction would not be applicable to PREPP because it is an existing facility.

11.3.4 Generator Treatment

Potential institutional issues associated with implementation of the generator treatment alternative relate to lack of acceptance by State, local, tribal, and environmental groups. Permitting and operation of a mobile treatment unit for the D&D-generated waste could be unacceptable to all parties.

The discussion of institutional issues relating to construction of a new MWSF at the INEL discussed above under the WERF alternative applies identically to generator treatment.

11.3.5 Offsite Treatment

The institutional issues associated with the offsite treatment alternative are expected to be among the most extensive for the treatment alternatives. Shipment of mixed waste and LLW offsite could raise issue with most high-level institutions.

This alternative could receive considerable criticism by State, local, tribal, and environmental groups. Transportation of radioactive waste is often perceived as dangerous due to a lack of accurate information and an abundance of misinformation available to the public. DOE public affairs organizations would be necessary in the State of Idaho and other states along the transportation route to address transportation issues.

Transportation of mixed waste and LLW across Indian lands could create institutional problems. Indian tribes might be concerned with the potential environmental, health, and safety risks of transporting these wastes to an offsite treatment facility. Transportation-related tribal concerns will need to be addressed and cooperative agreements established.

Institutional issues involving local labor unions could potentially disrupt implementation of the offsite alternative. Shipping wastes offsite for treatment would reduce the INEL labor force currently involved in waste treatment. This labor force reduction could cause union grievances.

Shipment of mixed waste will require interface with the DOT to ensure conformance to packaging and shipping requirements. Minor institutional issues could be expected; however, no insurmountable problems are anticipated.

11.3.6 IWPF

Institutional issues associated with the IWPF will be addressed by the IWPF project. Institutional issues associated with the IWPF will be similar to those associated with the MLLWTF. However, the disruptions are expected to be greater for the IWPF than for the MLLWTF because it is intended for treatment of TRU waste or slightly TRU-contaminated waste.

Institutional issues could also result from treating the mixed waste at the IWPF facility. Adding the mixed waste to the IWPF waste streams could potentially contaminate the mixed waste with TRU radionuclides, making disposal more difficult.

Although the IWPF could receive considerable criticism by State, local, tribal, and environmental groups, this alternative would essentially eliminate dual institutional issues resulting from the two waste-treatment projects.

11.3.7 Combinations

The institutional issues expected in implementing the selected combinations of alternatives would generally correspond to the institutional issues associated with the individual contributing alternatives. However, the combined alternatives remove the institutional issues associated with the need for indefinite storage of mixed wastes, as required under the WERF and generator treatment alternatives.

For brevity, the four combinations selected for study are not evaluated here in detail. The conclusions for the combinations of alternatives are given in Section 11.4.

11.3.8 No Action

Potential institutional issues associated with the no-action treatment alternative would be expected to be the greatest among the treatment alternatives. The State of Idaho, EPA Region 10, local citizens groups, Indian tribes, and environmental groups are not likely to accept a position of "no action" and no waste treatment at the INEL. These parties are likely to feel that the Federal government is responsible for producing the waste and, therefore, should assume full responsibility for adequate and safe treatment and disposal.

Under this alternative, no treatment capability will be available for mixed or LLW at the INEL. It is unlikely that the State of Idaho will allow indefinite storage of mixed wastes. Therefore, selection of this alternative could potentially shut down certain INEL waste generators.

11.4 Overall Conclusions

11.4.1 "Musts"

One of the "musts" listed in Table 6-1 applies to this section:

- Present no insurmountable institutional problems.

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The conclusion of this overview evaluation is that the no-action alternative would present insurmountable institutional problems. Treatment capability for mixed and LLW would not be present under this alternative, requiring indefinite storage of these wastes. The institutional issues associated with the lack of DOE responsibility for treating its wastes are expected to be insurmountable. This alternative fails this "must" criterion. All other alternatives would satisfy this requirement.

11.4.2 "Wants"

One of the "wants" listed in Table 6-1 applies to this section:

- Minimize potential institutional problems.

The subjective evaluation of performance on these "wants" is as follows in Table 11-2. (A score of 10 is assigned to the best-performing alternative. Lesser scores as appropriate, down to zero, are assigned to the other alternatives.)

Table 11-2. Subjective evaluation of performance on applicable "wants."

<u>Alternative</u>	<u>Minimize Potential Institutional Problems</u>
MLLWTF	
Maximum treatment	9
Minimum treatment	8
Modify WERF	5
Modify PREPP	10
Generator	5
Offsite	7
IWPF	8
Combinations	
WERF/offsite	6
WERF/IWPF	7
Generator/offsite	6
Generator/IWPF	7
No action	0

The rationale for these scores, by reference to Table 11-1, is as follows:

The score of the modify PREPP alternative was left at 10 because its institutional issues were judged to be the smallest.

The score for the MLLWTF, maximum-treatment alternative was reduced to 9 because of the potential for institutional problems associated with construction of a new treatment facility and operation of an incinerator for mixed waste and LLW. The score for the MLLWTF, minimum-treatment alternative was reduced to 8 because of the potential for the same problems as discussed under the maximum-treatment case and because of issues relating to direct disposal of LLW.

The score of the modify-WERF alternative was reduced to 5 because of the issues associated with the indefinite storage of mixed wastes and operation of an incinerator for mixed waste and LLW wastes.

The score of the generator treatment alternative was reduced to 5 because of the anticipated opposition to long-term storage of mixed wastes and operation of a mobile treatment unit for the D&D-generated waste.

The score of the offsite alternative was reduced to 7 because of the number of interfaces and issues involved with shipping radioactive and mixed wastes across several states.

The score of the IWPF alternative was reduced to 8 because of the potential problems associated with construction of a new treatment facility and operation of an incinerator for TRU mixed waste and TRU-contaminated waste and because of the potential for contaminating LLW with TRUs. However, consideration was given to the elimination of dual institutional issues resulting from the two waste treatment projects.

The scores of the combinations of alternatives were reduced according to the strengths and weaknesses of their constituent parts. However, the combined alternatives remove the need for indefinite storage of mixed wastes, decreasing the potential for related institutional issues.

The no-action alternative involves insurmountable institutional issues associated with indefinite storage of INEL mixed waste and LLW and was rated the lowest of the alternatives (a zero).

12. SCHEDULE EVALUATIONS

12.1 Introduction

This section identifies the requirements and criteria affecting the schedule for each alternative. Alternatives are compared on the basis of the date when operations are expected to start, as well as uncertainties in those dates. It is noted that implementation of a treatment alternative would involve integration of the compliance documentation with design, construction, and operation phases of the project. This section includes timelines for each treatment alternative that include the anticipated dates for the various stages of design and construction, as integrated with NEPA, siting, permitting, and safety analysis processes.

12.2 Requirements and Criteria

The major requirements and criteria that relate to schedule development for DOE programs and projects are found in several DOE Orders and Federal and State regulations. The requirements prohibit certain design, construction, and startup activities from proceeding until certain regulatory steps have been completed, as discussed below.

DOE Orders 4700.1 and 6430.1A require that safety and environmental protection be considered in program planning and in the acquisition of projects. Specifically, these orders require that a preliminary safety analysis report (PSAR) be initiated during the conceptual design phase of a project and further developed during preliminary (Title I) design and detailed (Title II) design phases. The PSAR must be completed and approved prior to the start of construction. The final safety analysis report (FSAR) must be completed and approved prior to the initiation of facility operations.

In order to meet the requirements of DOE Order 5440.1D, DOE Order 4700.1, and the appropriate implementing DOE-ID Orders, the environmental effects of all proposed Federal actions must be identified and assessed in the early planning stages of a project. NEPA approval is required before resources are unalterably committed and before work commences to implement the proposed action. This generally means that NEPA document approval should occur prior to Title II design.

No physical construction of a new RCRA facility at the INEL will begin without having a RCRA permit, and no facility modification can be made before the modified permit is approved. Detailed design information is required for the RCRA Part B permit application. The new or modified permit application must therefore be submitted during the Title II design phase.

State of Idaho regulations require that a PTC be obtained prior to construction or modification of any stationary source, major facility, or major modification. In order to perform the analysis for a PTC/PSD permit, some Title II design parameters would be required. The analysis could be performed as soon as Title II design is approved or as soon as the needed Title II design parameters are bounded.

Construction or modification of an emissions source of radionuclides may not commence until either a NESHAP approval to construct has been issued by the EPA, or the application meets all the

NESHAP requirements and an approval to construct is not required. NESHAP documentation preparation could start as soon as the specified Title II design parameters are complete or as soon as the needed Title II design parameters are bounded. The NESHAP analysis must be submitted to the State of Idaho, along with the PTC/PSD application. This means the NESHAP analysis must be approved in time to obtain the Idaho PTC/PSD.

For most projects of this magnitude, the critical path on the schedule would thus include (a) the NEPA process, (b) the NESHAP/PTC/PSD process, (c) the RCRA/TSCA permitting process, and (4) the process for obtaining line item funding. Thus, the traditional design, construction, and startup steps constitute only part of the critical path.

12.3 Evaluations of Alternatives Against Requirements/Criteria

Based on the foregoing discussion of requirements, schedules for the waste treatment alternatives were developed and are shown in Figure 12-1. The waste treatment alternatives were then evaluated on an overview basis to determine which alternative would begin production operations in the least amount of time and present the least amount of uncertainty.

Surveys of EDFs, project BUD, environmental compliance plans, and interviews with project management, permitting, and facility experts provide the basis for the dates and information relating to specific treatment alternatives.

12.3.1 Construct and Operate the MLLWTF

The MLLWTF alternative is used as the baseline against which other alternatives are compared. The discussion below applies to both the minimum and maximum treatment options.

MLLWTF operations are estimated to begin at the end of fiscal year (FY) 2003 (Figure 12-1a). The estimated time for preconceptual studies, design and construction activities, and technology verification is based on project management knowledge of current studies and projections of future activities, derived from experience and engineering judgment.

The rationale behind the estimated time for preparation and approval of NEPA documentation is based on the activity schedule for the INEL ER&WM EIS. Site selection is dependent on this same schedule. Preliminary siting activities are necessary to determine candidate sites for evaluation in the draft EIS. The preferred site would be determined by the end of the NEPA process. This discussion of NEPA applies to all alternatives and is not discussed again.

Permitting and SAR timelines are based on requirements discussed in Section 12.2, interviews with the permit coordinators, SAR preparation and review experience, and project management experience.

Uncertainty is associated with the MLLWTF schedule due to dependence on the INEL ER&WM EIS. Because the MLLWTF tiered EIS depends on the INEL ER&WM EIS, slippage in

Figure 12-1a.

Figure 12-1b.

Figure 12-1c.

Figure 12-1d.

Figure 12-1e.

Figure 12-1f.

Figure 12-19.

Figure 12-1h.

Figure 12-11.

Figure 12-1j.

[illegible]

the baseline EIS would impact the schedule for start of MLLWTF Title II design. A delay in the start of Title II design would delay the permitting processes and potentially the start of construction.

Uncertainty is associated with the initial date shown on the MLLWTF schedule. The schedule assumes that a decision on proceeding with the conceptual design of the MLLWTF will be made by July 1992. A delay in this step would delay the treatment alternative schedule.

MLLWTF schedule delays may result due to the potential for change in mission or funding during the design and construction phases of the project. Schedule delays may also result due to the potential for problems encountered during the startup phase of the project. These schedule uncertainties for the MLLWTF apply identically to all onsite alternatives and will not be discussed further here.

12.3.2 Modify and Operate WERF

Operations of the modify-WERF alternative are estimated to begin at the end of FY-2001 (Figure 12-1b), 2 yr sooner than for the MLLWTF.

The timelines for preconceptual studies, design and construction activities, and technology verification are shorter than for the MLLWTF because modifications would be made to an existing, smaller facility.

The safety analysis process for the modify-WERF alternative is shorter than that for the MLLWTF because modifications to the existing SAR would be required, rather than preparation of a new analysis. The permitting processes for the modify-WERF alternative are shorter than for the MLLWTF for these same reasons.

The requirements for the storage facilities proposed under this alternative will not impact the schedule for the modify-WERF alternative. Activities associated with the storage facility are assumed to occur simultaneously with those for the treatment facility and thereafter as needed.

12.3.3 Modify and Operate PREPP

PREPP operations are estimated to begin at the end of FY-2002 (Figure 12-1c), 1 yr sooner than for the MLLWTF.

The timelines for most activities are the same for the modify PREPP alternative as for the MLLWTF because the proposed modifications are considered to be significant and would take place in a facility with limited available space.

The safety analysis timelines for the modify PREPP alternative are the same as for the MLLWTF because major revisions to the existing draft preliminary SAR would be required.

The permitting processes are estimated to be shorter for the modify PREPP alternative than for the MLLWTF. Permit coordinators indicate that because PREPP is an existing facility with interim status and existing permit documentation to build from, the processes could be shortened by approximately 1 yr.

12.3.4 Generator Treatment

Generator treatment operations are estimated to begin during FY-2001 (Figure 12-1d), approximately 2 yr sooner than for the MLLWTF.

The timelines for preconceptual studies, design and construction activities, and technology verification are shorter for the generator treatment alternative than for the MLLWTF because the proposed facilities and treatment units are simpler and smaller.

The safety analysis and permitting processes for the generator treatment alternative are shorter than for the MLLWTF because the proposed facilities and treatment units are simpler and smaller.

Although many tasks are shorter for the generator treatment alternative than for other alternatives, the operational startup date is delayed due to the time required to obtain line item funding, NEPA approval, and the necessary permits.

The requirements for the storage facilities proposed under this alternative would not impact the generator treatment schedule. Activities associated with the storage facility are assumed to occur simultaneously with those for the treatment facilities and thereafter as needed.

12.3.5 Offsite Treatment

Offsite operations are estimated to begin at the end of FY-2003 (Figure 12-1e). The estimated operational date is the same as for the MLLWTF. Although partial treatment capability may be available sooner, treatment capability for all projected INEL mixed waste streams is not expected before this date. The projected start of operations is based on informal discussions with potential vendors of mixed waste treatment services.

Uncertainties are associated with this alternative schedule. NEPA documents will be reviewed and revised as necessary every 5 yr. This requirement could create problems for this alternative, because of the 7-yr gap between the completion of the INEL NEPA process and the start of offsite operations. These uncertainties and ramifications are discussed further in Section 14.

12.3.6 IWPF

IWPF mixed waste operations are estimated to begin during FY-2005 (Figure 12-1f), 1.5 yr later than for the MLLWTF. The timelines for the IWPF were developed based on recent project planning and backup documentation for the IWPF project.

The timelines for preconceptual studies, design and construction activities, technology verification, and safety analysis reporting are longer than for the MLLWTF. The IWPF is intended for treatment of waste that is TRU or slightly TRU-contaminated. Therefore, it is subject to additional design and safety requirements and will require more time for these phases of the project.

The timeline for IWPF permitting activities is shorter than for the MLLWTF. Based on discussions with permit coordinators and guidance provided in the regulations, the schedule for these

activities is probably optimistic. Because construction cannot take place until the RCRA permit and air permits are approved, the projected operational date is also considered to be optimistic.

Uncertainties and ramifications associated with this treatment alternative are discussed further in Section 14.

12.3.7 Combinations of Alternatives

The scheduling requirements and dates expected in achieving operations for the selected combinations of alternatives will generally correspond to the requirements and dates associated with the individual contributing alternatives (Figures 12-1g to 12-1j). A given combination would carry the uncertainties of both alternatives and the operational date of the later alternative.

For brevity, the four combinations are not evaluated here in detail. The conclusions for the combinations of alternatives are given in Section 12.4.

12.3.8 No Action

Because the no-action alternative requires indefinite storage of mixed waste, the schedule shown represents construction of a storage facility. Storage facility operations are estimated to begin at the end of FY-2000 (Figure 12-1k).

12.4 Overall Conclusions

12.4.1 "Musts"

None of the "musts" listed in Table 6-1 applies to this section.

12.4.2 "Wants"

One of the "wants" listed in Table 6-1 applies to this section:

- Minimize the schedule for beginning radioactive operations.

The subjective evaluation of performance on this "want" is as follows in Table 12-1. (A score of 10 is assigned to the best-performing alternative. Lesser scores as appropriate, down to zero, are assigned to the other alternatives.)

Reductions in scores were applied to the indicated alternatives, based on which alternative is expected to achieve operations first. The degree of uncertainty associated with each treatment alternative schedule correlates with the length of schedule and was not a major factor in the ranking process.

The no-action alternative achieved operations faster than any other alternative and was given a score of 10. All other alternatives were ranked relative to the no-action alternative. The scores

for the combinations of alternatives were reduced according to the date for which the combined alternative would be fully operational.

Table 12-1. Subjective evaluation of performance on applicable "want."

<u>Alternative</u>	<u>Minimize schedule for radioactive operations</u>
MLLWTF	
Maximum treatment	7
Minimum treatment	7
Modify WERF	9
Modify PREPP	8
Generator	9
Offsite	7
IWPF	6
Combinations	
WERF/Offsite	7
WERF/IWPF	6
Generator/Offsite	7
Generator/IWPF	6
No action	10

13. COST EVALUATIONS

13.1 INTRODUCTION

This section evaluates the ROM life-cycle cost associated with each alternative. The result of the evaluation is a ranking of alternatives on the basis of cost.

Many methods are used to express the cost of a waste-treatment alternative. Not all methods include the same cost elements. The guiding principle used for this cost evaluation was to develop cost estimates that are comprehensive, fair, and on a consistent basis among the treatment alternatives. This principle was followed in determining which cost elements to include in the estimate.

The cost method chosen was the life-cycle cost of each alternative. Life-cycle cost, as defined in DOE Order 4700.1, is

The sum total of the direct, indirect, recurring, non-recurring and other related costs incurred or estimated to be incurred in the design, development, production, operation, maintenance, support and final disposition of a major system over its anticipated useful life span. Where system or project planning anticipates use of existing sites or facilities, restoration and refurbishment costs should be included.

The life-cycle cost method is the most comprehensive of cost methods.

The life-cycle costs developed are the summations of seven categories of costs:

- Project management, siting, environmental permitting, NEPA, safety analyses, technology development, and other "up front" costs.
- Design-related costs.
- Construction costs, including the building, the equipment, etc. The costs of all required facilities are included (i.e., the treatment facility and any required waste-storage facilities).
- Startup and readiness review costs.
- Operating costs—labor, materials, utilities, etc.
- Waste disposal costs, including transport to the MLLWDF. The disposal costs include all LLW and mixed waste generated at the INEL (except for that reclassified from TRU waste by IWPF), regardless of whether it goes to the treatment facility or directly to the MLLWDF.
- D&D costs of the treatment facility and any required storage facilities.

Also included in the total cost are reserves and contingency.

A few comparatively small costs that would be equal or essentially equal for all alternatives were purposely not included. An example is the costs for treatment of sodium waste and contaminated lead. Costs that are independent of the treatment alternative can be omitted without affecting the validity of the cost comparisons.

The life-cycle costs developed are useful primarily for comparing alternatives. The absolute magnitudes of the life-cycle costs are not particularly useful because of the omission of some costs that are independent of the alternative, as discussed above.

The cost estimates in this section are not of budget quality; they are considered to be of planning quality. The stage of development for all the alternatives is very early. Detailed information about the alternatives is not available. Very limited preconceptual design work has been done. Therefore, only ROM costs can be developed at present.

The costs were estimated by a team composed of personnel who represented cost estimating, process engineering, environmental compliance, and program management. The costs were based primarily on engineering judgment applied to corresponding costs that had been incurred for WERF, PREPP, SWEPP, and other similar projects and facilities. Those earlier costs were escalated to 1992 dollars and modified to reflect today's more stringent regulatory environment. In some instances, current costs were used where available from vendors, recent INEL projects, or other cost studies. The building costs were based on parametric analysis of INEL construction costs on recent projects.

In many instances, determination of equitable costs among the various alternatives was very difficult due to differing implementation schedules, differing compliance levels, and many other factors. Nevertheless, fair comparison of alternatives was the goal of the cost estimates.

13.2 REQUIREMENTS/CRITERIA

For the purposes of this study, no unique requirements related to the cost of waste-treatment alternatives were identified.

Any alternative that is implemented would have to be managed in accordance with DOE Order 4700.1, "Project Management System." Per SEN-27-90, any alternative whose total project cost is \$100 million or more would be managed as a major system acquisition, as described in DOE Order 4700.1.

The criterion used in these evaluations is to minimize life-cycle costs.

13.3 EVALUATIONS OF ALTERNATIVES AGAINST THE REQUIREMENTS/CRITERIA

13.3.1 Approach for Estimating Waste-Disposal Costs

The life-cycle costs of waste-treatment alternatives can be quite sensitive to the estimated costs of waste disposal. Some alternatives achieve more volume-reduction of the waste and thereby result in reduced disposal costs, compared with other alternatives.

Unfortunately, the calculated unit costs (\$/ft³) of LLW disposal have varied widely in many studies. Even for shallow land burial of contact-handled LLW at the RWMC, cost estimates ranging from \$1.49 to \$56/ft³ have been located.

The wide range of estimated costs arises mostly because different studies include (apportion) different portions of the fixed costs. It is important to understand which cost elements are appropriate to use in a given instance, as discussed below.

Figure 13-1 depicts a representative curve of the total disposal cost, C , as a function of the total volume of waste disposed, V . Point 1 on the figure shows that large fixed costs C_1 would be incurred even if no waste were disposed of ($V_1=0$). Examples of the fixed costs are management salaries, regulatory compliance, and maintenance work on idle equipment. Point 2 shows a total cost C_2 for disposing of total volume V_2 . If the total volume to be disposed of increases to V_3 , the total cost increases only to C_3 , due to some use of idle time of personnel, excess equipment capacity, etc.

The question arises as to how the unit cost should be calculated. If the overall efficiency of a disposal site is of interest and volume V_3 is disposed of, then C_3/V_3 is the appropriate unit cost. The expression C_3/V_3 apportions all disposal costs over each unit of waste disposed of. The expression is referred to as the apportioned unit cost or the total unit cost.

The expression C_3/V_3 also applies in comparing two disposal sites, each of which disposes of total volume V_3 .

This expression is the one most commonly used in studies of the unit costs of waste disposal. It is appropriate for comparisons such as those just discussed.

Often, however, alternatives are compared that involve disposing of different volumes of waste at an existing disposal site. This is the situation for comparing the disposal costs associated with different treatment alternatives. In these comparisons, the expression C_3/V_3 , the apportioned unit cost or total unit cost, is not appropriate.

Widely accepted methods for performing engineering economics studies (e.g., References 1 and 2) indicate why C_3/V_3 is not the appropriate expression for these comparisons. "It is always **prospective differences** between alternatives that are significant in making a choice. In a going concern, all past receipts and disbursements and many future ones will be unaffected by a particular choice. . . . Average costs per unit (sometimes called unit costs) are misleading guides to making a decision. . . . The uncritical use of average costs can lead to an unsound analysis and incorrect conclusions." In making prospective comparisons, "everything that has happened in the past is irrelevant. It is a 'sunk' cost, . . . which cannot be changed by any choice among alternatives for the future" (References 1 and 2).

The accepted method for calculating unit costs is based on the use of incremental costs, sometimes called differential costs (References 1 and 2). This method is applied to compare the disposal costs for two treatment alternatives that ship different volumes of waste to an ongoing, government-owned^a disposal facility.

First, note that the disposal facility can be assumed to exist and operate, regardless of which mixed and LLW treatment alternative is implemented. The RWMC already exists and disposes of waste. Similarly, the MLLWDF will exist and operate, regardless of which treatment alternative is

a. The rates charged by a private disposal facility are not necessarily closely related to the costs of current operations and should not be used for estimating disposal costs at government-owned facilities.

VOLCOST

Figure 13-1. Total cost of waste disposal as a function of total volume disposed of.

implemented. (For example, the MLLWDF will be disposing of the LLW and mixed LLW from IWPF, regardless of whether MLLWTF is built.) Since the choice of treatment alternative will not cause a disposal facility to be built and operated, all costs associated with establishing the disposal facility are sunk costs. Sunk costs should not be included in comparisons of alternatives.

Next, determine the total disposal volume (from all sources) and the total disposal cost if the treatment alternative producing the larger disposal volume is implemented. This situation corresponds to point 3 on the figure, with total disposal volume V_3 and total disposal cost C_3 . Determine the total disposal volume V_2 and total disposal cost C_2 if the treatment alternative producing the lesser disposal volume is implemented. This situation corresponds to point 2 on the figure.

The appropriate incremental volume associated with implementing the larger-volume alternative, rather than the smaller-volume alternative, is $V_3 - V_2$. The appropriate incremental cost is $C_3 - C_2$. The incremental unit cost of disposal, for comparing these two treatment alternatives, is $(C_3 - C_2)/(V_3 - V_2)$, not C_3/V_3 .

Note that the inappropriate method of using C_3/V_3 will give a much higher, misleading number. This is the case with the cost estimates that give results in the neighborhood of \$50/ft³ for shallow land burial. They are not appropriate for comparing the impacts of treatment alternatives on a given disposal facility. They are appropriate for comparing one disposal facility against another.

For perspective, both incremental unit costs and apportioned unit costs for disposal are given in this section, but incremental unit costs are the appropriate ones to use.

13.3.2 Results

The summarized results of the cost evaluations are presented in Tables 13-1 and 13-2. The life-cycle cost for each alternative is given, as well as the subtotals for the seven cost categories listed and for reserves and contingency.

The costs are given in two forms. One form (Table 13-2) is escalated costs (year-of-expenditure). This form is used for budget purposes although, as stated earlier, the current estimates are not of budget quality. The other form (Table 13-1) is an approximation of present-worth equivalent costs. This form allows equivalence comparisons of alternatives whose expenditures occur at different times. "Equivalence comparisons (present worth calculations) are necessary for a fair comparison of different money-time series." (Reference 1)

The present-worth equivalent costs are graphically displayed in Figure 13-2. Costs from all seven categories are included, as well as reserves and contingency. Some combinations of categories are made, resulting in only five divisions on the bar-graph. Specifically, front-end and design costs are combined, construction and startup costs are combined, operating and disposal costs are combined, and reserves and contingency are combined.

Detailed cost breakdowns are given in Appendix A.

13.3.3 Bases

The bases for the cost estimates are given in Appendix A.

Table 13-1. Summary of life-cycle costs for the treatment alternatives—present-worth equivalent costs, FY-92 M\$.

Alternative	Up-front Cost ^a	Design Cost ^b	Construction Cost	Startup Cost	Operations Cost ^c	Waste Disposal Cost		D&D Cost ^f	Reserves and Contingency		Total Cost ^g	
						Inc. ^d	App. ^e		Inc.	App.	Inc.	App.
MLLWTF												
Maximum	20	11	44	8	247	40	125	7	93	115	470	575
Minimum	20	8	31	7	258	65	150	5	102	121	497	600
WERF	16	5	93	8	212	26	111	3	88	103	450	550
PREPP	16	7	22	8	247	40	125	3	78	99	422	527
Generator	13	5	102	4	150	42	126	5	88	109	410	515
Offsite	7	0	0	0	225	69	154	0	69	94	370	480
IWPF	4	0	14	0	137	65	149	0	51	73	270	377
Combinations												
WERF/Offsite	16	5	14	6	348	43	128	3	95	124	530	644
WERF/IWPF	16	5	28	6	251	40	125	3	81	94	428	525
Generator/Offsite	14	5	18	2	277	59	144	5	89	100	470	566
Generator/IWPF	13	5	32	2	186	55	140	5	72	97	370	480
No Action	9	3	90	2	104	50	134	1	72	98	330	441

a. Project management, NEPA, environmental permitting, safety analyses, technology demonstration, etc.

b. Includes waste storage buildings, as well as treatment facility. This applies to construction, startup, operations, and D&D costs, also.

c. Twenty-five yr of operations.

d. Incremental costs (recommended disposal costs for use in this study). Includes transportation.

e. Apportioned (total) costs. Includes transportation.

f. Assumed D&D mode is total dismantlement.

g. Total may not exactly equal the sum of the parts due to round-off errors.

Table 13-2. Summary of life-cycle costs for the treatment alternatives—cost escalated to year of expenditure, M\$.

Alternative	Up-front Cost ^a	Design Cost ^b	Construction Cost	Startup Cost	Operations Cost ^c	Waste Disposal Cost		D&D Cost ^f		Reserves and Contingency		Total Cost ^g	
						Inc. ^d	App. ^e			Inc.	App.	Inc.	App.
MLLWTF													
Maximum	27	14	72	14	872	140	440	44	335	415	1520	1900	
Minimum	27	10	51	13	911	229	528	32	387	458	1660	2030	
WERF	21	7	235	15	678	85	356	16	313	370	1370	1698	
PREPP	24	10	32	14	831	134	420	21	275	359	1340	1710	
Generator	17	7	259	9	481	134	404	32	251	320	1190	1530	
Grfsite	8	0	0	0	801	240	542	0	300	348	1350	1700	
IWPF	4	0	23	0	531	252	582	0	230	310	1040	1450	
Combinations													
WERF/Offsite	21	6	21	9	1162	138	410	18	379	463	1754	2110	
WERF/IWPF	20	6	41	9	801	127	399	18	287	350	1310	1644	
Generator/Offsite	17	6	28	4	942	190	462	32	282	330	1500	1820	
Generator/IWPF	16	6	48	4	544	178	449	32	222	290	1100	1440	
No Action	11	4	248	5	319	152	410	3	208	245	950	1245	

a. Project management, NEPA, environmental permitting, safety analyses, technology demonstration, etc.

b. Includes waste storage buildings, as well as treatment facility. This applies to construction, startup, operations, and D&D costs, also.

c. Twenty-five yr of operations.

d. Incremental costs (recommended disposal costs for use in this study). Includes transportation.

e. Apportioned (total) costs. Includes transportation.

f. Assumed D&D mode is total dismantlement.

g. Total may not exactly equal sum of the parts due to round-off errors.

Figure 13-2. Life-cycle costs—present-worth equivalent cost, FY-92.

13.3.4 Discussion of Results

For simplicity, the results are discussed in terms of comparisons with the MLLWTF maximum-treatment option (with incremental waste disposal cost) taken as a baseline case.

Note that the standard disposal unit is the 55-gal drum. This is done for convenience. Any changes will affect all alternatives and therefore are not expected to affect comparisons significantly.

The MLLWTF, minimum-treatment option, is \$27 million more expensive than the baseline MLLWTF, maximum-treatment option. The major contributors are increased cost for disposal (\$25 million), due to the increase in volume, and increased operating cost (\$11 million), due to the cost of drums for disposal. The increase in drum cost more than offsets the decrease in staff cost. There is a savings of \$19 million in engineering, startup, construction, and D&D costs due to the reduction in facility size. Reserves and contingency are \$9 million more.

The modify-WERF alternative is \$20 million less expensive than the baseline MLLWTF, maximum-treatment option. Front-end, engineering, and startup costs are \$10 million less because the framework is already laid by present WERF operations. Building operation is \$35 million less, due primarily to the smaller staff at WERF and the limited treatment of mixed waste. Waste disposal is \$14 million less because much of the mixed waste is being stored. D&D is \$4 million less because much of the cost is already sunk to cleanup the present facility. Construction is \$49 million more because of the need to construct numerous long-term storage facilities. The cost of storage facilities more than offsets any gains associated with use of the WERF facility, as far as construction costs are concerned. Reserves and contingency are \$5 million less.

The modify-PREPP alternative is \$48 million less expensive than the baseline MLLWTF, maximum-treatment option. About half the savings, \$22 million, is in reduced construction costs. This savings reflects a small savings in equipment cost and a major savings in facilities cost. There is a \$8 million savings in up-front and engineering cost (associated with using the framework for paper already laid in the PREPP project). There is a \$4 million savings in D&D cost because most of the cost is already sunk to cleanup the present facility. There is a \$15 million savings in reserves and contingency.

The generator-treatment alternative is \$60 million less expensive than the baseline MLLWTF, maximum-treatment option. Up-front, engineering, and start-up costs are reduced by \$17 million because the facilities are simpler. Building operation is also less expensive (\$97 million) primarily due to a smaller staff, slightly offset by purchasing more disposal drums. Waste disposal is \$2 million more, reflecting the opposing costs of storage of mixed waste and the disposal of a larger volume of LLW. The various gains are partially offset by more expensive construction (\$58 million). This is due to the cost of the numerous storage facilities. D&D costs are \$2 million less because the treatment facilities are smaller. Reserves and contingency are \$5 million less.

The offsite-treatment alternative is \$100 million less expensive than the baseline MLLWTF, maximum-treatment option. There are numerous opposing costs. First, the up-front costs are \$13 million less. Next, the engineering, construction, start-up, and D&D costs are nonexistent (\$70 million less). Operations costs are \$22 million less expensive due to the larger burden of staff at the MLLWTF. This is somewhat offset by the increased need for disposal containers. On the other hand, disposal cost is \$29 million more, due primarily to volume of waste to be disposed of, and partially to transportation costs. Reserves and contingency are \$24 million less.

The IWPF alternative is \$200 million less expensive than the baseline MLLWTF, maximum-treatment option. The up-front, engineering, construction, startup, and D&D costs are \$72 million less since most of this effort is handled by IWPF. Operation cost is \$110 million less due to savings in staff, slightly offset by the use of more drums in disposal. The disposal cost is \$25 million more due to the increase volumes to be disposed. Reserves and contingency cost are \$42 million less.

The WERF/offsite combination is \$60 million more expensive than the baseline MLLWTF, maximum-treatment option. Up-front, engineering, and startup costs are \$13 million less because the framework for paperwork is already laid at WERF and the cost to prepare for offsite treatment is minimal. Construction is \$30 million less because WERF facilities upgrades are less than a new facility and there are no offsite costs. Operating costs are \$101 million more, reflecting a substantial penalty for operating two facilities instead of one. The penalty is more than for the WERF/IWPF option because the offsite treatment charge reflects a profit. Disposal cost is \$3 million more, reflecting the increased shipping cost. D&D is \$4 million less because most of the cost for WERF is already sunk in the present facility and because there is no offsite D&D charge. Reserves and contingency are \$2 million more.

The WERF/IWPF combination is \$42 million less expensive than the baseline MLLWTF, maximum-treatment option. Up-front, engineering, and startup costs are \$12 million less because the framework for paperwork is already laid at WERF and the cost of IWPF is primarily a sunk cost charged to that project. Construction is \$16 million less because WERF facilities upgrades are less than a new facility and IWPF charges are mostly sunk in that project. Operating costs are \$4 million more, reflecting a small penalty for operating two facilities instead of one. D&D is \$4 million less because most of the cost for WERF and IWPF is sunk in those facilities. Disposal costs are the same since the same amount of waste is disposed. Reserves and contingency are \$12 million less.

The generator/offsite combination is the same cost as the baseline MLLWTF, maximum-treatment option. Up-front, engineering, startup, and D&D costs are \$20 million less because the generator facilities are simpler and the cost to prepare for offsite treatment is minimal. Construction is \$26 million less, once again reflecting the simpler generator facilities and that there are no offsite costs. Operating costs are \$30 million more because the offsite treatment charge reflects a profit. The generators treat only a portion of the LLW, resulting in a relatively small staff. The associated cost savings partially offsets the offsite profit charges. Disposal cost is \$19 million more due to the disposal of a larger volume of LLW and due to the increased cost of shipping offsite. Reserves and contingency are \$4 million less.

The generator/IWPF combination is \$100 million less expensive than the baseline MLLWTF, maximum-treatment option. Up-front, engineering, startup, and D&D costs are \$20 million less because the generator facilities are simpler and the cost of IWPF is primarily a sunk cost charged to that project. Construction is \$12 million less, once again reflecting the simpler generator facilities and the fact that the IWPF charges are mostly sunk in that project. Operating costs are \$61 million less, reflecting the smaller staff for operation of the generator facilities. Disposal costs are \$15 million more due to the disposal of a larger volume of LLW. Reserves and contingency are \$21 million less.

The no-action alternative is \$140 million less expensive than the baseline MLLWTF, maximum-treatment option. Up-front, engineering, and startup costs are about \$25 million less because it is easier to design, permit, and inspect storage facilities. Construction is \$46 million more because of all the storage buildings that need to be built. Operation is \$143 million less because of the large decrease in staff (only slightly offset by number of drums). Disposal cost is up \$10 million because

of the overall increase in the volume to be disposed of. D&D is \$6 million less since removal of only the first two storage buildings is included in the cost estimate. Reserves and contingency are \$21 million less.

13.4 OVERALL CONCLUSIONS

13.4.1 "Musts"

None of the "musts" listed in Table 6-1 applies to this section. No absolute limit has been established for the allowable cost of a treatment alternative.

13.4.2 "Wants"

One of the "wants" listed in Table 6-1 applies to this section:

- Minimize the life-cycle cost.

The subjective evaluation of performance on this "want" is as follows in Table 13-3. (The scores are based on the incremental, present-worth equivalent costs). The rationale for these scores, by reference to the results presented in Table 13-1, is as follows. The lowest cost option, IWPF at \$270 million, was assigned the score of 10. All other options were assigned a score based on ten times the ratio to the lowest cost option. For example, the most expensive option, WERF/offsite, at \$530 million, was assigned the score of 5, based on the calculation:

$$(270/530) * 10 = 5.1.$$

Thus, the most expensive option is a 5 and the remainder of the options fall between 5 and 10, inclusive.

13.5 Consideration of the Cost Effectiveness of Waste Treatment

It was mentioned in Section 7 that one of the treatment requirements/criteria is that techniques resulting in an increase in the life of the disposal facility and in long-term performance should be employed to the extent that they are cost effective. The term "cost effectiveness" is not defined in the criterion (which is taken from DOE Order 5820.2A) nor in guidance or regulatory documents.

Determining whether additional waste treatment is cost effective requires identifying and comparing a maximum-treatment option with a comparable minimum-treatment option. Of the twelve alternatives evaluated, MLLWTF maximum-treatment option, PREPP, WERF/offsite, and WERF/IWPF are the only maximum-treatment alternatives. The MLLWTF has a defined minimum-treatment option. The minimum-treatment options for the WERF/offsite and WERF/IWPF alternatives are effectively the offsite and IWPF options, respectively. PREPP has no evaluated minimum-treatment option, but it should behave similarly to the MLLWTF options.

WERF, generator treatment, and no-action alternatives cannot be altered to produce maximum-treatment options without effectively transforming them into another alternative (see discussion in sections 4.7 and 5.7.2).

Table 13-3. Subjective evaluation of performance on applicable "want."

<u>Alternative</u>	<u>Minimize life-cycle cost</u>
MLLWTF	
Maximum treatment	6
Minimum treatment	5
Modify WERF	6
Modify PREPP	6
Generator	7
Offsite	7
IWPF	10
Combinations	
WERF/Offsite	5
WERF/IWPF	6
Generator/Offsite	6
Generator/IWPF	7
No action	8

The offsite-treatment and generator/offsite alternatives can be altered to produce two new maximum-treatment options that were not evaluated as part of this study. In the new offsite-treatment option, all treatable waste is shipped to the offsite facility. In the new generator/offsite option, all the incinerable waste goes offsite, and all the compactible/mechanically size-reducible waste is treated in one of the two generator facilities.

The generator/IWPF alternative can also be expanded to produce a new option. In this option, all compactible/mechanically size-reducible waste is treated by the two generator facilities and all incinerable LLW is compacted at the two facilities. This results in a smaller size-reduction than incineration of LLW, but does result in treatment of all treatable waste.

Since all but three alternatives now have a maximum-treatment option, the question of cost effectiveness can now be considered. Cost effectiveness is not evaluated for the three alternatives that involve storage.

In the case of the MLLWTF minimum and maximum-treatment options, it is clearly cost effective to treat the maximum amount of waste. The maximum-treatment option actually costs less overall than the minimum-treatment option. This is because the cost to build and operate the facility is only slightly reduced in the minimum-treatment option, whereas the disposal costs increase dramatically.

The PREFP options would be expected to follow the same course. Therefore, if less than the maximum amount of waste is treated, the cost will likely be slightly higher due to increases in disposal cost.

The offsite-treatment alternative, a minimum-treatment option, can be compared to the WERF/offsite option and also to a modified-offsite option, which are both maximum-treatment options. The WERF/offsite alternative treats 13 times the volume of waste at 1.4 times the life-cycle cost. Thus, maximum-treatment offsite is estimated to be approximately \$135 million, or 1.4 times more expensive than minimum-treatment, based on the additional treatment and shipping costs as offset by the savings in disposal.

The IWPF alternative is a minimum-treatment option and can be compared to WERF/IWPF. The WERF/IWPF alternative treats 13 times more volume at 1.7 times the life-cycle cost.

The generator/offsite alternative, which is an intermediate treatment option, could be transformed into a maximum-treatment option if all the incinerable LLW were shipped offsite, and all the compactible/mechanically size-reducible waste were treated at the two generator facilities. This option results in an increase of a factor of 2.2 in volume treated. The increase in life-cycle cost for this expansion would be about \$85 million, or 1.2 times, to account for increases in staff, transportation, and offsite-treatment charges as offset by a decreased disposal cost.

The generator/IWPF alternative, which is an intermediate-treatment option, might be expanded to allow compaction and mechanical size-reduction, at NRF and ICPP, of waste from all other site generators. This approach results in treatment of 2.2 times the volume of waste. The increase in cost associated with staff and transportation, as offset by the decrease in disposal cost, is of the order of \$65 million, or 1.2 times. Note that the generator/IWPF expanded treatment option compacts the incinerable waste (it was assumed that it would be undesirable to burn LLW at the IWPF). Therefore, the option does not result in the same volume reduction as is achieved by the MLLWTF or offsite maximum-treatment options. The option does, however, treat all the treatable waste.

The end result of this analysis is, compared with their respective partial- or minimum-treatment options, (a) the MLLWTF maximum-treatment option is clearly more cost effective than the minimum-treatment option, and (b) the other maximum-treatment options may or may not be cost effective, depending on the definition of the term.

13.5.1 Escalation and Discount Factors

As a simplification, the present worth costs calculated here assumed that the discount rate equaled the inflation (escalation) rate. With this simplification, the present-worth costs are the same as the cost in FY-92 dollars.

A more precise estimation would use an escalation rate of about 5% and a discount rate of 7% to 8%. Because of the similarity of timing among alternatives, this approximation was expected to introduce only small changes in the present-worth costs of one alternative relative to another.

A quick check of this simplifying assumption was performed. The later expenditures for operations, disposal, and D&D were divided by two, the totals were re-evaluated, and the rankings were revised. The factor of two is a conservative estimate of the difference between the discount rate and the inflation rate adjustment (it is actually nearer to 1.8 using a discount rate of 8%). The reranking resulted in only three slight changes compared with the preceding table of scores on the

"want" of minimum life-cycle cost. The scores for MLLWTF, maximum-treatment option, and generator treatment both decreased by one because of the heavy up-front costs. Offsite treatment increased by one because the cost is skewed toward the latter years. The overall effect is, as assumed, very small. It causes no significant changes in the results.

13.6 REFERENCES

1. E. L. Grant and W. G. Ircson, *Principles of Engineering Economy*, 4th ed., The Ronald Press Company, 1964.
2. H. G. Thuesen and W. J. Fabrycky, *Engineering Economy*, 3rd ed., Prentice-Hall, Inc., 1964.

14. KEY UNCERTAINTIES

Sections 7 through 13 evaluated the treatment alternatives. Before proceeding to the analysis of the results (Section 15) and the recommendations (Section 16), this section discusses the key uncertainties affecting the recommendations.

Although the study encountered several key uncertainties, the following points need to be borne in mind:

- Uncertainties exist in all projects at all stages.
- The uncertainties should not be construed as cause to do nothing or to delay making a decision, unless delay will improve the situation. Such is not the case in this instance.
- The long-term capability to treat INEL mixed and LLW is needed promptly, to eliminate noncompliance with the LDRs of RCRA.

14.1 Introduction

Some of the assumptions in Section 3 cover areas that are not only uncertain, but also important enough to potentially affect the conclusions of the study. Such assumptions, along with some other factors, are termed here the "key uncertainties" of the study. The key uncertainties are items that are not known yet, whose nature had to be assumed, and that could change significantly between now and the date of facility startup.

The length of time required to implement a treatment alternative helps convey the significance of the key uncertainties. This study is being conducted in 1992. The selected alternative is planned to begin operations about 2003, 11 yr later. In the intervening 11 yr, events could occur that could

- Significantly change the attractiveness of one alternative relative to another
- Significantly change the viability of the selected alternative.

The key uncertainties focus on the major unknowns, not on the many lower-level uncertainties (e.g., the staff size for a given treatment facility). The lower-level uncertainties would not be expected to result in the two bulleted outcomes above.

The key uncertainties tend to fall into several categories:

- Regulations (uncertainties 14.2.1 and 14.2.2 in the following subsection)
- DOE policies, philosophies, and programs (uncertainties 14.2.3 through 14.2.7)
- Waste volumes and characteristics (uncertainties 14.2.8 and 14.2.9)

- Status and missions of various waste management facilities (uncertainties 14.2.10 through 14.2.13)
- Performance of waste management technologies (uncertainties 14.2.14 and 14.2.15)
- Other (uncertainties 14.2.16 through 14.2.18).

14.2 Key Uncertainties

14.2.1 Shifting Regulations

One assumption in the study involved complying with not only all existing regulations, but also all regulations that have been proposed or drafted. Even with this expanded vision of compliance, regulatory changes will impact the evaluations of this study during the 11-yr period before operations begin. Potential regulations already being formulated but not yet proposed include the RCRA reauthorization (which may allow a State tax on waste transported across individual states), planned restrictions on the siting of TSD facilities, treatment requirements for contaminated soil, State regulations stemming from the recent CAA Amendments, and revisions to DOE Order 5820.2A.

14.2.2 "Campaign Burning" and the "Derived from" Rule

The treatment alternatives reflect an assumption that reasonable "campaign burning" can take place, with a flexible regulatory interpretation concerning cross-contamination of residues. A strict interpretation of the EPA's "derived from" rule would result in assumed cross-contamination of contaminants to all subsequent batches of waste treated in the same equipment. For example, if a listed waste were treated in an incinerator, the residues of all subsequent waste batches treated in the same incinerator would be assumed to contain the listed contaminant. The "derived-from" rule has been successfully challenged in the courts, but may again take effect after revisions. The outcome of future negotiation is unknown. As a worst case, multiple treatment equipment might be required (e.g., one incinerator for LLW and one for mixed waste), which would increase the cost. This uncertainty would cause major difficulties for the WERF and PREPP alternatives, which probably would not have sufficient space to accommodate redundant treatment equipment.

A similar uncertainty related to "campaign burning" applies to treatment of LLW and TRU waste in the same equipment, for the IWPF alternative and its combinations.

14.2.3 Stability of DOE Policies and Practices

The long-term treatment alternative would require as long as 11 or more years to achieve operations. During the interim, significant changes are likely in DOE policies and practices, as represented by DOE Rules, Guides, Orders, and DOE-ID Supplementary Directives.

14.2.4 DOE Acceptance of Deficiencies in Existing Facilities

As stated in Section 10, the modify-WERF, modify-PREPP, and generator-treatment alternatives would still have some noncompliances with DOE Order 6430.1A, even after modifications. DOE acceptance of such noncompliances, at the time of facility startup, is uncertain. The policy on

noncompliance could be either more strict or less strict than that expressed currently in DOE Order 6430.1A, Section 0101-2.

The outcome of this factor could affect the cost to upgrade WERF and PREPP and to implement generator treatment.

14.2.5 Mandatory Volume Reduction of LLW

As discussed in Section 7, DOE Order 5820.2A (Chapter III, paragraph 3.f(2)) requires volume reduction of LLW only "to the extent that it is cost effective." However, two other DOE documents imply a stronger driving force for volume reduction. DOE Order 6430.1A, Division 1300-8.1, states, "volume reduction equipment for both liquid and solid wastes shall be required where feasible." The INEL Site-Specific Plan,¹ page 88, states, "To control ongoing waste management, the following activities will be incorporated into all aspects of waste management: . . . treatment of all waste to reduce volume and increase stability."

Strict application of the latter two requirements could eliminate from consideration several treatment alternatives that would perform less than the maximum feasible volume reduction of LLW.

14.2.6 Outcome of Mixed Waste Treatment Program Study for DOE-HQ

Department of Energy Headquarters (DOE-HQ) is sponsoring a DOE-wide study to unify the waste-treatment strategy of the sites having mixed waste. Preliminary waste characterization has been done. (For the INEL waste, the characterization did not include waste to be generated by remedial actions or D&D. The characterization did include the large volume of slightly contaminated, mixed TRU waste expected to be reclassified as mixed LLW.) The study has identified treatment options, developed process flow sheets, and scoped a prototype treatment facility. The DOE site at which the prototype facility would be constructed has not been determined. The relationship of the schedule for that facility to the schedules for treatment facilities at other DOE sites also has not been determined.

The future effect, if any, of this DOE-HQ study on the MLLWTF and IWPf projects at the INEL is not known.

14.2.7 Outcome of Other Ongoing INEL Studies on Waste Treatment

Two other INEL waste-treatment studies that are under way could affect the results of this alternatives study. Both studies focus on near-term actions. The eventual outcomes of the near-term actions, and their impacts on the long-term treatment alternatives, cannot be predicted.

One study is evaluating the possible shipment of INEL LLW offsite for treatment due to the shutdown of WERF and the accumulation of untreated waste. The offsite treatment could conceivably begin in several months. If the near-term precedent is set for offsite treatment of INEL LLW, an argument could then be made to continue that treatment indefinitely. Thus, the offsite treatment alternative could conceivably become the de facto alternative for long-term treatment, assuming offsite capability for mixed waste treatment also becomes available.

Another ongoing study is developing small-scale treatment capabilities for mixed waste currently stored at the MWSF. The capabilities could be implemented within 1 or 2 yr. Again, if the near-term action is successful in eliminating some of the mixed waste backlog, the near-term action could become (at least partially) the de facto alternative for long-term treatment.

14.2.8 Waste Volumes and Characteristics

The projections of waste volumes and characteristics are uncertain. The waste from ongoing operations is uncertain, because many activities that generate waste on an ongoing basis either will or may be shut down. An example is the ICPP reprocessing mission. Waste generation reduction may also impact the volume of waste requiring treatment. On the other hand, new facilities could be constructed and generate waste, tending to offset these reductions.

The waste to be treated from remedial actions and D&D activities is very uncertain. The waste uncertainties are primarily due to programmatic uncertainties about the remediation approach for each cleanup, as well as the schedule for expanding the D&D activities.

These waste uncertainties could affect the selection of processes for the treatment facility. (In particular, the assumed volume of mixed waste to be generated by D&D activities has a major effect. So does the possible need to treat remote-handled waste.) A given treatment alternative may prove to be underdesigned or overdesigned in capability, depending on the actual (as opposed to the assumed) waste volumes and characteristics.

14.2.9 Impacts of LLW WAC and of the Performance Assessment of the MLLWDF

The selection of treatment processes for LLW is strongly driven by the assumed WAC of the MLLWDF. In turn, the WAC will be affected by the doses calculated in the planned performance assessment of the MLLWDF.

If the actual WAC turn out to be less stringent than the assumed WAC, then the proposed treatment processes may be unnecessarily aggressive or comprehensive. On the other hand, if the performance assessment indicates that the doses from disposed waste are too high, the MLLWDF WAC will be strengthened, and more waste processing may be needed to increase waste immobilization. For example, increased treatment of remote-handled metallic waste might be needed.

14.2.10 Assumptions Concerning the Future of Other INEL Waste Management Facilities

In order to focus on alternatives for treating INEL mixed waste and LLW, assumptions were made that other INEL waste management facilities would be constructed or operated as planned. Included are the MLLWDF, IWPF, ICPP, sodium treatment facility, and lead treatment process. One or more of these facilities might not be constructed or operated, at least not on the planned schedule. A higher-level alternatives study than this one would be required to examine the impacts of various facilities not being constructed.

The impacts of canceling any of these facilities would differ for different alternatives. Lack of the IWPF would eliminate that alternative from consideration. Lack of the sodium treatment facility or lead recovery process or shutdown of ICPP aqueous waste treatment would result in adding those

capabilities to the other alternatives. Lack of the MLLWDF would not be a major impact on the treatment facility so long as the RWMC continued to operate, but reduction of disposal volumes would be of increased priority.

14.2.11 Uncertain Design of Disposal Facility

The fundamental design decisions for the MLLWDF have not yet been made. A key decision is the selection of shallow land burial versus engineered confinement for Class 1 LLW. The most important effect of this uncertainty on the selection of a treatment alternative involves the cost of waste disposal. Engineered confinement would cost much more than shallow land burial. Alternatives that most effectively reduce the volume of waste requiring disposal would be more attractive if the MLLWDF used engineered confinement.

14.2.12 Uncertainties of Offsite Treatment

Several uncertainties could result in eliminating the offsite treatment alternative. Worse, the uncertainties might not be resolved until after time and funds had been devoted to pursuing that alternative.

Obviously, lack of an offsite treatment facility for mixed waste would eliminate that alternative from consideration.

Another uncertainty concerns the traceability of the residuals from treating the INEL waste in an offsite facility. When a facility treats waste from several generators, tracking the residues from the waste of the individual generators can be difficult. Traceability is of most concern for the mixed waste because of the cradle-to-grave responsibility of the generator under RCRA. The use of batching schemes can reduce the problem but would increase the cost. If an acceptable batching scheme is not achieved, this factor could affect the viability of the alternative.

The viability of the alternative could be affected by several other unknowns. New regulations could reduce the profit potential or increase the liability causing the offsite operator to cease operations. A serious accident or financial problem could also lead to a shutdown. The offsite facility could elect not to treat certain waste streams generated at the INEL.

Although no classified waste was identified in the waste characterization study, classified waste requiring treatment could arise in the future. Treatment of classified waste by an offsite, non-DOE treatment facility would present major difficulties.

14.2.13 Lack of Preconceptual Designs

Preconceptual designs do not exist for any of the treatment alternatives. This lack of information affects the evaluations and comparisons of alternatives. The approach taken in this study was to develop only enough overview design information to allow approximate calculation of waste logistics (e.g., volumes of waste pre and posttreatment), ROM cost estimates, and qualitative safety comparisons (e.g., full or partial compliance with DOE Order 6430.1A).

14.2.14 Use of Technologies Not Totally Proven

One assumption used to formulate the treatment alternatives was that only technologies proven at full scale would be used. However, this restriction does not remove all technological risk. Some technologies have been proven at full scale, but not in a radiological environment or on a production basis. The limited number of DOE's operational, full-scale treatment facilities for radioactive waste, in spite of numerous pilot-scale units over the years, testifies to the challenges faced in applying technologies that are proven for different uses. Therefore, alternatives having the highest technology risk could encounter substantial difficulties in implementation.

14.2.15 Need for Flexibility in Treatment Processes

The treatment processes developed for this study reflect only limited flexibility to treat unplanned-for waste streams. The actual facility will need flexibility to deal with new or one-of-a-kind waste streams. The form that the flexibility will take is difficult to predict. Allowance would be made in a new treatment facility for flexibility. Because of restricted space at WERF and PREPP, this need might be more of a problem than it would for a new facility.

14.2.16 Schedule Uncertainties

Experience has shown that long-range schedules of the type developed here have substantial uncertainties. However, the uncertainties would tend to affect most of the alternatives similarly (e.g., stretching out NEPA schedules). Significant changes in schedule ranking, from one alternative to another, would not be expected.

As discussed in Section 9, one major schedule uncertainty relates to the link in NEPA compliance between this project and the INEL ER&WM EIS. If the ROD for that EIS is delayed more than 2 months (considered a likely situation), all steps in implementing any treatment alternative, from Title II design on, will be correspondingly delayed.

Another schedule uncertainty relates to assuming that DOE-HQ approval is received about July 1992 in order to start conceptual design on October 1, 1992. Delays in receiving the approval will be expected to delay the entire project.

14.2.17 Cost Uncertainties

Because of the lack of design information, the life-cycle cost estimates have substantial uncertainties. For alternatives whose costs are close to one another, these uncertainties could result in some change of the cost ranking.

One major cost uncertainty relates to disposing of the waste. Three underlying cost uncertainties are responsible. One is the uncertainty in the volume of waste to be generated. Another is the unknown disposal method for contact-handled LLW at the MLLWDF (i.e., shallow land burial versus engineered confinement). The third underlying uncertainty is whether to use the incremental cost of disposal (assuming the MLLWDF already exists and operates as a sunk cost) or the apportioned cost of disposal (assuming each additional cubic foot of waste disposed bears part of the entire cost of the MLLWDF). This study concludes, in Section 13 and Appendix A, that the

incremental cost of disposal should be used for comparing treatment alternatives whose treated waste would be disposed of in a given disposal facility.

14.2.18 Subjective Rankings

The treatment alternatives were evaluated in several areas and then compared against several "musts" and weighted "wants." The "must" comparisons are generally objective. The "want" comparisons are subjective, as is any multivariable qualitative comparison, to some extent. For alternatives whose scores on the "wants" are close to one another, the relative ranking could change.

14.3 References

1. U.S. Department of Energy Idaho Field Office, *Environmental Restoration and Waste Management Site-Specific Plan (SSP) for Fiscal Year 1992 (FY-92)*, DOE/ID-10253, September 1991.

15. ANALYSIS OF RESULTS

15.1 Introduction

Sections 7 through 13 presented overview evaluations of the alternatives for treating mixed waste and LLW at the INEL. The evaluations included process, safety, environmental, institutional, schedule, cost, and facility interface comparisons, based on a set of simplifying assumptions. The purpose of this section is to (a) analyze the results presented in those sections and (b) identify other decision-making considerations.

Sections 7 through 13 also evaluated the alternatives on their performance against a list of "musts" and "wants." This section compiles the rankings into one master table for "musts" and another for "wants."

15.2 Results On "Musts"

The list of "musts" comprises the mandatory criteria for recommendation of a treatment alternative. To be considered viable, an alternative must comply with every listed "must." Table 15-1 summarizes the "musts" and whether each alternative passed or failed each criterion.

The WERF, generator treatment, and no-action alternatives require indefinite waste storage because some mixed waste cannot be treated to meet disposal requirements. Therefore, these three alternatives failed the following "must" criteria and are not considered viable:

- Comply with all environmental and waste management regulations
- Perform all required treatment of mixed waste and LLW generated at the INEL over a period of 25 yr.
- All waste forms that are produced must be acceptable for disposal at the proposed MLLWDF.

The no-action alternative also failed the following "must" criterion:

- Present no insurmountable institutional problems.

The MLLWTF, PREPP, offsite treatment, IWPF, and all four combinations of alternatives satisfy all "must" criteria and are considered viable.

15.3 Results On "Wants"

The list of "wants" comprises criteria that would impact the recommendation of an alternative, but are not strict requirements. Each "want" was assigned an importance weight, based on perceived priority to DOE and on engineering judgment.

Table 15-1. Summary of performance of alternatives against "musts."

Alternative	Musts						
	Comply with all environmental and waste management regulations	Present acceptable risk to the workers, the public, and the environment	Perform all required treatment of mixed waste and LLW generated at the INEL over a period of 25 yr	All waste forms that are produced must be acceptable for disposal at the proposed MLLWDF	Have acceptable development risk, as measured by a requirement to use only proven technology	Present no potential major conflicts with the missions or operations of other existing or planned INEL waste management facilities	Present no insurmountable institutional problems
MLLWTF (maximum treatment)	P	P	P	P	P	P	P
MLLWTF (minimum treatment)	P	P	P	P	P	P	P
• Modify WERF	F	P	F	F	P	P	P
Modify PREPP	P	P	P	P	P	P	P
• Generator treatment	F	P	F	F	P	P	P
Offsite	P	P	P	P	P	P	P
IWPF	P	P	P	P	P	P	P
WERF/offsite	P	P	P	P	P	P	P
WERF/IWPF	P	P	P	P	P	P	P
Generator/offsite	P	P	P	P	P	P	P
Generator/IWPF	P	P	P	P	P	P	P
• No action	F	P	F	F	P	P	F

P = Passed the "must" criterion.

F = Failed the "must" criterion.

• Alternatives that are no longer considered viable treatment options.

The top row of Table 15-2 summarizes the "wants;" the importance weights appear in parentheses. Minimizing risk to the workers, the public, and the environment is considered to be the most important "want" and is assigned an importance weight of five. Minimizing noncompliances with the safety-related criteria of DOE Order 6430.1A and consensus national standards is important but is included in the risk-related "want" and is not scored here, in order to avoid double counting. Minimizing problems in operability, reliability, and maintainability, and minimizing the use of technologies proven only under nonradiological conditions or only by the vendor are each assigned a weight of three. Minimizing the schedule for beginning operations, and minimizing the life-cycle cost are each assigned a weight of two. Minimizing potential interface problems with other INEL waste management facilities and minimizing potential institutional problems are considered least important and are each assigned a weight of one.

The remainder of Table 15-2 presents the weighted scores. The viable treatment alternatives are ranked as follows:

1. MLLWTF—Maximum treatment option
2. MLLWTF—Minimum treatment option
3. IWPF
4. Generator/IWPF
5. Modify PREPP
6. WERF/IWPF
7. Offsite
8. Generator/Offsite
9. WERF/Offsite

The degree of resolution of the ratings in Table 15-2 has a limit. It is estimated that total scores within about 10% of one another, as scored against the maximum possible of 170 points, are clearly within the uncertainty range. Thus, total scores within 17 points of one another are probably within the uncertainty range. The three top-scoring viable alternatives (both MLLWTF options and IWPF) are within that range of one another. The lower-scoring alternatives are probably not within the uncertainty range of the top-scoring MLLWTF maximum-treatment option. The major impacts on the total scores are the risk-related "want," with a spread of 35 points for the viable alternatives, and the operability-related "want," with an 18-point spread.

In Section 13, the evaluation of the cost effectiveness of the alternatives brought to light three additional treatment options for consideration. A brief discussion is given here of how well these three additional options would score on Table 15-2.

Table 15-2. Summary of performance of alternatives against "wants."

Alternative	Minimize risk to workers, the public, and the environment. (5)	Wants							Sum
		Minimize noncompliance with safety-related criteria of DOE Order 6430.1A**	Minimize problems in operability, reliability, and maintainability. (3)	Minimize use of technologies proven only under nonradioactive logical conditions or only by the vendor. (3)	Minimize the schedule for beginning radioactive operations. (2)	Minimize the life-cycle cost. (2)	Minimize potential interface problems with other INEL waste management facilities. (1)	Minimize potential institutional problems. (1)	
MLLWTF (maximum treatment)	50	**	15	18	14	12	9	9	127
MLLWTF (minimum treatment)	35	**	24	18	14	10	7	8	116
*Modify WERF	15	**	12	27	18	12	10	5	99
Modify PREPP	30	**	6	18	16	12	9	10	101
*Generator treatment	15	**	24	30	18	14	7	5	113
Offsite	20	**	15	18	14	14	6	7	94
IWPF	35	**	12	18	12	20	7	8	112
WERF/offsite	15	**	9	24	14	10	9	6	87
WERF/IWPF	30	**	6	24	12	12	9	7	100
Generator/offsite	20	**	15	18	14	12	7	6	92
Generator/IWPF	35	**	12	18	12	14	7	7	105
*No action	10	**	30	30	20	16	6	0	112

() = Importance weight.

* Alternatives that failed a "must" and are not considered viable.

** Performance on this "want" is also a factor in the performance on the "want" related to risk. To avoid double counting of compliance with safety-related criteria, the scoring on this "want" is deleted.

The option of treating all the waste offsite, rather than only the mixed waste, would score slightly lower than the offsite treatment alternative.

The option of expanding the generator/offsite alternative to treat all LLW, rather than only part of it, would score slightly higher than the parent alternative.

The option of expanding the generator/IWPF alternative to compact or size reduce all LLW, rather than only that generated at NRC or ICPP, would score higher than the parent alternative. The ranking would improve significantly from that of the parent alternative. The option would rank near the top but still well behind the top-ranked alternative.

15.4 Decision-making Considerations

If the recommendation were based strictly on the "musts" and "wants," the preferred alternative for treatment of INEL mixed waste and LLW would be the MLLWTF maximum-treatment option. However, selecting an alternative is extremely complex and involves many factors; some do not readily lend themselves to lists of "musts" and "wants." The decision is not completely determined by any evaluation of numbers.

This subsection suggests several major factors that the decision-maker needs to consider, in addition to the results of the "musts" and "wants" in Tables 15-1 and 15-2.

15.4.1 Should a Decision Be Made Now or Delayed?

The first major consideration is whether a treatment alternative should be selected now.

If the decision were delayed for a year or two, would the key uncertainties identified in this study (see Section 14) be greatly reduced? Only a few uncertainties associated with selecting an alternative would be resolved by delaying the decision for a year or two. For example, some first signs of progress toward offsite mixed waste treatment might be apparent in a couple of years. Also, as discussed in subsection 15.4.3 and Section 16, a task to develop improved projections of D&D waste could (if funded) be completed in 6 to 8 months. Would other benefits accrue from delay? Within the scope of this study, no other benefits from delay in the decision were identified.

The negative impacts of delay would include (a) a corresponding delay in complying with the LDR regulations of EPA; (b) the need to correspondingly extend the operating life of WERF, which would already be past its intended shutdown date of 2000;¹ (c) increased costs due to escalating mixed waste storage; and (d) a negative public perception of indecision.

Another part of this consideration is the notion that generation of mixed waste could be eliminated, thereby eliminating the need for a treatment capability. However, the D&D Program will be the primary generator of mixed waste, and the D&D Program cannot be permanently shutdown.

The arguments appear to favor making a decision now.

15.4.2 Will the Waste Management Philosophy of the Future Reflect Maximum Treatment or Minimum Required Treatment?

The next consideration in the decision-making process is whether the future DOE philosophy will favor the maximum or the minimum required treatment of LLW. Presently, treatment of LLW is required to satisfy only DOE Orders and is not subject to State or other Federal regulations. The key point of the DOE Orders is that LLW must be treated to satisfy the requirements of the performance assessment. In addition, DOE Orders require treatment to stabilize and reduce volume if it is cost effective. DOE Orders also require treatment if it is feasible.

The amount of LLW that must be treated to satisfy the performance requirements (beyond what the generators presently do in packaging their waste) is expected to be quite small. On the other hand, it may be feasible and/or cost effective to further treat the bulk of the waste. Therefore, the interpretation of what is feasible and what is cost effective, and the relationship between the two, is extremely important in selecting a treatment alternative.

Other considerations may also make it desirable to treat more waste. For example, public perception of the INEL may necessitate treatment of additional waste. Also, the need to conserve space in the disposal facility may be more important if the MLLWDF is delayed and disposal at the RWMC continues longer than planned. Later deletion of waste treatment capability from a project is easier than the later addition of capability. Tougher future regulations may lead to the requirement for additional capability.

The above considerations on maximum and minimum treatment of LLW are displayed on the decision flowchart in Figure 15-1. Note that, on a stream-by-stream basis, any one "yes" will necessitate treatment of the stream, whereas a complete series of "no" answers is required to justify not treating the stream of waste.

15.4.3 Waste Volume Projections

Consideration should be given to the uncertainty associated with the waste volume projections used in this study.

The three sources of waste are listed in Table 15-3: waste from ongoing operations, waste from D&D, and waste from environmental remedial actions. Ideally, an analyst could obtain high estimates (upper bounds), low estimates (lower bounds), and best estimates of the waste volume expected from each source. Then, an informed judgment could be used in specifying the baseline assumption for waste volumes.

Re-examination of Section 2 reveals that the projection for waste from ongoing operations is probably a high estimate. The projection was based on current generation levels. Several INEL operations are ceasing, and waste generation reduction activities will also result in lower volumes in the future. Thus, an X is shown in Table 15-3 under high estimate for waste from ongoing operations.

Sections 2 and 3 reveal that the projection used for waste from D&D is also a high estimate. The projection assumed that the planned major expansion in D&D activities will occur. The projection is also based on dismantlement of all facilities undergoing D&D, the mode expected to

- a. Presently, no State or Federal regulations, other than DOE regulations, are applicable.
- b. The amount of waste that must be treated to satisfy performance requirements is expected to be small.
- c. That is to say, is treatment required by DOE Orders, etc., in addition to the performance assessment and the cost effectiveness? For example, feasibility or stated commitments in the Environmental/Restoration and Waste Management Site-Specific Plan.
- d. Examples of considerations include potential tougher future regulations for LLW, public perception, and lengthening RWMC life if MLLWDF is delayed.

Figure 15-1. Decision chart for treatment of LLW.

Table 15-3. Projections used for waste volumes.

Waste Source	High estimate	Low estimate	Best Estimate
Ongoing operations	X		
D&D	X		
Remedial actions		X	

result in the largest volume of waste. Thus, an X is shown in Table 15-3 under high estimate for waste from D&D.

Sections 2 and 3 also reveal that the projection of waste from environmental remedial action is a low estimate, namely, zero. This estimate was based on guidance received from remedial action personnel. Thus, an X is shown in Table 15-3 under low estimate for waste from remedial actions.

The available projections of the three sources of waste do not provide the desired complete set of bounding estimates. Projections for two of the waste sources are biased on the high side, and the remaining projection is a lower bound.

To evaluate the impact that uncertainty in waste volume projections has on a treatment alternative, consider the impacts if the waste volume were increased or decreased. If the actual waste volumes exceeded those used in the study (an unlikely situation), the expected impacts are as follows. There would be little impact of the increased throughput on the MLLWTF, maximum-treatment alternative. There could be significant impacts on the other alternatives. Many alternatives send large volumes of LLW directly to the MLLWDF without size reduction, and an increase in waste volumes could impact the disposal facility. WERF and PREPP could encounter throughput problems. Some alternatives also store large volumes of mixed waste. Increased volumes would worsen the storage problem. Thus, increases in waste volumes would increase the attractiveness of the MLLWTF, maximum-treatment alternative.

The more likely case is that the actual waste volumes will be less than those used in the study. In particular, D&D is projected to generate 44% of the total INEL LLW, but 84% of the mixed waste. The impact of reduced D&D waste on treatment and disposal of LLW would not be significant (less than a factor of two, even if D&D were completely shut down). However, the impact of reduced D&D waste on management of mixed waste could be dramatic. In the limiting case of no D&D waste, the volume of mixed waste to be treated would decrease by a factor of six. The amount of mixed waste sludge, soil, and rubble requiring treatment would particularly decrease.

In this limiting-case scenario of no D&D waste, a rotary kiln incinerator might not be needed. A facility with a controlled air incinerator, such as that in modified WERF, might accommodate all of the mixed waste, and no indefinite storage of mixed waste would be required. The small amounts (12 m³/yr) of sludge, soil, and rubble from ongoing operations might be interspersed with the feed of combustibles to the WERF incinerator. Modify WERF might become a viable alternative,

although generator treatment, and no action would remain nonviable. Combinations of modify WERF with other alternatives would become redundant. The rotary kiln incinerators of the modify PREPP and MLLWTF alternatives would become unnecessary capability for the treatment needs. The IWPF option would also become more attractive since the amount of waste to be treated would be insignificant compared to the TRU and low-level TRU. Finally, the offsite option becomes much more viable because the present operational treatment technology (e.g., controlled-air incineration) could likely be used. This assumes that a permit to treat mixed waste is obtained. (If the decrease in D&D waste were known by the design stage, the incinerator for MLLWTF could be changed to the controlled air type. This change would save some funds, but the MLLWTF alternative would still cost more than the modify-WERF alternative.)

This scenario is especially attractive for the modify-WERF alternative because it removes the need for indefinite storage. Thus, all the "musts" would be satisfied. The scores on several of the "wants" of Table 15-2 would increase significantly but this version would still not be the top-rated alternative.

The likelihood of this scenario, or any scenario resembling it, cannot be determined. In addition, the maximum amount of mixed waste sludge, soil, and rubble that a modified WERF could accommodate has not been calculated. Opinions of WERF personnel and former WERF personnel vary widely on this question. As a rough estimate, if the volume of D&D mixed waste sludge, soil, and rubble were reduced from the projection by a factor of 2 to 5, a rotary kiln incinerator probably would still be required. If it were reduced by a factor of 10 or more, a controlled air incinerator might be sufficient.

15.4.4 Technology Risk

Another factor for consideration is the risk of applying technology that is not proven for the proposed application. Selection of the MLLWTF (both options), modify PREPP, IWPF, IWPF combinations, and potentially the offsite-treatment alternative would involve use of a rotary kiln incinerator. This treatment technology has not been proven in radiological application. A technology risk is therefore assumed should one of these alternatives be selected. The modify-WERF alternative, on the other hand, uses a controlled air incinerator, which has been proven in radiological application and in a production environment.

15.4.5 Will Other Facilities Be Available?

Consideration must also be given to the question of whether other INEL and offsite waste treatment facilities will be available in the future as hoped. The IWPF and offsite treatment alternatives were based on the assumption that facilities would be constructed and operated as planned. Selecting either alternative means accepting a risk that the treatment facility will not be available 11 or 12 yr in the future.

15.5 References

1. U.S. Department of Energy Idaho Field Office, *Environmental Restoration and Waste Management Site-Specific Plan (SSP) for Fiscal Year 1992 (FY-92)*, DOE/ID-10253, September 1991.

16. RECOMMENDATIONS

Based on the analyses of results presented in Section 15, the recommendations from this preliminary study are the following:

1. **It is recommended that a detailed building-by-building study be performed as soon as possible to obtain the best estimate of future D&D waste volumes and characteristics.**

Arriving at best-estimate projections would involve facility-by-facility walkthrough and evaluation for all significant INEL facilities. Projections would be conducted by D&D personnel, INEL regulatory/waste treatment personnel, and past facility operators, if possible. No waste sampling would be performed. Perhaps the most significant 100 of the 300 to 400 INEL facilities would be addressed in this matter. The remaining facilities would be addressed by engineering judgment.

The time necessary to complete the study, including entry of the data into a database, is estimated to be 6 to 8 months. The cost is estimated to be \$250K to \$350K. The quality of data to be obtained from the study would not match that developed in the usual detailed characterizations of facilities, which cost \$50K to \$250K each for nonreactor facilities. However, the data quality would far exceed that available today for waste projections in the INEL D&D Program.

2. **Based on the milestones in the final INEL Action Plan for Implementation of The Federal Facility Agreement and Consent Order, it is recommended that the Environmental Restoration Department re-evaluate periodically the projected timing and volume of waste from remedial actions (including self-generated waste) and the need for waste treatment at the INEL centralized treatment facility.**

Recommendations 1 and 2 reflect the requirements of the DOE-HQ Environmental Restoration Program EM-40 Management Plan, which states that EM-40 is responsible for "advising EM-30 of projected needs for waste treatment, storage, and disposal capability."¹

3. **The MLLWTF maximum treatment alternative is the conditionally recommended alternative for the following reasons:**
 - It satisfies all "must" criteria
 - It ranks first against the "wants" criteria
 - It satisfies all DOE requirements and commitments as stated in DOE Order 6430.1A and the INEL Environmental Restoration and Waste Management Site-Specific Plan²
 - It offers assurance that long-term treatment capability would be available for treatment of INEL mixed waste and LLW.

The recommended alternative is conditional on the results of the waste volume and characteristic projections, which would be confirmed in the studies discussed under Recommendations 1 and 2.

4. **It is recommended that conceptual design and all other supporting activities begin on the recommended alternative as scheduled in the BUD, while re-evaluating the waste volume projections, so that additional time is not lost. This approach will help the INEL to manage the mixed waste and LLW in accordance with Federal, State, and DOE requirements as soon as feasible.**

16.1 References

1. U.S. Department of Energy, *Environmental Restoration Program EM-40 Management Plan*, DOE/EM/RM/02, Rev. 1, February 1992.
2. U.S. Department of Energy Idaho Field Office, *Environmental Restoration and Waste Management Site-Specific Plan (SSP) for Fiscal Year 1992 (FY-92)*, DOE/ID-10253, September 1991.

APPENDIX A

Details and Bases for Cost Estimates

A.1 INTRODUCTION

This appendix provides the cost-estimate details that led to the estimates in Tables 13-1 and 13-2. The basis for the estimate of each cost element is also provided.

Section A.2 provides a table of the estimated costs of disposing of the various types of waste. The source of each estimate is also discussed.

The remainder of the appendix (Section A.3) consists of a set of Detailed Cost Estimate Sheets for each treatment alternative. For each entry on an estimate sheet, the column headings call out the cost account number, activity description, type of source of information, estimated cost, present-worth total cost for that entry, escalated cost to year of expenditure, activity schedule for escalation, and the basis for the estimate. Subtotals are given for the seven categories of life cycle costs listed in Section 13.3.

Note that present-worth cost is generally rounded to the nearest thousand and escalated cost is rounded to the nearest ten thousand, hundred thousand, or million. As a result, the totals are sometimes not exactly equal to the sum of the individual parts; however, the error involved in these round-offs is less than 1%.

Also note that the contact-handled waste is assumed to be packaged in 55-gal drums. This is done for convenience and consistency. If other containers were used, their use would affect every alternative such that the results of the comparisons would not change significantly.

A.2 UNIT COSTS OF WASTE DISPOSAL AT THE MLLWDF

Unit costs of waste disposal were developed for three types of INEL mixed waste and LLW: contact-handled (CH) LLW, remote-handled (RH) LLW, and CH mixed waste. (The RH mixed waste is all characteristic waste and can be treated such that it is no longer mixed waste and may be reclassified as RH LLW.) As discussed in Section 13.3, both incremental unit costs and apportioned (total) unit costs were developed.

As explained in Section 13, a wide range of values can be developed for unit disposal costs, depending on which fixed costs are included or apportioned. Listed below in Table A-1 are the values selected for each type of waste.

Table A-1. Incremental and apportioned unit costs for waste disposal.

Type of Waste	Incremental Unit Cost (\$/ft ³)	Apportioned Unit Cost (\$/ft ³)
CH LLW	5.2	$\{ \$2,700,000 + (5.2 \text{ \$/ft}^3 \cdot V_{LLW}) + (7.3 \text{ \$/ft}^3 \cdot V_{MW}) \} / (V_{LLW} + V_{MW})$
RH LLW	73	$\{ \$680,000 + (73 \text{ \$/ft}^3 \cdot V_{RH-LLW}) \} / V_{RH-LLW}$
CH mixed waste	7.3	$\{ \$2,700,000 + (5.2 \text{ \$/ft}^3 \cdot V_{LLW}) + (7.3 \text{ \$/ft}^3 \cdot V_{MW}) \} / (V_{LLW} + V_{MW})$

where

V_{LLW} = volume of LLW

V_{MW} = volume of mixed waste

V_{RH-LLW} = volume of remote-handled LLW

The bases for these values are discussed in the following paragraphs.

The incremental unit costs for CH LLW and RH LLW were based on a detailed cost estimate by Cost Estimating, Mechanical Engineering, and RWMC personnel. All the steps required to dispose of waste containers were included. The types of workers performing each step were identified, as well as the number of labor hours and the salary grade of each worker. Equipment use costs were included. Preparation of new pit space was included. The waste volumes used correspond to the treatment alternatives resulting in the maximum and minimum volumes of waste requiring disposal. The results are documented in letter DNS-29-92, from D. N. Stoddard to T.H. Smith, dated June 8, 1992.

In the absence of any design information for the MLLWDF, the same values derived for the RWMC are assumed to apply for the MLLWDF. If concrete vaults rather than soil vaults are used for RH LLW at the MLLWDF, the incremental unit cost would increase by \$50 to \$123/ft³, according to one preliminary design study for concrete vaults at the RWMC. Because all the treatment alternatives would result in the same volume of RH LLW requiring disposal, the value picked for incremental disposal cost of RH LLW will not affect the cost differences among alternatives.

Virtually no data are available on mixed waste disposal costs. Therefore, the incremental costs for CH mixed waste were based on the costs just described, plus the cost for the dual liner and leak-detection system required under RCRA regulations. Discussions were held on this subject with INEL landfill personnel and NTS mixed waste disposal personnel. Documentation is available in the letter cited above.

The apportioned unit cost for CH waste was calculated based on the center of the range of recent estimates (from \$44 to \$56/ft³) given by four RWMC studies or communications with RWMC personnel. Some of the estimates were detailed; others were not. The value used for the disposal of 60,000 ft³/yr of waste was 50 \$/ft³. Since the incremental disposal cost was found to be constant at 5.2 \$/ft³, it cost \$300,000 to bury the waste, with the remaining \$2.7 million being the fixed cost that must be apportioned. Therefore, the total cost can be calculated from the equation:

$$\text{Total cost} = \$2,700,000 + 5.2 \text{ \$/ft}^3 * V_{LLW}$$

If the volume of mixed waste is added at 7.3 \$/ft³, the apportioned cost can be calculated as

$$\text{Apportioned cost} = \{ \$2,700,000 + (5.2 \text{ \$/ft}^3 * V_{LLW}) + (7.3 \text{ \$/ft}^3 * V_{MW}) \} / (V_{LLW} + V_{MW}).$$

The recent estimates for RH LLW at the RWMC range from a detailed estimate at \$270/ft³ to a quick estimate at \$398/ft³. A value of \$300/ft³ was selected, based on the disposal of 3000 ft³. Using similar logic as before, the equation for apportioned cost is

$$\text{Apportioned cost} = \{ \$680,000 + (73 \text{ \$/ft}^3 * V_{RH-LLW}) \} / V_{RH-LLW}.$$

A.3 DETAILED COST ESTIMATE SHEETS

Following are the Detailed Cost Estimate Sheets. The sheets for the various alternatives are ordered in the same sequence as that used throughout the main text of this document.

"Providing research and development services to the government"

INTEROFFICE CORRESPONDENCE

Date: June 26, 1992

To: T. H. Smith, MS 3505

From: T. E. Sivill, MS 3508 *TS*

Subject: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW LEVEL WASTE - TES-19-92

References: (a) D. N. Stoddard letter to T. H. Smith, DNS-22-92, Incremental Cost for MLLWDF, April 17, 1992
(b) Rough Draft Document, EG&E-WMO-10251, April 14, 1992
(c) D. N. Stoddard letter to T. H. Smith, DNS-25-92, same subject, May-19-92
(d) D. N. Stoddard letter to T. H. Smith, DNS-29-92, Incremental Cost for MLLWDF, June 8, 1992

Cost Estimating has prepared the attached twelve (12) Cost Estimate Studies for the above referenced project. Each alternative investigated will be included in a report to be published by Mr. T. H. Smith on Alternative Methods for Treating Mixed and Low-Level Waste at the INEL. As instructed, the resulting data is based upon the information provided at the time the work package was received by Cost Estimating. Subsequent meetings were necessary to define the scope and parameters of each alternative. Based upon the above references and verbal communication, the resulting costs encompass those items as shown on the attached Data Recapitulation, Summary, Contingency Analysis and Detail Sheets. Rough Cost data has been adjusted to the specific application and escalated accordingly for the appropriate scheduled time frame of occurrence.

It is imperative to recognize that these cost studies view waste disposal from two (2) different approaches. The first approach includes Incremental cost difference of one segment of waste disposal and not the total cost of waste disposal. Reference (a) above addresses the incremental cost and its estimate. The second approach includes the apportioned cost of waste disposal which attempts to encompass all costs attached to waste disposal.

T. H. Smith
June 26, 1992
TES-19-92
Page 2

Should you have any questions, feel free to contact either of us,
T. E. Sivill at 526-9273 or D. N. Stoddard at 526-5484.

TES:sd

Attachments:
As Stated

cc: W. S. Roesener, MS 3505
D. E. Sheldon, MS 3921
J. Jorgenson-Waters, MS 3422
Central Files, MS 1651
Estimate File M-212
T. E. Sivill File
D. N. Stoddard File

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study File No. M-212, Alt. 1A Date: 06/20/92
(Rev. 1)

Project: MLLWTF - MAXIMUM TREATMENT
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			20,275,000	27,070,000
Project Management	3,750,000	5,100,000		
Studies	3,975,000	4,440,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	8,900,000	13,220,000		
Technology Development	400,000	510,000		
ENGINEERING, DESIGN AND INSPECTION.....			10,900,000	14,100,000
Performance Specification				
Conceptual and Title I / II Design	10,000,000	12,600,000		
Title III Inspection	900,000	1,500,000		
CONSTRUCTION.....			44,273,000	72,095,000
Building Costs	25,875,000	41,460,000		
Equipment Costs	11,965,000	20,160,000		
Construction Management	6,433,000	10,475,000		
START-UP AND READINESS.....			8,088,000	14,300,000
BUILDING OPERATION.....			247,100,000	872,200,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			39,768,000	140,400,000
DECONTAMINATION AND.....			6,641,000	44,800,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			4,427,000	7,210,000
SUBTOTAL.....			381,472,000	1,192,175,000
CONTINGENCY ** 23% of Subtotal.....			88,528,000	
CONTINGENCY ** 27% of Subtotal.....				327,825,000

TOTAL PROJECT COST: \$470,000,000 \$1,520,000,000

Comments: **Total contingency is 24% and 28% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.1A
(Rev. I)

Date: 06/20/92

Project: MLLWTF - MAXIMUM TREATMENT
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			20,275,000	27,070,000
Project Management	3,750,000	5,100,000		
Studies	3,975,000	4,440,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	8,900,000	13,220,000		
Technology Development	400,000	510,000		
ENGINEERING, DESIGN AND INSPECTION.....			10,900,000	14,100,000
Performance Specification				
Conceptual and Title I / II Design	10,000,000	12,600,000		
Title III Inspection	900,000	1,500,000		
CONSTRUCTION.....			44,273,000	72,095,000
Building Costs	25,875,000	41,460,000		
Equipment Costs	11,965,000	20,160,000		
Construction Management	6,433,000	10,475,000		
START-UP AND READINESS.....			8,088,000	14,300,000
BUILDING OPERATION.....			247,100,000	872,200,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			124,577,000	440,200,000
DECONTAMINATION AND.....			6,641,000	44,800,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			4,427,000	7,210,000
SUBTOTAL.....			466,281,000	1,491,975,000
CONTINGENCY ** 23% of Subtotal.....			108,719,000	
CONTINGENCY ** 27% of Subtotal.....				408,025,000
TOTAL PROJECT COST:			\$575,000,000	\$1,900,000,000

Comments: **Total contingency is 24% and 28% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - MAXIMUM TREATMENT
File No: M-212, Alt.1A, REV. 1
Estimator: D. N. Stoddard
T. E. Sivill
Data: 06/19/92
Approved By: MS

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 1A, Maximum Treatment. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of a maximum treatment facility including all equipment, start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992 and May 8, 1992
- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration of year 2032.

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the Maximum Treatment alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development).
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection of the facilities required. The Maximum Treatment alternative requires a new facility to contain the treatment processes and the associated support staff as well as Lag Storage facilities.
- CONSTRUCTION COSTS include land improvement, building construction and utility costs as well as special construction (hot cells) and initial complements (office areas). Process equipment associated with the facility are also included in these costs and Construction Management for this phase has been included at the current rate of seventeen percent of construction costs.
- START-UP AND READINESS includes the costs associated with initial system testing, system operation and maintenance manuals, and training of personnel associated with the operations of the processes. A crew has been sized based upon similar operations presently functioning at other facilities.
- OPERATING COSTS include the staff, materials, equipment, maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of similar facilities and adjusted for this specific project.

(Continued)

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

Page -3-

III. ASSUMPTIONS: (Continued)

- WASTE TRANSPORT AND DISPOSAL COSTS include the costs to transport the waste from the generator (initial waste location) to the treatment facility, from the generator directly to the disposal site, and from the treatment facility to the disposal site. The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.
- DECONTAMINATION AND DECOMMISSIONING includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Engineer/Project Manager direction, D & D costs have been estimated at 15% of the original facility and process construction costs.
- Management Reserve has also been allowed for based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

The Maximum Treatment alternative will process as much waste as possible therefore, the total volume of waste actually disposed of will be less than that resulting from the Minimum Treatment alternative.

DETAILED COST ESTIMATE SHEET

EG&G Idaho, Inc.

PROJECT EVALUATION OF ALTERNATIVES FOR TREATING
INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - MAXIMUM TREATMENT
INEL

REQUESTER T. H. SMITH

Type of Est. Study
SOURCE
(E) Eng. Est.
(V) Vendor
(P) Pur. Order
(H) Handbook Ref.

File No. M-212, Alt. 1A
(Rev. 1)

Date: 06/25/92
Page: 1 of 6
Prep. By: T. E. Shull
App'd By: *holl*

ACCT NO.	ACTIVITY DESCRIPTION	E/V	ESTIMATED COST	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
PROJECT COSTS							
	Project Management	E		3,750,000	5,100,000	FY MID - 1991 THRU 2003	BUD Sheet, dated 1/31/92
	Project Studies - 2 People, Full-time	E	\$250K/YR/EA	2,000,000	2,300,000	FY 1992 THRU FY 1995	BUD Sheet, dated 1/31/92
	Design Support Studies (F&OR's, etc.)	E	\$1MIL TO DATE/\$250K/YR	1,750,000	1,900,000	FY 1993 THRU FY 1995	BUD Sheet, dated 1/31/92, Engineer's Estimate
	Siting Studies (Assume Site Partially Characterized, NPR Area)	E	\$150K - 1992, \$75K - 1993	225,000	240,000	FY 1992 THRU FY 1993	BUD Sheet, dated 1/31/92, Engineer's Estimate
	NEPA (EIS)	E	\$750K/\$1M/\$750K/\$750K	3,250,000	3,800,000	FY 1993 THRU FY 1996	Engineer's Estimate
	Permitting (NESHAP, etc.)						
	TSCA	E	\$250K/\$250K/\$500K	1,000,000	1,500,000	FY 1995, FY 1998, FY 2003	Engineer's Est. (Includes Trial Burn/Sampling)
	RCRA	E	\$375K/\$375K/\$500K/\$1.5M	2,750,000	4,300,000	FY '95, '96, 2000, 2003	Engineer's Est. (Includes Trial Burn/Sampling)
	Other	E	\$250K/YR	750,000	1,100,000	FY 1998 Thru 2000	Engineer's Est.
	Safety Analysis Report (SAR)	E	\$300K/\$850K/\$850K	2,000,000	3,000,000	(93, '94) (98 - 2000) (01, 02)	Data from similar SAR's
	Other Regulatory Items						
	ESH&Q	E	\$100K/YR	1,100,000	1,500,000	FY 1993 THRU FY 2003	Engineer's Estimate
	CX's	E	\$50K/YR	50,000	60,000	FY 1994	Engineer's Estimate
	PSD	E	\$250K/YR	1,000,000	1,400,000	FY 1997 THRU FY 2000	Engineer's Estimate
	PTC/NESHAP	E	\$250K	250,000	360,000	FY 1997 THRU FY 2000	Engineer's Estimate
	TECHNOLOGY DEVELOPMENT						
	Incineration (Demo) - Rotary Kilo/Offgas System (Demo)	E	\$100K	100,000	120,000	FY 1995	Vendor Demonstration, Engineer Estimate
	Immobilization (Demo)						
	Jointly Heated Glass Mel, Vitrification	E	\$100K	100,000	130,000	FY 1996	Engineer Estimate
	Modified Sulfur Cement (MSC)	E	\$100K	100,000	130,000	FY 1997	Engineer Estimate
	Cementation	E	\$100K	100,000	130,000	FY 1996	Engineer Estimate
	SUBTOTAL - FRONT END COSTS			20,275,000	27,070,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning - Includes Design Support Studies, etc., Ref: Page 1						
	Conceptual	E	\$2MIL	2,000,000	2,300,000	FY 1993 THRU FY 1994	ICE Review Team
	Title I	E	\$4MIL	4,000,000	5,000,000	FY 1996	Engineer's Estimate
	Title II	E	\$4MIL	4,000,000	5,300,000	FY 1997	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			10,000,000	12,600,000		
	TITLE III INSPECTION - 3 People, Full-time	E	\$450K/YR	900,000	1,500,000	FY 2001 THRU FY 2002	Engineer's Estimate
	SUBTOTAL - TITLE III INSPECTION			900,000	1,500,000		
	CONSTRUCTION						
4000	Improvements To Land	E	\$1 MIL	1,000,000	1,600,000	FY 2001	Comparative Parametric Mod'g/Hist Data
5000	Buildings and Structures						
	Treatment Facility Approximately 35,000 sf bldg	E	\$17.5 MIL	17,500,000	28,000,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Miscellaneous Equipment, i.e., 10T, 50T Cranes	E	\$175K	175,000	300,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Hot Cells (3 each)	E	\$200K/EA	600,000	1,000,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Initial Complements	E	\$100K	100,000	160,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Miscellaneous Instrumentation, annunciators, etc.	E	\$1MIL	1,000,000	1,600,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Lag Storage Bldg. Approximately 15,000 SF	E	\$2 MIL	2,000,000	3,200,000	FY 2001	Historical Data
	Indefinite Storage Bldg.	E	-0-				
6000	Utilities	E	\$3.5 MIL	3,500,000	5,600,000	FY 2001	Engineer's Estimate
	SUBTOTAL - CONSTRUCTION COSTS			25,875,000	41,480,000		

PROJECT MILLWTF - MAXIMUM TREATMENT

Type of Est. Study

File No M-212, Alt. 1A
(Rev. 1)

Date: 06/11/92

Page: 3 of 6

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Rotary Kiln Incinerator	H/E	\$2 MIL	2,000,000	3,400,000	FY 2002	Historical Data for Similar Incinerator (WERF)
	Included in the above cost of the Rotary Kiln: Basic Equipment, Feed Systems, Controls, Instrumentation, Misc. Filters, Dampers, Safety, Scales & Monitoring, Feed & Secondary Combust. Chambers, Ash Disch Sy						
	Safety Systems - 2 diesel generators, etc.,	E	\$185K	185,000	300,000	FY 2002	WERF/PREPP/Engineering Experience
	Offgas System Including Stack & Ducting	E	\$1.5MIL	1,500,000	2,500,000	FY 2002	WERF/PREPP/Engineering Experience
	Package Examination Equipment	E	\$480K	480,000	800,000	FY 2002	Engineer's Estimate
	Shredder	E	\$300K	300,000	500,000	FY 2002	PREPP Experience
	Grinder	E	\$200K	200,000	300,000	FY 2002	Engineer's Estimate
	Torch Cutting	E	\$100K	100,000	200,000	FY 2002	Engineer's Estimate
	Compactor	E	\$1MIL	1,000,000	1,700,000	FY 2002	WERF/Engineer Experience
	Immobilization Equipment - Ash Handling/Solidification	E	\$600K	600,000	1,000,000	FY 2002	Engineer's Estimate
	Glass Meter	E	\$300K	300,000	500,000	FY 2002	Engineer's Estimate
	Sulphur Treatment	E	\$600K	600,000	1,000,000	FY 2002	Engineer's Estimate
	Remote Size Reduction (Robotics)	E	\$1 MIL	1,000,000	1,700,000	FY 2002	Engineer's Estimate
	Sorting Chamber (Remote Handling)	E	\$1 MIL	1,000,000	1,700,000	FY 2002	Engineer's Estimate
	Decon Equipment	E	\$350K	350,000	600,000	FY 2002	Engineer's Estimate
	Hd Cell Manipulators & Equipment	E	\$1 MIL	1,000,000	1,700,000	FY 2002	Engineer's Estimate
	Other Equipment - Lab Equipment	E	\$600K	600,000	1,000,000	FY 2002	Engineer's Estimate
	Elevator	E	\$250K	250,000	420,000	FY 2002	Engineer's Estimate
	Miscellaneous Conveyance, i.e., 2 Forklifts, etc.	E	\$500K	500,000	840,000	FY 2002	Engineer's Estimate
	SUBTOTAL EQUIPMENT COSTS			11,965,000	20,160,000		
	CONSTRUCTION MANAGEMENT	E	\$ 433MIL	6,433,000	10,475,000	FY 2003	Engineer's Estimate
	TESTING/STARTUP/PERSONNEL TRAINING - 50 People	E	\$7.8 MIL	7,800,000	13,800,000	FY 2003	WERF/Engineer Experience
	READINESS REVIEW - 10 People, 3 Months, 480 Hours ea.	E	\$288K	288,000	500,000	FY 2003	Readiness Review Experience
	SUBTOTAL STARTUP/READINESS COSTS			8,088,000	14,300,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY		ESCALATED COSTS	ACTMITY SCHEDULE ESCALATION	ESTIMATE BASIS
				COSTS				
OPERATING COSTS								
	Labor based on 2080 Hours/Year/Each							
	Operating Personnel, 15 People	E	\$125K/YR/EA	46,900,000		165,700,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Maintenance Personnel, 8 People	E	\$120K/YR/EA	24,000,000		84,800,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Training Personnel, 2 People	E	\$96K/YR/EA	4,800,000		17,000,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Recordkeeping, 2 People	E	\$78K/YR/EA	3,900,000		13,800,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Management, 4 People	E	\$285K/YR/EA	28,500,000		100,700,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Engineering, 5 People	E	\$177K/YR/EA	22,125,000		78,200,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	ESH&O Personnel, 4 People	E	\$178K/YR/EA	17,800,000		63,000,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Budget Support Personnel, 1 Person	E	\$115K/YR/EA	2,875,000		10,200,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Health Physicists (HP's), 2 People	E	\$128K/YR/EA	6,400,000		22,600,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Lab Personnel, 3 People	E	\$128K/YR/EA	9,600,000		34,000,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Materials							
	Process Materials, i.e., Sulfur Cement, etc.,	E	\$100K/YR	2,500,000		8,800,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Waste Containers							
	55 Gal. Drums, est. 20,000 drums @ \$35/ea.	E	\$700K/YR	17,500,000		61,800,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Remote Handled Waste Disposal Vaults	E	\$1.9M/LYR	47,500,000		167,900,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Lab Materials and Supplies	E	\$50K/YR	1,300,000		4,400,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Other							
	Equipment							
	Process Improvements	E						
	Replacement Parts	E	\$100K/YR	2,500,000		8,800,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
SUBTOTAL OPERATING COSTS (Continued)								
				238,200,000		841,700,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electrical	E	\$65K/YR	1,700,000	5,800,000	FY 2003 THRU FY 2028	Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc..	E	\$225K/YR	5,900,000	20,200,000	FY 2003 THRU FY 2028	Based on WERF Facility, adjusted and escalated
	Other	E	\$50K/YR	1,300,000	4,500,000	FY 2003 THRU FY 2028	Based on WERF Facility, adjusted and escalated
	SUBTOTAL - OPERATING COSTS (Continued)			8,900,000	30,500,000		
	WASTE TRANSPORT COSTS	E	\$390K/YR	9,800,000	34,500,000	FY 2004 THRU FY 2028	EGG - WTD - 10082
	DISPOSAL - INCREMENTAL COSTS IN MILLWDF						
	Contact Handled Low Level Waste 90,300cf @ \$5.2/cf	E	\$470K/YR	11,738,000	41,500,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Remde Handled Low Level Waste In Soil Vaults 4700cf @ \$73.4/cf	E	\$343K/YR	8,575,000	30,300,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ \$7.3/cf	E	\$386K/YR	9,654,000	34,100,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			29,968,000	105,900,000		
	APPORTIONED DISPOSAL COSTS						
	Contact Handled Low Level Waste 90,300cf @ \$24.84/cf	E	\$2,243 MIL/YR	56,078,000	198,200,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Remde Handled Low Level Waste In Soil Vaults 4700cf @ \$220/cf	E	\$1,034 MIL/YR	25,850,000	91,400,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ 24.84/cf	E	\$1,314 MIL/YR	32,851,000	116,100,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			114,777,000	405,700,000		

06/20/92

Date:

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File No. M-212, Alt. 1A
(Rev. 1)

Type of Est. Study

PROJECT MILLWTF - MAXIMUM TREATMENT

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	15% Original Const Cost	6,641,000	44,800,000	FY 2029 THRU FY 2032	Data from Previous D & D Projects
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			20,275,000	27,070,000		
	DESIGN COSTS			10,900,000	14,100,000		
	CONSTRUCTION COSTS			44,273,000	72,095,000		
	STARTUP/READINESS COSTS			8,088,000	14,300,000		
	OPERATING COSTS			247,100,000	872,200,000		
	WASTE TRANSPORT/INCREMENTAL DISPOSAL COSTS			39,768,000	140,400,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			6,641,000	44,800,000		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			377,045,000	1,184,965,000		
	SUMMARY - MILLWTF - APPORTIONED DISPOSAL						
	FRONT END COSTS			20,275,000	27,070,000		
	DESIGN COSTS			10,900,000	14,100,000		
	CONSTRUCTION COSTS			44,273,000	72,095,000		
	STARTUP/READINESS COSTS			8,088,000	14,300,000		
	OPERATING COSTS			247,100,000	872,200,000		
	WASTE TRANSPORT/APPORTIONED DISPOSAL COSTS			124,577,000	440,200,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			6,641,000	44,800,000		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			461,854,000	1,484,765,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.1A

Date: 06/20/92

(Rev. 1)

Project : MLLWTF - MAXIMUM TREATMENT (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: BOK

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,750,000	1.0		100	10	25	0.10	0.25
Studies	3,975,000	1.1		100	10	25	0.11	0.26
NEPA Documentation	3,250,000	0.9		100	25	70	0.22	0.60
Permitting	8,900,000	2		100	10	35	0.24	0.83
Tech. Development	400,000	0.11		100	10	25	0.01	0.03
Conceptual, Title I & II	10,000,000	3		100	15	40	0.40	1.06
Title III Inspection	900,000	0.2		100	15	35	0.04	0.08
Building Costs	25,875,000	7		100	15	25	1.03	1.72
Equipment Costs	11,965,000	3		100	5	50	0.16	1.59
Constr Mgmt	6,433,000	2		100	5	50	0.09	0.85
Startup and Readiness	8,088,000	2		100	5	40	0.11	0.86
Building Operation	247,100,000	66		100	5	25	3.28	16.38
Waste Trans/Disposal	39,768,000	11		100	5	30	0.53	3.16
Decon/Decommission	6,641,000	2		100	5	35	0.09	0.62
Total	377,045,000	100					5.95	27.18

Comments: Analysis results in an overall project contingency of 23.86% Use 24%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.1A
(Rev. 1)

Date: 06/20/92

Project : MLLWTF - MAXIMUM TREATMENT (ESCALATED COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: for

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est				
					-	+	-	+
Project Management	5,100,000	0.4		100	10	35	0.04	0.15
Studies	4,440,000	0.4		100	10	35	0.04	0.13
NEPA Documentation	3,800,000	0.3		100	25	70	0.08	0.22
Permitting	13,220,000	1		100	10	35	0.11	0.39
Tech. Development	510,000	0.04		100	10	25	0.00	0.01
Conceptual, Title I & II	12,600,000	1.1		100	15	40	0.16	0.43
Title III Inspection	1,500,000	0.1		100	15	35	0.02	0.04
Building Costs	41,460,000	3		100	15	40	0.52	1.40
Equipment Costs	20,160,000	1.7		100	5	60	0.09	1.02
Constr Mgmt	10,475,000	0.9		100	5	50	0.04	0.44
Startup and Readiness	14,300,000	1.2		100	5	40	0.06	0.48
Building Operation	872,200,000	74		100	5	30	3.68	22.08
Waste Trans/Disposal	140,400,000	12		100	5	40	0.59	4.74
Decon/Decommission	44,800,000	4		100	5	35	0.19	1.32
Total	1,184,965,000	100					5.47	32.36

Comments: Analysis results in an overall project contingency of 28.58% Use 28%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study File No. M-212, Alt.1B Date: 06/20/92
 (Rev. 1)
 Project: MLLWTF - MINIMUM TREATMENT
 (INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)
 Prepared By: D. N. Stoddard / T. E. Sivill Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			20,275,000	27,070,000
Project Management	3,750,000	5,100,000		
Studies	3,975,000	4,440,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	8,900,000	13,220,000		
Technology Development	400,000	510,000		
ENGINEERING, DESIGN AND INSPECTION.....			7,900,000	10,400,000
Performance Specification				
Conceptual and Title I / II Design	7,000,000	8,900,000		
Title III Inspection	900,000	1,500,000		
CONSTRUCTION.....			31,403,000	51,089,000
Building Costs	18,875,000	30,260,000		
Equipment Costs	7,965,000	13,406,000		
Construction Management	4,563,000	7,423,000		
START-UP AND READINESS.....			7,464,000	12,500,000
BUILDING OPERATION.....			258,150,000	911,400,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			64,694,000	228,600,000
DECONTAMINATION AND.....			4,710,000	31,800,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			3,140,000	5,109,000
SUBTOTAL.....			397,736,000	1,277,968,000
CONTINGENCY ** 25% of Subtotal.....			99,264,000	
CONTINGENCY ** 30% of Subtotal.....				382,032,000
TOTAL PROJECT COST:			\$497,000,000	\$1,660,000,000

Comments: **Total contingency is 24% and 29% respectively, including Management Reserve.
 Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt. 1B
(Rev. 1)

Date: 06/20/92

Project: MLLWTF - MINIMUM TREATMENT
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			20,275,000	27,070,000
Project Management	3,750,000	5,100,000		
Studies	3,975,000	4,440,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	8,900,000	13,220,000		
Technology Development	400,000	510,000		
ENGINEERING, DESIGN AND INSPECTION.....			7,900,000	10,400,000
Performance Specification				
Conceptual and Title I / II Design	7,000,000	8,900,000		
Title III Inspection	900,000	1,500,000		
CONSTRUCTION.....			31,403,000	51,089,000
Building Costs	18,875,000	30,260,000		
Equipment Costs	7,965,000	13,406,000		
Construction Management	4,563,000	7,423,000		
START-UP AND READINESS.....			7,464,000	12,500,000
BUILDING OPERATION.....			258,150,000	911,400,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			149,451,000	528,200,000
DECONTAMINATION AND.....			4,710,000	31,800,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			3,140,000	5,109,000
SUBTOTAL.....			482,493,000	1,577,568,000
CONTINGENCY ** 24% of Subtotal.....			117,507,000	
CONTINGENCY ** 29% of Subtotal.....				452,432,000
TOTAL PROJECT COST:			\$600,000,000	\$2,030,000,000

Comments: **Total contingency is 24% and 29% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - MINIMUM TREATMENT
File No: M-212, Alt.1B, Rev. 1
Estimator: D. N. Stoddard
T. E. Sivill
Date: 06/19/92
Approved By: ASL

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 1B, Minimum Treatment. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of a maximum treatment facility including all equipment, start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992 and May 8, 1992
- (b) Rough Draft Document, EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration of year 2032.

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)****III. ASSUMPTIONS: (Continued)**

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the Minimum Treatment alternative, the following major categories were identified (same as the maximum treatment alternative) and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development). These costs remain the same for both maximum and minimum treatment.
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection of the facilities required. The Minimum Treatment alternative requires a new facility to contain the treatment processes and the associated support staff as well as Lag Storage facilities. The overall size of the facility, equipment and staff will be less than that of the maximum treatment alternative. Less waste will be treated under this alternative.
- CONSTRUCTION COSTS include land improvement, building construction and utility costs as well as special construction (hot cells) and initial complements (office areas). Process equipment associated with the facility is also included in these costs. Construction Management for this phase has been included at the current rate of seventeen percent of construction costs.
- START-UP AND READINESS includes the costs associated with initial system testing, system operation and maintenance manuals and training of personnel associated with the operations of the processes. A crew has been sized based upon similar operations presently functioning at other facilities.
- OPERATING COSTS include the staff, materials, equipment maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of similar facilities and adjusted for this specific project.

(Continued)

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

Page -3-

III. ASSUMPTIONS: (Continued)

- WASTE TRANSPORT AND DISPOSAL includes the costs to transport the waste from the generator (initial waste location) to the treatment facility or directly to the disposal site, and from the treatment facility to the disposal site. The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.
- DECONTAMINATION AND DECOMMISSIONING includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Project Manager/Engineer direction, D&D costs have been estimated at 15% of the original facility and process construction costs.
- Management Reserve has also been allowed for based on the Construction Costs. This is calculated in the overall percentage of Contingency.

The Minimum Treatment alternative investigate the costs of a smaller facility in building size as well as process capabilities. The minimum treatment will process less waste and ship more waste directly from the generator to the disposal site. Therefore, the total volume of waste treated will decrease and total volume of waste disposed of will be greater than that resulting from the Maximum Treatment alternative.

Comparing the findings shown on the summary sheets, although building and operational costs are less for the minimum treatment alternative, the overall Total Project Costs are higher. As a result the increased volume of waste being disposed increases the TPC.

DETAILED COST ESTIMATE SHEET

EG&G Idaho, Inc.

PROJECT EVALUATION OF ALTERNATIVES FOR TREATING
MILLWTF - MINIMUM TREATMENT

LOCATION INEL

REQUESTER T H SMITH

Type of Est Study

SOURCE

(E) Eng Est

(M) Vendor

(P) Per Order

(H) Handbook Ref

File No M-212, AR 18

(Rev 1)

Date

Page 1 of 6

Prep By T E Sudd

App'd By *TS*

08/23/92

ACCT NO	ACTIVITY DESCRIPTION	E/V	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE	ESTIMATE BASIS
		P/H				ESCALATION	
PROJECT COSTS							
	Project Management	E		\$300K/YR	3,750,000	FY 1980 - 1991 THRU FY 2003	BUD Sheet, dated 1/31/92
	Project Studies - (2) People, Full-time	E		\$250K/YR/EA	2,000,000	FY 1982 THRU FY 1985	BUD Sheet, dated 1/31/92
	Design Support Studies (FACRs, etc.)	E	\$1M/L TO DATE (\$250K/YR)	1,750,000	1,900,000	FY 1983 THRU FY 1985	BUD Sheet, dated 1/31/92, Engineer's Estimate
	Siting Studies (Assume Site Partially Characterized, NPR Area)	E	\$150K - 1982 - 1983	225,000	240,000	FY 1982 THRU FY 1983	BUD Sheet, dated 1/31/92, Engineer's Estimate
	NEPA (EIS)	E	\$750K/\$1M/\$750K/\$750K	3,250,000	3,800,000	FY 1983 THRU FY 1986	Engineer's Estimate
	Permitting (NESHAP, etc.)						
	TSCA	E	\$250K/\$250K/\$500K	1,000,000	1,500,000	FY 1985, FY 1988, FY 2003	Engineer's Est (Includes Total Burn Sampling)
	RCRA	E	\$375K/\$375K/\$500K/\$1.5M	2,750,000	4,300,000	FY 95, 96, 2000, 2003	Engineer's Est (Includes Total Burn Sampling)
	Other	E	\$250K/YR	750,000	1,100,000	FY 98 Thru 2000	Engineer's Est
	Safety Analysis Report (SAR)	E	\$300K/\$500K/\$850K	2,000,000	3,000,000	(193, 194) (58 - 2000) (101, 02) Data from similar SAR's	
	Other Regulatory Items						
	ESH&O	E	\$100K/YR	1,100,000	1,500,000	FY 1983 THRU FY 2003	Engineer's Estimate
	CT's	E	\$50K/YR	50,000	80,000	FY 1984	Engineer's Estimate
	PSD	E	\$250K/YR	1,000,000	1,400,000	FY 1987 THRU FY 2000	Engineer's Estimate
	PIC/NESHAP	E	\$250K	250,000	380,000	FY 1987 THRU FY 2000	Engineer's Estimate
	TECHNOLOGY DEVELOPMENT						
	Incineration (Demo) - Rotary Kiln/Orgas System (Demo)	E	\$100K	100,000	120,000	FY 1985	Vendor Demonstration, Engineer Estimate
	Immobilization (Demo)						
	Joule Heated Glass Mel. Verification	E	\$100K	100,000	130,000	FY 1986	Engineer Estimate
	Modified Sulfur Cement (MSC)	E	\$100K	100,000	130,000	FY 1987	Engineer Estimate
	Cementation	E	\$100K	100,000	130,000	FY 1986	Engineer Estimate
	SUBTOTAL - FRONT END COSTS			20,275,000	27,070,000		

ACCT NO	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning - Includes Design Support Studies, etc. Ref: Page 1	E					
	Conceptual	E	\$500K/\$500K	1,000,000	1,100,000	FY 1993 THRU FY 1994	ICE Review Team
	Title I	E	\$3MIL	3,000,000	3,800,000	FY 1996	Engineer's Estimate
	Title II	E	\$3MIL	3,000,000	4,000,000	FY 1997	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			7,000,000	8,900,000		
	TITLE III INSPECTION - 3 People, Full-time	E	\$450K/YR	900,000	1,500,000	FY 2001 THRU FY 2002	Engineer's Estimate
	SUBTOTAL - INSPECTION COSTS			900,000	1,500,000		
	CONSTRUCTION						
4000	Improvements To Land	E	\$1 MIL	1,000,000	1,600,000	FY 2001	Comparative Parametric Mod'g/Hist Data
5000	Buildings and Structures						
	Treatment Facility, Approximately 24,000 sf bld'g	E	\$12 MIL	12,000,000	19,200,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Miscellaneous Equipment, i.e., 10T, 50T Cranes	E	\$175K	175,000	300,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Hot Cells (3 each)	H/E	\$200K/EA	600,000	1,000,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Initial Complements	E	\$100K	100,000	160,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Miscellaneous Instrumentation, annunciators, etc.	E	\$1MIL	1,000,000	1,600,000	FY 2001	Comparative Parametric Mod'g/Hist Data
	Lag Storage Bldg. Approximately 8,600 sf bld'g	E	\$1 MIL	1,000,000	1,600,000	FY 2001	Historical Data
	Indefinite Storage Bldg.	E	-0-				
6000	Utilities	E	\$3 MIL	3,000,000	4,800,000	FY 2001	Engineer's Estimate
	SUBTOTAL - CONSTRUCTION COSTS			18,975,000	30,260,000		

PROJECT MLLWTF - MINIMUM TREATMENT
Type of Est. Study

File No. M-212, Alt. 1B

Date: 06/11/82

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(Rev. 1)

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Rotary Kin Incinerator	H/E	\$1 MIL	1,000,000	1,700,000	FY 2002	Historical Data for Similar Incinerator (WERF)
	Included in the above cost of the Rotary Kin: Basic Equipment, Feed Systems, Controls, Instrumentation, Misc. Filters, Dampers, Safety, Scales & Monitoring, Feed & Secondary Combust. Chambers, Ash Disch Sy						
	Offgas System Including Stack & Ducting	E	\$750K	750,000	1,300,000	FY 2002	WERF/PREPP/Engineering Experience
	Safety Systems - 2 Diesel Generators, etc.	E	\$185K	185,000	300,000	FY 2002	WERF/PREPP/Engineering Experience
	Package Examination Equipment	E	\$480K	480,000	800,000	FY 2002	Engineer's Estimate
	Shredder	E	\$150K	150,000	250,000	FY 2002	PREPP Experience
	Grinder	E	\$200K	200,000	336,000	FY 2002	Engineer's Estimate
	Torch Cutting	E	-0-				
	Compactor	E	-0-				
	Immobilization Equipment - Ash Handling/Solidification	E	\$600K	600,000	1,000,000	FY 2002	Engineer's Estimate
	Glass Meter	E	\$300K	300,000	500,000	FY 2002	Engineer's Estimate
	Sulphur Treatment	E	\$600K	600,000	1,000,000	FY 2002	Engineer's Estimate
	Remote Size Reduction (Robotics)	E	-0-				Engineer's Estimate
	Sorting Chamber (Remote Handling)	E	\$1 MIL	1,000,000	1,700,000	FY 2002	Engineer's Estimate
	Decon Equipment	E	\$350K	350,000	600,000	FY 2002	Engineer's Estimate
	Hot Cell Manipulators & Equipment	E	\$1 MIL	1,000,000	1,700,000	FY 2002	Engineer's Estimate
	Other Equipment - Lab Equipment	E	\$600K	600,000	1,000,000	FY 2002	Engineer's Estimate
	Elevator	E	\$250K	250,000	420,000	FY 2002	Engineer's Estimate
	Miscellaneous Conveyance, i.e. 2 Forklifts, etc.	E	\$500K	500,000	800,000	FY 2002	Engineer's Estimate
	SUBTOTAL EQUIPMENT COSTS			7,965,000	13,405,000		
	CONSTRUCTION MANAGEMENT	E	\$4,563MIL	4,563,000	7,423,000	FY 2003	Engineer's Estimate
	TESTING/STARTUP/PERSONNEL TRAINING - 46 People	E	\$7,176 MIL	7,176,000	12,000,000	FY 2003	WERF/Engineer Experience
	READINESS REVIEW - 10 People, 3 Months, 480 Hours es	E	\$288K	288,000	500,000	FY 2003	Readiness Review Experience
	SUBTOTAL STARTUP/READINESS COSTS			7,464,000	12,500,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
OPERATING COSTS							
	Labor based on 2080 Hours/Year/Each						
	Operating Personnel, 12 People	E	\$125K/YR/EA	37,500,000	132,800,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Maintenance Personnel, 8 People	E	\$120K/YR/EA	24,000,000	84,800,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Training Personnel, 2 People	E	\$99K/YR/EA	4,800,000	17,000,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Recordkeeping, 2 People	E	\$78K/YR/EA	3,900,000	13,800,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Management, 4 People	E	\$285K/YR/EA	28,500,000	100,700,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Engineering, 5 People	E	\$177K/YR/EA	22,100,000	78,000,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	ESH&Q Personnel, 4 People	E	\$178K/YR/EA	17,800,000	62,900,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Budget Support Personnel, 1 Person	E	\$115K/YR/EA	2,800,000	10,200,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Health Physicists (HPs), 2 People	E	\$128K/YR/EA	6,400,000	22,600,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Lab Personnel, 3 People	E	\$128K/YR/EA	9,600,000	33,900,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Materials						
	Process Materials, i.e., Sulfur Cement, etc.	E	\$100K/YR	2,500,000	8,800,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Waste Containers						
	55 Gal. Drums, est. 48,000 drums @ \$35/ea.	E	\$168 MIL/YR	42,000,000	148,400,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Remedie Handled Waste Disposal Vaults	E	\$1.9MIL/YR	47,500,000	167,900,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Lab Materials and Supplies	E	\$50K/YR	1,250,000	4,400,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
	Other						
	Equipment						
	Process Improvements						
	Replacement Parts	E	\$100K/YR	2,500,000	8,800,000 FY 2004 THRU FY 2028		Engineer Judgment based on WERF Operations
SUBTOTAL OPERATING COSTS (Continued)				253,250,000	894,800,000		

06/11/92

Date:

Page: 5 of 6

File No. M-212, Alt. 1B

Type of Est. Study

PROJECT MILLWTF - MINIMUM TREATMENT

(Rev. 1)

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
UTILITIES							
	Electrical	E	\$60K/YR	1,600,000	5,400,000	FY 2003 THRU FY 2028	Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc.	E	\$75K/YR	2,000,000	6,700,000	FY 2003 THRU FY 2028	Based on WERF Facility, adjusted and escalated
	Other	E	\$50K/YR	1,300,000	4,500,000	FY 2003 THRU FY 2028	Based on WERF Facility, adjusted and escalated
	SUBTOTAL - OPERATING COSTS (Continued)			4,900,000	16,600,000		
WASTE TRANSPORT COSTS							
		E	\$363K/YR	9,100,000	32,100,000	FY 2004 THRU FY 2028	EGG - WTD - 10092
DISPOSAL - INCREMENTAL COSTS IN MILLWDF							
	Contact Handled Low Level Waste 287,400cf @ \$5.2/cf	E	\$1,484 MIL/YR	37,362,000	132,100,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Remide Handled Low Level Waste in Soil Vaults 4700cf @ \$73.4/cf	E	\$343K/YR	8,578,000	30,300,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ \$7.3/cf	E	\$386K/YR	9,654,000	34,100,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
							Based on data from RWMC & Eng. Est.
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			55,594,000	196,500,000		
APPORTIONED DISPOSAL COSTS							
	Contact Handled Low Level Waste 287,400cf @ \$13.48/cf	E	\$3,888 MIL/YR	96,700,000	341,800,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Remide Handled Low Level Waste in Soil Vaults 4700cf @ \$220/cf	E	\$1,034 MIL/YR	25,850,000	91,400,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ \$13.48/cf	E	\$712K/YR	17,801,000	62,900,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			140,351,000	496,100,000		

Date: 06/20/82

Page: 6 of 6

File No. M-212, At. 1B

Type of Est. Study

PROJECT MILLWTF - MINIMUM TREATMENT

(Rev. 1)

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	15% Original Const Cost	4,710,000	31,800,000	FY 2028 THRU FY 2032	Data from Previous D & D Projects
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			20,275,000	27,070,000		
	DESIGN COSTS			7,900,000	10,400,000		
	CONSTRUCTION COSTS			31,400,000	51,089,000		
	STARTUP/READINESS COSTS			7,464,000	12,500,000		
	OPERATING COSTS			258,150,000	911,400,000		
	WASTE TRANSPORT/INCREMENTAL DISPOSAL COSTS			64,694,000	228,600,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			4,710,000	31,800,000		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			394,596,000	1,272,859,000		
	SUMMARY - MILLWTF - APPORTIONED DISPOSAL						
	FRONT END COSTS			20,275,000	27,070,000		
	DESIGN COSTS			7,900,000	10,400,000		
	CONSTRUCTION COSTS			31,400,000	51,089,000		
	STARTUP/READINESS COSTS			7,464,000	12,500,000		
	OPERATING COSTS			258,150,000	911,400,000		
	WASTE TRANSPORT/APPORTIONED DISPOSAL COSTS			149,451,000	528,200,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			4,710,000	31,800,000		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			479,353,000	1,572,459,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.1B
(Rev. 1)

Date 06/20/92

Project : MLLWTF - MINIMUM TREATMENT (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: for

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,750,000	1.0		100	10	25	0.10	0.24
Studies	3,975,000	1.0		100	10	25	0.10	0.25
NEPA Documentation	3,250,000	0.8		100	25	70	0.21	0.58
Permitting	8,900,000	2		100	10	35	0.23	0.79
Tech. Development	400,000	0.10		100	10	25	0.01	0.03
Conceptual, Title I & II	7,000,000	2		100	15	40	0.27	0.71
Title III Inspection	900,000	0.2		100	15	35	0.03	0.08
Building Costs	18,875,000	5		100	15	25	0.72	1.20
Equipment Costs	7,965,000	2		100	5	50	0.10	1.01
Constr Mgmt	4,563,000	1		100	5	50	0.06	0.58
Startup and Readiness	7,464,000	2		100	5	40	0.09	0.76
Building Operation	258,150,000	65		100	5	25	3.27	16.36
Waste Trans/Disposal	64,694,000	16		100	5	30	0.82	4.92
Decon/Decommission	4,710,000	1		100	5	35	0.06	0.42
Total	394,596,000	100					5.66	26.84

Comments: Analysis results in an overall project contingency of 23.59% Use 24%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.1B
(Rev. 1)

Date: 06/20/92

Project : MLLWTF - MINIMUM TREATMENT (ESCALATED COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: hml

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	5,100,000	0.4		100	10	35	0.04	0.14
Studies	4,440,000	0.3		100	10	35	0.03	0.12
NEPA Documentation	3,800,000	0.3		100	25	70	0.07	0.21
Permitting	13,220,000	1		100	10	35	0.10	0.36
Tech. Development	510,000	0.04		100	10	25	0.00	0.01
Conceptual, Title I & II	8,900,000	0.7		100	15	40	0.10	0.28
Title III Inspection	1,500,000	0.1		100	15	35	0.02	0.04
Building Costs	30,260,000	2		100	15	40	0.36	0.95
Equipment Costs	13,406,000	1.1		100	5	60	0.05	0.63
Constr Mgmt	7,423,000	0.6		100	5	50	0.03	0.29
Startup and Readiness	12,500,000	1.0		100	5	40	0.05	0.39
Building Operation	911,400,000	72		100	5	30	3.58	21.48
Waste Trans/Disposal	228,600,000	18		100	5	40	0.90	7.18
Decon/Decommission	31,800,000	2		100	5	35	0.12	0.87
Total	1,272,859,000	100					5.32	32.50

Comments: Analysis results in an overall project contingency of 28.72% Use 29%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.2

Date: 06/20/92

Project: MLLWTF - MODIFY AND OPERATE WERF
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			15,875,000	21,088,000
Project Management	3,150,000	4,000,000		
Studies	2,975,000	3,240,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	6,300,000	9,788,000		
Technology Development	200,000	260,000		
ENGINEERING, DESIGN AND INSPECTION.....			5,010,000	7,030,000
Performance Specification				
Conceptual and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	1,260,000	2,400,000		
CONSTRUCTION.....			92,682,000	235,305,000
Building Costs	71,000,000	188,720,000		
Equipment Costs	8,215,000	12,395,000		
Construction Management	13,467,000	34,190,000		
START-UP AND READINESS.....			7,808,000	14,860,000
BUILDING OPERATION.....			211,895,000	678,200,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			26,353,000	84,500,000
DECONTAMINATION AND.....			2,600,000	15,900,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			9,268,000	23,531,000
SUBTOTAL.....			371,491,000	1,080,414,000
CONTINGENCY **	21% of Subtotal.....		78,509,000	
CONTINGENCY **	27% of Subtotal.....			289,586,000
TOTAL PROJECT COST:			\$450,000,000	\$1,370,000,000

Comments: **Total contingency is 23% and 29% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.2

Date: 06/20/92

Project: MLLWTF - MODIFY AND OPERATE WERF
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Smith

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			15,875,000	21,088,000
Project Management	3,150,000	4,000,000		
Studies	2,975,000	3,240,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	6,300,000	9,788,000		
Technology Development	200,000	260,000		
ENGINEERING, DESIGN AND INSPECTION.....			5,010,000	7,030,000
Performance Specification				
Conceptual and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	1,260,000	2,400,000		
CONSTRUCTION.....			93,402,000	237,305,000
Building Costs	71,000,000	188,720,000		
Equipment Costs	8,215,000	12,395,000		
Construction Management	14,187,000	36,190,000		
START-UP AND READINESS.....			7,808,000	14,860,000
BUILDING OPERATION.....			211,895,000	678,200,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			110,790,000	356,000,000
DECONTAMINATION AND.....			2,600,000	15,900,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			9,340,000	23,731,000
SUBTOTAL.....			456,720,000	1,354,114,000
CONTINGENCY ** 20% of Subtotal.....			93,280,000	
CONTINGENCY ** 26% of Subtotal.....				345,886,000
TOTAL PROJECT COST:			\$550,000,000	\$1,700,000,000

Comments: **Total contingency is 23% and 29% respectively, including Management Reserve.

Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - MODIFY AND OPERATE WERF
Estimator: T. E. Sivill
D. N. Stoddard
Date: 06/19/92
File No: M-212, Alt.2
Approved By: *DS*

I. SCOPE OF WORK: *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 2, Modify and Operate WERF. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of modifications to WERF and new storage facilities, including start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve.

II. BASIS OF THE ESTIMATE: *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992, May 8, 1992

(Continued)

III. ASSUMPTIONS: *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration through D&D in the year 2030.

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

Page -2-

II. BASIS OF THE ESTIMATE: (Continued)

- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings
- (d) T. E. Sivill/D. N. Stoddard letter to T. H. Smith, DNS-25-92, Evaluations of Alternative to Treating INEL Mixed and Low-Level Waste

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the Maximum Treatment alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development).
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection of the required modifications and upgrades to the existing facilities at WERF and new storage buildings. The WERF alternative requires upgrades in the existing utilities as well as installation of new and replacement of existing equipment. Storage requirements for this alternative also require extensive construction of buildings estimated at (2) 10,000 sf indefinite storage buildings per year for the duration of the project.
- CONSTRUCTION COSTS include land improvement for the storage buildings, construction costs to modify and update the existing WERF facility and construction of the new storage buildings. New process equipment and replacement of existing equipment associated with this facility are also included. Construction Management for this phase has been include at the current rate of seventeen percent of construction costs.

(Continued)

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

Page -3-

III. ASSUMPTIONS: (Continued)

- **START-UP AND READINESS** includes the costs associated with initial system testing, system operation and maintenance manuals, and training of personnel associated with the operations of the processes. As crew has been sized based upon existing operations presently functioning at WERF and adjusted to handle the requirements of this alternative.
- **OPERATING COSTS** include the staff, materials, equipment maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of existing facilities and adjusted for this specific alternative.
- **WASTE TRANSPORT AND DISPOSAL COSTS** include the costs to transport the waste from the generator (initial waste location) to the treatment facility, from the generator directly to the disposal site. Treated waste will be housed in the indefinite storage areas, there will be no additional transportation costs.

The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.

- **DECONTAMINATION AND DECOMMISSIONING** includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Project Manager/Engineer direction, D&D costs have been estimated at 15% of the original facility and process construction costs.

D&D for this alternative consideration has been made for only the initial two years of storage buildings. D&D costs for the remaining storage facilities will bear cost consideration in the future.
- **Management Reserve** has also been allowed for based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

PROJECT	EVALUATION OF ALTERNATIVES FOR TREATING MEL MILD AND LOW - LEVEL WASTE MILWTF - MODIFY AND OPERATE WERE MEL
LOCATION	

RECUMSTER T H SMITH

DETAILED COST ESTIMATE SHEET

Type of Est	Study
SOURCE	
(E) Eng. Est	
(M) Vendor	
(P) Pur. Order	
(H) Handbook Ref.	

File No. M-212, A12

Date

25/06/200

1001
1002

Prep By T E 500

App'd By

ACCT NO	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	PROJECT COSTS (Including Storage Facilities)						
	Project Management	E	\$300K/YR	3,150,000	4,000,000	FY MID - 1981 THRU 2001	BUD Sheet, dated 1/31/82
	Project Studies - (2) People, Full-time	E	\$500K/YR	1,000,000	1,100,000	FY 1982 THRU FY 1983	BUD Sheet, dated 1/31/82
	Design Support Studies (F&ORs, Etc.)	E	\$1 MIL TO DATE/\$250K/YR	1,750,000	1,900,000	FY 1983 THRU FY 1985	BUD Sheet, dated 1/31/82. Engineer's Estimate
	Siting Studies (Facility Existing - Site Storage Only)		\$150K/\$75K	225,000	240,000	FY 1982 Thru FY 1983	BUD Sheet, dated 1/31/82. Engineer's Estimate
	NEPA (EIS)	E	\$750K/\$1M/\$750K/\$750K	3,250,000	3,600,000	FY 1983 THRU FY 1988	Engineer's Estimate
	Permitting (ME SHAP, etc.)						
	TSCA	E	\$250K/\$250K/\$500K	1,000,000	1,400,000	FY '88, '87, '2001	Engineer's Estimate (Includes Trial Burn/Sampling)
	RCPA (Includes 48 Stor Facilities @ \$500K (2000-2023)	E	\$250K/\$250K/\$500K/\$1.5M	3,000,000	5,200,000	FY '88, '87, '88, '2001	Engineer's Estimate (Includes Trial Burn/Sampling)
	Other	E	\$250K/YR	500,000	710,000	FY 1988 THRU FY 1989	Engineer's Estimate
	Safety Analysis Report (SAR)	E	\$100K/\$300K/\$300K	700,000	980,000	(82-88)/(87-88)/(89-2000)	Engineer's Estimate
	Other Regulatory Items						
	ESH&Q	E	\$50K/YR	450,000	600,000	FY 1983 THRU FY 2001	Engineer's Estimate
	CX's	E	\$25K/YR	25,000	26,000	FY 1983	Engineer's Estimate
	PSD	E	\$250K/\$250K	500,000	700,000	FY 1988 THRU FY 1989	Engineer's Estimate
	PTCHESHAP	E	\$125K	125,000	170,000	FY 1987 & FY 1988	Engineer's Estimate
	TECHNOLOGY DEVELOPMENT						
	Immobilization						
	Cementation	E	\$100K	100,000	130,000	FY 1988	Engineer's Estimate
	Modified Sulfur Cement (MSC)	E	\$100K	100,000	130,000	FY 1988	Engineer's Estimate
	SUBTOTAL - FRONT END COSTS			15,875,000	21,088,000		

ACCT NO	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESNT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning						
	Conceptual	E	\$750K	750,000	800,000	FY 1990	Engineer's Estimate
	Title I	E	\$1.5 MIL	1,500,000	1,800,000	FY1990	Engineer's Estimate
	Title II	E	\$1.5 MIL	1,500,000	2,000,000	FY 1997	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			3,750,000	4,600,000		
	TITLE III INSPECTION - WERF 3 people, fulltime	E	\$450K/YR	900,000	1,400,000	FY 2000, FY 2001	Engineer's Estimate
	TITLE III INSPECTION - 1 Person, 1 month per year	E	\$15K/YR	360,000	1,000,000	FY 2000 Thru FY 2023	Engineer's Estimate
	SUBTOTAL - TITLE III INSPECTION	E		1,260,000	2,400,000		
	CONSTRUCTION						
4000	Improvements To Land (includes Storage Facilities, 20 acres)	E	\$2.4 MIL	2,400,000	3,700,000	FY 2000	Engineer's Estimate
5000	Buildings and Structures (includes modifications to the existing WERF treatment facility, (48) 10,000 SF include Storage buildings)						
	Treatment Facility Modifications	E	\$2 MIL	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Building Structure Upgrades	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Engineer's Estimate
	Electrical Utilities Upgrade	E	\$500K	500,000	760,000	FY 2000	Engineer's Estimate
	Lag Storage Buildings. (Existing WERF Storage Facilities will be Used)						
	Indehabite Storage Buildings, (48) ea @ 10,000 SF. (23/YR)	E	\$1.2 MIL/EUA	57,600,000	161,000,000	FY 2000 Thru FY 2023	Engineer's Estimate
6000	Utilities (Treatment Fac. Upgrades and New)	E	\$500K	500,000	760,000	FY 2000	Engineer's Estimate
	Utilities (Storage Fac. Upgrades and New)	E	\$1 MIL + \$250K/YR	7,000,000	18,000,000	FY 2000 Thru FY 2023	Engineer's Estimate
	SUBTOTAL - CONSTRUCTION COSTS			71,000,000	138,720,000

4 of 5

06/16/92

Date:

Page: 3 of 6

File No. M-212, Alt. 2

Type of Est. Study

PROJECT MILLWTF - MODIFY AND OPERATE WERF

ACCT NO.	ACTIVITY DESCRIPTION	P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Controlled Air Incinerator	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Historical Data WERF Incinerator
	Wet Offgas System (Includes Stack/Ductwork)	E	\$1.5 MIL	1,500,000	2,300,000	FY 2000	Historical Data WERF Incinerator
	Package Examination Equipment	E	\$480K	480,000	730,000	FY 2000	Engineer's Estimate
	Lab Equipment	E	\$600K	600,000	910,000	FY 2000	Engineer's Estimate
	Elevators	E	\$250K	250,000	360,000	FY 2000	Engineer's Estimate
	Conveyors	E	\$250K	250,000	380,000	FY 2000	Engineer's Estimate
	Torch Cutting (Remdte)	E	\$100K	100,000	150,000	FY 2000	Engineer's Estimate
	Compactor	E	\$1 MIL	1,000,000	1,500,000	FY 2000	WERF/Engineer's Estimate
	Immobilization Equipment (Pelt w/handling)	E	\$1.2 MIL	1,200,000	1,800,000	FY 2000	Engineer's Estimate
	Remdte Size Reduction (Robotics)	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Engineer's Estimate
	Forklift	E	\$200K	200,000	305,000	FY 2000	Engineer's Estimate
	Safety Systems - (2) Diesel Generators	E	\$185K	185,000	280,000	FY 2000	Engineer's Estimate
	SUBTOTAL - EQUIPMENT COSTS			7,765,000	11,735,000		
	DEMOLITION AND REMOVAL						
	Remove Existing Incinerator	E	\$250K	250,000	360,000	FY 1999	Engineer's Estimate
	Remove Other Equipment (Compactor, Offgas System)	E	\$100K	100,000	150,000	FY 1999	Engineer's Estimate
	Disposition of Equipment	E	\$100K	100,000	150,000	FY 1999	Engineer's Estimate
	SUBTOTAL - DEMOLITION COSTS			450,000	660,000		
	CONSTRUCTION MANAGEMENT	E	\$13.4 MIL	13,467,000	34,180,000	FY 2000	Engineer's Estimate
	TESTING/STARTUP/PEPS. TRAINING - (3) @ 1 month every yr.	E	\$30K	720,000	2,000,000	FY 2000 Thru FY 2023	WERF/Engineer's Estimate
	READINESS REVIEW - (5) People, 1 Month every yr.	E	\$50K	1,200,000	3,400,000	FY 2000 Thru FY 2023	WERF/Engineer's Estimate
	TESTING/STARTUP/PERSONNEL TRAINING - (36) People	E	\$5.6 MIL	5,600,000	9,000,000	FY 2001	WERF/Engineer's Estimate
	READINESS REVIEW - (10) People, 480 Hours ea.	E	\$288K	288,000	460,000	FY 2001	Readiness Review Experience
	SUBTOTAL STARTUP/READINESS COSTS			7,808,000	14,860,000		

ACCT NO.	ACTMITY DESCRIPTION	E.V. P.H	ESTIMATED COSTS		PRESENT DAY		ACTIMTY SCHEDULE ESCALATION	ESTIMATE BASIS
					COSTS	COSTS		
OPERATING COSTS								
	Labor based on 2080 Hours/Year/Each							
	Operating Personnel, 14 People	E	\$125K/YR/EA	43,750,000	140,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Maintenance Personnel, 9 People	E	\$120K/YR/EA	27,000,000	87,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Training Personnel, 2 People	E	\$98K/YR/EA	4,800,000	15,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Recordkeeping, 3 People	E	\$78K/YR/EA	5,850,000	19,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Management, 3 People	E	\$285K/YR/EA	21,400,000	68,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Engineering, 3 People	E	\$177K/YR/EA	13,300,000	43,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	ESH&Q Personnel, 3 People	E	\$178K/YR/EA	13,400,000	43,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Budget Support Personnel, 1 Person	E	\$115K/YR/EA	2,800,000	9,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Health Physicists (HPs), 3 People	E	\$128K/YR/EA	9,600,000	31,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Other, Lab Personnel, 1 Person	E	\$128K/YR/EA	3,200,000	10,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Materials							
	Process Materials, Cement	E	\$20K/YR	500,000	1,600,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Waste Containers							
	55 Gal. Drums, Low-Level, est. 12,600 drums @ \$35/ea.	E	\$441K/YR	11,000,000	35,300,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Remote Handled Waste Disposal Vaults	E	\$1.9MIL	47,500,000	152,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Other, Lab Materials/Supplies	E	\$25K/YR	625,000	2,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	Equipment							
	Process Improvements							
	Replacement Parts	E	\$80K/YR	2,000,000	6,400,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations	
	SUBTOTAL - OPERATING COSTS			206,825,000	562,300,000			

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electrical	E	\$70K/YR	1,820,000	5,700,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc.	E	\$80K/YR	2,080,000	6,500,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	Other	E	\$45K/YR	1,170,000	3,700,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	SUBTOTAL - OPERATING COSTS (Continued)			5,070,000	15,900,000		
	WASTE TRANSPORT COSTS	E	\$324K/YR	8,100,000	26,000,000	FY 2002 THRU FY 2026	EGG - WTD - 10092
	DISPOSAL - INCREMENTAL COSTS IN MILLWDF						
	Contact Handled Low Level Waste 73,300cf @ \$5.2/cf	E	\$361K/YR	9,529,000	30,500,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng Est
	Remnde Handled Low Level Waste In Soil Vaults 4,600cf @ \$73/cf	E	\$336K/YR	8,395,000	26,900,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng Est
	Contact Handled Mixed Waste 1,800cf @ \$7.3/cf	E	\$13K/YR	329,000	1,100,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng Est
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			18,253,000	58,500,000		
	DISPOSAL - APPORTIONED COSTS IN MILLWDF						
	Contact Handled Low Level Waste 73,300cf @ \$41.22/cf	E	\$3,021 MIL/YR	75,535,000	243,100,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng Est
	Remnde Handled Low Level Waste In Soil Vaults 4,600cf @ \$220/cf	E	\$1,012 MIL/YR	25,300,000	81,000,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng Est
	Contact Handled Mixed Waste 1,800cf @ \$41.22/cf	E	\$74K/YR	1,855,000	5,900,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng Est
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			102,690,000	330,000,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	\$2.0MIL	2,600,000	15,900,000	FY 2027 THRU FY 2030	
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			15,875,000	21,068,000		
	DESIGN COSTS			5,010,000	7,030,000		
	CONSTRUCTION COSTS			92,682,000	235,305,000		
	STARTUP/READINESS COSTS			7,808,000	14,860,000		
	OPERATING COSTS			211,885,000	678,200,000		
	WASTE TRANSPORT/INCREMENTAL DISPOSAL COSTS			26,353,000	84,500,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			2,600,000	15,900,000		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			362,223,000	1,056,883,000		
	SUMMARY - MILLWTF - APPORTIONED DISPOSAL						
	FRONT END COSTS			15,875,000	21,068,000		
	DESIGN COSTS			5,010,000	7,030,000		
	CONSTRUCTION COSTS			93,402,000	237,305,000		
	STARTUP/READINESS COSTS			7,808,000	14,860,000		
	OPERATING COSTS			211,885,000	678,200,000		
	WASTE TRANSPORT/APPORTIONED DISPOSAL COSTS			110,790,000	356,000,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			2,600,000	15,900,000		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			447,360,000	1,330,363,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.2

Date: 06/20/92

Project : MLLWTF - MODIFY AND OPERATE WERF (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By:

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,150,000	0.9		100	10	25	0.09	0.22
Studies	2,975,000	0.8		100	10	25	0.08	0.21
NEPA Documentation	3,250,000	0.9		100	25	70	0.22	0.63
Permitting	6,300,000	2		100	10	35	0.17	0.61
Tech. Development	200,000	0.06		100	10	25	0.01	0.01
Conceptual, Title I & II	3,750,000	1		100	15	40	0.16	0.41
Title III Inspection	1,260,000	0.3		100	15	35	0.05	0.12
Building Costs	71,000,000	20		100	15	25	2.94	4.90
Equipment Costs	8,215,000	2		100	5	50	0.11	1.13
Constr Mgmt	13,467,000	4		100	5	50	0.19	1.86
Startup and Readiness	7,808,000	2		100	5	40	0.11	0.86
Building Operation	211,895,000	58		100	5	25	2.92	14.62
Waste Trans/Disposal	26,353,000	7		100	5	30	0.36	2.18
Decon/Decommission	2,600,000	1		100	5	35	0.04	0.25
Total	362,223,000	100					7.06	26.97

Comments: Analysis results in an overall project contingency of 23.57% Use 23%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M -212, Alt.2

Date: 06/20/92

Project : MLLWTF - MODIFY AND OPERATE WERF (ESCALATED DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: DBL

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	4,000,000	0.4		100	10	35	0.04	0.13
Studies	3,240,000	0.3		100	10	35	0.03	0.11
NEPA Documentation	3,800,000	0.4		100	25	70	0.09	0.25
Permitting	9,788,000	1		100	10	35	0.09	0.32
Tech. Development	260,000	0.02		100	10	25	0.00	0.01
Conceptual, Title I & II	4,630,000	0.4		100	15	40	0.07	0.18
Title III Inspection	2,400,000	0.2		100	15	35	0.03	0.08
Building Costs	188,720,000	18		100	15	40	2.68	7.14
Equipment Costs	12,395,000	1.2		100	5	60	0.06	0.70
Constr Mgmt	34,190,000	3.2		100	5	50	0.16	1.62
Startup and Readiness	14,860,000	1.4		100	5	40	0.07	0.56
Building Operation	678,200,000	64		100	5	30	3.21	19.25
Waste Trans/Disposal	84,500,000	8		100	5	40	0.40	3.20
Decon/Decommission	15,900,000	2		100	5	35	0.08	0.53
Total	1,056,883,000	100					6.85	33.59

Comments: Analysis results in an overall project contingency of 29.54% Use 29%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.3

Date: 06/20/92

Project: MLLWTF - MODIFY AND OPERATE PREPP
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			16,425,000	23,900,000
Project Management	3,450,000	4,600,000		
Studies	2,225,000	4,440,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	7,100,000	10,540,000		
Technology Development	400,000	520,000		
ENGINEERING, DESIGN AND INSPECTION.....			7,400,000	9,600,000
Performance Specification				
Concept. and Title I / II Design	6,500,000	8,200,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			21,587,000	32,456,000
Building Costs	8,550,000	12,840,000		
Equipment Costs	9,900,000	14,900,000		
Construction Management	3,137,000	4,716,000		
START-UP AND READINESS.....			8,100,000	13,500,000
BUILDING OPERATION.....			247,050,000	830,500,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			39,770,000	134,300,000
DECONTAMINATION AND.....			3,238,000	20,800,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			2,159,000	3,246,000
SUBTOTAL.....			345,729,000	1,068,302,000
CONTINGENCY ** 22% of Subtotal.....			76,271,000	
CONTINGENCY ** 25% of Subtotal.....				271,698,000
TOTAL PROJECT COST:			\$422,000,000	\$1,340,000,000

Comments: **Total contingency is 23% and 27% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

Date: 06/20/92

Project: MLLWTF - MODIFY AND OPERATE PREPP
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			16,425,000	23,900,000
Project Management	3,450,000	4,600,000		
Studies	2,225,000	4,440,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	7,100,000	10,540,000		
Technology Development	400,000	520,000		
ENGINEERING, DESIGN AND INSPECTION.....			7,400,000	9,600,000
Performance Specification				
Conceptual and Title I / II Design	6,500,000	8,200,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			21,587,000	32,456,000
Building Costs	8,550,000	12,840,000		
Equipment Costs	9,900,000	14,900,000		
Construction Management	3,137,000	4,716,000		
START-UP AND READINESS.....			8,100,000	13,500,000
BUILDING OPERATION.....			247,050,000	830,500,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			124,557,000	419,800,000
DECONTAMINATION AND.....			3,238,000	20,800,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			2,159,000	3,246,000
SUBTOTAL.....			430,516,000	1,353,802,000
CONTINGENCY ** 22% of Subtotal.....			96,484,000	
CONTINGENCY ** 26% of Subtotal.....				356,198,000
TOTAL PROJECT COST:			\$527,000,000	\$1,710,000,000

Comments: **Total contingency is 23% and 27% respectively, including Management Reserve.

Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - MODIFY AND OPERATE PREPP
Estimator: T. E. Sivill
D. N. Stoddard
Date: 06/19/92
File No: M-212, Alt.3
Approved By: *[Signature]*

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 3, Modify and Operate PREPP. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of modifications to PREPP, new support and storage facilities, including start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, and Revision, April 17, 1992

(Continued)

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration through D&D in the year 2030.

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

II. BASIS OF THE ESTIMATE: (Continued)

- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings
- (d) T. E. Sivill/D. N. Stoddard letter to T. H. Smith, DNS-25-92, Evaluations of Alternative to Treating INEL Mixed and Low-Level Waste

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the Modify and Operate PREPP alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development).
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection of the required modifications and upgrades to the existing facilities at PREPP and new buildings. The PREPP alternative requires upgrades to the existing structure, existing utilities as well as installation of new and replacement of existing equipment. Also 24,000 sf of lag storage and size-reduction buildings are required.
- CONSTRUCTION COSTS include land improvement for the storage and support buildings (including a mechanical size reduction facility and small lab within the lag storage facility), construction costs to modify and update the existing PREPP facility and construction of the new storage buildings. New process equipment and replacement of existing equipment associated with this facility are also included. Construction Management for this phase has been included at the current rate of seventeen percent of construction costs.

(Continued)

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

Page -3-

III. ASSUMPTIONS: (Continued)

- **START-UP AND READINESS** includes the costs associated with initial system testing, system operation and maintenance manuals, and training of personnel associated with the operations of the processes. As the crew has been sized based upon existing operations presently functioning at WERF and adjusted to handle the requirements of this alternative.
- **OPERATING COSTS** include the staff, materials, equipment maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of existing facilities and adjusted for this specific alternative.
- **WASTE TRANSPORT AND DISPOSAL COSTS** include the costs to transport the waste from the generator (initial waste location) to the treatment facility, from the generator directly to the disposal site. Treated waste will be housed in the indefinite storage areas, there will be no additional transportation costs.

The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.

- **DECONTAMINATION AND DECOMMISSIONING** includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Project Manager/Engineer direction, D&D costs have been estimated at 15% of the original facility and process construction costs.
- **Management Reserve** has also been allowed for based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

EG&G Idaho, Inc.

PROJECT EVALUATION OF ALTERNATIVES FOR TREATING
INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - MODIFY AND OPERATE PREPP
INEL

LOCATION

REQUESTER T. H. SMITH

Type of Est. Study

SOURCE

(E) Eng. Est.

(M) Vendor

(P) Pur. Order

(H) Handbook Ref.

File No. M-212, Alt.3

Date: 06/25/92

Page: 1 of 6

Prep. By: T. E. Skill

Appr'd By: *TSK*

DETAILED COST ESTIMATE SHEET

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
PROJECT COSTS							
	Project Management	E	\$300K/YR	3,450,000	4,600,000	FY MID-1991 THRU 2002	BUD Sheet, dated 1/31/92
	Project Studies - 2 People, Full-time	E	\$250K/YR/EA	250,000	2,300,000	FY 1992 THRU FY 1995	BUD Sheet, dated 1/31/92
	Design Support Studies (F&OR's, etc.)	E	\$1MIL TO DATE/\$250K/YR	1,750,000	1,900,000	FY 1993 THRU FY 1995	BUD Sheet, dated 1/31/92, Engineer's Estimate
	Siting Studies (Facility exist., site storage only)	E	\$150K/\$75K	225,000	240,000	FY 1992 THRU FY 1993	BUD Sheet, dated 1/31/92, Engineer's Estimate
	NEPA (EIS)	E	\$750K/\$1M/\$750K/\$750K	3,250,000	3,800,000	FY 1993 THRU FY 1996	Engineer's Estimate
	Permitting (NESHAP, etc.)						
	TSCA	E	\$250K/\$250K/\$500K	1,000,000	1,500,000	FY '95, '96, 2002	Engineer's Estimate (includes Trial Burn/Sampling)
	RCRA	E	\$250K/\$250K/\$500K/\$1.5M	2,500,000	3,900,000	FY '95, '96, '99, 2002	Engineer's Estimate (includes Trial Burn/Sampling)
	Other	E	\$250K/YR	500,000	710,000	FY 1996, FY 1999	Engineer's Estimate
	Safety Analysis Report (SAR)	E	\$200K/\$500K/\$500K	1,200,000	1,700,000	[93-94] [97-99] [00-01]	Engineer's Estimate
	Other Regulatory Items						
	ESH&Q	E	\$100K/YR	900,000	1,400,000	FY 1993 THRU FY 2002	Engineer's Estimate
	CX's	E	\$50K/YR	50,000	60,000	FY 1994	Engineer's Estimate
	PSD	E	\$250K/\$250K/\$250K	750,000	1,000,000	FY 1997 THRU FY 1999	Engineer's Estimate
	PTC/NES/AP	E	\$200K	200,000	270,000	FY 1996 Thru FY 1999	Engineer's Estimate
	TECHNOLOGY DEVELOPMENT						
	Incineration (Demo) - Rotary Klin/Origas System (Demo)	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	Immobilization (Demo)						
	Joule Heated Glass Melt, Vitrification	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	Modified Sulfur Cement (MSC)	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	Cementation	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	SUBTOTAL - FRONT END COSTS			16,425,000	23,900,000		

ACCT NO.	ACTIVITY DESCRIPTION	E/V P.H.	ESTIMATED COSTS	PRESIDENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning - Includes Design Support Studies, etc., Ref. Page 1						
	Conceptual	E	\$1.5 MIL	1,500,000	1,700,000	FY 1993 THRU FY 1994	Engineer's Estimate
	Title I	E	\$2.5 MIL	2,500,000	3,200,000	FY 1996	Engineer's Estimate
	Title II	E	\$2.5 MIL	2,500,000	3,300,000	FY 1997	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			6,500,000	8,200,000		
	TITLE III INSPECTION - (3) People, Full-time	E	\$150K/YR/EA	900,000	1,400,000	FY 2000 THRU FY 2001	Engineer's Estimate
	SUBTOTAL - TITLE III INSPECTION			900,000	1,400,000		
	CONSTRUCTION						
4000	Improvements To Land (includes (2) buildings)	E	\$250K	250,000	380,000	FY 2000	Engineer's Estimate
5000	Buildings and Structures (includes modifications to the existing PREPP treatment facility and new lag storage building w/lab and mechanical size reduction building)						
	Treatment Facility Mode approximately 8,000 sf of existing bldg	E	\$2 MIL	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Building structure Upgrades	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Engineer's Estimate
	Electrical Utilities Upgrades	E	\$500K	500,000	760,000	FY 2000	Engineer's Estimate
	Lag Storage Building Including Lab @ 22,000 sf	E	\$2.8 MIL	2,800,000	3,900,000	FY 2000	Engineer's Estimate
	Mechanical Size Reduction/Compaction Building @ 2000 sf	E	\$1.2 MIL	1,200,000	1,800,000	FY 2000	Engineer's Estimate
6000	Utilities Upgrades	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Engineer's Estimate
	SUBTOTAL - CONSTRUCTION COSTS			\$3,550,000	12,840,000		

Date: 06/16/92

Page: 3 of 6

File No. M-212, Alt.3

Type of Est. Study

PROJECT MILLWTF - MODIFY AND OPERATE PREPP

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Rotary Klin Incinerator	E	\$2 MIL	2,000,000	3,000,000	FY 2000	Historical Data for Similar Incinerator (WERF)
	Included in the above cost of the Rotary Klin: Upgrade/Replacement of Basic Equipment, Feed Systems, Controls, Instrumentation, Filters, Dampers, Scales & Monitoring, Fuel & Secondary Combust., Ash Disch.						
	Safety Systems - (2) diesel generators, etc.,	E	\$185K	185,000	280,000	FY 2000	WERF/PREPP/Engineering Experience
	Offgas System including Stack & Ducting	E	\$1.5 MIL	1,500,000	2,300,000	FY 2000	WERF/PREPP/Engineering Experience
	Package Examination Equipment	E	\$480K	480,000	730,000	FY 2000	Engineer's Estimate
	Shredder	E	-0-	-0-	-0-		
	Grinder	E	-0-	-0-	-0-		
	Torch Cutting	E	\$100K	100,000	150,000	FY 2000	Engineer's Estimate
	Compactor	E	\$1 MIL	1,000,000	1,500,000	FY 2000	WERF/Engineer Experience
	Immobilization Equipment						
	Ash Handling - Solidification	E	\$600K	600,000	910,000	FY 2000	Engineer's Estimate
	Sulphur Treatment	E	\$600K	600,000	910,000	FY 2000	Engineer's Estimate
	Glass Melter	E	\$300K	300,000	480,000	FY 2000	Engineer's Estimate
	Remote Size Reduction (Robotics)	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Engineer's Estimate
	Sorting Chamber (Remote Handling)	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Engineer's Estimate
	Other Equipment						
	Lab Equipment	E	\$600K	600,000	910,000	FY 2000	Engineer's Estimate
	Miscellaneous Conveyance, i.e., Forklifts, etc. (2)	E	\$500K	500,000	760,000	FY 2000	Engineer's Estimate
	SUBTOTAL EQUIPMENT COSTS			9,900,000	14,900,000		
	CONSTRUCTION MANAGEMENT		\$3,137 MIL	3,137,000	4,716,000	FY 2001	
	TESTING/STARTUP/PERSONNEL TRAINING - (50) People	E	\$7.8 MIL	7,800,000	13,000,000	FY 2002	WERF/Engineer Experience
	READINESS REVIEW - (10) People, (3) Months, 480 Hours ea.	E	\$288K	288,000	480,000	FY 2002	Readiness Review Experience
	SUBTOTAL STARTUP/READINESS COSTS			8,100,000	13,500,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY		ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
				COSTS	ESCALATED COSTS		
OPERATING COSTS							
	Labor based on 2080 Hours/Year/Each						
	Operating Personnel, 15 People	E	\$125K/YR/EA	46,900,000	158,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Maintenance Personnel, 8 People	E	\$120K/YR/EA	24,000,000	81,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Training Personnel, 2 People	E	\$96K/YR	4,800,000	16,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Recordkeeping, 2 People	E	\$78K/YR	3,900,000	13,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Management, 4 People	E	\$285K/YR	28,500,000	96,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Engineering, 5 People	E	\$177K/YR	22,100,000	74,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	ESH&Q Personnel, 4 People	E	\$178K/YR	17,800,000	60,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Budget Support Personnel, 1 Person	E	\$115K/YR	2,900,000	9,700,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Health Physicists (HPs), 2 People	E	\$128K/YR	8,400,000	22,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Lab Personnel, 3 People	E	\$128K/YR	9,600,000	32,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Materials						
	Process Materials,	E	\$100K/YR	2,500,000	8,400,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Waste Containers						
	55 Gal. Drums, est. 20,000 drums @ \$-5/ea	E	\$700K/YR	17,500,000	58,900,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Remote Handled Waste Disposal Vaults	E	\$1.9MIL/YR	47,500,000	160,000,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Lab Materials and Supplies	E	\$50K/YR	1,250,000	4,200,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	Other						
	Equipment						
	Replacement Parts and Equipment	E	\$100K/YR	2,500,000	8,400,000	FY 2003 THRU FY 2027	Engineer Judgment based on WERF Operations
	SUBTOTAL OPERATING COSTS (Continued)			238,150,000	801,600,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DATA		ACTIVITY SCHEDULE		ESTIMATE BASIS
				COSTS	ESCALATED COSTS	ESCALATION		
	UTILITIES							
	Electrical	E	\$65K/YR	1,700,000	5,600,000	FY 2002 THRU FY 2027		Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc.	E	\$225K/YR	5,900,000	19,000,000	FY 2002 THRU FY 2027		Based on WERF Facility, adjusted and escalated
	Other, phones etc.	E	\$50K/YR	1,300,000	4,300,000	FY 2002 THRU FY 2027		Based on WERF Facility, adjusted and escalated
	SUBTOTAL - OPERATING COSTS (Continued)			8,900,000	28,900,000			
	WASTE TRANSPORT COSTS	E	\$390K/YR	9,800,000	32,800,000	FY 2003 THRU FY 2027		EGG - WTD - 10092
	DISPOSAL - INCREMENTAL COSTS IN MILLWDF							
	Contact Handled Low Level Waste, 90,300 cf @ \$5.20/cf	E	\$470K/YR	11,739,000	39,500,000	FY 2003 THRU FY 2027		Based on data from RWMC & Eng. Est.
	Remote Handled Low Level Waste in Soil Vaults, 4700 cf @ \$73/cf	E	\$343K/YR	8,577,000	29,000,000	FY 2003 THRU FY 2027		Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste, 52,900 cf @ \$7.30/cf	E	\$388K/YR	9,854,000	33,000,000	FY 2003 THRU FY 2027		Based on data from RWMC & Eng. Est.
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			29,970,000	101,500,000			
	APPORTIONED DISPOSAL COSTS							
	Contact Handled Low Level Waste, 90,300 cf @ \$24.84/cf	E	\$2,243 MIL/YR	58,056,000	189,000,000	FY 2003 THRU FY 2027		Based on data from RWMC & Eng. Est.
	Remote Handled Low Level Waste - Soil Vaults, 4700 cf @ \$220/cf	E	\$1,034 MIL/YR	25,850,000	87,000,000	FY 2003 THRU FY 2027		Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste, 52,900 cf @ \$24.4/cf	E	\$1,314 MIL/YR	32,851,000	111,000,000	FY 2003 THRU FY 2027		Based on data from RWMC & Eng. Est.
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			114,757,000	387,000,000			

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	15% of Construction	3,238,000	20,800,000	FY 2028 THRU FY 2031	Data from Previous D & D Projects
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			16,425,000	23,900,000		
	DESIGN COSTS			7,400,000	9,600,000		
	CONSTRUCTION COSTS			21,587,000	32,456,000		
	STARTUP/READINESS COSTS			8,100,000	13,500,000		
	OPERATING COSTS			247,050,000	830,500,000		
	INCREMENTAL DISPOSAL COSTS			39,770,000	134,300,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			3,238,000	20,800,000		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			343,570,000	1,065,056,000		
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			16,425,000	23,900,000		
	DESIGN COSTS			7,400,000	9,600,000		
	CONSTRUCTION COSTS			21,587,000	32,456,000		
	STARTUP/READINESS COSTS			8,100,000	13,500,000		
	OPERATING COSTS			247,050,000	830,500,000		
	APPORTIONED DISPOSAL COSTS			124,567,000	419,800,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			3,238,000	20,800,000		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			429,367,000	1,350,556,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.3

Date: 06/20/92

Project : MLLWTF - MODIFY AND OPERATE PREPP (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: BOR

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,450,000	1.0		100	10	25	0.10	0.25
Studies	2,225,000	0.6		100	10	25	0.06	0.16
NEPA Documentation	3,250,000	0.9		100	25	70	0.24	0.66
Permitting	7,100,000	2		100	10	35	0.21	0.72
Tech. Development	400,000	0.12		100	10	25	0.01	0.03
Conceptual, Title I & II	6,500,000	2		100	15	40	0.28	0.76
Title III Inspection	900,000	0.3		100	15	35	0.04	0.09
Building Costs	8,550,000	2		100	15	35	0.37	0.87
Equipment Costs	9,900,000	3		100	5	50	0.14	1.44
Constr Mgmt	3,137,000	1		100	5	50	0.05	0.46
Startup and Readiness	8,100,000	2		100	5	40	0.12	0.94
Building Operation	247,050,000	72		100	5	25	3.60	17.98
Waste Trans/Disposal	39,770,000	12		100	5	30	0.58	3.47
Decon/Decommission	3,238,000	1		100	5	35	0.05	0.33
Total	343,570,000	100					5.44	27.09

Comments: Analysis results in an overall project contingency of

23.84%

Use 23%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.3

Date: 06/20/92

Project : MLLWTF - MODIFY AND OPERATE PREPP (ESCALATED COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: bat

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	4,600,000	0.4		100	10	35	0.04	0.15
Studies	4,440,000	0.4		100	10	35	0.04	0.15
NEPA Documentation	3,800,000	0.4		100	25	70	0.09	0.25
Permitting	10,540,000	1		100	10	35	0.10	0.35
Tech. Development	520,000	0.05		100	10	25	0.00	0.01
Conceptual, Title I & II	8,200,000	0.8		100	15	40	0.12	0.31
Title III Inspection	1,400,000	0.1		100	15	35	0.02	0.05
Building Costs	12,840,000	1		100	15	25	0.18	0.30
Equipment Costs	14,900,000	1.4		100	5	50	0.07	0.70
Constr Mgmt	4,716,000	0.4		100	5	50	0.02	0.22
Startup and Readiness	13,500,000	1.3		100	5	40	0.06	0.51
Building Operation	830,500,000	78		100	5	30	3.90	23.39
Waste Trans/Disposal	134,300,000	13		100	5	35	0.63	4.41
Decon/Decommission	20,800,000	2		100	5	35	0.10	0.68
Total	1,065,056,000	100					5.20	30.93

Comments: Analysis results in an overall project contingency of 27.32% Use 27%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.4

Date: 06/20/92

Project: MLLWTF - GENERATOR
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			13,225,000	16,868,000
Project Management	3,150,000	3,900,000		
Studies	3,225,000	3,540,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	3,500,000	5,498,000		
Technology Development	100,000	130,000		
ENGINEERING, DESIGN AND INSPECTION.....			5,010,000	7,030,000
Performance Specification	N/A	N/A		
Concept. and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	1,260,000	2,400,000		
CONSTRUCTION.....			102,463,000	259,155,000
Building Costs	79,925,000	209,980,000		
Equipment Costs	7,650,000	11,520,000		
Construction Management	14,888,000	3,655,000		
START-UP AND READINESS.....			4,300,000	9,180,000
BUILDING OPERATION.....			150,325,000	481,260,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			41,678,000	133,600,000
DECONTAMINATION AND.....			5,000,000	32,200,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			10,246,000	25,916,000
SUBTOTAL.....			332,247,000	965,209,000
CONTINGENCY ** 23% of Subtotal.....			77,753,000	
CONTINGENCY ** 23% of Subtotal.....				224,791,000
TOTAL PROJECT COST:			\$410,000,000	\$1,190,000,000

Comments: **Total contingency is 26% and 26% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study File No. M-212, Alt.4 Date: 06/20/92

Project: MLLWTF - GENERATOR
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Simill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			13,225,000	16,868,000
Project Management	3,150,000	3,900,000		
Studies	3,225,000	3,540,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	3,500,000	5,498,000		
Technology Development	100,000	130,000		
ENGINEERING, DESIGN AND INSPECTION.....			5,010,000	7,030,000
Performance Specification				
Conceptual and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	1,260,000	2,400,000		
CONSTRUCTION.....			102,463,000	259,155,000
Building Costs	79,925,000	209,980,000		
Equipment Costs	7,650,000	11,520,000		
Construction Management	14,888,000	37,655,000		
START-UP AND READINESS.....			4,300,000	9,180,000
BUILDING OPERATION.....			150,325,000	481,260,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			126,144,000	404,400,000
DECONTAMINATION AND.....			5,000,000	32,200,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			10,246,000	25,916,000
SUBTOTAL.....			416,713,000	1,236,009,000
CONTINGENCY ** 24% of Subtotal.....			98,287,000	
CONTINGENCY ** 24% of Subtotal.....				293,991,000
TOTAL PROJECT COST:			\$515,000,000	\$1,530,000,000

Comments: **Total contingency is 26% and 26% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

Page -2-

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the Generator alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development).
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection of the facilities required. The Generator alternative requires a two new scaled down treatment facilities to contain the treatment processes and the associated support staff. Support requirements for this alternative also require extensive construction of buildings estimated at a minimum of (2) 11,000 sf indefinite storage buildings per year for the duration of the project. A mobile unit will also service various outlying sites.
- CONSTRUCTION COSTS include land improvement, building construction and utility costs. Process equipment associated with the facility are also included in these costs and Construction Management for this phase has been included at the current rate of seventeen percent of construction costs.
- START-UP AND READINESS includes the costs associated with initial system testing, system operation and maintenance manuals, and training of personnel associated with the operations of the processes. A crew has been sized based upon similar operations presently functioning at other facilities.
- OPERATING COSTS include the staff, materials, equipment, maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of similar facilities and adjusted for this specific project.

(Continued)

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

III. ASSUMPTIONS: (Continued)

- WASTE TRANSPORT AND DISPOSAL COSTS include the costs to transport the waste from the generator (initial waste location) to the treatment facility, from the generator directly to the disposal site, and from the treatment facility to the disposal site. The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.
- DECONTAMINATION AND DECOMMISSIONING includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Engineer/Project Manager direction, D & D costs have been estimated at 15% of the original facility and process construction costs.

D&D for this alternative consideration has been made for only the initial two years of storage buildings. D&D costs for the remaining storage facilities will bear cost consideration in the future.
- Management Reserve has also been allowed for based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - GENERATOR TREATMENT
File No: M-212, Alt.4
Estimator: D. N. Stoddard
T. E. Sivill
Date: 06/19/92
Approved By: *[Signature]*

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 4, Generator. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of a maximum treatment facility including all equipment, start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992, May 8, 1992
- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration of year 2030.

Date: 08/17/82

Page: 2 of 6

File No. M-212, Alt. 4

Type of Est. Study

PROJECT MILLWTF - GENERATOR

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning - Includes Design Support Studies, etc., Ref: Page 1						
	Conceptual	E	\$750K	750,000	830,000	FY 1993	ICE Revelle Team
	Title I	E	\$1.5 MIL	1,500,000	1,800,000	FY 1995	Engineer's Estimate
	Title II	E	\$1.5 MIL	1,500,000	2,000,000	FY 1997	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			3,750,000	4,630,000		
	TITLE III INSPECTION - Storage, 1 Mo. per Yr.	E	\$15K/YR/EA	380,000	1,000,000	FY 2000 THRU FY 2023	Engineer's Estimate
	TITLE III INSPECTION - New Facility, 3 People, Full-time	E	\$150K/YR/EA	900,000	1,400,000	FY 2000 THRU FY 2001	Engineer's Estimate
	SUBTOTAL - TITLE III INSPECTION			1,280,000	2,400,000		
	CONSTRUCTION						
4000	Improvements To Land (Includes Storage Facilities, 20 acres)	E	\$500K/\$2.6 MIL	3,100,000	4,700,000	FY 2000	Engineer's Estimate
5000	Buildings and Structures (Includes modifications to existing facilities around the Site, (2) new 2,000 sf mini-treatment facilities)						
	Treatment Facilities, Approximately 2,000 sf bldg ea.	E	\$1.2 MIL/EA	2,400,000	3,700,000	FY 2000	Engineer's Estimate
	Miscellaneous Equipment, i.e., 10T, 50T Cranes	E	\$175K	175,000	270,000	FY 2000	Engineer's Estimate
	Existing Facilities Modifications	E	\$2 MIL	2,000,000	3,030,000	FY 2000	Engineer's Estimate
	Utilities, new and existing facilities upgrade	E	\$1.25 MIL	1,250,000	1,900,000	FY 2000	Engineer's Estimate
	Htd Cells (3 each)		-0-	-0-	-0-	FY 2000	Engineer's Estimate
	Initial Complements		-0-	-0-	-0-		
	Miscellaneous instrumentation, annunciators, etc.	C	\$800K	800,000	910,000	FY 2000	Engineer's Estimate
	Indefinite Storage Bldg. 48 Ea. @ 11000sf - Bldg. 2 Per/Yr	E	\$1.3 MIL/EA	62,400,000	176,000,000	FY 2000 Thru FY 2023	Engineer's Estimate
6000	Utilities - Treatment Facility		\$1 MIL	1,000,000	1,500,000	FY 2000	Comparative Parametric Modifying/Hist Data
	Utilities - Storage Facilities		\$1 MIL + \$250K/YR	7,000,000	18,000,000	FY 2000 Thru FY 2023	
	SUBTOTAL - CONSTRUCTION COSTS			79,925,000	209,980,000		

08/16/92

Date:

Page: 3 of 6

File No. M-212, Att. 4

Type of Est. Study

PROJECT MILLWTF - GENERATOR

ACCT NO.	ACTIVITY DESCRIPTION	EV/PH	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Rotary Kln Incinerator						
	Included in the above cost of the Rotary Kln:						
	Safety Systems - (2) diesel generators, etc.,		-0-	-0-	-0-		
	Offgas System Including Stack & Ducting		-0-	-0-	-0-		
	Package Examination Equipment		-0-	-0-	-0-		
	Shredder		-0-	-0-	-0-		
	Grinder		-0-	-0-	-0-		
	Torch Cutting, 2 Ea.		\$100K/EA	200,000	300,000	FY 2000	Engineer's Estimate
	Compactor, 2 Ea.	E	\$1 MIL/EA	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Immobilization Equipment, Solidification Package	E	\$600K	600,000	910,000	FY 2000	Engineer's Estimate
	Ash Handling - Solidification		-0-	-0-	-0-		
	Sulphur Treatment & Glass Meter		-0-	-0-	-0-		
	Remote Size Reduction (Robotics), 2 Ea.	E	\$1 MIL/EA	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Other Equipment		-0-	-0-	-0-		
	Lab Equipment		-0-	-0-	-0-		
	Elevator		-0-	-0-	-0-		
	Sorting Chamber (Remote Handling)		-0-	-0-	-0-		
	Miscellaneous Mobile Unit/Truck, Forklifts, etc.	E	\$2.5 MIL	2,500,000	3,800,000	FY 2000	Engineer's Estimate
	Demolition and Removal	E	\$350K	350,000	510,000	FY 1999	Engineer's Estimate
	SUBTOTAL EQUIPMENT COSTS			7,650,000	11,520,000		
	CONSTRUCTION MANAGEMENT	E	\$14.8 MIL	14,888,000	37,740,000	FY 2001	
	TESTING/STARTUP/PERS. TRAINING - (3) @ 1 month every yr	E	\$30K/YR	720,000	2,000,000	FY 2000 THRU FY 2023	WERF Engineer's Estimate
	READINESS REVIEW - (5) People @ 1 month every yr	E	\$50K/YR	1,200,000	3,400,000	FY 2000 THRU FY 2023	WERF Engineer's Estimate
	TESTING/STARTUP/PERSONNEL TRAINING - 18 People @ 8 Months	E	\$2.2 MIL	2,200,000	3,500,000	FY 2001	WERF Engineer's Estimate
	READINESS REVIEW - 8 People, 2 Months	E	\$180K	180,000	280,000	FY 2001	Readiness Review Experience
	SUBTOTAL STARTUP/READINESS COSTS			4,300,000	9,180,000		

PROJECT MILLWTF - GENERATOR

Type of Est. Study

Type of Est. Study

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRES. DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	OPERATING COSTS						
	Labor based on 2080 Hours/Year/Each						
	Operating Personnel, 8 People	E	\$125K/YR/EA	25,000,000	80,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Maintenance Personnel, 5 Person	E	\$120K/YR/EA	15,000,000	48,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Training Personnel, 1 Person	E	\$88K/YR/EA	2,400,000	7,700,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Recordkeeping, 2 Person	E	\$78K/YR/EA	3,900,000	12,600,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Management, 1 Person	E	\$285K/YR/EA	7,125,000	22,800,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Engineering, 1 Person	E	\$177K/YR/EA	4,425,000	14,200,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	ESH&Q Personnel, 1 Person	E	\$178K/YR/EA	4,450,000	14,300,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Budget Support Personnel, 1 Person	E	\$115K/YR/EA	2,875,000	9,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Health Physicists (HPs), 2 Person	E	\$128K/YR	6,400,000	20,600,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Lab Personnel, 1 Person	E	\$128K/YR	3,200,000	10,300,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Materials						
	Process Materials,	E	\$20K/YR	500,000	1,600,000	FY 2002 THRU FY 2026	
	Waste Containers						
	55 Gal. Drums, est. 30,000 drums @ \$35/ea.	E	\$1.05 MIL/YR	26,250,000	84,100,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Remotely Handled Waste Disposal Vaults	E	\$1.9 MIL/YR	47,500,000	152,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Equipment						
	Replacement Parts and Equipment	E	\$15K	375,000	1,200,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	SUBTOTAL OPERATING COSTS (Continued)			149,400,000	478,400,000		

PROJECT MILLWTF - GENERATOR Type of Est. Study File No. M-212, Alt. 4

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electrical	E	\$20K/YR	540,000	1,600,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc..	E	\$5K/YR	135,000	410,000		
	Other	E	\$10K/YR	250,000	850,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	SUBTOTAL - OPERATING COSTS (Continued)			925,000	2,860,000		
	WASTE TRANSPORT COSTS	E	\$312K/YR	7,800,000	25,000,000	FY 2002 THRU FY 2026	EGG - WTD - 10092
	DISPOSAL - INCREMENTAL COSTS IN MILLWDF						
	Contact Handled Low Level Waste, 195,800 cf @ \$5.20/cf	E	\$1.018 MIL	25,454,000	81,600,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Remde Handled Low Level Waste In Soil Vaults, 4616 cf @ \$73/cf	E	\$337K/YR	8,424,000	27,000,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste, -0-		-0-	-0-	-0-	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			33,878,000	108,600,000		
	APPORTIONED DISPOSAL COSTS						
	Contact Handled Low Level Waste, 195,800 cf @ \$18.99/cf	E	\$3.7 MIL/YR	92,956,000	298,000,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Remde Handled Low Level Waste In Soil Vaults, 4616 cf @ \$220/cf	E	\$1 MIL/YR	25,388,000	81,400,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste, -0-	E	-0-	-0-	-0-	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			118,344,000	379,400,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	\$5 MIL	5,000,000	32,200,000	FY 2026 THRU FY 2031	Data From Previous D&D Projects
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			13,225,000	16,868,000		
	DESIGN COSTS			5,010,000	7,030,000		
	CONSTRUCTION COSTS			102,463,000	259,155,000		
	STARTUP/READINESS COSTS			4,300,000	9,180,000		
	OPERATING COSTS			150,325,000	481,250,000		
	INCREMENTAL DISPOSAL COSTS			41,878,000	133,800,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			5,000,000	32,200,000		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			322,001,000	939,253,000		
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			13,225,000	16,868,000		
	DESIGN COSTS			5,010,000	7,030,000		
	CONSTRUCTION COSTS			102,463,000	259,155,000		
	STARTUP/READINESS COSTS			4,300,000	9,180,000		
	OPERATING COSTS			150,325,000	481,250,000		
	APPORTIONED DISPOSAL COSTS			126,144,000	404,400,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			5,000,000	32,200,000		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			408,467,000	1,210,093,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.4

Date: 06/20/92

Project : MLLWTF - GENERATOR (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: DS

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,150,000	1.0		100	10	25	0.10	0.24
Studies	3,225,000	1.0		100	10	25	0.10	0.25
NEPA Documentation	3,250,000	1.0		100	25	70	0.25	0.71
Permitting	3,500,000	1		100	10	35	0.11	0.38
Tech. Development	100,000	0.03		100	10	25	0.00	0.01
Conceptual, Title I & II	3,750,000	1		100	15	40	0.17	0.47
Title III Inspection	1,260,000	0.4		100	15	35	0.06	0.14
Building Costs	79,925,000	25		100	15	35	3.72	8.69
Equipment Costs	7,650,000	2		100	5	50	0.12	1.19
Constr Mgmt	14,888,000	5		100	5	50	0.23	2.31
Startup and Readiness	4,300,000	1		100	5	40	0.07	0.53
Building Operation	150,325,000	47		100	5	25	2.33	11.67
Waste Trans/Disposal	41,678,000	13		100	5	25	0.65	3.24
Decon/Decommission	5,000,000	2		100	5	30	0.08	0.47
Total	322,001,000	100					7.54	29.09

Comments: Analysis results in an overall project contingency of 25.42% Use 26%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.4

Date: 06/20/92

Project : MLLWTF - GENERATOR (ESCALATED COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: TSB

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,900,000	0.4		100	10	35	0.04	0.15
Studies	3,540,000	0.4		100	10	35	0.04	0.13
NEPA Documentation	3,800,000	0.4		100	25	70	0.10	0.28
Permitting	5,498,000	1		100	10	35	0.06	0.20
Tech. Development	130,000	0.01		100	10	25	0.00	0.00
Conceptual, Title I & II	4,630,000	0.5		100	15	40	0.07	0.20
Title III Inspection	2,400,000	0.3		100	15	35	0.04	0.09
Building Costs	209,980,000	22		100	15	35	3.35	7.82
Equipment Costs	11,520,000	1.2		100	5	50	0.06	0.61
Constr Mgmt	37,655,000	4.0		100	5	50	0.20	2.00
Startup and Readiness	9,180,000	1.0		100	5	40	0.05	0.39
Building Operation	481,260,000	51		100	5	25	2.56	12.81
Waste Trans/Disposal	133,600,000	14		100	5	30	0.71	4.27
Decon/Decommission	32,200,000	3		100	5	35	0.17	1.20
Total	939,293,000	100					7.28	29.60

Comments: Analysis results in an overall project contingency of 25.92% Use 26%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study File No. M-212, Alt.5 Date: 06/20/92

Project: MLLWTF - OFFSITE
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			7,200,000	8,440,000
Project Management	1,050,000	1,200,000		
Studies	1,850,000	1,910,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	550,000	770,000		
Technology Development	500,000	760,000		
ENGINEERING, DESIGN AND INSPECTION.....			N/A	N/A
Performance Specification	N/A	N/A		
Concept. and Title I / II Design	N/A	N/A		
Title III Inspection	N/A	N/A		
CONSTRUCTION.....			N/A	N/A
Building Costs	N/A	N/A		
Equipment Costs	N/A	N/A		
Construction Management	N/A	N/A		
START-UP AND READINESS.....			N/A	N/A
BUILDING OPERATION.....			225,432,000	800,830,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			68,710,000	240,400,000
DECONTAMINATION AND.....			N/A	N/A
DECOMMISSIONING				
MANAGEMENT RESERVE.....			N/A	N/A
SUBTOTAL.....			301,342,000	1,049,670,000
CONTINGENCY ** 23% of Subtotal.....			68,658,000	
CONTINGENCY ** 29% of Subtotal.....				300,330,000

TOTAL PROJECT COST: \$370,000,000 \$1,350,000,000

Comments: **Total contingency is 23% and 27% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study File No. M-212, Alt.5 Date: 06/20/92

Project: MLLWTF - OFFSITE
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			7,200,000	8,440,000
Project Management	1,050,000	1,200,000		
Studies	1,850,000	1,910,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	550,000	770,000		
Technology Development	500,000	760,000		
ENGINEERING, DESIGN AND INSPECTION.....			N/A	N/A
Performance Specification	N/A	N/A		
Conceptual and Title I / II Design	N/A	N/A		
Title III Inspection	N/A	N/A		
CONSTRUCTION.....			N/A	N/A
Building Costs	N/A	N/A		
Equipment Costs	N/A	N/A		
Construction Management	N/A	N/A		
START-UP AND READINESS.....			N/A	N/A
BUILDING OPERATION.....			225,432,000	800,830,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			153,465,000	542,400,000
DECONTAMINATION AND DECOMMISSIONING.....			N/A	N/A
MANAGEMENT RESERVE.....			N/A	N/A
SUBTOTAL.....			386,097,000	1,351,670,000
CONTINGENCY ** 24% of Subtotal.....			93,903,000	
CONTINGENCY ** 26% of Subtotal.....				348,330,000
TOTAL PROJECT COST:			\$480,000,000	\$1,700,000,000

Comments: **Total contingency is 23% and 27% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - OFFSITE
Estimator: T. E. Sivill
D. N. Stoddard
Date: 06/19/92
File No: M-212, Alt.5
Approved By: *BS*

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 5, Offsite (shipment of waste to an offsite treatment facility and returned for storage). Total Project Costs include the up-front documentation, permitting and minimal research and development. There will be no costs associated with engineering/design and construction, start-up and readiness. Minimal operational costs and waste transportation/disposal costs for a period of twenty-five years have been included.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

(a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992, May 8, 1992

(Continued)

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration through the year 2032.

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

Page -2-

II. BASIS OF THE ESTIMATE: (Continued)

- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings
- (d) T. E. Sivill/D. N. Stoddard letter to T. H. Smith, DNS-25-92, Evaluations of Alternative to Treating INEL Mixed and Low-Level Waste

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the Offsite alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and minimal Research and Development (technology development). Processes not presently functional at the offsite treatment facility may incur some initial R&D costs.
- ENGINEERING, DESIGN AND INSPECTION - no costs will be incurred for these services.
- CONSTRUCTION COSTS - no costs will be incurred.
- START-UP AND READINESS - no costs will be incurred.
- OPERATING COSTS will be minimal under this alternative. A skeleton crew will be necessary to the shipping and receiving of the waste to and from the treatment facility or direct disposal.
- WASTE TRANSPORT AND DISPOSAL COSTS include the costs to transport the waste from the generator (initial waste location) directly to the disposal site or to the treatment facility, assumed to be in the State of Tennessee, and back for disposal.

(Continued)

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

III. ASSUMPTIONS: (Continued)

• **WASTE TRANSPORT AND DISPOSAL COSTS (Continued)**

The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.

- **DECONTAMINATION AND DECOMMISSIONING** includes minimal costs.

EVALUATION OF ALTERNATIVES FOR TREATING MEL MIXED AND LOW - LEVEL WASTE MILLWTF - OFFSITE

LOCATION
INEL

BEQUESTER T H SMITH

DETAILED COST ESTIMATE SHEET

Type of End Study

SOURCE
(E) Eng. Est
(M) Vendor
(P) Pur. Order
(H) Handover

File No M-212, AHS

1

Page 1 of 6

Prepared By: T E SQU

August 9, 1941

257A / 200

[illegible]

ACCT NO	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESNT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning - Include Design Support Studies, etc. Ref. Page 1						
	Conceptual		-0-	-0-	-0-		
	Title I		-0-	-0-	-0-		
	Title II		-0-	-0-	-0-		
	SUBTOTAL - DESIGN COSTS		-0-	-0-	-0-		
	TITLE III INSPECTION - (3) People, Full-time		-0-	-0-	-0-		
	SUBTOTAL - TITLE III INSPECTION		-0-	-0-	-0-		
	CONSTRUCTION						
4000	Improvements To Land		-0-	-0-	-0-		
5000	Buildings and Structures						
	Treatment Facility Approximately 35,000 sf bid g		-0-	-0-	-0-		
	Miscellaneous Equipment, i.e., 10T, 50T Cranes		-0-	-0-	-0-		
	Hot Cells (3 each)		-0-	-0-	-0-		
	Initial Complements		-0-	-0-	-0-		
	Miscellaneous Instrumentation, annunciators, etc.		-0-	-0-	-0-		
	Lug Storage Bldg.		-0-	-0-	-0-	Existing Facility will be used	
	Industrial Storage Bldg		-0-	-0-	-0-		
6000	Utilities		-0-	-0-	-0-		
	SUBTOTAL - CONSTRUCTION COSTS						

PROJECT MLWTF - OFFSITE

Type of Est. Study

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Rotary Kiln Incinerator						
	Included in the above cost of the Rotary Kiln:						
	Safety Systems - 23 diesel generators, etc.,		-0-	-0-	-0-		
	Office System Including Stack & Ducting		-0-	-0-	-0-		
	Package Examination Equipment		-0-	-0-	-0-		
	Shredder		-0-	-0-	-0-		
	Grinder		-0-	-0-	-0-		
	Torch Cutting		-0-	-0-	-0-		
	Compactor		-0-	-0-	-0-		
	Immobilization Equipment		-0-	-0-	-0-		
	Ash Handling - Solidification		-0-	-0-	-0-		
	Sulphur Treatment & Glass Melter		-0-	-0-	-0-		
	Remote Size Reduction (Robotics)		-0-	-0-	-0-		
	Other Equipment		-0-	-0-	-0-		
	Lab Equipment		-0-	-0-	-0-		
	Elevator		-0-	-0-	-0-		
	Sorting Chamber (Remote Handling)		-0-	-0-	-0-		
	Miscellaneous Conveyance, i.e., Forklifts, etc.		-0-	-0-	-0-		
	Demolition and Removal		-0-	-0-	-0-		
	SUBTOTAL EQUIPMENT COSTS		-0-	-0-	-0-		
	CONSTRUCTION MANAGEMENT		-0-	-0-	-0-		
	TESTING/STARTUP/PERSONNEL TRAINING - (50) People		-0-	-0-	-0-		
	READINESS REVIEW - (10) People, (3) Months, 480 Hours ea.		-0-	-0-	-0-		
	SUBTOTAL STARTUP/READINESS COSTS		-0-	-0-	-0-		

PROJECT MILLWTF - OFFSITE

Type of Est. Study

Type of Est. Study

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	OPERATING COSTS						
	Labor based on 2080 Hours/Year/Each						
	Operating Personnel, 2 People		\$125K/YR/EA	6,250,000	22,000,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Maintenance Personnel, 1 Person		\$120K/YR/EA	3,000,000	11,000,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Borrowed Personnel, 1 Person		\$125K/YR/EA	3,125,000	11,000,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Recordkeeping		-0-	-0-	-0-		
	Management		-0-	-0-	-0-		
	Engineering		-0-	-0-	-0-		
	ESH&Q Personnel		-0-	-0-	-0-		
	Budget Support Personnel		-0-	-0-	-0-		
	Health Physicists (HPs)		-0-	-0-	-0-		
	Lab Personnel		-0-	-0-	-0-		
	Training Personnel		-0-	-0-	-0-		
	Materials		-0-	-0-	-0-		
	Process Materials,		-0-	-0-	-0-		
	Waste Containers						
	55 Gal. Drums, est. 37,000 drums @ \$35/ea.	E	\$1,265MIL/YR	32,375,000	114,400,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Remde Handled Waste Disposal Vaults	E	\$1.9MIL/YR	47,500,000	170,000,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Equipment						
	Replacement Parts and Equipment	E	\$20K/YR	500,000	1,800,000	FY 2004 THRU FY 2028	Engineer Judgment based on WERF Operations
	Treatment @ Offsite Facility	E	\$5.3 MIL/YR	132,500,000	470,000,000	FY 2004 THRU FY 2028	EG&G ID Memo JDM-23-92
	SUBTOTAL OPERATING COSTS (Continued)			225,250,000	800,200,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electrical	E	\$5K/YR	130,000	450,000	FY 2003 THRU FY 2028	Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc.	E	\$2K/YR	52,000	180,000	FY 2003 THRU FY 2028	Based on WERF Facility, adjusted and escalated
	Other		-0-	-0-	-0-		
	SUBTOTAL - OPERATING COSTS (Continued)			182,000	630,000		
	WASTE TRANSPORT COSTS ONSITE AND OFFSITE	E	\$525K/YR	13,125,000	46,400,000	FY 2004 THRU FY 2028	EGG - WTD - 10082
	DISPOSAL - INCREMENTAL COSTS IN MILLWDF						
	Contact Handled Low Level Waste 287,339cf @ \$5.2/cf	E	\$1.484 MIL/YR	37,354,000	130,000,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Remdie Handled Low Level Waste in Soil Vaults 4,700cf @ \$73/cf	E	\$343K/YR	8,577,000	30,000,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ \$7.3/cf	E	\$386K/YR	9,654,000	34,000,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			55,585,000	194,000,000		
	APPORTIONED DISPOSAL COSTS						
	Contact Handled Low Level Waste 287,339cf @ \$13.46/cf	E	\$3,869 MIL/YR	96,690,000	342,000,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Remdie Handled Low Level Waste in Soil Vaults 4,700cf @ \$220/cf	E	\$1MIL/YR	25,850,000	91,000,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ \$13.46/cf	E	\$712K/YR	17,800,000	63,000,000	FY 2004 THRU FY 2028	Based on data from RWMC & Eng. Est.
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			140,340,000	496,000,000		

PROJECT MILLWTF - OFFSITE Type of Est. Study File No. M-212,Alt.5

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E		-0-	-0-		
	Note: Existing Storage Building At WERF						
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			7,200,000	8,440,000		
	DESIGN COSTS			-0-	-0-		
	CONSTRUCTION COSTS			-0-	-0-		
	STARTUP/READINESS COSTS			-0-	-0-		
	OPERATING COSTS			225,432,000	800,830,000		
	INCREMENTAL DISPOSAL COSTS			68,710,000	240,400,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			-0-	-0-		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			301,342,000	1,049,670,000		
	SUMMARY - MILLWTF - APPORTIONED DISPOSAL						
	FRONT END COSTS			7,200,000	8,440,000		
	DESIGN COSTS			-0-	-0-		
	CONSTRUCTION COSTS			-0-	-0-		
	STARTUP/READINESS COSTS			-0-	-0-		
	OPERATING COSTS			225,432,000	800,830,000		
	APPORTIONED DISPOSAL COSTS			153,465,000	542,400,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			-0-	-0-		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			386,097,000	1,351,670,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.5

Date: 06/20/92

Project : MLLWTF - OFFSITE (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: Bob

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	1,050,000	0.3		100	10	25	0.03	0.09
Studies	1,850,000	0.6		100	10	25	0.06	0.15
NEPA Documentation	3,250,000	1.1		100	25	70	0.27	0.75
Permitting	550,000	0		100	10	35	0.02	0.06
Tech. Development	500,000	0.17		100	10	25	0.02	0.04
Conceptual, Title I & II								
Title III Inspection								
Building Costs								
Equipment Costs								
Constr Mgmt								
Startup and Readiness								
Building Operation	225,432,000	75		100	5	25	3.74	18.70
Waste Trans/Disposal	68,710,000	23		100	5	30	1.14	6.84
Decon/Decommission								
Total	301,342,000	100					4.92	25.65

Comments: Analysis results in an overall project contingency of

22.59%

Use 23%

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.5

Date: 06/20/92

Project : MLLWTF - OFFSITE (ESCALATED COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: *hok*

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est				
					-	+	-	+
Project Management	1,200,000	0.1		100	10	35	0.01	0.04
Studies	1,910,000	0.2		100	10	35	0.02	0.06
NEPA Documentation	3,800,000	0.4		100	25	70	0.09	0.25
Permitting	770,000	0		100	10	35	0.01	0.03
Tech Development	760,000	0.07		100	10	25	0.01	0.02
Conceptual, Title I & II								
Title III Inspection								
Building Costs								
Equipment Costs								
Constr Mgmt								
Startup and Readiness								
Building Operation	800,830,000	76		100	5	30	3.81	22.89
Waste Trans/Disposal	240,400,000	23		100	5	35	1.15	8.02
Decon/Decommission								
Total	1,049,670,000	100					4.97	30.95

Comments: Analysis results in an overall project contingency of 27.36% Use 27%

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study File No. M-212, Alt.6 Date: 06/20/92

Project: MLLWTF - MWPF
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivil

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			3,875,000	4,318,000
Project Management	450,000	470,000		
Studies	2,525,000	2,750,000		
NEPA Documentation	300,000	350,000		
Permitting	200,000	268,000		
Technology Development	400,000	480,000		
ENGINEERING, DESIGN AND INSPECTION.....			N/A	N/A
Performance Specification	N/A	N/A		
Concept. and Title I / II Design	N/A	N/A		
Title III Inspection	N/A	N/A		
CONSTRUCTION.....			13,502,000	22,967,000
Building Costs	10,990,000	18,700,000		
Equipment Costs	550,000	930,000		
Construction Management	1,962,000	3,337,000		
START-UP AND READINESS.....			N/A	N/A
BUILDING OPERATION.....			136,810,000	530,800,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			64,689,000	252,400,000
DECONTAMINATION AND..... DECOMMISSIONING			N/A	N/A
MANAGEMENT RESERVE.....			1,350,000	2,297,000
SUBTOTAL.....			220,226,000	812,782,000
CONTINGENCY ** 23% of Subtotal.....			49,774,000	
CONTINGENCY ** 28% of Subtotal.....				227,218,000
TOTAL PROJECT COST:			\$270,000,000	\$1,040,000,000

Comments: **Total contingency is 23% and 27% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

Date: 06/20/92

Project: MLLWTF - WPF
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			3,875,000	4,318,000
Project Management	450,000	470,000		
Studies	2,525,000	2,750,000		
NEPA Documentation	300,000	350,000		
Permitting	200,000	268,000		
Technology Development	400,000	480,000		
ENGINEERING, DESIGN AND INSPECTION.....			N/A	N/A
Performance Specification	N/A	N/A		
Conceptual and Title I / II Design	N/A	N/A		
Title III Inspection	N/A	N/A		
CONSTRUCTION.....			13,502,000	22,967,000
Building Costs	10,990,000	18,700,000		
Equipment Costs	550,000	930,000		
Construction Management	1,962,000	3,337,000		
START-UP AND READINESS.....			N/A	N/A
BUILDING OPERATION.....			136,810,000	530,800,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			149,461,000	582,000,000
DECONTAMINATION AND DECOMMISSIONING.....			N/A	N/A
MANAGEMENT RESERVE.....			1,350,000	2,297,000
SUBTOTAL.....			304,998,000	1,142,382,000
CONTINGENCY ** 24% of Subtotal.....			72,002,000	
CONTINGENCY ** 27% of Subtotal.....				307,618,000
TOTAL PROJECT COST:			\$377,000,000	\$1,450,000,000

Comments: **Total contingency is 23% and 27% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - TREATMENT-AT IWPf
Estimator: T. E. Sivill
D. N. Stoddard
Date: 06/19/92
File No: M-212, Alt.6
Approved By: *[Signature]*

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 6, Treatment at Idaho Waste Processing Facility (IWPf). It will be assumed that the IWPf will be in existence and operational to treat the waste. Total Project Costs include additional costs to the IWPf in order to handle the waste considered in this project. Added costs include up-front documentation, permitting and research and development, construction costs to enlarge the treatment facility to accommodate equipment with greater capacity, the additional operational costs and waste transportation/disposal costs for a period of twenty-five years, and decontamination/decommissioning and contingency.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

(Continued Page 2)

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

All costs shown for this alternative are additional costs to the planned IWPf project.

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration through D&D in the year 2030.

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

Page -2-

II. BASIS OF THE ESTIMATE: (Continued)

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992, May 8, 1992
- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings
- (d) T. E. Sivill/D. N. Stoddard letter to T. H. Smith, DNS-25-92, Evaluations of Alternative to Treating INEL Mixed and Low-Level Waste

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the Maximum Treatment alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include minimal Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development). This is necessary only to handle the additional waste generated by this project.
- ENGINEERING, DESIGN AND INSPECTION costs will not be incurred in this alternate.
- CONSTRUCTION COSTS include any additional square footage required to house sized-up equipment to handle the additional waste generated by this project. New process equipment will need to be sized up to handle additional capacity. Construction Management for this phase has been include at the current rate of seventeen percent of construction costs.
- START-UP AND READINESS costs will not be incurred by this project (these costs will have been attributed to the IWPF)

(Continued)

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

III. ASSUMPTIONS: (Continued)

- OPERATING COSTS includes costs for the additional staff, materials, equipment maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of existing facilities and adjusted for this specific alternative.
- WASTE TRANSPORT AND DISPOSAL COSTS include the costs to transport the waste from the generator (initial waste location) to the IWPf facility, from the generator directly to the disposal site, and from the IWPf to the disposal site.

The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.

- DECONTAMINATION AND DECOMMISSIONING includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Engineer/Project Manager direction, D & D costs have been estimated at 15% of the original facility and process construction costs.
- Management Reserve has also been allowed for, based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

DETAILED COST ESTIMATE SHEET

EG&G Idaho, Inc.

PROJECT EVALUATION OF ALTERNATIVES FOR TREATING
INELIMINATED AND LOW-LEVEL WASTE
MILLWTF - INFT

LOCATION INEL

REQUESTER T. H. SMITH

Type of Est. Study

SOURCE
(E) Eng. Est.
(V) Vendor
(P) Per. Order
(H) Headquarters Ref.

File No. M-212, A18.6

Date

Page 1 of 6

Prep By T. E. Shaw

App'd By *MS*

08/25/82

ACCT NO.	ACTIVITY DESCRIPTION	E/V P/H	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
PROJECT COSTS							
	Project Management	E	\$300K/YR	450,000	470,000	FY MID - 1991 THRU 1992	BUD Sheet, dated 1/31/92
	Project Studies - (2) People, Full-time	E	\$250K/YR/EA	1,000,000	1,100,000	FY 1992 THRU 1993	BUD Sheet, dated 1/31/92
	Design Support Studies (F&ORFs, etc.) (1) person @ 1/2 hr	E	\$11ML TO DATE/\$75K/YR	1,375,000	1,500,000	FY 1993 THRU FY 1997	BUD Sheet, dated 1/31/92, Engineer's Estimate
	Siting Studies	E	\$150K TO DATE	150,000	150,000	FY 1992	BUD Sheet, dated 1/31/92, Engineer's Estimate
	NEPA (EIS)	E	\$75K/YR	300,000	350,000	FY 1993 THRU FY 1996	Engineer's Estimate
	Permitting (NESHAP, etc.)						
	TSCA		-0-	-0-	-0-		
	RCRA		-0-	-0-	-0-		
	Other		-0-	-0-	-0-		
	Safety Analysis Report (SAR)	E	\$75K/YR	150,000	210,000	FY 1998 THRU FY 1999	Data from similar SAR's
	Other Regulatory Items						
	ESH&O		-0-	-0-	-0-		Engineer's Estimate
	CE's		\$50K/YR	50,000	50,000	FY 1994	
	PSD		-0-	-0-	-0-		
	PTC/NESHAP		-0-	-0-	-0-		
	TECHNOLOGY DEVELOPMENT						
	Incineration (Demo) - Rotary Kilo/Origas System (Demo)	E	\$100K	100,000	120,000	FY 1995	Vendor Demonstration, Engineer's Estimate
	Immobilization (Demo)						
	Joule Heated Glass Mel. Verification	E	\$100K	100,000	120,000	FY 1995	Engineer's Estimate
	Modified Sulfur Cement (MSC)	E	\$100K	100,000	120,000	FY 1995	Engineer's Estimate
	Cementation	E	\$100K	100,000	120,000	FY 1995	Engineer's Estimate
SUBTOTAL - FRONT END COSTS				3,875,000	4,318,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning - Includes Design Support Studies, etc. Ref. Page 1						
	Conceptual		-0-	-0-	-0-		
	Title I		-0-	-0-	-0-		
	Title II		-0-	-0-	-0-		
	SUBTOTAL - DESIGN COSTS		-0-	-0-	-0-		
	TITLE III INSPECTION - (3) People, Full-time		-0-	-0-	-0-		
	SUBTOTAL - TITLE III INSPECTION		-0-	-0-	-0-		
	CONSTRUCTION						
4000	Improvements To Land		-0-	-0-	-0-		
5000	Buildings and Structures						
	Treatment Facility - Increase NWFF by 10%		\$10 MIL	10,000,000	17,000,000	FY 2002	Engineering Estimate
	Miscellaneous Equipment, i.e., 10T, 50T Cranes		-0-	-0-	-0-		
	Hot Cells (3 each)		-0-	-0-	-0-		
	Initial Complements		-0-	-0-	-0-		
	Miscellaneous Instrumentation, sensors, etc.		-0-	-0-	-0-		
	Lag Storage Bldg. Approximately 8,000 SF	E	900K	900,000	1,700,000	FY 2002	Engineering Estimate
	Indefinite Storage Bldg.		-0-	-0-	-0-		
6000	Utilities		-0-	-0-	-0-		
	SUBTOTAL - CONSTRUCTION COSTS			10,900,000	18,700,000		

08/18/92

Date

Page 3 of 6

File No. M-212, AR 6

Type of Est. Study

PROJECT MILLWTF - NWFF

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.M.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Rotary Kiln Incinerator	E	\$200K	200,000	340,000	FY 2002	
	Included in the above cost of the Rotary Kiln: Basic Equip., Feed Systems, Controls, Instrumentation, Misc. Filters, Dumpers, Safety, Scales & Monitoring, Feed & Secondary Combust. Chambers, Ash Disch. Sys						
	Safety Systems - (2) diesel generators, etc.		-0-	-0-	-0-		
	Oil/gas System including Stack & Ducting	E	\$150K	150,000	250,000	FY 2002	
	Package Examination Equipment		-0-	-0-	-0-		
	Shredder		-0-	-0-	-0-		
	Grinder		-0-	-0-	-0-		
	Torch Cutting		-0-	-0-	-0-		
	Compactor		-0-	-0-	-0-		
	Immobilization Equipment		-0-	-0-	-0-		
	Ash Handling - Solidification	E	\$200K	200,000	340,000		
	Sulphur Treatment & Glass Melter		-0-	-0-	-0-		
	Remote Size Reduction (Robotics)		-0-	-0-	-0-		
	Other Equipment		-0-	-0-	-0-		
	Lab Equipment		-0-	-0-	-0-		
	Elevator		-0-	-0-	-0-		
	Sorting Chamber (Remote Handling)		-0-	-0-	-0-		
	Miscellaneous Conveyance, Ia., Feeds, etc.		-0-	-0-	-0-		
	Demolition and Removal		-0-	-0-	-0-		
	SUBTOTAL EQUIPMENT COSTS			550,000	930,000		
	CONSTRUCTION MANAGEMENT		\$1,002 MIL	1,002,000	3,337,000	FY 2002	Engineer's Estimate
	TESTING/STARTUP/PERSONNEL TRAINING - (50) People		-0-	-0-	-0-		
	READINESS REVIEW - (10) People, (2) Months, 480 Hours ea.		-0-	-0-	-0-		
	SUBTOTAL STARTUP/READINESS COSTS		-0-	-0-	-0-		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	OPERATING COSTS						
	Labor based on 2080 Hours/Year/Each						
	Operating Personnel, 4 People	E	\$125K/YR/EA	12,500,000	49,000,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Maintenance Personnel, 2 Person	E	\$120K/YR/EA	6,000,000	23,000,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Training Personnel		-0-	-0-	-0-		
	Recordkeeping, 1 Person	E	\$78K/YR/EA	1,950,000	7,600,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Management		-0-	-0-	-0-		
	Engineering, 1 Person	E	\$177K/YR/EA	4,400,000	17,000,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	ESH&Q Personnel, 1 Person	E	\$178K/YR/EA	4,500,000	17,000,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Budget Support Personnel		-0-	-0-	-0-		
	Health Physicists (H/Ps), 1 Person	E	\$128K/YR/EA	3,200,000	12,000,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Lab Personnel, 1 Person	E	\$128K/YR/EA	3,200,000	12,000,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Materials						
	Process Materials, i.e., Sulfur Cement, etc.,	E	\$100K/YR	2,500,000	9,700,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Waste Containers		-0-	-0-	-0-		
	55 Gal. Drums, est. 48,000 drums @ \$35/ea.	E	\$1.68 MIL/YR	42,000,000	163,600,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Remotely Handled Waste Disposal Vaults	E	\$1.9 MIL	47,500,000	185,000,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Other Lab Materials/Supplies	E	\$50K/YR	1,250,000	4,900,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	Equipment						
	Replacement Parts and Equipment	E	\$120K/YR	3,000,000	11,700,000	FY 2006 THRU FY 2030	Engineer Judgment based on WERF Operations
	SUBTOTAL OPERATING COSTS (Continued)			132,000,000	512,500,000		

06/16/92

Date:

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File No. M-212, Alt. 8

Type of Est. Study

PROJECT MILLWTF - IWPF

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electrical	E	\$60K/YR	1,560,000	5,900,000	FY 2005 THRU FY 2030	Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc..	E	\$75K/YR	1,950,000	7,400,000	FY 2005 THRU FY 2030	Based on WERF Facility, adjusted and escalated
	Other	E	\$50K/YR	1,300,000	5,000,000	FY 2005 THRU FY 2030	
	SUBTOTAL - OPERATING COSTS (Continued)			4,810,000	18,300,000		
	WASTE TRANSPORT COSTS	E	\$363K/YR	9,100,000	35,000,000	FY 2006 THRU FY 2030	EGG - WTD - 10092
	DISPOSAL - INCREMENTAL COSTS IN MILLWTF						
	Contact Handled Low Level Waste 287,400cf @ \$5.2/cf	E	\$1,494 MIL/YR	37,382,000	146,000,000	FY 2006 THRU FY 2030	Based on data from RWMC & Eng. Est.
	Remide Handled Low Level Waste In Soil Vaults 4,700cf @ \$73/cf	E	\$343K/YR	8,577,000	33,400,000	FY 2006 THRU FY 2030	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ \$7.3/cf	E	\$386K/YR	9,650,000	38,000,000	FY 2006 THRU FY 2030	Based on data from RWMC & Eng. Est.
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			55,588,000	217,400,000		
	COSTS OF SHIPPING RESIDUE TO INEL		-0-	-0-	-0-		
	APPORTIONED DISPOSAL COSTS						
	Contact Handled Low Level Waste 287,400cf @ \$13.46/cf	E	\$3,868 MIL/YR	96,710,000	377,000,000	FY 2006 THRU FY 2030	Based on data from RWMC & Eng. Est.
	Remide Handled Low Level Waste In Soil Vaults 4,700cf @ \$220/cf	E	\$1,034 MIL/YR	25,850,000	101,000,000	FY 2006 THRU FY 2030	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ \$13.46/cf	E	\$712K/YR	17,801,000	69,000,000	FY 2006 THRU FY 2030	Based on data from RWMC & Eng. Est.
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			140,361,000	547,000,000		

06/20/92

Date:

Page: 6 of 6

File No. M-212, Alt 6

Type of Est. Study

PROJECT MILLWTF - IWPF

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	-0-	-0-	-0-		
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			3,875,000	4,318,000		
	DESIGN COSTS			-0-	-0-		
	CONSTRUCTION COSTS			13,502,000	22,967,000		
	STARTUP/READINESS COSTS			-0-	-0-		
	OPERATING COSTS			136,810,000	530,800,000		
	INCREMENTAL DISPOSAL COSTS			64,668,000	252,400,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			-0-	-0-		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			218,876,000	810,485,000		
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			3,875,000	4,318,000		
	DESIGN COSTS			-0-	-0-		
	CONSTRUCTION COSTS			13,502,000	22,967,000		
	STARTUP/READINESS COSTS			-0-	-0-		
	OPERATING COSTS			136,810,000	530,800,000		
	APPORTIONED DISPOSAL COSTS			149,461,000	582,000,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			-0-	-0-		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			303,646,000	1,140,085,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.6

Date: 06/20/92

Project : MLLWTF - IWP (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: Bob

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	450,000	0.2		100	10	25	0.02	0.05
Studies	2,525,000	1.2		100	10	25	0.12	0.29
NEPA Documentation	300,000	0.1		100	25	70	0.03	0.10
Permitting	200,000	0		100	10	35	0.01	0.03
Tech. Development	400,000	0.18		100	10	25	0.02	0.05
Conceptual, Title I & II								
Title III Inspection								
Building Costs	10,990,000	5		100	15	25	0.75	1.26
Equipment Costs	550,000	0		100	5	50	0.01	0.13
Constr Mgmt	1,962,000	1		100	5	50	0.04	0.45
Startup and Readiness								
Building Operation	136,810,000	63		100	5	25	3.13	15.63
Waste Trans/Disposal	64,689,000	30		100	5	30	1.48	8.87
Decon/Decommission								
Total	218,876,000	100					5.44	26.40

Comments: Analysis results in an overall project contingency of 23.22% Use 23%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.6

Date: 06/20/92

Project : MLLWTF - WPF (ESCALATED COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: ASD

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	470,000	0.1		100	10	35	0.01	0.02
Studies	2,750,000	0.3		100	10	35	0.03	0.12
NEPA Documentation	350,000	0.0		100	25	70	0.01	0.03
Permitting	268,000	0		100	10	35	0.00	0.01
Tech. Development	480,000	0.06		100	10	25	0.01	0.01
Conceptual, Title I & II								
Title III Inspection								
Building Costs	18,700,000	2		100	15	25	0.35	0.58
Equipment Costs	930,000	0.1		100	5	50	0.01	0.06
Constr Mgmt	3,337,000	0.4		100	5	50	0.02	0.21
Startup and Readiness								
Building Operation	530,800,000	65		100	5	30	3.27	19.65
Waste Trans/Disposal	252,400,000	31		100	5	35	1.56	10.90
Decon/Decommission								
Total	810,485,000	100					5.21	31.41

Comments: Analysis results in an overall project contingency of 27.75% Use 27%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study File No. M-212, Alt.7A Date: 06/25/92

Project: MLLWTF - COMBINATION WERF - OFFSITE
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			16,350,000	21,138,000
Project Management	3,150,000	4,000,000		
Studies	2,900,000	3,160,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	6,350,000	9,158,000		
Technology Development	700,000	1,020,000		
ENGINEERING, DESIGN AND INSPECTION.....			4,650,000	6,030,000
Performance Specification				
Conceptual and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			14,058,000	21,189,000
Building Costs	4,000,000	6,020,000		
Equipment Costs	8,015,000	12,090,000		
Construction Management	2,043,000	3,079,000		
START-UP AND READINESS.....			5,888,000	9,460,000
BUILDING OPERATION.....			348,105,000	1,161,500,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			43,100,000	138,000,000
DECONTAMINATION AND.....			2,600,000	17,900,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			1,406,000	2,119,000
SUBTOTAL.....			436,157,000	1,377,336,000
CONTINGENCY ** 22% of Subtotal.....			93,843,000	
CONTINGENCY ** 27% of Subtotal.....				376,664,000
TOTAL PROJECT COST:			\$530,000,000	\$1,754,000,000

Comments: **Total contingency is 23% and 28% respectively, including Management Reserve.
Actual contingency used may vary a amximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study File No. M-212, Alt.7A Date: 06/25/92

Project: MLLWTF - COMBINATION WERF - OFFSITE
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			16,350,000	21,138,000
Project Management	3,150,000	4,000,000		
Studies	2,900,000	3,160,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	6,350,000	9,158,000		
Technology Development	700,000	1,020,000		
ENGINEERING, DESIGN AND INSPECTION.....			4,650,000	6,030,000
Performance Specification				
Conceptual and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			14,058,000	21,189,000
Building Costs	4,000,000	6,020,000		
Equipment Costs	8,015,000	12,090,000		
Construction Management	2,043,000	3,079,000		
START-UP AND READINESS.....			5,888,000	9,460,000
BUILDING OPERATION.....			348,105,000	1,161,500,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			127,900,000	410,000,000
DECONTAMINATION AND..... DECOMMISSIONING			2,600,000	17,900,000
MANAGEMENT RESERVE.....			1,406,000	2,119,000
SUBTOTAL.....			520,957,000	1,649,336,000
CONTINGENCY ** 24% of Subtotal.....			123,043,000	
CONTINGENCY ** 28% of Subtotal.....				460,664,000
TOTAL PROJECT COST:			\$644,000,000	\$2,110,000,000

Comments: **Total contingency is 23% and 28% respectively, including Management Reserve.

Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - COMBINATION WERF - OFFSITE
File No: M-212, Alt.7A
Estimator: T. E. Sivill
D. N. Stoddard
Date: 06/22/92
Approved By: *[Signature]*

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 7A, combination WERF - OFFSITE. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of modifications to WERF and new storage facility, including start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992, May 8, 1992

(Continued)

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration through D&D in the year 2030.

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

Page -2-

II. BASIS OF THE ESTIMATE: (Continued)

- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings
- (d) T. E. Sivill/D. N. Stoddard letter to T. H. Smith, DNS-25-92, Evaluations of Alternative to Treating INEL Mixed and Low-Level Waste

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the WERF-OFFSITE Treatment alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development).
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection of the required modifications and upgrades to the existing facilities at WERF and a new storage building. The WERF-IWPF alternative requires upgrades in the existing utilities as well as installation of new and replacement of existing equipment. Storage requirements for this alternative also require construction of an 8,600 sf lag storage building.
- CONSTRUCTION COSTS include construction costs to modify and update the existing WERF facility. New process equipment and replacement of existing equipment associated with this facility are also included. Construction Management for this phase has been included at the current rate of seventeen percent of construction costs.

(Continued)

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

III. ASSUMPTIONS: (Continued)

- **START-UP AND READINESS** includes the costs associated with initial system testing, system operation and maintenance manuals, and training of personnel associated with the operations of the processes. As crew has been sized based upon existing operations presently functioning at WERF and adjusted to handle the requirements of this alternative.
- **OPERATING COSTS** include the staff, materials, equipment maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of existing facilities and adjusted for this specific alternative.
- **WASTE TRANSPORT AND DISPOSAL COSTS** include the costs to transport the waste from the generator (initial waste location) to the treatment facility, from the generator directly to the disposal site. Treated waste will be housed in the existing WERF storage area, or offsite to the State of Tennessee, and back for disposal.

The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.

- **DECONTAMINATION AND DECOMMISSIONING** includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Project Manager/Engineer direction, D&D costs have been estimated at 15% of the original facility and process construction costs.
- **Management Reserve** has also been allowed for based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

DETAILED COST ESTIMATE SHEET

EG&G Idaho, Inc.
 PROJECT EVALUATION OF ALTERNATIVES FOR TREATING
 INELIMINATED AND LOW-LEVEL WASTE
 MILLWTF - COMBINATION WEF - OFFSITE
 LOCATION INEL
 REQUESTER T. H. SMITH

File No M-212, AE 7A
 Date 06/22/82
 Page 1 of 6
 Prep By T. E. Seal
 App'd By [Signature]

Type of Est. Study
 SOURCE
 (E) Eng. Est.
 (V) Vendor
 (P) Pur. Order
 (H) Handbook Ref.

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS		ESCALATED COSTS	ACTIVITY SCHEDULE		ESTIMATE BASIS
				COSTS			ESCALATION		
PROJECT COSTS (Including Storage Facilities)									
	Project Management	E	\$300K/YR	3,150,000	4,000,000	FY MD - 1991 THRU 2001	BUD Sheet, dated 1/31/92		
	Project Studies - (2) People, Full-time	E	\$500K/YR	1,000,000	1,100,000	FY 1992 THRU FY 1993	BUD Sheet, dated 1/31/92		
	Design Support Studies (FACR's, Etc.)	E	\$1MIL TO DATE/\$250K/YR	1,750,000	1,900,000	FY 1993 THRU FY 1995	BUD Sheet, dated 1/31/92, Engineer's Estimate		
	Siting Studies (Facility Existing - Site Storage Only)		\$150K	150,000	180,000	FY 1992	BUD Sheet, dated 1/31/92, Engineer's Estimate		
	NEPA (EIS)	E	\$750K/\$1M/\$750K/\$750K	3,250,000	3,800,000	FY 1993 THRU FY 1998	Engineer's Estimate		
	Permitting (NESHAP, etc.)								
	TSCA	E	\$250K/\$250K/\$500K	1,000,000	1,400,000	FY 98, 97, 2001	Engineer's Estimate (includes Trial Burn/Sampling)		
	RCRA	E	\$250K/\$250K/\$500K/\$1.5M	2,500,000	3,800,000	FY 98, 97, 99, 2001	Engineer's Estimate (includes Trial Burn/Sampling)		
	Other	E	\$250K/YR	500,000	710,000	FY 1998 THRU FY 1999	Engineer's Estimate		
	Safety Analysis Report (SAR)	E	\$100K/\$300K/\$300K	700,000	980,000	[92 - 93] [97 - 99] [99 - 2000]	Engineer's Estimate		
	Other Regulatory Items	E	\$50K/YR	550,000	770,000	FY 1993 THRU FY 2003	Engineer's Estimate		
	ESH&O	E	\$50K/YR	450,000	600,000	FY 1993 THRU FY 2001	Engineer's Estimate		
	CT's	E	\$25K/YR	25,000	28,000	FY 1993	Engineer's Estimate		
	PSD	E	\$250K/\$250K	500,000	700,000	FY 1998 THRU FY 1999	Engineer's Estimate		
	PTC/NESHAP	E	\$125K	125,000	170,000	FY 1997 & FY 1998	Engineer's Estimate		
TECHNOLOGY DEVELOPMENT									
	Immobilization	E	\$500K	500,000	760,000	FY 2000	Engineer's Estimate		
	Cementation	E	\$100K	100,000	130,000	FY 1998	Engineer's Estimate		
	Modified Sulfur Cement (MSC)	E	\$100K	100,000	130,000	FY 1998	Engineer's Estimate		
SUBTOTAL - FRONT END COSTS									
				16,350,000	21,138,000				

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning						
	Conceptual	E	\$750K	750,000	830,000	FY 1983	Engineer's Estimate
	Title I	E	\$1.5 MIL	1,500,000	1,800,000	FY 1985	Engineer's Estimate
	Title II	E	\$1.5 MIL	1,500,000	2,000,000	FY 1987	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			3,750,000	4,630,000		
	TITLE III INSPECTION - WERF, 3 people, fulltime	E	\$450K/YR	900,000	1,400,000	FY 2000, FY 2001	Engineer's Estimate
	SUBTOTAL - TITLE III INSPECTION	E		900,000	1,400,000		
	CONSTRUCTION						
5000	Buildings and Structures (includes modifications to the existing WERF treatment facility)						
	Treatment Facility Modifications	E	\$2 MIL	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Building Structure Upgrades	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Engineer's Estimate
	Electrical Utilities Upgrade	E	\$500K	500,000	760,000	FY 2000	Engineer's Estimate
	Lag Storage Buildings, (Existing WERF Storage Facilities will be Used)						
6000	Utilities (Treatment Fac. Upgrades and New)	E	\$500K	500,000	760,000	FY 2000	Engineer's Estimate
	SUBTOTAL - CONSTRUCTION COSTS			4,000,000	6,020,000		

08/22/82

Date

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File No M-212, AR 7A

Type of Est. Study

PROJECT MILLWTF - COMBINATION WERF - OFF-SITE

ACCT NO.	ACTIVITY DESCRIPTION	P, H	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Controlled Air Incinerator	E	\$1 MIL	1,000,000	1,500,000 FY 2000		Historical Data WERF Incinerator
	Wet Offgas System (includes Stack/Ductwork)	E	\$1.5 MIL	1,500,000	2,300,000 FY 2000		Historical Data WERF Incinerator
	Package Examination Equipment	E	\$400K	400,000	730,000 FY 2000		Engineer Experience
	Lab Equipment	E	\$800K	800,000	910,000 FY 2000		Engineer Experience
	Elevators	E	\$250K	250,000	380,000 FY 2000		Engineer Experience
	Conveyors	E	\$250K	250,000	380,000 FY 2000		Engineer Experience
	Torch Cutting (Remede)	E	\$100K	100,000	150,000 FY 2000		Engineer's Estimate
	Compressor	E	\$1 MIL	1,000,000	1,500,000 FY 2000		WERF /Engineer Experience
	Immobilization Equipment (Pelt rehandling)	E	\$1.2 MIL	1,200,000	1,800,000 FY 2000		Engineer's Estimate
	Remede Size Reduction (Robotics)	E	\$1 MIL	1,000,000	1,500,000 FY 2000		Engineer's Estimate
	Safety Systems - (2) Diesel Generators	E	\$185K	185,000	280,000 FY 2000		Engineer's Estimate
	SUBTOTAL - EQUIPMENT COSTS			7,505,000	11,430,000		
	DEMOLITION AND REMOVAL						
	Remove Existing Incinerator	E	\$250K	250,000	380,000 FY 1989		Engineer's Estimate
	Remove Other Equipment (Compressor, Offgas System)	E	\$100K	100,000	150,000 FY 1989		Engineer's Estimate
	Disposition of Equipment	E	\$100K	100,000	150,000 FY 1989		Engineer's Estimate
	SUBTOTAL - DEMOLITION COSTS			450,000	680,000		
	CONSTRUCTION MANAGEMENT	E	\$2.04 MIL	2,043,000	3,078,000 FY 2000		Engineer's Estimate
	TESTING/STARTUP/PERSONNEL TRAINING - (36) People	E	\$5.6 MIL	5,600,000	8,000,000 FY 2001		WERF /Engineer Experience
	READINESS REVIEW - (10) People, (3) Months, 480 Hours ea	E	\$208K	208,000	460,000 FY 2001		Readiness Review Experience
	SUBTOTAL STARTUP/READINESS COSTS			5,808,000	9,460,000		

ACCT NO	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	OPERATING COSTS						
	Labor based on 2080 Hours/Year/Each						
	Operating Personnel, 14 People	E	\$125K/YREA	43,750,000	140,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Maintenance Personnel, 8 People	E	\$120K/YREA	27,000,000	87,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Training Personnel, 3 People	E	\$68K/YREA	7,200,000	23,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Recordkeeping, 2 People	E	\$78K/YREA	3,900,000	13,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Management, 3 People	E	\$285K/YREA	21,400,000	68,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Engineering, 3 People	E	\$177K/YREA	13,300,000	43,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	ES&H/Q Personnel, 3 People	E	\$178K/YREA	13,400,000	43,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Budget Support Personnel, 1 Person	E	\$115K/YREA	2,900,000	9,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Health Physicists (HP's), 2 People	E	\$128K/YREA	6,400,000	21,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Other, Lab Personnel, 1 Person	E	\$128K/YREA	3,200,000	10,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Materials						
	Process Materials, Cement	E	\$20K/YR	500,000	1,600,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Waste Containers						
	55 Gal Drums, Low-Level, est. 20,000 drums @ \$35/dm.	E	\$700K/YR	17,500,000	56,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Remotely Handled Waste Disposal Vaults	E	\$1 BBL	47,500,000	152,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Other, Lab Materials/Supplies	E	\$25K/YR	625,000	2,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Equipment						
	Process Improvements						
	Replacement Pumps	E	\$65K/YR	2,400,000	8,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Treatment at Offsite Facility	E	\$5.3 MIL	132,500,000	470,000,000	FY 2004 THRU FY 2026	Engineer Judgment based on WERF Operations
	SUBTOTAL - OPERATING COSTS			343,475,000	1,148,000,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electrical	E	\$65K/YR	1,630,000	5,300,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc.	E	\$77K/YR	2,000,000	6,300,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	Other	E	\$40K/YR	1,000,000	3,300,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	SUBTOTAL - OPERATING COSTS (Continued)			4,630,000	14,900,000		
	WASTE TRANSPORT COSTS ONSITE AND OFFSITE	E	\$525K/YR	13,125,000	42,000,000	FY 2002 THRU FY 2026	EGG - WTD - 100%±
	DISPOSAL - INCREMENTAL COSTS IN MILLWDF						
	Contact Handled Low Level Waste 60,300cf @ \$5.2/cf	E	\$470K/YR	11,750,000	36,000,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Remedie Handled Low Level Waste in Soil Vaults 4,700cf @ \$73/cf	E	\$343K/YR	8,575,000	27,000,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ \$7.3/cf	E	\$386K/YR	9,650,000	31,000,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			29,975,000	86,000,000		
	DISPOSAL - APPORTIONED COSTS IN MILLWDF						
	Contact Handled Low Level Waste 90,300cf @ \$24.84/cf	E	\$2,243 MIL/YR	56,075,000	180,000,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Remedie Handled Low Level Waste in Soil Vaults 4,700cf @ \$220/cf	E	\$1,034 MIL/YR	25,850,000	83,000,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste 52,900cf @ \$24.84/cf	E	\$1,314 MIL/YR	32,850,000	105,000,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			114,775,000	368,000,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	\$2.6MIL	2,600,000	17,900,000	FY 2027 THRU FY 2030	
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			16,350,000	21,136,000		
	DESIGN COSTS			4,650,000	6,030,000		
	CONSTRUCTION COSTS			14,056,000	21,189,000		
	STARTUP/READINESS COSTS			5,888,000	9,460,000		
	OPERATING COSTS			348,105,000	1,161,500,000		
	WASTE TRANSPORT/INCREMENTAL DISPOSAL COSTS			43,100,000	138,000,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			2,600,000	17,900,000		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			434,751,000	1,375,217,000		
	SUMMARY - MILLWTF - APPORTIONED DISPOSAL						
	FRONT END COSTS			16,350,000	21,136,000		
	DESIGN COSTS			4,650,000	6,030,000		
	CONSTRUCTION COSTS			14,056,000	21,189,000		
	STARTUP/READINESS COSTS			5,888,000	9,460,000		
	OPERATING COSTS			348,105,000	1,161,500,000		
	WASTE TRANSPORT/APPORTIONED DISPOSAL COSTS			127,900,000	410,000,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			2,600,000	17,900,000		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			519,561,000	1,647,217,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.7A

Date: 06/25/92

Project : MLLWTF - COMBINATION WERF - OFFSITE (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By:

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,150,000	0.7		100	10	25	0.07	0.18
Studies	2,900,000	0.7		100	10	25	0.07	0.17
NEPA Documentation	3,250,000	0.7		100	25	70	0.19	0.52
Permitting	6,350,000	1		100	10	35	0.15	0.51
Tech. Development	700,000	0.16		100	10	25	0.02	0.04
Conceptual, Title I & II	3,750,000	1		100	15	40	0.13	0.35
Title III Inspection	900,000	0.2		100	15	35	0.03	0.07
Building Costs	4,000,000	1		100	15	25	0.14	0.23
Equipment Costs	8,015,000	2		100	5	50	0.09	0.92
Constr Mgmt	2,043,000	0		100	5	50	0.02	0.23
Startup and Readiness	5,888,000	1		100	5	40	0.07	0.54
Building Operation	348,105,000	80		100	5	25	4.00	20.02
Waste Trans/Disposal	43,100,000	10		100	5	30	0.50	2.97
Decon/Decommission	2,600,000	1		100	5	35	0.03	0.21
Total	434,751,000	100					5.17	26.10

Comments: Analysis results in an overall project contingency of 22.97% Use 23%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.7A

Date: 06/25/92

Project : MLLWTF - COMBINATION WERF - OFFSITE (ESCALATED DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: gdc

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	4,000,000	0.3		100	10	35	0.03	0.10
Studies	3,160,000	0.2		100	10	35	0.02	0.08
NEPA Documentation	3,800,000	0.3		100	25	70	0.07	0.19
Permitting	9,158,000	1		100	10	35	0.07	0.23
Tech. Development	1,020,000	0.07		100	10	25	0.01	0.02
Conceptual, Title I & II	4,630,000	0.3		100	15	40	0.05	0.13
Title III Inspection	1,400,000	0.1		100	15	35	0.02	0.04
Building Costs	6,020,000	0		100	15	40	0.07	0.18
Equipment Costs	12,090,000	0.9		100	5	60	0.04	0.53
Constr Mgmt	3,079,000	0.2		100	5	50	0.01	0.11
Startup and Readiness	9,460,000	0.7		100	5	40	0.03	0.28
Building Operation	1,161,500,000	84		100	5	30	4.22	25.34
Waste Trans/Disposal	138,000,000	10		100	5	40	0.50	4.01
Decon/Decommission	17,900,000	1		100	5	35	0.07	0.46
Total	1,375,217,000	100					5.08	31.32

Comments: Analysis results in an overall project contingency of 27.68% Use 28%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.7B

Date: 06/22/92

Project: MLLWTF - COMBINATION WERF - IWP
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			15,575,000	19,988,000
Project Management	3,150,000	4,000,000		
Studies	2,900,000	3,160,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	5,875,000	8,508,000		
Technology Development	400,000	520,000		
ENGINEERING, DESIGN AND INSPECTION.....			4,650,000	6,030,000
Performance Specification				
Conceptual and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			27,501,000	41,430,000
Building Costs	14,990,000	22,520,000		
Equipment Costs	8,515,000	12,890,000		
Construction Management	3,996,000	6,020,000		
START-UP AND READINESS.....			5,888,000	9,460,000
BUILDING OPERATION.....			250,560,000	800,600,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			39,777,000	127,400,000
DECONTAMINATION AND.....			2,600,000	17,900,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			2,750,000	4,143,000
SUBTOTAL.....			349,301,000	1,026,951,000
CONTINGENCY **	23% of Subtotal.....		78,699,000	
CONTINGENCY **	28% of Subtotal.....			283,049,000
TOTAL PROJECT COST:			\$428,000,000	\$1,310,000,000

Comments: **Total contingency is 23% and 29% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.7B

Date: 06/22/92

Project: MLLWTF - COMBINATION WERF - IWPF
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			15,575,000	19,988,000
Project Management	3,150,000	4,000,000		
Studies	2,900,000	3,160,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	5,875,000	8,508,000		
Technology Development	400,000	520,000		
ENGINEERING, DESIGN AND INSPECTION.....			4,650,000	6,030,000
Performance Specification				
Conceptual and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			27,501,000	41,430,000
Building Costs	14,990,000	22,520,000		
Equipment Costs	8,515,000	12,890,000		
Construction Management	3,996,000	6,020,000		
START-UP AND READINESS.....			5,888,000	9,460,000
BUILDING OPERATION.....			250,560,000	800,600,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			124,575,000	399,000,000
DECONTAMINATION AND.....			2,600,000	17,900,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			2,750,000	4,143,000
SUBTOTAL.....			434,099,000	1,298,551,000
CONTINGENCY **	21% of Subtotal.....		90,901,000	
CONTINGENCY **	27% of Subtotal.....			345,449,000
TOTAL PROJECT COST:			\$525,000,000	\$1,644,000,000

Comments: **Total contingency is 23% and 29% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - COMBINATION WERF - IWPF
Estimator: T. E. Sivill
D. N. Stoddard
Date: 06/22/92
File No: M-212, Alt.7B
Approved By: *[Signature]*

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 7B, combination WERF - IWPF. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of modifications to WERF and new storage facility, including start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992, May 8, 1992

(Continued)

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration through D&D in the year 2030.

**COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)**

Page -2-

II. BASIS OF THE ESTIMATE: (Continued)

- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings
- (d) T. E. Sivill/D. N. Stoddard letter to T. H. Smith, DNS-25-92, Evaluations of Alternative to Treating INEL Mixed and Low-Level Waste

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the WERF-IWPF Treatment alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development).
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection of the required modifications and upgrades to the existing facilities at WERF and a new storage building. The WERF-IWPF alternative requires upgrades in the existing utilities as well as installation of new and replacement of existing equipment. Storage requirements for this alternative also require construction of an 8,600 sf lag storage building.
- CONSTRUCTION COSTS include land improvement for the storage buildings, construction costs to modify and update the existing WERF facility and construction of the new storage building. New process equipment and replacement of existing equipment associated with this facility are also included. Construction Management for this phase has been include at the current rate of seventeen percent of construction costs.

(Continued)

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

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III. ASSUMPTIONS: (Continued)

- **START-UP AND READINESS** includes the costs associated with initial system testing, system operation and maintenance manuals, and training of personnel associated with the operations of the processes. As crew has been sized based upon existing operations presently functioning at WERF and adjusted to handle the requirements of this alternative.
- **OPERATING COSTS** include the staff, materials, equipment maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of existing facilities and adjusted for this specific alternative.
- **WASTE TRANSPORT AND DISPOSAL COSTS** include the costs to transport the waste from the generator (initial waste location) to the treatment facility, from the generator directly to the disposal site. Treated waste will be housed in the lag storage area, there will be no additional transportation costs.

The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.

- **DECONTAMINATION AND DECOMMISSIONING** includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Project Manager/Engineer direction, D&D costs have been estimated at 15% of the original facility and process construction costs.
- **Management Reserve** has also been allowed for based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
PROJECT COSTS (Including Storage Facilities)							
	Project Management	E	\$300K/YR	3,150,000	4,000,000	FY MID - 1991 THRU 2001	BUD Sheet, dated 1/31/92
	Project Studies - (2) People, Full-time	E	\$500K/YR	1,000,000	1,100,000	FY 1992 THRU FY 1993	BUD Sheet, dated 1/31/92
	Design Support Studies (F&OR's, Etc.)	E	\$1 MIL TO DATE/\$250K/YR	1,750,000	1,900,000	FY 1993 THRU FY 1995	BUD Sheet, dated 1/31/92, Engineer's Estimate
	Siting Studies (Facility Existing - Site Storage Only)	E	\$150K	150,000	160,000	FY 1992	BUD Sheet, dated 1/31/92, Engineer's Estimate
	NEPA (ES)	E	\$750K/\$1M/\$750K/\$750K	3,250,000	3,800,000	FY 1993 THRU FY 1996	Engineer's Estimate
	Permitting (NESHAP, etc.)						
	TSCA	E	\$250K/\$250K/\$500K	1,000,000	1,400,000	FY'96, '97, '2001	Engineer's Estimate (Includes Trial Burn/Sampling)
	RCRA	E	\$250K/\$250K/\$500K/\$1.5M	2,500,000	3,800,000	FY'96, '97, '98, 2001	Engineer's Estimate (Includes Trial Burn/Sampling)
	Other	E	\$250K/YR	500,000	710,000	FY 1998 THRU FY 1999	Engineer's Estimate
	Safety Analysis Report (SA/R)	E	\$100K/\$375K/\$300K	775,000	1,100,000	[92 - 93] [97 - 99] [99 - 2001]	Engineer's Estimate
	Other Regulatory Items						
	ESH&O	E	\$50K/YR	450,000	600,000	FY 1993 THRU FY 2001	Engineer's Estimate
	CX's	E	\$25K/YR	25,000	28,000	FY 1993	Engineer's Estimate
	PSD	E	\$250K/\$250K	500,000	700,000	FY 1998 THRU FY 1999	Engineer's Estimate
	PTC/NESHAP	E	\$125K	125,000	170,000	FY 1997 & FY 1998	Engineer's Estimate
	TECHNOLOGY DEVELOPMENT						
	Immobilization - Jewel Heated Glass Melter	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	Cementation	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	Modified Sulfur Cement (MSC)	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	Incinerator (Demo) Rotary Kiln/Oil Gas System	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate

ACCT NO	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning						
	Conceptual	E	\$750K	750,000	830,000	FY 1993	Engineer's Estimate
	Title I	E	\$1.5 MIL	1,500,000	1,800,000	FY 1995	Engineer's Estimate
	Title II	E	\$1.5 MIL	1,500,000	2,000,000	FY 1997	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			3,750,000	4,630,000		
	TITLE III INSPECTION - WERF, 3 people, fulltime	E	\$450K/YR	900,000	1,400,000	FY 2000, FY 2001	Engineer's Estimate
	SUBTOTAL - TITLE III INSPECTION	E		900,000	1,400,000		
	CONSTRUCTION						
5000	Buildings and Structures (includes modifications to the existing WERF treatment facility)						
	Treatment Facility Modifications	E	\$12 MIL	12,000,000	18,000,000	FY 2000	Engineer's Estimate
	Building Structure Upgrades	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Engineer's Estimate
	Electrical Utilities Upgrade	E	\$500K	500,000	760,000	FY 2000	Engineer's Estimate
	Lag Storage Buildings	E	\$990K	990,000	1,500,000	FY 2000	Engineer's Estimate
6000	Utilities (Treatment Fac. Upgrades and New)	E	\$500K	500,000	760,000	FY 2000	Engineer's Estimate
	SUBTOTAL - CONSTRUCTION COSTS			14,990,000	22,520,000		

ACCT NO.	ACTIVITY DESCRIPTION	P.H.	ESTIMATED COSTS		PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE		ESTIMATE BASIS
								ESCALATION	
	Equipment								
	Inchinerators		E	\$1.2 MIL	1,200,000	1,800,000	FY 2000		Historical Data WEPF Incinerator
	Wet Offgas System (includes Stack/Ductwork)		E	\$1.6 MIL	1,600,000	2,500,000	FY 2000		Historical Data WEPF Incinerator
	Package Examination Equipment		E	\$480K	480,000	730,000	FY 2000		Engineer Experience
	Lab Equipment		E	\$600K	600,000	910,000	FY 2000		Engineer Experience
	Elevators		E	\$250K	250,000	380,000	FY 2000		Engineer Experience
	Conveyors		E	\$250K	250,000	380,000	FY 2000		Engineer Experience
	Torch Cutting (Remedial)		E	\$100K	100,000	150,000	FY 2000		Engineer's Estimate
	Compactor		E	\$1 MIL	1,000,000	1,500,000	FY 2000		WEPF/Engineer Experience
	Immobilization Equipment (Full offloading)		E	\$1.4 MIL	1,400,000	2,100,000	FY 2000		Engineer's Estimate
	Remedial Site Reduction (Robotics)		E	\$1 MIL	1,000,000	1,500,000	FY 2000		Engineer's Estimate
	Safety Systems - (2) Diesel Generators		E	\$165K	165,000	260,000	FY 2000		Engineer's Estimate
	SUBTOTAL - EQUIPMENT COSTS				8,065,000	12,230,000			
	DEMOLITION AND REMOVAL								
	Remove Existing Incinerator		E	\$250K	250,000	360,000	FY 1999		Engineer's Estimate
	Remove Other Equipment (Compactor, Offgas System)		E	\$100K	100,000	150,000	FY 1999		Engineer's Estimate
	Disposition of Equipment		E	\$100K	100,000	150,000	FY 1999		Engineer's Estimate
	SUBTOTAL - DEMOLITION COSTS				450,000	660,000			
	CONSTRUCTION MANAGEMENT		E	\$3.9 MIL	3,998,000	6,026,000	FY 2000		Engineer's Estimate
	TESTING/STARTUP/PERSONNEL TRAINING - (36) People		E	\$5.8 MIL	5,800,000	9,000,000	FY 2001		WEPF/Engineer Experience
	READINESS REVIEW - (16) People, (2) Months, 480 Hours ea.		E	\$268K	268,000	460,000	FY 2001		Readiness Review Experience
	SUBTOTAL STARTUP/READINESS COSTS				5,868,000	9,460,000			

06/22/92

Date

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File No M-212, AR 78

Type of Est. Study

PROJECT MILLWTF - COMBINATION WERF - NWPF

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	OPERATING COSTS						
	Labor based on 2080 Hours/Year/Each						
	Operating Personnel, 18 People	E	\$125K/YREA	50,000,000	180,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Maintenance Personnel, 10 People	E	\$120K/YREA	30,000,000	96,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Training Personnel, 2 People	E	\$98K/YREA	4,800,000	15,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Recordkeeping, 3 People	E	\$78K/YREA	5,850,000	19,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Management, 3 People	E	\$285K/YREA	21,400,000	68,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Engineering, 4 People	E	\$177K/YREA	17,700,000	57,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	ESH&Q Personnel, 4 People	E	\$178K/YREA	17,800,000	57,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Budget Support Personnel, 1 Person	E	\$115K/YREA	2,900,000	9,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Health Physicists (HPEs), 3 People	E	\$128K/YREA	9,600,000	31,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Other, Lab Personnel, 2 Person	E	\$128K/YREA	8,400,000	20,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Materials						
	Process Materials, Cement	E	\$120K/YR	3,000,000	9,600,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Waste Containers						
	55 Gal Drums, Low-Level, est. 20,000 drums @ \$35/ea	E	\$700K/YR	17,500,000	56,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Remotely Handled Waste Storage Vials	E	\$1.8M/L	47,500,000	152,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Other, Lab Materials/Supplies	E	\$75K/YR	1,875,000	6,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	Equipment						
	Process Improvements						
	Replacement Parts	E	\$185K/YR	4,875,000	16,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WERF Operations
	SUBTOTAL - OPERATING COSTS			241,200,000	771,600,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electrical	E	\$1200/YR	3,120,000	10,000,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc.	E	\$1500/YR	3,900,000	12,000,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	Other	E	900/YR	2,340,000	7,000,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	SUBTOTAL - OPERATING COSTS (Continued)			9,360,000	29,000,000		
	WASTE TRANSPORT COSTS	E	\$3000/YR	9,900,000	31,000,000	FY 2002 THRU FY 2026	EGG - WTD - 10082
	DISPOSAL - INCREMENTAL COSTS IN MILLWTF						
	Contact Handled Low Level Waste 70,300cf @ \$5.2/cf	E	\$4700/YR	11,750,000	38,000,000	FY 2008 THRU FY 2030	Based on data from RRM&C & Eng Est
	Residue Handled Low Level Waste In Soil Vents 4,700cf @ \$7.3/cf	E	\$3430/YR	9,570,000	27,400,000	FY 2008 THRU FY 2030	Based on data from RRM&C & Eng Est
	Contact Handled Mixed Waste 52,800cf @ \$7.3/cf	E	\$3880/YR	9,850,000	31,000,000	FY 2008 THRU FY 2030	Based on data from RRM&C & Eng Est
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			29,970,000	96,400,000		
	APPORTIONED DISPOSAL COSTS						
	Contact Handled Low Level Waste 267,400cf @ \$24.84/cf	E	\$2.24 MIL/YR	58,075,000	180,000,000	FY 2008 THRU FY 2030	Based on data from RRM&C & Eng Est
	Residue Handled Low Level Waste Soil Vents 4,700cf @ \$220/cf	E	\$1.034 MIL/YR	25,850,000	83,000,000	FY 2008 THRU FY 2030	Based on data from RRM&C & Eng Est
	Contact Handled Mixed Waste 52,800cf @ \$24.84/cf	E	\$1.314 MIL/YR	32,850,000	105,000,000	FY 2008 THRU FY 2030	Based on data from RRM&C & Eng Est
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			114,775,000	368,000,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	\$2.6 MIL	2,600,000	17,900,000	FY 2027 THRU FY 2030	
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			15,575,000	19,988,000		
	DESIGN COSTS			4,650,000	6,030,000		
	CONSTRUCTION COSTS			27,501,000	41,430,000		
	STARTUP/READINESS COSTS			5,888,000	9,460,000		
	OPERATING COSTS			250,560,000	800,600,000		
	WASTE TRANSPORT/INCREMENTAL DISPOSAL COSTS			39,777,000	127,400,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			2,600,000	17,900,000		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			346,551,000	1,022,808,000		
	SUMMARY - MILLWTF - APPORTIONED DISPOSAL						
	FRONT END COSTS			15,575,000	19,988,000		
	DESIGN COSTS			4,650,000	6,030,000		
	CONSTRUCTION COSTS			27,501,000	41,430,000		
	STARTUP/READINESS COSTS			5,888,000	9,460,000		
	OPERATING COSTS			250,560,000	800,600,000		
	WASTE TRANSPORT/APPORTIONED DISPOSAL COSTS			124,575,000	399,000,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			2,600,000	17,900,000		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			431,349,000	1,294,408,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.7B

Date: 06/22/92

Project : MLLWTF - COMBINATION WERF - IWPf (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: bor

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,150,000	0.9		100	10	25	0.09	0.23
Studies	2,900,000	0.8		100	10	25	0.08	0.21
NEPA Documentation	3,250,000	0.9		100	25	70	0.23	0.66
Permitting	5,875,000	2		100	10	35	0.17	0.59
Tech. Development	400,000	0.12		100	10	25	0.01	0.03
Conceptual, Title I & II	3,750,000	1		100	15	40	0.16	0.43
Title III Inspection	900,000	0.3		100	15	35	0.04	0.09
Building Costs	14,990,000	4		100	15	25	0.65	1.08
Equipment Costs	8,515,000	2		100	5	50	0.12	1.23
Constr Mgmt	3,996,000	1		100	5	50	0.06	0.58
Startup and Readiness	5,888,000	2		100	5	40	0.08	0.68
Building Operation	250,560,000	72		100	5	25	3.62	18.08
Waste Trans/Disposal	39,777,000	11		100	5	30	0.57	3.44
Decon/Decommission	2,600,000	1		100	5	35	0.04	0.26
Total	346,551,000	100					5.52	26.49

Comments: Analysis results in an overall project contingency of 23.29% Use 23%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.7B

Date: 06/22/92

Project : MLLWTF - COMBINATION WERF - IWP (ESCALATED DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: SDR

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	4,000,000	0.4		100	10	35	0.04	0.14
Studies	3,160,000	0.3		100	10	35	0.03	0.11
NEPA Documentation	3,800,000	0.4		100	25	70	0.09	0.26
Permitting	8,508,000	1		100	10	35	0.08	0.29
Tech. Development	520,000	0.05		100	10	25	0.01	0.01
Conceptual, Title I & II	4,630,000	0.5		100	15	40	0.07	0.18
Title II' Inspection	1,400,000	0.1		100	15	35	0.02	0.05
Building Costs	22,520,000	2		100	15	40	0.33	0.88
Equipment Costs	12,890,000	1.3		100	5	60	0.06	0.76
Constr Mgmt	6,020,000	0.6		100	5	50	0.03	0.29
Startup and Readiness	9,460,000	0.9		100	5	40	0.05	0.37
Building Operation	800,600,000	78		100	5	30	3.91	23.48
Waste Trans/Disposal	127,400,000	12		100	5	40	0.62	4.98
Decon/Decommission	17,900,000	2		100	5	35	0.09	0.61
Total	1,022,808,000	100					5.27	31.91

Comments: Analysis results in an overall project contingency of 28.19% Use 29%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.7C

Date: 06/25/92

Project: MLLWTF - COMBINATION GENERATOR - OFFSITE
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			13,775,000	16,998,000
Project Management	3,150,000	3,900,000		
Studies	3,225,000	3,540,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	3,550,000	4,868,000		
Technology Development	600,000	890,000		
ENGINEERING, DESIGN AND INSPECTION.....			4,650,000	6,030,000
Performance Specification	N/A	N/A		
Concept. and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			18,223,000	27,612,000
Building Costs	7,925,000	12,080,000		
Equipment Costs	7,650,000	11,520,000		
Construction Management	2,648,000	4,012,000		
START-UP AND READINESS.....			2,380,000	3,780,000
BUILDING OPERATION.....			277,460,000	941,670,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			59,449,000	190,000,000
DECONTAMINATION AND.....			5,000,000	32,200,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			1,822,000	2,761,000
SUBTOTAL.....			382,759,000	1,221,051,000
CONTINGENCY ** 23% of Subtotal.....			87,241,000	
CONTINGENCY ** 23% of Subtotal.....				278,949,000
TOTAL PROJECT COST:			\$470,000,000	\$1,500,000,000

Comments: **Total contingency is 23% and 23% respectively, including Management Reserve.

Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

L.G. & G. Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.7C

Date: 06/25/92

Project: MLLWTF - COMBINATION GENERATOR - OFFSITE
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			13,775,000	16,998,000
Project Management	3,150,000	3,900,000		
Studies	3,225,000	3,540,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	3,550,000	4,868,000		
Technology Development	600,000	890,000		
ENGINEERING, DESIGN AND INSPECTION.....			4,650,000	6,030,000
Performance Specification				
Conceptual and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			18,223,000	27,612,000
Building Costs	7,925,000	12,080,000		
Equipment Costs	7,650,000	11,520,000		
Construction Management	2,648,000	4,012,000		
START-UP AND READINESS.....			2,380,000	3,780,000
BUILDING OPERATION.....			277,460,000	941,670,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			144,195,000	461,600,000
DECONTAMINATION AND.....			5,000,000	32,200,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			1,822,000	2,761,000
SUBTOTAL.....			467,505,000	1,492,651,000
CONTINGENCY ** 21% of Subtotal.....			98,495,000	
CONTINGENCY ** 22% of Subtotal.....				327,349,000

TOTAL PROJECT COST: \$566,000,000 \$1,820,000,000

Comments: **Total contingency is 23% and 23% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - COMBINATION GENERATOR - OFFSITE
File No: M-212, Alt.7C
Estimator: T. E. Sivill
D. N. Stoddard
Date: 06/22/92
Approved By: *DS*

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 7C, combination Generator-Offsite. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of a maximum treatment facility including all equipment, including start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve. Minimal operational costs and waste transportation/disposal costs for a period of twenty-five years have been included.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992, May 8, 1992

(Continued)

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration through D&D in the year 2030.

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

II. BASIS OF THE ESTIMATE: (Continued)

- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings
- (d) T. E. Sivill/D. N. Stoddard letter to T. H. Smith, DNS-25-92, Evaluations of Alternative to Treating INEL Mixed and Low-Level Waste

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the GENERATOR-OFFSITE Treatment alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development).
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection of the facilities required. The GENERATOR-IWPF alternative requires two new scaled down treatment facilities and the associated support staff. A mobile unit will also serve various outlying sites.
- CONSTRUCTION COSTS include improvements to land, building construction, and utility costs. Also included are costs for process equipment associated with the facility. Construction Management for this phase has been included at the current rate of seventeen percent of construction costs.

(Continued)

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

III. ASSUMPTIONS: (Continued)

- START-UP AND READINESS includes the costs associated with initial system testing, system operation and maintenance manuals, and training of personnel associated with the operations of the processes. As crew has been sized based upon similar operations presently functioning at other facilities.
- OPERATING COSTS include the staff, materials, equipment maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of existing facilities and adjusted for this specific alternative.
- WASTE TRANSPORT AND DISPOSAL COSTS include the costs to transport the waste from the generator (initial waste location) to the treatment facility, from the generator directly to the disposal site and from the IWPF to the disposal site.

The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.

- DECONTAMINATION AND DECOMMISSIONING includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Project Manager/Engineer direction, D&D costs have been estimated at 15% of the original facility and process construction costs.
- Management Reserve has also been allowed for based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning - Includes Design Support Studies, etc. Ref: Page 1						
	Conceptual	E	\$750K	750,000	830,000	FY 1993	ICE Review Team
	Title I	E	\$1.5 MIL	1,500,000	1,800,000	FY 1995	Engineer's Estimate
	Title II	E	\$1.5 MIL	1,500,000	2,000,000	FY 1997	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			3,750,000	4,630,000		
	CONSTRUCTION						
	Improvements To Land	E	\$500K	500,000	600,000	FY 2000	Engineer's Estimate
	Buildings and Structures (Includes modifications to existing facilities around the Site, (2) new 2,000 sf mini-treatment facilities)						
	Treatment Facilities, Approximately 2,000 sf bldgs ea.	E	\$12 MIL/EA	2,400,000	3,700,000	FY 2000	Engineer's Estimate
	Miscellaneous Equipment, i.e., 10T, 50T Cranes	E	\$175K	175,000	270,000	FY 2000	Engineer's Estimate
	Existing Facilities Modifications	E	\$2 MIL	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Utilities, new and existing facilities upgrade	E	\$1.25 MIL	1,250,000	1,900,000	FY 2000	Engineer's Estimate
	Hd Cals (3 each)		-0-	-0-	-0-	FY 2000	Engineer's Estimate
	Initial Complements		-0-	-0-	-0-		
	Miscellaneous Instrumentation, annunciators, etc.	E	\$600K	600,000	910,000	FY 2000	Engineer's Estimate
	Utilities - Treatment Facility						
	SUBTOTAL - CONSTRUCTION COSTS			7,925,000	12,080,000		
	Comparative Parametric Modification Data						

08/22/82

Date

Page 3 of 6

File No. M-212,AL7C

Type of Est. Study

PROJECT MLLWTF - COMBINATION GENERATOR - OFFSITE

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Rotary Kiln Incinerator						
	Included in the above cost of the Rotary Kiln		-0-	-0-	-0-		
	Safety Systems - (2) diesel generators, etc.		-0-	-0-	-0-		
	Offgas System Including Stack & Ducting		-0-	-0-	-0-		
	Package Examination Equipment		-0-	-0-	-0-		
	Shredder		-0-	-0-	-0-		
	Grinder		-0-	-0-	-0-		
	Torch Cutting, 2 Ea.		\$100K/EA	200,000	300,000	FY 2000	Engineer's Estimate
	Compactor, 2 Ea.	E	\$1 MIL/EA	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Immobilization Equipment, Solidification Package	E	\$600K	600,000	910,000	FY 2000	Engineer's Estimate
	Ash Handling - Solidification		-0-	-0-	-0-		
	Sulphur Treatment & Glass Melter		-0-	-0-	-0-		
	Remedie Size Reduction (Robotics), 2 Ea.	E	\$1 MIL/EA	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Other Equipment		-0-	-0-	-0-		
	Lab Equipment		-0-	-0-	-0-		
	Elevator		-0-	-0-	-0-		
	Sorting Chamber (Remedie Handling)		-0-	-0-	-0-		
	Miscellaneous Mobile Unit/Truck, Ferrihite, etc.	E	\$2.5 MIL	2,500,000	3,800,000	FY 2000	Engineer's Estimate
	Dismantling and Removal	E	\$350K	350,000	510,000	FY 1989	Engineer's Estimate
	SUBTOTAL EQUIPMENT COSTS			7,850,000	11,520,000		
	CONSTRUCTION MANAGEMENT	E	\$2.8 MIL	2,848,000	4,012,000	FY 2001	
		E					
		E					
	TESTING/STARTUP/PERSONNEL TRAINING - 19 People 9 Months	E	\$2.2 MIL	2,200,000	3,500,000	FY 2001	WEPP Engineer Experience
	READINESS REVIEW - 9 People, 2 Months	E	\$180K	180,000	280,000	FY 2001	Readiness Review Experience
	SUBTOTAL STARTUP/READINESS COSTS			2,380,000	3,780,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	OPERATING COSTS						
	Labor Based on 2000 Hours/Year/Each						
	Operating Personnel, 8 People	E	\$125K/YR/EA	25,000,000	80,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Maintenance Personnel, 5 Person	E	\$120K/YR/EA	15,000,000	48,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Training Personnel, 2 Person	E	\$88K/YR/EA	4,800,000	15,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Recordkeeping, 1 Person	E	\$78K/YR/EA	1,850,000	6,300,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Management, 1 Person	E	\$285K/YR/EA	7,125,000	22,800,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Engineering, 1 Person	E	\$177K/YR/EA	4,425,000	14,200,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	ESH&Q Personnel, 1 Person	E	\$178K/YR/EA	4,450,000	14,300,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Budget Support Personnel, 1 Person	E	\$115K/YR/EA	2,875,000	9,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Health Physicists (HPR), 1 Person	E	\$128K/YR	3,200,000	10,300,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Lab Personnel, 1 Person	E	\$128K/YR	3,200,000	10,300,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Materials						
	Process Materials	E	\$20K/YR	500,000	1,600,000	FY 2002 THRU FY 2026	
	Waste Containers						
	55 Gal. Drums, est. 27,000 drums @ \$35/ea	E	\$945K/YR	23,625,000	75,700,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Remedial Handled Waste Disposal Vials	E	\$1,944K/YR	47,500,000	152,000,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Equipment						
	Replacement Pumps and Equipment	E	\$30K	750,000	2,400,000	FY 2002 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	Treatment at Offsite Facility	E	\$5.3 M/L/YR	132,500,000	478,000,000	FY 2004 THRU FY 2026	Engineer Judgment based on WEF/ Operations
	SUBTOTAL OPERATING COSTS (Continued)			276,300,000	838,800,000		

PROJECT MILLWTF - COMBINATION GENERATOR - OFF-SITE

Type of Est. Study

File No. M-212, AL 7C

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electricity	E	\$150/HR	375,000	1,200,000	FY 2001 THRU FY 2008	Based on WEFF Facility, adjusted and escalated
	Fuels/Propane etc.	E	\$25/HR	50,000	160,000	FY 2001 THRU FY 2008	Based on WEFF Facility, adjusted and escalated
	Other	E	\$54/HR	135,000	410,000	FY 2001 THRU FY 2008	Based on WEFF Facility, adjusted and escalated
	SUBTOTAL - OPERATING COSTS (As Estimated)			560,000	1,770,000		
	WASTE TRANSPORT COSTS ON-SITE AND OFF-SITE	E	\$343K/HR	13,568,000	43,000,000	FY 2002 THRU FY 2008	EGG - WTD - 10082
	DISPOSAL - INCREMENTAL COSTS IN MILLWTF						
	Contact Handled Low Level Waste, 212,700 cf @ \$5.78/cf	E	\$1.103 MIL	27,851,000	88,800,000	FY 2002 THRU FY 2008	Based on data from REMC & Eng. Est.
	Remade Handled Low Level Waste in Soil Vents, 4700 cf @ \$7.34/cf	E	\$343K/HR	8,578,000	27,500,000	FY 2002 THRU FY 2008	Based on data from REMC & Eng. Est.
	Contact Handled Mixed Waste, 52000 cf @ \$7.34/cf	E	\$368K/HR	9,854,000	30,800,000	FY 2002 THRU FY 2008	Based on data from REMC & Eng. Est.
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			45,883,000	147,000,000		
	APPORTIONED DISPOSAL COSTS						
	Contact Handled Low Level Waste, 212,700 cf @ \$15.78/cf	E	\$3,358 MIL/HR	83,910,000	268,800,000	FY 2002 THRU FY 2008	Based on data from REMC & Eng. Est.
	Remade Handled Low Level Waste in Soil Vents, 4700 cf @ \$22.00/cf	E	\$1,004 MIL/HR	25,850,000	82,800,000	FY 2002 THRU FY 2008	Based on data from REMC & Eng. Est.
	Contact Handled Mixed Waste, 52000 cf @ \$15.78/cf	E	\$635K/HR	20,888,000	68,800,000	FY 2002 THRU FY 2008	Based on data from REMC & Eng. Est.
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			130,629,000	419,800,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	30 MIL	5,000,000	32,200,000	FY 2000 THRU FY 2001	Data From Previous DAD Projects
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			13,775,000	16,988,000		
	DESIGN COSTS			4,000,000	6,000,000		
	CONSTRUCTION COSTS			16,223,000	27,512,000		
	STARTUP/READINESS COSTS			2,300,000	3,780,000		
	OPERATING COSTS			277,480,000	941,670,000		
	INCREMENTAL DISPOSAL COSTS			58,440,000	100,000,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			5,000,000	32,200,000		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			360,957,000	1,216,250,000		
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			13,775,000	16,988,000		
	DESIGN COSTS			4,000,000	6,000,000		
	CONSTRUCTION COSTS			16,223,000	27,512,000		
	STARTUP/READINESS COSTS			2,300,000	3,780,000		
	OPERATING COSTS			277,480,000	941,670,000		
	APPORTIONED DISPOSAL COSTS			144,955,000	481,600,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			5,000,000	32,200,000		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			493,953,000	1,468,860,000

5 of 5

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.7C

Date: 06/25/92

Project : MLLWTF - COMBINATION GENERATOR - OFFSITE (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: 106

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,150,000	0.8		100	10	25	0.08	0.21
Studies	3,225,000	0.8		100	10	25	0.08	0.21
NEPA Documentation	3,250,000	0.9		100	25	70	0.21	0.60
Permitting	3,550,000	1		100	10	35	0.09	0.33
Tech. Development	600,000	0.16		100	10	25	0.02	0.04
Conceptual, Title I & II	3,750,000	1		100	15	40	0.15	0.39
Title III Inspection	900,000	0.2		100	15	35	0.04	0.08
Building Costs	7,925,000	2		100	15	35	0.31	0.73
Equipment Costs	7,650,000	2		100	5	50	0.10	1.00
Constr Mgmt	2,648,000	1		100	5	50	0.03	0.35
Startup and Readiness	2,380,000	1		100	5	40	0.03	0.25
Building Operation	277,460,000	73		100	5	25	3.64	18.21
Waste Trans/Disposal	59,449,000	16		100	5	25	0.78	3.90
Decon/Decommission	5,000,000	1		100	5	30	0.07	0.39
Total	380,937,000	100					5.26	25.68

Comments: Analysis results in an overall project contingency of

22.58%

Use 23%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.7C

Date: 06/25/92

Project : MLLWTF - COMBINATION GENERATOR - OFFSITE(ESCALATED COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: *[Signature]*

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,900,000	0.3		100	10	35	0.03	0.11
Studies	3,540,000	0.3		100	10	35	0.03	0.10
NEPA Documentation	3,800,000	0.3		100	25	70	0.08	0.22
Permitting	4,868,000	0		100	10	35	0.04	0.14
Tech. Development	890,000	0.07		100	10	25	0.01	0.02
Conceptual, Title I & II	4,630,000	0.4		100	15	40	0.06	0.15
Title III Inspection	1,400,000	0.1		100	15	35	0.02	0.04
Building Costs	12,080,000	1		100	15	35	0.15	0.35
Equipment Costs	11,520,000	0.9		100	5	50	0.05	0.47
Constr Mgmt	4,012,000	0.3		100	5	50	0.02	0.16
Startup and Readiness	3,780,000	0.3		100	5	40	0.02	0.12
Building Operation	941,670,000	77		100	5	25	3.86	19.32
Waste Trans/Disposal	190,000,000	16		100	5	30	0.78	4.68
Decon/Decommission	32,200,000	3		100	5	35	0.13	0.93
Total	1,218,290,000	100					5.13	26.39

Comments: Analysis results in an overall project contingency of 23.24% Use 23%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.7D

Date: 06/25/92

Project: MLLWTF - COMBINATION GENERATOR - WPF
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			13,100,000	15,968,000
Project Management	3,150,000	3,900,000		
Studies	3,225,000	3,540,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	3,075,000	4,208,000		
Technology Development	400,000	520,000		
ENGINEERING, DESIGN AND INSPECTION.....			4,650,000	6,030,000
Performance Specification	N/A	N/A		
Concept. and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			31,725,000	48,239,000
Building Costs	18,915,000	28,880,000		
Equipment Costs	8,200,000	12,350,000		
Construction Management	4,610,000	7,009,000		
START-UP AND READINESS.....			2,380,000	3,780,000
BUILDING OPERATION.....			185,770,000	594,600,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			55,483,000	177,600,000
DECONTAMINATION AND.....			5,000,000	32,200,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			3,173,000	4,824,000
SUBTOTAL.....			301,281,000	883,241,000
CONTINGENCY ** 23% of Subtotal.....			68,719,000	
CONTINGENCY ** 25% of Subtotal.....				216,759,000
TOTAL PROJECT COST:			\$370,000,000	\$1,100,000,000

Comments: **Total contingency is 24% and 24% respectively, including Management Reserve.

Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.7D

Date: 06/25/92

Project: MLLWTF - COMBINATION GENERATOR - IWPF
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			13,100,000	15,968,000
Project Management	3,150,000	3,900,000		
Studies	3,225,000	3,540,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	3,075,000	4,208,000		
Technology Development	400,000	520,000		
ENGINEERING, DESIGN AND INSPECTION.....			4,650,000	6,030,000
Performance Specification				
Conceptual and Title I / II Design	3,750,000	4,630,000		
Title III Inspection	900,000	1,400,000		
CONSTRUCTION.....			31,725,000	48,239,000
Building Costs	18,915,000	28,880,000		
Equipment Costs	8,200,000	12,350,000		
Construction Management	4,610,000	7,009,000		
START-UP AND READINESS.....			2,380,000	3,780,000
BUILDING OPERATION.....			185,770,000	594,600,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			140,229,000	449,200,000
DECONTAMINATION AND.....			5,000,000	32,200,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			3,173,000	4,824,000
SUBTOTAL.....			386,027,000	1,154,841,000
CONTINGENCY ** 24% of Subtotal.....			93,973,000	
CONTINGENCY ** 25% of Subtotal.....				285,159,000
TOTAL PROJECT COST:			\$480,000,000	\$1,440,000,000

Comments: **Total contingency is 24% and 24% respectively, including Management Reserve.
Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - COMBINATION GENERATOR - IWP Date: 06/22/92
File No: M-212, Alt.7D Approved By: *[Signature]*

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 7D, combination Generator-IWPF. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of a maximum treatment facility including all equipment and new storage facility, including start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

- (a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992, May 8, 1992

(Continued)

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued Page 2)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration through D&D in the year 2030.

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

II. BASIS OF THE ESTIMATE: (Continued)

- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings
- (d) T. E. Sivill/D. N. Stoddard letter to T. H. Smith, DNS-25-92, Evaluations of Alternative to Treating INEL Mixed and Low-Level Waste

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the GENERATOR-IWPF Treatment alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development).
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection additional square footage required to house new equipment, and a new storage building. The GENERATOR-IWPF alternative requires upgrades in the existing utilities as well as installation of new and replacement of existing equipment. Storage requirements for this alternative also require construction of an 8,600 sf lag storage building.
- CONSTRUCTION COSTS include building construction and utility costs. New process equipment and replacement of existing equipment associated with this facility are also included. Construction Management for this phase has been include at the current rate of seventeen percent of construction costs.

(Continued)

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

III. ASSUMPTIONS: (Continued)

- **START-UP AND READINESS** includes the costs associated with initial system testing, system operation and maintenance manuals, and training of personnel associated with the operations of the processes. As crew has been sized based upon existing operations presently functioning at WERF and adjusted to handle the requirements of this alternative.
- **OPERATING COSTS** include the staff, materials, equipment maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of existing facilities and adjusted for this specific alternative.
- **WASTE TRANSPORT AND DISPOSAL COSTS** include the costs to transport the waste from the generator (initial waste location) to the treatment facility, from the generator directly to the disposal site and from the IWPF to the disposal site.

The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.

- **DECONTAMINATION AND DECOMMISSIONING** includes costs associated with the total dismantlement of the facility and its processes including disposal. Per Project Manager/Engineer direction, D&D costs have been estimated at 15% of the original facility and process construction costs.
- **Management Reserve** has also been allowed for based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

EG&G Idaho, Inc.

PROJECT EVALUATION OF ALTERNATIVES FOR TREATING
INEL MIXED AND LOW-LEVEL WASTE
LOCATION MILLWTF - COMBINATION GENERATOR - WPPF
INEL

REQUESTER T. H. SMITH

DETAILED COST ESTIMATE SHEET

Type of Est. Study

SOURCE
(E) Eng. Est.
(V) Vendor
(P) Pur. Order
(H) Handbook Ref.

File No. M-212, Alt. 7D

Date 06/25/92

Page 1 of 6

Prep By: T. E. Swill

App'd By: *ES*

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	PROJECT COSTS						
	Project Management	E	\$300K/YR	3,150,000	3,900,000	FY MID-1991 THRU 2001	BUD Sheet, dated 1/31/92
	Project Studies - (2) People, Full-time	E	\$500K/YR	1,500,000	1,700,000	FY 1992 THRU 1994	BUD Sheet, dated 1/31/92
	Design Support Studies (F&OR's, etc.)	E	\$1MIL TO DATE/\$250K/YR	1,500,000	1,600,000	FY 1993 THRU 1994	BUD Sheet, dated 1/31/92, Engineer's Estimate
	Siting Studies (Assume Site Partially Characterized, NPRI Area 7)	E	\$150K/\$75K	225,000	240,000	FY 1992 THRU FY 1993	BUD Sheet, dated 1/31/92, Engineer's Estimate
	NEPA (EIS)	E	\$750K/\$1M/\$750K/\$750K	3,250,000	3,800,000	FY 1993 THRU FY 1996	Engineer's Estimate
	Permitting (NESHAP, etc.)						
	TSCA		-0-	-0-	-0-		
	RCRA	E	\$375K/\$375K/\$500K	1,250,000	1,700,000	FY 95, '96, '99	Engineer's Estimate
	Other	E	\$250K/YR	500,000	710,000	FY 1998 THRU FY 1999	Engineer's Estimate
	Safety Analysis Report (SAR)	E	\$75K/\$325K/\$250K	650,000	910,000	(93)(98-99)(99-2000)	Engineer's Estimate
	Other Regulatory Items						
	ESH&Q	E	\$50K/YR	450,000	600,000	FY 1993 THRU FY 2001	Engineer's Estimate
	CX's	E	\$25K/YR	25,000	28,000	FY 1993	Engineer's Estimate
	PSD	E	\$50K/YR	100,000	130,000	FY 1997 THRU FY 1998	Engineer's Estimate
	PTC/NESHAP	E	\$50K/YR	100,000	130,000	FY 1996 & FY 1997	Engineer's Estimate
	TECHNOLOGY DEVELOPMENT						
	Immobilization - Joule Heated Glass Meter	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	Cementation	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	Modified Sulfur Cement (MSC)	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	Incinerator (Demo) Rotary Kbin/Offgas System	E	\$100K	100,000	130,000	FY 1996	Engineer's Estimate
	SUBTOTAL - FRONT END COSTS			13,100,000	15,968,000		

06/22/82

Date

Page 2 of 6

File No. M-212, Alt. 7D

Type of Est. Study

PROJECT MILLWTF - COMBINATION GENERATOR - IMPF

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning - Includes Design Support Studies, etc., Ref: Page 1						
	Conceptual	E	\$750K	750,000	830,000	FY 1993	ICE Review Team
	Title I	E	\$1.5 MIL	1,500,000	1,800,000	FY 1995	Engineer's Estimate
	Title II	E	\$1.5 MIL	1,500,000	2,000,000	FY 1997	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			3,750,000	4,630,000		
	CONSTRUCTION						
	Improvements To Land	E	\$500K	500,000	800,000	FY 2000	Engineer's Estimate
	Buildings and Structures (Includes modifications to existing facilities around the Site, (2) new 2,000 sf mini-treatment facilities)						
	Treatment Facilities, Approximately 2,000 sf bldgs ea./NWPF	E	\$1.2 MIL/EV/10 MIL	12,400,000	19,000,000	FY 2000	Engineer's Estimate
	Miscellaneous Equipment, i.e., 10T, 50T Cranes	E	\$175K	175,000	270,000	FY 2000	Engineer's Estimate
	Existing Facilities Modifications	E	\$2 MIL	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Utilities, new and existing facilities upgrade	E	\$1.25 MIL	1,250,000	1,800,000	FY 2000	Engineer's Estimate
	Hot Cells (3 each)		-0-	-0-	-0-	FY 2000	Engineer's Estimate
	Initial Complements		-0-	-0-	-0-		
	Miscellaneous instrumentation, annunciators, etc.	E	\$800K	800,000	910,000	FY 2000	Engineer's Estimate
	Lag Storage	E	\$890K	890,000	1,500,000	FY 2000	Engineer's Estimate
	Utilities - Treatment Facility	E	\$1 MIL	1,000,000	1,500,000	FY 2000	Comparative Parametric Mod/igh-list Data
	SUBTOTAL - CONSTRUCTION COSTS			18,915,000	28,660,000		

PROJECT MILLWTF - COMBINATION GENERATOR - IMPF Type of Est. Study

File No. M-212, AL 70

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	Equipment						
	Rotary Kiln Incinerators	E	\$200K/EA	200,000	300,000	FY 2000	Engineer's Estimate
	Included in the above cost of the Rotary Kiln:						
	Safety Systems - (2) diesel generators, etc.						
	Offgas System including Stack & Ducting		\$150K/EA	150,000	230,000	FY 2000	Engineer's Estimate
	Package Examination Equipment						
	Shredder						
	Grinder						
	Torch Cutting, 2 Ea.	E	\$100K/EA	200,000	300,000	FY 2000	Engineer's Estimate
	Compactor, 2 Ea.	E	\$1 M/EA	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Immobilization Equipment, Solidification Package	E	\$800K	800,000	910,000	FY 2000	Engineer's Estimate
	Ash Handling - Solidification	E	\$200K/EA	200,000	300,000	FY 2000	Engineer's Estimate
	Sulphur Treatment & Glass Melter						
	Remote Size Reduction (Robotics), 2 Ea.	E	\$1 M/EA	2,000,000	3,000,000	FY 2000	Engineer's Estimate
	Other Equipment						
	Lab Equipment						
	Elevator						
	Sorting Chamber (Remote Handling)						
	Miscellaneous Mobile Unit/Truck, Fordlha, etc.	E	\$2.5 MIL	2,500,000	3,800,000	FY 2000	Engineer's Estimate
	Demolition and Removal	E	\$350K	350,000	510,000	FY 1999	Engineer's Estimate
	SUBTOTAL EQUIPMENT COSTS			8,200,000	12,350,000		
	CONSTRUCTION MANAGEMENT	E	\$4.6 MIL	4,610,000	7,009,000	FY 2001	
	TESTING/STARTUP/PERSONNEL TRAINING - 19 People 8 Months	E	\$2.2 MIL	2,200,000	3,500,000	FY 2001	WEPP/Engineer Experience
	READINESS REVIEW - 9 People, 2 Months	E	\$180K	180,000	280,000	FY 2001	Readiness Review Experience
	SUBTOTAL STARTUP/READINESS COSTS			2,380,000	3,780,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY		ESCALATED COSTS	ACTIVITY SCHEDULE		ESTIMATE BASIS
				COSTS				ESCALATION	
OPERATING COSTS									
	Labor based on 2080 Hours/Year/Each								
	Operating Personnel, 10 People	E	\$125K/YR/EA	31,250,000		100,000,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Maintenance Personnel, 6 Person	E	\$120K/YR/EA	18,000,000		58,000,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Training Personnel, 1 Person	E	\$68K/YR/EA	2,400,000		7,700,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Recordkeeping, 2 Person	E	\$78K/YR/EA	3,900,000		12,600,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Management, 1 Person	E	\$285K/YR/EA	7,125,000		22,800,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Engineering, 2 Person	E	\$177K/YR/EA	6,900,000		26,000,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	ESH&Q Personnel, 2 Person	E	\$178K/YR/EA	8,950,000		29,000,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Budget Support Personnel, 1 Person	E	\$115K/YR/EA	2,875,000		9,000,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Health Physicists (H-Ps), 2 Person	E	\$126K/YR	6,400,000		20,600,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Lab Personnel, 2 Person	E	\$128K/YR	6,400,000		20,000,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Materials								
	Process Materials,	E	\$20K/YR	500,000		1,600,000	FY 2002 THRU FY 2026		
	Waste Containers								
	55 Gal. Drums, est. 30,000 drums @ \$35/ea.	E	\$1.3M/L/YR	33,250,000		107,000,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Remotely Handled Waste Disposal Vaults	E	\$1.9M/L/YR	47,500,000		152,000,000	FY 2002 THRU FY 2026		Engineer Judgment based on WERF Operations
	Equipment								
	Replacement Parts and Equipment	E	\$130K	3,250,000		10,000,000	FY 2002 THRU FY 2025		Engineer Judgment based on WERF Operations
SUBTOTAL OPERATING COSTS (Continued)				180,700,000		578,300,000			

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electrical	E	\$70K/YR	1,820,000	5,700,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	Fuels/ Propane etc..	E	\$75K/YR	1,875,000	6,100,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	Other	E	\$55K/YR	1,375,000	4,500,000	FY 2001 THRU FY 2026	Based on WERF Facility, adjusted and escalated
	SUBTOTAL - OPERATING COSTS (Continued)			5,070,000	16,300,000		
	WASTE TRANSPORT COSTS	E	\$382K/YR	9,600,000	30,600,000	FY 2002 THRU FY 2026	EGG - WTD - 10082
	DISPOSAL - INCREMENTAL COSTS IN MILLWDF						
	Contact Handled Low Level Waste, 212,700 cf @ \$5.20/cf	E	\$1.106 MIL	27,651,000	88,600,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Remdte Handled Low Level Waste In Soil Vaults, 4700 cf @ \$73/cf	E	\$343K/YR	8,578,000	27,500,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste, 52800 cf @ \$7.3/cf	E	\$386K/YR	9,654,000	30,900,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			45,883,000	147,000,000		
	APPORTIONED DISPOSAL COSTS						
	Contact Handled Low Level Waste, 212,700 cf @ \$15.78/cf	E	\$3.356 MIL/YR	83,910,000	268,900,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Remdte Handled Low Level Waste In Soil Vaults, 4700 cf @ \$220/cf	E	\$1,034 MIL/YR	25,850,000	82,800,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	Contact Handled Mixed Waste, 52800 cf @ \$15.78/cf	E	\$835K/YR	20,869,000	66,900,000	FY 2002 THRU FY 2026	Based on data from RWMC & Eng. Est.
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			130,629,000	418,600,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTMITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	\$5 MIL	5,000,000	32,200,000	FY 2028 THRU FY 2031	Data From Previous D&D Projects
	SUMMARY - MLLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			13,100,000	15,968,000		
	DESIGN COSTS			4,650,000	6,030,000		
	CONSTRUCTION COSTS			31,725,000	48,238,000		
	STARTUP/READINESS COSTS			2,380,000	3,780,000		
	OPERATING COSTS			185,770,000	594,800,000		
	INCREMENTAL DISPOSAL COSTS			55,483,000	177,600,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			5,000,000	32,200,000		
	TOTAL COSTS MLLWTF INCREMENTAL DISPOSAL			298,108,000	878,417,000		
	SUMMARY - MLLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			13,100,000	15,968,000		
	DESIGN COSTS			4,650,000	6,030,000		
	CONSTRUCTION COSTS			31,725,000	48,238,000		
	STARTUP/READINESS COSTS			2,380,000	3,780,000		
	OPERATING COSTS			185,770,000	594,800,000		
	APPORTIONED DISPOSAL COSTS			140,229,000	449,200,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			5,000,000	32,200,000		
	TOTAL COSTS MLLWTF APPORTIONED DISPOSAL			382,854,000	1,150,017,000		

CONTINGENCY ANALYSIS

Type of Estimate: Stud,

File No. M-212, Alt.7D

Date: 06/25/92

Project : MLLWTF - GENERATOR - WPF (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By:

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,150,000	1.1		100	10	25	0.11	0.26
Studies	3,225,000	1.1		100	10	25	0.11	0.27
NEPA Documentation	3,250,000	1.1		100	25	70	0.27	0.76
Permitting	3,075,000	1		100	10	35	0.10	0.36
Tech. Development	400,000	0.13		100	10	25	0.01	0.03
Conceptual, Title I & II	3,750,000	1		100	15	40	0.19	0.50
Title III Inspection	900,000	0.3		100	15	35	0.05	0.11
Building Costs	18,915,000	6		100	15	35	0.95	2.22
Equipment Costs	8,200,000	3		100	5	50	0.14	1.38
Constr Mgmt	4,610,000	2		100	5	50	0.08	0.77
Startup and Readiness	2,380,000	1		100	5	40	0.04	0.32
Building Operation	185,770,000	62		100	5	25	3.12	15.58
Waste Trans/Disposal	55,483,000	19		100	5	25	0.93	4.65
Decon/Decommission	5,000,000	2		100	5	30	0.08	0.50
Total	298,108,000	100					5.69	26.43

Comments: Analysis results in an overall project contingency of 23.22% Use 24%

This includes 10% for Management Reserve.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.7D

Date: 06/25/92

Project : MLLWTF - GENERATOR - IWP (ESCALATED COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: *[Signature]*

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	3,900,000	0.4		100	10	35	0.04	0.16
Studies	3,540,000	0.4		100	10	35	0.04	0.14
NEPA Documentation	3,800,000	0.4		100	25	70	0.11	0.30
Permitting	4,208,000	0		100	10	35	0.05	0.17
Tech. Development	520,000	0.06		100	10	25	0.01	0.01
Conceptual, Title I & II	4,630,000	0.5		100	15	40	0.08	0.21
Title III Inspection	1,400,000	0.2		100	15	35	0.02	0.06
Building Costs	28,880,000	3		100	15	35	0.49	1.15
Equipment Costs	12,350,000	1.4		100	5	50	0.07	0.70
Constr Mgmt	7,009,000	0.8		100	5	50	0.04	0.40
Startup and Readiness	3,780,000	0.4		100	5	40	0.02	0.17
Building Operation	594,600,000	68		100	5	25	3.38	16.92
Waste Trans/Disposal	177,600,000	20		100	5	30	1.01	6.07
Decon/Decommission	32,200,000	4		100	5	35	0.18	1.28
Total	878,417,000	100					5.36	27.14

Comments: Analysis results in an overall project contingency of 23.89% Use 24%

This includes 10% for Management Reserve.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

File No. M-212, Alt.8

Date: 06/20/92

Project: MLLWTF - NO ACTION
(INCREMENTAL WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivill

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			8,525,000	10,903,000
Project Management	1,650,000	2,000,000		
Studies	1,725,000	1,770,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	1,900,000	3,333,000		
Technology Development	N/A	N/A		
ENGINEERING, DESIGN AND INSPECTION.....			2,900,000	4,200,000
Performance Specification	N/A	N/A		
Concept. and Title I / II Design	2,500,000	3,150,000		
Title III Inspection	360,000	1,000,000		
CONSTRUCTION.....			90,090,000	247,525,000
Building Costs	76,800,000	211,260,000		
Equipment Costs	200,000	300,000		
Construction Management	13,090,000	35,965,000		
START-UP AND READINESS.....			1,920,000	5,400,000
BUILDING OPERATION.....			104,495,000	319,020,000
WASTE TRANSPORT/DISPOSAL INCREMENTAL COST.....			49,549,000	152,000,000
DECONTAMINATION AND.....			600,000	3,300,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			9,009,000	24,753,000
SUBTOTAL.....			267,088,000	767,101,000
CONTINGENCY **	24% of Subtotal.....		62,912,000	
CONTINGENCY **	24% of Subtotal.....			182,899,000
TOTAL PROJECT COST:			\$330,000,000	\$950,000,000

Comments: **Total contingency is 26% and 27% respectively, including Management Reserve.

Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUMMARY

EG&G Idaho, Inc.

Type of Estimate: Study

Date: 06/20/92

Project: MLLWTF - NO ACTION
(APPORTIONED WASTE TRANSPORT/DISPOSAL COSTS)

Prepared By: D. N. Stoddard / T. E. Sivil

Appr'd By:

	Present Day Subtotal	Escalated Cost Subtotal	Totals Present Day	Totals Escalated
FRONT END DOCUMENTATION			8,525,000	10,903,000
Project Management	1,650,000	2,000,000		
Studies	1,725,000	1,770,000		
NEPA Documentation	3,250,000	3,800,000		
Permitting	1,900,000	3,333,000		
Technology Development				
ENGINEERING, DESIGN AND INSPECTION.....			2,860,000	4,150,000
Performance Specification				
Conceptual and Title I / II Design	2,500,000	3,150,000		
Title III Inspection	360,000	1,000,000		
CONSTRUCTION.....			90,090,000	247,531,000
Building Costs	76,800,000	211,260,000		
Equipment Costs	200,000	305,000		
Construction Management	13,090,000	35,966,000		
START-UP AND READINESS.....			1,920,000	5,400,000
BUILDING OPERATION.....			104,495,000	319,020,000
WASTE TRANSPORT/DISPOSAL APPORTIONED COST.....			134,065,000	409,600,000
DECONTAMINATION AND.....			600,000	3,300,000
DECOMMISSIONING				
MANAGEMENT RESERVE.....			9,009,000	24,753,000
SUBTOTAL.....			351,564,000	1,024,657,000
CONTINGENCY ** 25% of Subtotal.....			89,436,000	
CONTINGENCY ** 22% of Subtotal.....				220,343,000

TOTAL PROJECT COST: \$441,000,000 \$1,245,000,000

Comments: **Total contingency is 26% and 27% respectively, including Management Reserve.

Actual contingency used may vary a maximum of 2% of the calculated contingency to incorporate rounding.

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: EVALUATIONS OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW-LEVEL WASTE
MLLWTF - NO ACTION
Estimator: T. E. Sivill
D. N. Stoddard
Date: 06/19/92
File No: M-212, Alt.8
Approved By: *DS*

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Perform a Cost Study of Mixed and Low-Level Waste Treatment Facility, Alternate 8, No Action. Total Project Costs include the up-front documentation, permitting and research and development, engineering/design and construction of new storage facilities, including start-up and readiness, operational costs for a period of twenty-five years, waste transportation/disposal, decontamination and decommissioning and contingency including management reserve.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers notes, and/or other documentation upon which the estimate is originated.*

(a) D. N. Stoddard letters to T. H. Smith, DNS-22-92, DNS-29-92, Incremental Cost for MLLWDF, April 17, 1992, May 8, 1992

(Continued)

III. **ASSUMPTIONS:** *Condition statements accepted or supposed true without proof or demonstration. An assumption has a direct impact on total estimated cost.*

(Continued)

IV. **OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:**

Contingency has been included in Total Project Costs (TPC), present net worth and TPC, escalated costs. Contingency is higher on escalated costs as changing climate in the area of regulatory requirements, process advancements, code compliance and disposal costs are difficult to predict for the project duration through D&D in the year 2032.

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

II. BASIS OF THE ESTIMATE: (Continued)

- (b) Rough Draft Document EG&G-WMO-10251, April 14, 1992
- (c) Scoping meetings with project participants, April 27, 1992, April 29, 1992, May 5, 1992, May 6, 1992, May 14, 1992 and interim meetings
- (d) T. E. Sivill/D. N. Stoddard letter to T. H. Smith, DNS-25-92, Evaluations of Alternative to Treating INEL Mixed and Low-Level Waste

III. ASSUMPTIONS: (Continued)

During the course of defining the scope and cost factors necessary to arrive at the Total Project Costs for the No Action alternative, the following major categories were identified, and associated assumptions recognized:

- FRONT END COSTS include Project Management, preliminary studies (project definition, design support, siting, etc.), documentation and permitting (NEPA, NESHAP, TSCA, RCRA, SAR, etc.) and Research and Development (technology development).
- ENGINEERING, DESIGN AND INSPECTION includes performance specifications, conceptual and Title I/II design and Title III inspection of the required new storage buildings. There will be no costs incurred for a treatment facility or process equipment. Storage requirements for this alternative also require extensive construction of buildings estimated at a minimum of (2) 12,000 sf indefinite storage buildings per year for the duration of the project.
- CONSTRUCTION COSTS include land improvement for the storage buildings, construction costs for the new storage buildings. Construction Management for this phase has been included at the current rate of seventeen percent of construction costs.
- START-UP AND READINESS includes costs associated with initial system testing, system operation and maintenance manuals, and training of personnel associated with the operations. A skeleton crew to handle storage has been sized based upon existing operations presently at similar facilities and adjusted for this specific alternative.

(Continued)

COST ESTIMATE SUPPORT DATA RECAPITULATION
(CONTINUATION)

III. ASSUMPTIONS: (Continued)

- OPERATING COSTS include the staff, materials, equipment maintenance (improvements and replacement parts) and utilities necessary to the facility function over a period of twenty-five years. Again, the staff size and utility usage has been derived from the operations of existing facilities and adjusted for this specific alternative.
- WASTE TRANSPORT AND DISPOSAL COSTS include the costs to transport the waste from the generator (initial waste location) to storage, or from the generator directly to the disposal site.

The disposal costs are viewed from two different aspects, the first being Incremental Costs and the second Apportioned Costs. The Incremental costs reflect only the additional costs incurred to dispose of the waste. The Apportioned costs reflect the total costs of the waste disposal operation apportioned by volumes of waste disposed.

- DECONTAMINATION AND DECOMMISSIONING includes costs associated with the total dismantlement of the storage buildings including disposal. Per Project Manager/Engineer direction, D&D costs have been estimated at 15% of the original storage building construction costs.

In the D&D for this alternative, consideration has been made for only the initial two years of storage buildings. D&D costs for the remaining storage facilities will bear cost consideration in the future.

- Management Reserve has also been allowed for based upon the Construction Costs. This is calculated in the overall percentage of Contingency.

PROJECT	EVALUATION OF ALTERNATIVES FOR TREATING INEL MIXED AND LOW - LEVEL WASTE M'LLWTF - NO ACTION INEL
LOCATION	

REQUESTER T. H. SMITH

DETAILED COST ESTIMATE SHEET

Type of Est.	Study
SOURCE	
(E) Eng. Est.	
(V) Vendor	
(P) Pur. Order	
(H) Handbook Ref.	

File No. M-212 AIR.B

Date:

06/18/92

Page: 1 of 6

Prep By: T. E. Small

Approved By:

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
PROJECT COSTS							
	Project Management - 1 Person	E	\$150K/\$300K/150K	1,650,000	2,000,000	FY MID - 1991 THRU 2000	[BUD Sheet, dated 1/31/92]
	Project Studies - 2 People, Full-time	E	\$500K	500,000	530,000	FY 1992	[BUD Sheet, dated 1/31/92]
	Design Support Studies (F&OR's, etc.)	E	\$1M/L TO DATE	1,000,000	1,000,000		[BUD Sheet, dated 1/31/92, Engineer's Estimate]
	Siting Studies (Storage Only)	E	\$150K/\$75K	225,000	240,000	FY 1992, FY 1993	[BUD Sheet, dated 1/31/92, Engineer's Estimate]
	NEPA (EIS)	E	\$750K/\$1M/\$750K/\$750K	3,250,000	3,800,000	FY 1993 THRU FY 1996	[Engineer's Estimate]
	Permitting (NESHAP, etc.)						
	TSCA		-0-	-0-	-0-		
	RCRA (Includes 48 Stor. Facilities @ \$500K (2000 - 2023)	E	\$200K/\$200K/\$100K	1,000,000	2,100,000	FY 1997, FY1998, FY1999	[Engineer's Estimate]
	Other	E	\$100K/\$100K/\$50K	250,000	340,000	FY 1997 THRU FY 1999	[BUD Sheet, dated 1/31/92, Engineer's Estimate]
	Safety Analysis Report (SAR)	E	\$75K/\$200K/\$150K	425,000	600,000	FY90, '96 - '99, 2000	[Data from similar SAR's]
	Other Regulatory Items						
	ESH&Q	E	\$25K/YR	200,000	260,000	FY 1993 THRU FY 2000	[Engineer's Estimate]
	CX's		-0-	-0-	-0-		
	PSD		-0-	-0-	-0-		
	PTC/NESHAP	E	\$25K	25,000	33,000	FY 1997	[Engineer's Estimate]
	TECHNOLOGY DEVELOPMENT		-0-	-0-	-0-		
SUBTOTAL - FRONT END COSTS				8,525,000	10,900,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DESIGN						
	Planning - Includes Design Support Studies, etc., Ref: Page 1						
	Conceptual	E	\$500K	500,000	550,000	FY 1993	Engineer's Estimate
	Title I	E	\$1 MIL	1,000,000	1,300,000	FY 1996	Engineer's Estimate
	Title II	E	\$1 MIL	1,000,000	1,300,000	FY 1997	Engineer's Estimate
	SUBTOTAL - DESIGN COSTS			2,500,000	3,150,000		
	TITLE III INSPECTION - (1) Person, Full-time	E	\$15K/YR	360,000	1,000,000	FY 2000 THRU FY 2023	Engineer's Estimate
	SUBTOTAL - TITLE III INSPECTION			360,000	1,000,000		
	CONSTRUCTION						
4000	Improvements To Land (Includes 49 Storage Facilities, 20 acres)	E	\$2.8 MIL	2,800,000	4,260,000	FY 2000	Engineer's Estimate
5000	Buildings and Structures						
	Treatment Facility		-0-	-0-	-0-		
	Miscellaneous Equipment, i.e., 10T, 50T Cranes		-0-	-0-	-0-		
	Htd Cells (3 each)		-0-	-0-	-0-		
	Initial Complements		-0-	-0-	-0-		
	Miscellaneous Instrumentation, annunciators, etc.		-0-	-0-	-0-		
	Lag Storage Bldg		-0-	-0-	-0-		
	Indefinite Storage Bldg. (49) @ 12,000 sf ea, 2 per year	E	\$1.4 MIL/YR	67,000,000	189,000,000	FY 2000 THRU FY 2023	Comparative Parametric Modeling/Historical Data
6000	Utilities \$1 MIL Initially, \$250K/YR THRU 2024	E	\$1MIL+\$250K/YR	7,000,000	18,000,000	FY 2000 THRU FY 2023	Engineer's Estimate
	SUBTOTAL - CONSTRUCTION COSTS			76,800,000	211,260,000		

PROJECT MILLWTF - NO ACTION

Type of Est. Study

Type of Est. Study

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	OPERATING COSTS						
	Labor based on 2080 Hours/Year/Each						
	Operating Personnel, 2 People	E	\$125K/YR/EA	6,250,000	19,000,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	Maintenance Personnel, 1 Person	E	\$120K/YR/EA	3,000,000	9,200,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	Training Personnel		-0-	-0-	-0-		
	Recordkeeping, 1 Person	E	\$78K/YR/EA	2,000,000	6,000,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	Management, 1 Person @ 1/2 FTE	E	\$145K/YR	3,600,000	11,000,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	Engineering, 1 Person @ 1/4 FTE	E	\$44K/YR	1,100,000	3,400,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	ESH&Q Personnel, 1 Person @ 1/2 FTE	E	\$68K/YR	2,200,000	6,600,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	Budget Support Personnel		-0-	-0-	-0-		
	Health Physicists (HPS), 1 Person	E	\$128K/YR	3,200,000	9,600,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	Lab Personnel						
	Materials						
	Process Materials						
	Waste Containers						
	55 Gal. Drums, est. 40,000 drums @ \$35/ea	E	\$1.4 MIL/YR	35,000,000	106,800,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	Remade Handled Waste Disposal Vials	E	\$1.98M/YR	47,500,000	145,000,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	Equipment						
	Replacement Parts and Equipment	E	\$5K/YR	125,000	380,000	FY 2001 THRU FY 2025	Engineer Judgment based on WERF Operations
	SUBTOTAL OPERATING COSTS (Continued)			123,975,000	317,380,000		

05/10/92

Date:

Page: 5 of 6

File No. M-212, AR.8

Type of Est. Study

PROJECT MILLWTF - NO ACTION

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	UTILITIES						
	Electrical	E	\$10K/yr	280,000	820,000	FY 2000 THRU FY 2025	Based on WEFF Facility, adjusted and escalated
	Fuel/ Propane etc.	E	\$3K/yr	130,000	410,000	FY 2000 THRU FY 2025	Based on WEFF Facility, adjusted and escalated
	Other	E	\$5K/yr	130,000	410,000	FY 2000 THRU FY 2025	
	SUBTOTAL - OPERATING COSTS (Continued)			500,000	1,640,000		
	WASTE TRANSPORT COSTS TO MILLWDF	E	\$285K/yr	7,125,000	22,000,000	FY 2001 THRU FY 2025	EGG - WTD - 10082
	DISPOSAL - INCREMENTAL COSTS IN MILLWDF						
	Contact Handled Low Level Waste, 261,900 cf @ \$5.20/cf	E	\$1,382 MIL/yr	34,000,000	104,000,000	FY 2001 THRU FY 2025	Based on data from RHWAC & Eng. Est.
	Remade Handled Low Level Waste in Soil Vaults, 4616 cf @ \$73/cf	E	\$337K/yr	8,424,000	26,000,000	FY 2001 THRU FY 2025	Based on data from RHWAC & Eng. Est.
	Contact Handled Mixed Waste - 0 -		-0-	-0-	-0-		
	SUBTOTAL - INCREMENTAL DISPOSAL COSTS			42,424,000	130,000,000		
	APPORTIONED DISPOSAL COSTS						
	Contact Handled Low Level Waste 261,900 cf @ \$15.51/cf	E	\$4,082 MIL/yr	101,952,000	310,100,000	FY 2001 THRU FY 2025	Based on data from RHWAC & Eng. Est.
	Remade Handled Low Level Waste in Soil Vaults 4616 cf @ \$220/cf	E	\$1,015 MIL/yr	25,368,000	77,500,000	FY 2001 THRU FY 2025	Based on data from RHWAC & Eng. Est.
	Contact Handled Mixed Waste		-0-	-0-	-0-		
	SUBTOTAL - APPORTIONED DISPOSAL COSTS			126,940,000	387,600,000		

ACCT NO.	ACTIVITY DESCRIPTION	E.V. P.H.	ESTIMATED COSTS	PRESENT DAY COSTS	ESCALATED COSTS	ACTIVITY SCHEDULE ESCALATION	ESTIMATE BASIS
	DECONTAMINATION AND DECOMMISSIONING	E	\$600K	600,000	3,150,000	FY 2026, FY 2027	Data from previous D @ D Projects
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			8,525,000	10,903,000		
	DESIGN COSTS			2,860,000	4,150,000		
	CONSTRUCTION COSTS			90,090,000	247,530,000		
	STARTUP/READINESS COSTS			1,920,000	5,400,000		
	OPERATING COSTS			104,465,000	319,020,000		
	INCREMENTAL DISPOSAL COSTS			49,549,000	152,000,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			600,000	3,300,000		
	TOTAL COSTS MILLWTF INCREMENTAL DISPOSAL			258,039,000	742,303,000		
	SUMMARY - MILLWTF - INCREMENTAL DISPOSAL						
	FRONT END COSTS			8,525,000	10,903,000		
	DESIGN COSTS			2,860,000	4,150,000		
	CONSTRUCTION COSTS			90,090,000	247,530,000		
	STARTUP/READINESS COSTS			1,920,000	5,400,000		
	OPERATING COSTS			104,465,000	319,020,000		
	APPORTIONED DISPOSAL COSTS			134,065,000	409,600,000		
	DECONTAMINATION & DECOMMISSIONING COSTS			600,000	3,300,000		
	TOTAL COSTS MILLWTF APPORTIONED DISPOSAL			342,565,000	969,903,000		

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.8

Date: 06/20/92

Project : MLLWTF - NO-ACTION (PRESENT DAY COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: RS

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	1,650,000	0.6		100.00	10.00	25.00	0.06	0.16
Studies	1,725,000	0.7		100.00	10.00	25.00	0.07	0.17
NEPA Documentation	3,250,000	1.3		100.00	25.00	70.00	0.31	0.88
Permitting	1,900,000	1		100.00	10.00	35.00	0.07	0.26
Tech. Development								
Conceptual, Title I & II	2,500,000	1		100.00	15.00	40.00	0.15	0.39
Title III Inspection	360,000	0.1		100.00	15.00	35.00	0.02	0.05
Building Costs	76,800,000	30		100.00	15.00	35.00	4.46	10.42
Equipment Costs	200,000	0		100.00	5.00	50.00	0.00	0.04
Constr Mgmt	13,090,000	5		100.00	5.00	50.00	0.25	2.54
Startup and Readiness	1,920,000	1		200.00	5.00	40.00	0.04	0.30
Building Operation	104,495,000	40		100.00	5.00	25.00	2.02	10.12
Waste Trans/Disposal	49,549,000	19		100.00	5.00	30.00	0.96	5.76
Decon/Decommission	600,000	0		100.00	5.00	35.00	0.01	0.08
Total	258,039,000	100					8.00	29.95

Comments: Analysis results in an overall project contingency of 26.16% Use 26%

This includes 10% for Management Reserves.

CONTINGENCY ANALYSIS

Type of Estimate: Study

File No. M-212, Alt.8

Date: 06/20/92

Project : MLLWTF - NO-ACTION (ESCALATED COST)

Prepared By: D. N. Stoddard / T. E. Sivill

Checked/Approved By: Dot

Item	Cost	% Total Cost	Est. Basis		Prob % Var From Est		Wt % of Prob	
			Quote	Est	-	+	-	+
Project Management	2,000,000	0.3		100.00	10.00	35.00	0.03	0.09
Studies	1,770,000	0.2		100.00	10.00	35.00	0.02	0.08
NEPA Documentation	3,800,000	0.5		100.00	25.00	70.00	0.13	0.36
Permitting	3,333,000	0		100.00	10.00	35.00	0.04	0.16
Tech. Development								
Conceptual, Title I & II	3,150,000	0.4		100.00	15.00	40.00	0.06	0.17
Title III Inspection	1,000,000	0.1		100.00	15.00	35.00	0.02	0.05
Building Costs	211,260,000	28		100.00	15.00	35.00	4.27	9.96
Equipment Costs	300,000	0.0		100.00	5.00	50.00	0.00	0.02
Constr Mgmt	35,965,000	4.8		100.00	5.00	50.00	0.24	2.42
Startup and Readiness	5,400,000	0.7		200.00	5.00	40.00	0.04	0.29
Building Operation	319,020,000	43		100.00	5.00	25.00	2.15	10.74
Waste Trans/Disposal	152,000,000	20		100.00	5.00	30.00	1.02	6.14
Decon/Decommission	3,300,000	0		100.00	5.00	35.00	0.02	0.16
Total	742,298,000	100					7.87	30.11

Comments: Analysis results in an overall project contingency of 26.31% Use 27%

This includes 10% for Management Reserve.

**DATE
FILMED**

10 / 6 / 93

END