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PUBLIC WORKSHOP ON THE RECYCLING METHODOLOGY/PLANT 4 CASE STUDY HELD NOVEMBER 7, 1996, AGENDA, OVERHEADS AND HANDOUT

11/07/96

FDF/DOE-FN PUBLIC
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AGENDA

PUBLIC WORKSHOP ON THE RECYCLING METHODOLOGY/PLANT 4 CASE STUDY

7-9 p.m. on November 7, 1996 in Alpha Building, Classroom B

Introduction — **Mike Jacobs, DOE-FEMP**

- Recap of June 11 Meeting

Workshop Objectives — **John Trygier, DOE-FEMP**

- Walk through application of Recycling Methodology and the Plant 4 Case Study
- Collect public feedback on ranking and weighting process
- Identify path forward and opportunities for future public involvement

General Recap of Methodology — **Pete Yerace, DOE-FEMP**

Life Cycle Analysis Phase — **Bob Lehrter, FDF**

- Description of Matrix
- Description of Disposition Alternatives
- Description of Performance Measures
- *Exercise 1: Ranking the Alternatives for Plant X*
- *Exercise 2: Assigning Weight Factors to Performance Measures*

Break (and tabulation)

Results of Exercises — **Bob Lehrter**

Plant 4 Case Study (150 tons vs. 15,200 tons) — **Bob Lehrter**

Decision Phase — **Pete Yerace**

- Discussion of how to evaluate inputs
- Selection of most desirable alternative

Future Stakeholder Input and Path Forward — **John Trygier**

Adjourn

GENERAL RECAP OF RECYCLING METHODOLOGY

FERNALD

PURPOSE: Valuable management tool which will enable DOE-FEMP decision makers to continuously track various disposition options and identify the most economically advantageous options throughout the life of decontamination and dismantling projects.

TWO-PHASED METHODOLOGY

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A.) Analysis Phase

B.) Decision Phase

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ANALYSIS PHASE

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Performance Measures

- NET Present Value
- Undiscounted Cost
- Schedule Impacts
- Local Economic Impacts
- Institutional Preferences
- Local Social Preferences
- Protectiveness of the Environment
- Public Health Impacts
- Worker Safety Impacts

ALTERNATIVES

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1. On-site Disposal Facility
2. Nevada Test Site
3. Envirocare
4. FEMP Material Release Facility (MRF)
5. Vendor MRF
6. Recycle 2000
7. Privatized FEMP MRF

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DECISION PHASE

FERNALD

During this phase, the alternatives will be compared using a sophisticated technique of evaluating, weighting and measuring the intangible performance measures against the more tangible measures. This effort will produce sound decision making data which DOE-FEMP will use when selecting the final disposition option for a specific inventory of metal.

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STAKEHOLDER INPUT

FERNALD

- Conducted public workshop on June 11, 1996, to introduce draft Recycling Methodology
- Submitted draft Recycling Methodology to EPAs (6/96)
- Received EPA and public comments (7/96-8/96)
- Prepared response package to comments (9/96)
- Provide response to stakeholders (11/96)
- Issue final Recycling Methodology (12/96)

Recycling Methodology is a living document which would change if significant comments/data necessitate. Stakeholder comments on the methodology were considered in developing the Plant 4 evaluation.

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PLANT X EXERCISE

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Medium Inventory of metal (1500 tons)

THREE SCENARIOS

- Small inventory of metal* (150 tons)
- Medium inventory of metal* (1500 tons)
- Large inventory of metal* (15,000 tons)

*Accessible Steel

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Overview of Multiple Criteria Decision Making

STEP 1: DEFINE DECISION CRITERIA

Decision criteria are those variables that are used in the process of evaluating alternatives and making the decision:

1. Cost -- Net Present Value
2. Cost -- Total Undiscounted Cost
3. Schedule Impacts
4. Local Economic Impacts
5. Institutional Preference
6. Local Social Preference
7. Protectiveness of the Environment
8. Public Health Impacts
9. Worker Safety Impacts

STEP 2: DEVELOP MEASUREMENT SCALES FOR QUANTIFYING THE DEGREE TO WHICH OBJECTIVES ARE ACHIEVED

Decision Criteria	Performance Measure (measurement scale)	Range for 15,200 tons of metal	
		Best Score	Worst Score
Cost	Net Present Value	$159M	$189M
Cost	Total Undiscounted Cost	$190M	$225M
Schedule Impacts	Time to completion	1 week	21 years
Local Economic Impacts	Scale of 1 to 5	5	1
Institutional Preference	Scale of 1 to 5	5	1
Local Social Preference	Scale of 1 to 5	5	1
Protectiveness of the Environment	Scale of 1 to 5	5	1
Public Health Impacts	Expected number of fatalities in total population	0.0020 **	0.068 **
Worker Safety Impacts	Expected number of fatalities in total population	0.0025 **	0.011 **

** Note that for all alternatives, the expected number of fatalities is always less than 1.

STEP 3: VALUE STRUCTURE: QUANTIFYING PREFERENCES BY ASSESSMENT OF WEIGHTING FACTORS

- Assess weights to represent preferences -- "willingness to pay" to achieve benefits or avoid adverse impacts of various types.

- The weights reflect judgments regarding the relative value of making improvements according to one objective (e.g., reducing public health impacts) relative to making improvements according to another objective (e.g., reducing cost).

- Rate the performance measures by assigning weighting factors on the worksheet provided and submit the worksheet.

STEP 4: COMBINE SCORES ON INDIVIDUAL DECISION CRITERIA INTO AN OVERALL RATING FOR THE ALTERNATIVE

- Use a weighted linear additive scoring rule. This scoring rule provides a weighted linear sum of the performance measure scores, normalized by the sum of the weights.

- The weighted linear additive scoring rule favors alternatives that score best on the criteria with the greatest weights.

- Rating for j-th alternative $= \dfrac{\sum_{i=1}^{9} w_i r_{ij}}{\sum_{i=1}^{9} w_i} = \dfrac{w_1 r_{1j} + w_2 r_{2j} + w_3 r_{3j} + \ldots + w_9 r_{9j}}{100}$

Where:

w_i = Weight of i-th performance measure

r_{ij} = Score of j-th alternative on the i-th performance measure

STEP 5: PERFORM SENSITIVITY ANALYSIS

- This is the most important step

- Sensitivity analyses analyze the implications of alternative value judgments (weighting factors) or alternative scores on the priority ranking of alternatives. Sensitivity analyses are conducted to determine whether plausible changes in weights or scores have a significant impact on the ranking of alternatives.

- Weights or scores may be changed individually or simultaneously to examine the following:

  -- What is the *critical* decision criterion?
  -- When do specific alternatives *reverse* positions in ordering?
  -- What maximum, minimum, or target values result in alternatives *reversing* positions in ordering?

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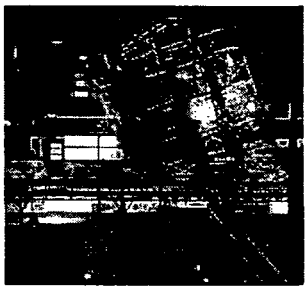
FERNALD
Environmental Management Project

November 1996

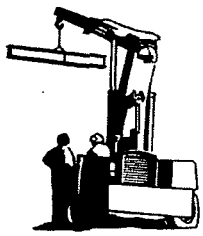
FEMP Recycling, Waste Minimization and Pollution Prevention Initiatives



FEMP File Photo: 5848-170

Plant 7 Steel Recycling
Of 761 tons of Plant 7 structural steel, 460 tons were decontaminated and recycled by Alaron, near Pittsburgh, Pa. The remaining 300 tons were returned to the Fernald Environmental Management Project (FEMP) for storage and are available for future recycling efforts.

Material Release Facility
A total of 275 tons of scrap steel, including 120 tons of furnace pots, 40 tons of battleship steel, 60 tons of miscellaneous I-beams, and other steel, have been decontaminated and free released for sale. The steel was decontaminated using steam detergent spraying. The majority of steel has been sold and removed from the site. Additional decontamination activities are planned in this facility.



Grit Blast Project
This project entails size-reducing and grit blasting structural steel (mainly I-beams from the Plant 1 Ore Silo Project) for free release. To date, approximately 10 tons of steel have been processed.

Poly-Peanut Reuse (polystyrene)
Packaging "peanuts" are separated from the boxes at RIMIA before they are broken down and transported to a local company for reuse. To date, more than 70 bags of peanuts have been reused, saving valuable landfill space and avoiding disposal costs.

Copper Recycling
An engineering study was awarded to MSC Inc., of Oak Ridge, Tenn., to size reduce (shred) and decontaminate 30 tons of the 1,500 tons of copper on site for free release and subsequent sale. The copper is wrapped with asbestos insulation and is potentially radiologically contaminated. Material processing began in August 1996.

"Green Is Clean" Program
The FEMP is currently achieving 55 percent recovery rate of trash, originally destined as low-level radioactive waste (LLW), by diverting it to a sanitary landfill. Cost savings to date are approximately $393,000. A total of 74,000 cubic feet of trash have been diverted.

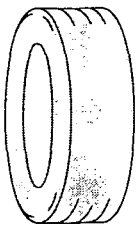
Receiving Incoming Material Inspection Area (RIMIA) Packaging Material Segregation
Certain products received at RIMIA and destined for the contaminated area are removed from shipping packages and placed into reusable crates. The clean packaging is then recycled. To date, cost savings are approximately $35,000; a total of 5,250 cubic feet of clean packaging have been diverted.

Paper Recycling

Due to declining paper markets, Fluor Daniel Fernald is now using a "credit" to pay for recycling of paper products. At $25 per collection, this alternative is still significantly less expensive than other recycling companies and sanitary trash disposal fees. In addition, the paper recycler has agreed to collect paper from Fluor Daniel Fernald locations at Springdale, Showcase, Northstar Warehouse and the Records Management Center for no fee. To date, the FEMP has recycled 865,024 cubic feet of paper.

Lead Acid Batteries
All lead acid batteries are recycled in Indianapolis. The most recent shipment in September included over 33,000 pounds of batteries, with a $1,000 rebate returned to Fluor Daniel Fernald.

Used Tires



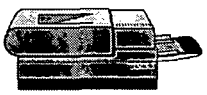
A contract was awarded in May 1996 to ensure tires are recycled and not buried or used in energy-to-fuel operations. The first tire collection included removal of 395 tires at a cost of $445, roughly 90 cents per tire. The next collection will occur during early spring 1997.

Aluminum Cans

The FEMP's aluminum cans are donated to Southwest and Ross Local Schools, scouts, and other local organizations, which recycle the cans and use the money for environmental projects. To date 38,644 pounds of cans have been recycled.

Fluorescent Lights
Fluorescent lights and ballasts are collected and recycled. Lights are recycled at an average of 42 cents each; ballasts are recycled at $25 each.

Laserjet Toner Cartridge Recycling



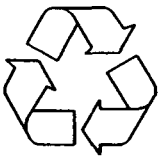
A local vendor takes the FEMP's used cartridges at no charge. The FEMP receives reduced prices to purchase refurbished cartridges. Annual cost savings are approximately $140,000. To date, a total of 4,311 laserjet units have been recycled.

Reusable Laundry Bags
In a selected facility, the FEMP has replaced disposable plastic bags with reusable laundry bags to collect used personal protective clothing from contamination areas. The project is currently in a test phase, with projected annual savings of $46,000 for site wide implementation.

Reuse Bulletin Board
The FEMP has established an electronic bulletin board to provide a mechanism for employees to advertise items for reuse. To date, cost savings are approximately $178,000. This program has been approved for future expansion to other DOE Ohio Field Office sites within the next year.

Respirator Container Program
In June, the FEMP implemented a program to replace cardboard boxes with plastic reusable containers to store and transport reconditioned respirators. This program has a projected annual savings of $20,000. To date, 126 cubic feet of waste have been avoided at a cost savings of $6,900.

Affirmative Procurement



Executive Order 12873 requires federal agencies to purchase EPA-designated items containing recycled contents. Currently there are 24 items, and 13 more -- announced in October -- will be added to the list in 1997.

Of the items the FEMP purchased from EPA's list during fiscal year 1995, 87 percent contained recycled contents, which exceeded DOE's fiscal year 1995 goal to purchase 50 percent. The FEMP achieved the highest rating in the DOE complex.

For More Information . . .

Call DOE Public Information Officer Gary Stegner, 513-648-3153, or write to him at the following address:

Gary Stegner
U.S. Department of Energy
Fernald Environmental Management Project
P. O. Box 538705
Cincinnati, OH 45253-8705

SUMMARY OF DISPOSITION ALTERNATIVES

The seven material disposition alternatives that will be evaluated as part of this exercise are summarized below. Since the Methodology is designed to be a "living" document, disposition alternatives are subject to change based on new information, such as evolving technologies.

On-Site Disposal Facility (OSDF): This alternative involves the disposal of structural steel in the FEMP OSDF along with other remediation wastes. Steel from several dismantlement projects would have to be stockpiled for 2-3 years until the OSDF would be available for steel placement; thereafter the steel could be placed as it is generated. The OU3 steel (15,200 tons) comprises about 0.09% of the total OSDF volume. No treatment is anticipated.

Off-Site Disposal at Nevada Test Site (NTS): This alternative involves transporting structural steel by truck to the DOE NTS low-level waste repository for burial. This alternative involves the purchase of burial containers, which would also be buried with the steel, rather than reused. Shipment of steel to NTS could occur as the metal is generated, so stockpiling would be minimized. No treatment is anticipated.

Off-Site Disposal at a Commercial Disposal Facility (Envirocare): This alternative involves transporting structural steel by train to an off-site commercial low-level waste disposal facility, such as the Envirocare facility in Utah, for burial. Rail cars would be leased or purchased and reused. OU3 steel would be packaged with OU1 dried pit material to reduce costs; however, this would require some amount of stockpiling until OU1 drying operations are performed. No treatment of the steel is anticipated.

On-Site Decontamination and Unrestricted Release (FEMP MRF): Steel would be decontaminated at the on-site Material Release Facility (MRF) by abrasive blasting, surveyed for free-release, and sold as cleaned steel to a scrap dealer. Any secondary wastes would be sent to NTS for burial. All material handling, packaging, decontamination, and radiological monitoring would be performed by Fluor Daniel Fernald personnel.

Vendor Facility Decontamination and Unrestricted Release (Vendor MRF): This alternative is similar in concept to the FEMP MRF, except that the contaminated steel would be containerized and shipped off-site to a commercial facility, where the material would be decontaminated, surveyed, released, and sold as scrap by a vendor. Any secondary wastes would be returned to the FEMP for DOE to transport to NTS for burial.

Metal Melt and Fabrication of Restricted Use Products (Recycle 2000): Structural steel would be transported to an off-site commercial facility, where it would be melted and fabricated into B-25-type containers for DOE use. Any secondary wastes would be returned to the FEMP for DOE to transport to NTS for burial.

Vendor-Operated FEMP MRF (Privatized FEMP MRF): This alternative is identical to the FEMP MRF discussion above, except that a vendor would be hired to operate the FEMP MRF. The decontamination method would include removing the radionuclides and other contaminants from the surface of the metal using equipment supplied by the vendor, but operated by the FEMP labor force. The vendor would lease the MRF, would retain ownership of (and liability for) the equipment after the project is completed, and would return the leased space to "as found" conditions.

SUMMARY OF PERFORMANCE MEASURES

Net Present Value: This performance measure accounts for inflation and the time value (or investment potential) of money by using a net present value approach to cost estimating. Net present value is the amount of money that would have to be invested today to pay for the alternative over the years of implementation. A real discount rate of 3.0% was used.

Total Undiscounted Cost: This performance measure is expressed in three ways: life-cycle cost (which is similar to net present value, except no discount rate was applied); incremental cost (which is the total cost of the alternative); and unit cost (which is the incremental cost divided by the volume of steel).

Schedule Impacts: Schedule impacts are expressed as the time required to complete each alternative, and also the time that the alternative will reduce or lengthen the FEMP remediation schedule (i.e. the accelerated scenario).

Local Economic Impacts: This performance measure captures local economic impacts on the surrounding community, employment effects, property values, and the impact of the recycled material on the larger market for scrap metal or contaminated scrap metal. For example, each alternative will have direct employment impacts (i.e, an increase or decrease in jobs). Also, based on public acceptance and the alternative's economic impact, property values for the community may improve or decline.

Institutional Preference: Institutional preference measures stakeholder perception on how consistent an alternative is with DOE and EPA policies. These can include such policies as preferences for recycle, resource conservation mandates, privatization, or obligations to utilize final rather than interim solutions to clean-up.

Local Social Preference: This performance measure addresses the public's preference of an alternative. On the national level, key social issues may include interstate shipment of radioactive waste and disposal of waste generated out-of-state. In the local area, key social issues may include impact on community services and the legacy left for the community after the alternative is completed.

Protectiveness of the Environment: This performance measure addresses potential adverse (or beneficial) impacts on the environment, including physical degradation of surrounding or affected ecological systems and harmful effects on plants and animals. This performance measure is used to assess potential widespread, localized, and long- and short-term impacts on entire ecological systems or constituents.

Public Health Impacts: This performance measure addresses the operational risk to off-site populations, expressed as total expected number of fatalities, associated with each alternative. It addresses potential adverse impacts on the health and safety of the surrounding or affected off-site human population, for the DOE site, commercial disposal site, recycle facility, or the commercial decontamination facility. This performance measure also assesses potential health impacts to communities from accidents involving the release of radioactive or hazardous materials or the dangers of accidents during transportation on public roads.

Worker Safety Impacts: This performance measure addresses potential adverse impacts on the health and safety of personnel involved with executing the alternative, expressed as total number of fatalities. This measure includes the potential impact from release of hazardous and radioactive materials and conventional industrial accidents.

NAME: _____

Exercise 1: Ranking the Disposition Alternatives for "Plant X" (1,500 tons)

This exercise is intended for you to express your relative preference for each of the seven disposition alternatives based on the four subjective (qualitative) performance measures. Place a value of 1, 2, 3, 4, or 5 in each empty box of Matrix Table "X", with a value of "1" indicating your lowest preference or least benefit and a value of "5" indicating your highest preference or most benefit.

Exercise 2: Assigning Weight Factors to Performance Measures

This exercise is intended to gauge the importance of the different performance measures to you. For example, if you think cost is a very important factor in determining how to disposition structural steel, you should assign a high weight factor to cost. However, if you think cost should have little to do with the decision-making process, you should assign a low weight factor. Once you have finished filling in a weight percent for each performance measure, make sure that the weight percent column adds up to 100%.

Performance Measures	Weight Percent
Net Present Value	
Total Undiscounted Cost	
Schedule Impacts	
Local Economic Impacts	
Institutional Preference	
Local Social Preference	
Protectiveness of the Environment	
Public Health Impacts	
Worker Safety Impacts	
Total:	100 %

Name: _____

TABLE "X" - EXERCISE (for DEMONSTRATION ONLY)
Disposition Summary Matrix
1,500 Tons Scenario

ALTERNATIVES		1 OSDF	2 NTS	3 ENVIROCARE	4 FEMP MRF	5 VENDOR MRF	6 RECYCLE 2000	7 PRIVATIZED FEMP MRF
A. NET Present Value	LC	*	*	*	*	*	*	*
B. Total Undiscounted Cost	LC	*	*	*	*	*	*	*
	Incre mental	$60K	$2.2M	$460K	$800K	$3.3M	$3.6M	$1.7M
	Unit	$15/ bcf	$372/ bcf	$75/bcf	$133/bcf	$537/bcf	$588/bcf	$275/bcf
C. Schedule Impacts	Total	1wk	20 wks	20 wks	2 yrs	1.5 yrs	1 yr	1.5 yrs
	Accel. Scenario	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
D. Local Economic Impacts								
E. Institutional Preferences								
F. Local Social Preference								
G.Protectiveness of the Environment								

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ALTERNATIVES	1 OSDF	2 NTS	3 ENVIROCARE	4 FEMP MRF	5 VENDOR MRF	6 RECYCLE 2000	7 PRIVATIZED FEMP MRF
H. Public Health Impacts (Fatalities)	*	*	*	*	*	*	*
I. Worker Safety Impacts (Fatalities)	*	*	*	*	*	*	*

Recycling Methodology/Plant 4 Case Study
Public Workshop Evaluation

November 7, 1996, 7 p.m. to 9 p.m., Alpha Building, Classroom B

1. Did the exercise tonight help you to better understand the Recycling Methodology evaluation process?

2. Do you feel prepared to complete a similar exercise on the Plant 4 Case Study?

3. Has the level of public involvement/information **on this topic** been

   too little _____
   adequate _____
   too much _____

4. Was the information discussed tonight

   clear and easy to follow _____
   too detailed and technical _____

Thank you for your participation!

APPROACH, ASSUMPTIONS, AND DATA FOR THE APPLICATION OF THE "FERNALD METALS DISPOSITION METHODOLOGY" TO THE PLANT 4 CATEGORY A/ACCESSIBLE METALS

September 1996

Prepared by:

Fluor Daniel Fernald
in cooperation with Oak Ridge National Laboratory

Prepared for:
U.S. Department of Energy
Fernald Environmental Management Project
Cincinnati, Ohio 45253

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Table A: Disposition Summary Matrix, 150 Tons Scenario

Table B: Disposition Summary Matrix, 15,200 Tons Scenario

Attachment 1: Cost Estimates for Alternative 1

Attachment 2: Cost Estimates for Alternative 2

Attachment 3: Cost Estimates for Alternative 3

Attachment 4: Cost Estimates for Alternative 4

Attachment 5: Cost Estimates for Alternative 5

Attachment 6: Cost Estimates for Alternative 6

Attachment 7: Cost Estimates for Alternative 7

ACRONYMS

Operable Unit 1	OU1
Operable Unit 2	OU2
Operable Unit 3	OU3
Operable Unit 5	OU5
Applicable or Relevant and Appropriate Standards, Limitations, Criteria, and Requirements	ARAR's
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Title 42)	CERCLA
Department of Energy-Fernald	DOE-FN
Department of Energy-Environmental Management	DOE-EM
Fluor Daniel Fernald	FDF
Fernald Environmental Management Project	FEMP
Large White Metal Box	LWMB
Material Release Facility	MRF
Nevada Test Site	NTS
On-Site Disposal Facility	OSDF
Receiving and Incoming Materials Inspection Area	RIMIA
Record of Decision (CERCLA)	ROD
Waste Acceptance Criteria	WAC

APPROACH, ASSUMPTIONS, AND DATA FOR THE APPLICATION OF THE "FERNALD METALS DISPOSITION METHODOLOGY" TO THE PLANT 4 CATEGORY A/ACCESSIBLE METALS

I. Scope

This document presents the detailed approach, assumptions, and data for the analysis phase of the evaluation of seven disposition alternatives for the Category A - Accessible Metals (i.e. structural steel) from the demolition of Building 4A/Plant 4. Disposition of the remainder of materials from Plant 4 (transite, concrete, lead, process equipment, light gauge metals, etc.) was not evaluated, although the Methodology can be conveniently modified to address other material categories in the future.

Two scenarios were evaluated, with the primary difference being the quantity of steel considered. In the first scenario, only 10% of the Plant. 4 steel was considered (approximately 150 tons). A Disposition Summary Matrix (Table A), which consolidates all the pertinent data and other information for evaluation of the 150 tons scenario, is attached.

As part of this evaluation, a Sensitivity Analysis was performed in which the primary parameter (the amount of steel considered) was changed from 150 tons (10% of Plant 4 structural steel) to 15,200 tons (100% of OU3 structural steel) and the analysis was repeated. In light of regulator and stakeholder input, the 15,200 tons scenario appears to have much greater value in addressing the recycling vs. disposal issue for structural steel, at Fernald and throughout the DOE weapons complex. A Disposition Summary Matrix (Table B) for the 15,200 tons scenario is also attached.

The information presented in the Matrix tables will be used as the focal point for a dialogue involving DOE, Fluor Daniel Fernald (FDF), the regulators, and other stakeholder groups to discuss the pros and cons of the various disposition alternatives. Input received will likely result in changes to some of the entries on the tables, to more accurately reflect stakeholder views and preferences. This dialogue will in turn lead into the decision phase of the analysis, which is described in greater detail in Section IX.

II. Background

The basis for this evaluation is the "Decision Methodology for Fernald Scrap Metal Disposition Alternatives" (also called the "Fernald Metals Disposition Methodology" or simply the "Methodology"). The DRAFT Methodology was presented to the regulators and other stakeholders at a public meeting on June 11, 1996, and comments were requested by July 26, 1996. After all comments received were evaluated, it was determined that no changes to the Methodology text were required. Therefore, the Methodology was essentially issued as an approved document on June 11, 1996.

The Methodology was developed to help decision makers compare and select among competing disposition alternatives for OU3 radioactive scrap steel. The performance measures which form the basis of this analysis consider both quantitative and qualitative factors, including direct costs and benefits, socio-economic issues, and environmental, safety, and health impacts.

The Methodology was designed to be a flexible, "living" document. Although it will be applied only to structural steel for this initial test case, the Methodology may be a valuable tool for evaluating disposition alternatives for a variety of other materials in the future, such as concrete, transite, lead, copper, or light gauge metal.

For this application of the Methodology, seven disposition alternatives for structural steel were evaluated based on nine performance measures. The disposition alternatives are described in Section V, and the performance measures are described in Section VI.

III. Data Sources

In evaluating scrap metal disposition alternatives, the Methodology considers both qualitative and quantitative information. Several of the performance measures used in this study, although important in the evaluation of competing disposition alternatives, are not conveniently expressed in numerical terms. For these qualitative criteria, information sources include DOE policy documents, comments received from regulators and other stakeholders at public meetings or through the CERCLA process, published reports, and discussions with industry experts.

Quantitative performance measures are expressed numerically in terms of money, time, risk, weight, volume, or some other standard unit of measure. The major quantitative data sources used for this analysis include the following:

OU3 RI/FS	FEMP OU3 Remedial Investigation and Feasibility Study Report, February 1996.
Warren 1995	Stephen Warren et al. Cost Model for DOE Radioactively Contaminated Carbon Steel Recycling.
Chen 1995	S.Y. Chen et al., "Transportation Risk Assessment," Recycle Policy Workshop, September 26-27, 1995, Salt Lake City, UT.
Cohen 1995	S. Cohen & Associates, Analysis of the Potential Recycling of Department of Energy Radioactive Scrap Metal, August 14, 1995, Washington, DC.
Means 1994	Means Site Work and Landscape Cost Data. 1994 Edition.
MSE 1995	MSE Inc./Western Environmental Technology Office, Feasibility Analysis of Recycling Radioactive Scrap Steel, Rev. B, September 11, 1995, Butte, MT.
Alaron	Alaron Corporation. Final Report for the FERMCO Metal Recycling Treatability Study, January 1996.
GeoSyntec	GeoSyntec Consultants, Impacted Materials Placement Plan OSDF, March 1996.
ORNL 1995	Preliminary Analysis of Recycle of Metal from Building K-31 at the Oak Ridge Site. Oak Ridge National Laboratory. 1995.
Simek 1995	Mary Ann Simek et al. "Limiting Concentrations and Risk Evaluation," Recycle Policy Workshop, September 26-27, 1995, Salt Lake City, UT.
WM PEIS	Waste Management Programmatic Environmental Impact Statement.

IV. Key Data and Assumptions

Presented below are the key data and assumptions which form the basis for this study. Other assumptions relating to specific disposition alternatives are included with the descriptions of the alternatives in Section V.

- Total On-Site Disposal Facility (OSDF) Volume = 2,500,000 cu. yd. (bank)

a.	OU2 material	=	450,000	18% of total
b.	OU3 material	=	300,000	12%
c.	OU5 material	=	1,750,000	70%
	Total		2,500,000 cu. yd.	100%

NOTE: The OU3 total of 300,000 bank cu. yd. remains basically unchanged whether or not the structural steel is included, since 150 tons equates to only about 23 bank cu. yd. and 15,200 tons is only about 2,300 bank cu. yd.

- For secondary waste management for both the vendor-facility unrestricted release and the metal-melt alternatives, the vendor performs packaging of secondary wastes. The secondary wastes are then transported from the vendor facility back to Fernald prior to being shipped to Nevada Test Site (NTS) for disposal. For the on-site unrestricted release alternative, the secondary wastes will be packaged on site and then transported to NTS for disposal.

- "Bank" volume is essentially equal to "unbulked" volume.

- A bulking factor of 16.7 is used for evaluating containerized transportation or disposition of the structural steel. The density of the structural steel is assumed to be 490 lbs per bank cu.ft.

- Cost estimates include only those costs directly incurred by DOE-FN (e.g., long-term monitoring and maintenance costs for incurred by NTS are not included).

- Cost estimates do not include contingency.

- Scrap steel from the FEMP is currently sold to a local broker for $0.02 per pound. The value of 150 tons is approximately $6,000 and the value of 15,200 tons is approximately $608,000.

V. Alternatives to be Evaluated

Seven material disposition alternatives will be evaluated for this initial application of the Methodology. These are described in sections V.1-V.7. All of the alternatives considered will fully comply with ARARs and are implementable (i.e., are technically and administratively feasible and rely on available services and materials).

NOTE: The Methodology is designed to accommodate emerging technologies and changes to key parameters over time; the Disposition Summary Matrix tables may be updated periodically to include new alternatives and new information.

V.1 On-Site Disposal Facility (OSDF)

Dispose of the structural steel in the FEMP permanent on-site disposal facility (OSDF) along with wastes generated by OU2 and OU5. This alternative consists of the following steps:

- Purchase containers and prepare for loading steel.
- Load steel into containers.
- Transport containerized steel to OSDF.
- Place steel in OSDF.
- Transport empty containers back to material staging area and perform container maintenance activities in preparation for loading additional steel.
- Size-reduce and dispose of unusable containers in OSF.

The key assumptions for this alternative are as follows:

- The OSDF will be designed and constructed in accordance with the relevant requirements of the Resource Conservation and Recovery Act and the Uranium Mill Tailings Remediation Control Act. As described in the OU2 ROD, the facility will feature a multi-layer capping system, including a vegetative soil layer, a filter layer, a biotic barrier, a drainage layer, and an infiltration barrier. The disposal facility will also feature a multi-layer liner that will include a leachate collection system, primary and secondary liners separated by a leak detection system, and a low-permeability compacted clay layer. The layers of both the cap and liner will be separated by geotextile fabrics and high-density polyethylene and bentonite composites for added protection. The disposal facility will prevent contaminant migration to the air and surface water and is modeled to protect groundwater for a 200 to 1,000 year performance period.
- This alternative also includes the imposition of administrative controls through real estate deed restrictions and access controls, and incorporation of post-remediation activities that include long-term monitoring and maintenance of the OSDF and operation of a groundwater monitoring network to evaluate the performance of the OSDF.
- Steel beams will be placed in the OSDF per the "Impacted Materials Placement Plan" as follows:

  > Beams will be spread or placed into a lift no higher than 18 inches and will be delivered to the OSDF by the truckload and dumped in loose lifts (en masse). Initial compaction of the beams shall be accomplished with a bulldozer as the beams are laterally spread. Soil will then be spread over the beams to bring the layer thickness to approximately 21 in. Final compaction shall be accomplished by four passes of a self-propelled, static foot-pad compactor (e.g., Caterpillar 815C). Any soft spots indicated by tire ruts more than ½ in. or excessive deflection under a rolling vehicle which cannot be stabilized with further compaction shall be cause for additional treatment, including removal, replacement, and recompaction of the soil material, and, if needed, filling the soft areas with grout or other material.

- The steel meets the OSDF WAC.
- The OSDF will be shut down (i.e., will not accept waste) for an average of three months each year because of frost conditions.
- Containers for transporting steel to OSDF will be reused 25 times.
- Steel from the Plant 4 demolition will stay in interim storage for approximately 2 years until the OSDF is engineered, constructed, and begins accepting the metal.
- Structural steel material placed into the OSDF will be calculated as bank (unbulked) volumes, since it will not be containerized.
- The placement cost for structural steel is 11.9 times that for soil ($1.23/bank cu.ft. for soil and $14.63/bank cu.ft. for steel).
- The OU3 steel (15,200 tons or 62,000 bank cu.ft.) comprises about 0.09% of the total OSDF volume.

V.2 Off-site Disposal at Nevada Test Site (NTS)

Package and transport structural steel to the DOE Nevada Test Site (NTS) low level waste (LLW) repository and dispose (bury). This alternative consists of the following steps:

- Purchase large white metal box (LWMB) containers and prepare for packaging.
- Package containers with steel. (Any additional cost which may be required for size reduction of steel to facilitate more efficient packaging was not estimated.)
- Stage containers prior to shipment.
- Transport to NTS by truck in LWMB containers.
- Dispose (bury) LWMB containers at NTS.

The key assumptions for this alternative are as follows:

- The metals all meet the NTS WAC, therefore no treatment is required.
- Metal will be shipped to the NTS by truck in top-loading large white metal boxes/LWMB (approximate volume of LWMB containers is 1,280 cu.ft.). The containers and their contents are buried at NTS.
- Schedule assumptions: continuous operation (one shift, 40 hours per week for duration of activity). Some interim storage of steel is required, although this time and associated cost have not been quantified. Shipment schedule may be limited by availability of steel per OU3 facilities demolition schedule and by availability of LWMB containers.

V.3 Off-Site Disposal at a Commercial Disposal Facility (Envirocare)

Package and transport structural steel to an off-site commercial LLW disposal facility (Envirocare in Utah) and bury. This alternative consists of the following steps:

- Lease/purchase gondola rail cars and prepare for loading.
- Load containers with steel and transport to gondola cars.
- Remove steel from containers and place steel in gondola cars.
- Transport to Envirocare (Utah) by rail for disposal .
- Dispose of gondola car contents.
- Return empty gondola cars to FEMP by rail.
- Maintain gondola cars to prepare for future shipments.

The key assumptions for this alternative are as follows:

- OU3 steel will be packaged in combination with OU1 dried pit material in gondola cars and shipped by train from the FEMP to Envirocare (Utah). Contents will be dumped for unbulked burial at Envirocare. Empty gondola cars will be shipped via rail from Envirocare back to the FEMP.
- A burial rate of $6.39 per ft3 of combined steel/dried OU1 pit waste is assumed for Envirocare.
- The metals all meet the commercial disposal facility WAC, therefore no waste treatment is needed.
- Schedule assumptions: continuous operation (one shift, 40 hours per week for duration of activity). Some interim storage of steel is required, although this time and associated cost have not been quantified. Shipment schedule limited by OU1 schedule and OU3 facilities demolition schedule.
- An exemption can be obtained from DOE Order 5820.2A to allow use of a commercial disposal facility. (The cost to obtain this exemption was not quantified.)

V.4 On-Site Decontamination and Unrestricted Release (FEMP MRF)

Decontaminate steel at FEMP Material Release Facility (MRF). Structural steel is released from the FEMP radiologically controlled area, with no restrictions on end use, after documenting that residual radioactivity meets the guidelines of DOE Order 5400.5. This alternative consists of the following steps:

- Load steel onto trailers and transport to the MRF.
- Unload steel and decontaminate at MRF by abrasive blasting.

- Survey steel for free-release.
- Load steel onto flatbed trailers and move to clean side (RIMIA).
- Dispose of secondary waste at NTS.
- Sell cleaned steel as scrap.

The key assumptions for this alternative are as follows:

- The decontamination method includes removal of the radionuclides and other contaminants from the surface of the metal using existing grit blaster (assume 25% rework rate).
- Material handling, packaging, decontamination, radiological monitoring, and other activities for this disposition alternative are performed by FERMCO personnel.
- Schedule assumptions: continuous operation (one shift, 40 hours per week for duration of activity). Some interim storage of steel is required, although this time and associated cost have not been quantified. Limiting factors are production rate for decontamination equipment, FERMCO labor schedules, and free-release survey rates.
- Market price for product: steel reclamation market value is assumed to be $0.02/lb.

NOTE: The FEMP MRF is currently located in Building 78 (New D&D). Since this building is scheduled to be demolished in 1998, the location of the MRF will change. However, since the systems and equipment that comprise the MRF are mobile or portable, reestablishing the MRF elsewhere in OU3 should be easily accomplished. Although the cost associated with reestablishing the MRF has not been quantified, it is expected to be insignificant in terms of this analysis.

V.5 Vendor Facility Decontamination and Unrestricted Release (Vendor MRF)

Containerize and ship structural steel from the FEMP to a commercial decontamination facility, where the material is decontaminated, surveyed, and documented to meet DOE Order 5400.5 residual radioactivity guidelines. The material is then sold as scrap with no restrictions on end use. This alternative consists of the following steps:

- Purchase containers and prepare for packaging.
- Package steel into containers.
- Stage containers prior to shipping.
- Transport to vendor facility.
- Decontaminate steel with automated abrasive blaster/descaler.
- Survey steel for free-release.
- Sell steel as scrap.

- Return containers and secondary waste to FEMP.
- Dispose secondary waste at NTS.

The key assumptions for this alternative are as follows:

- The decontamination method includes removal of the radionuclides and other contaminants from the surface of the metal using an automated, continuous flow abrasive blaster/descaler.
- Structural steel will be shipped to the vendor facility by truck in roll-offs.
- Lessons learned from the Plant 7/Alaron steel recycling project will result in a success rate of 90% of steel meeting free-release criteria after first pass through descaler.
- Schedule assumptions: continuous operation. Some interim storage of steel is required, although this time and associated cost have not been quantified. Limiting factor is vendor production rate.
- Market price for product: Steel reclamation market value is assumed to be $0.02/lb.

V.6 Melt of Metal and Fabrication of Restricted Use Products (Recycle 2000)

Transport the structural steel from the FEMP to an off-site commercial facility, where it is melted and fabricated into B-25-type containers for DOE use. The containers are then returned to FEMP. Because the processing facility will not commingle the scrap metal from different generating sites, the secondary waste remains site-specific and is disposed of at the FEMP's normal disposal site (NTS). All packaging and transportation is consistent with current transportation and disposal practices. This alternative is consistent with the DOE's Recycle 2000 Concept -- processing radioactively contaminated carbon steel into disposal containers for one-time use for the disposal of DOE-EM Program generated wastes.

This alternative consists of the following steps:

- Purchase containers and prepare for packaging.
- Package containers with steel.
- Stage containers prior to transport.
- Transport to the metal-melt facility.
- Melt the steel and fabricate containers. This consists of four steps: size-reducing the steel to fit the furnace; melting the steel to form billets; rolling the billets to sheet; and fabricating new disposal containers.
- Transport fabricated containers and secondary waste to FEMP.
- Dispose (bury) secondary waste at NTS.

The following are the key assumptions made for the structural steel metal-melt alternative:

- The structural steel will be shipped to a commercial metal-melt facility by truck in large top-loading containers (LWMB).
- The secondary wastes generated as a result of the metal-melting processes will be returned to the FEMP and then dispositioned at NTS.
- The cost of new B-25-type containers is $584.85 each.
- Schedule assumptions: continuous operation. Limiting factor is material availability per OU3 facilities demolition schedule.

V.7 Vendor-operated FEMP MRF (Privatized FEMP MRF)

Establish a subcontract with a private supplier of decontamination services to operate the FEMP Material Release Facility (MRF). Decontaminate steel at FEMP Material Release Facility (MRF) using equipment supplied by vendor. Structural steel is released from the FEMP radiologically controlled area, with no restrictions on end use, after documenting that residual radioactivity meets the guidelines of DOE Order 5400.5. This alternative consists of the following steps:

- Load steel onto trailers and transport to the MRF.
- Decontaminate steel at MRF by abrasive blasting (automated, continuous flow steel descaler).
- Survey steel for free-release.
- Load steel onto flatbed trailers and move to clean side (RIMIA).
- Dispose of secondary waste at NTS.
- Sell cleaned steel as scrap.

The key assumptions for this alternative are as follows:

- The vendor leases the FEMP MRF.
- The subcontract is firm, fixed price per pound, assuming an annual feed rate of 1,000 tons per year of "acceptable" steel. The price per pound includes the cost of equipment, operating supplies, and FERMCO labor.
- The vendor retains ownership of (and liability for) the automated, continuous flow descaler after the project is completed, and returns the leased space to "as found" conditions.
- The decontamination method includes removal of the radionuclides and other contaminants from the surface of the metal using equipment supplied by vendor, but operated by FERMCO labor force.
- Material handling, packaging, decontamination, radiological monitoring, and other activities for this disposition alternative are performed by FERMCO personnel.

- Schedule assumptions: continuous operation (one shift, 40 hours per week for duration of activity). Limiting factor is production rate for decontamination equipment.

- Market price for product: steel reclamation market value is assumed to be $0.02/lb. FEMP retains 100% of scrap sale proceeds.

VI. Performance Measures to be Evaluated

For each of the seven alternatives, the following nine performance measures will be evaluated. (Regulatory compliance is not included as a performance measure because it is assumed that all of the alternatives will fully comply with ARARs. Therefore, regulatory compliance will not differentiate among the alternatives, and does not need to be included in this comparative evaluation.)

VI.1 Net Present Value

This performance measure is the net present value of the direct financial costs and benefits that are directly paid or received by the Department of Energy.

The objective of the Present Worth Analysis (PW) is to use a method of economic evaluation that compares the sums of discounted dollar costs or benefits of capital investments, replacements, operations, maintenance, and dismantlement of two or more systems or operations over their anticipated useful life span. The analysis technique identifies the system or operation considered to be the lowest-cost alternative for satisfying a particular need. The PW analysis complies with the requirements described by the Office of Management and Budget (OMB) Circular No. A-94, the National Institute of Standards and Technology (NIST) Handbook 135, and the United States Environmental Protection Agency (USEPA) OSWER Directive 9355.3-01.

The PW analysis approach was applied in the analysis to evaluate the material disposition alternatives. The PW techniques sum all the time-equivalent dollar costs attributable to the economic alternatives. The positive cash flows (salvage value) are treated as negative costs. These costs are discounted to the base year and subtracted from the total.

All cash flow amounts are stated in present value constant dollars; hence, all dollars will have the same purchasing power. Constant dollars indicate what the same good or service would cost at different times if no inflation or deflation exists to change the purchasing power of the dollar. A straightforward means was used to express cash flows in constant dollars by establishing a reference (base) year for which the value of the dollar is set.

The constant dollar cash flows are adjusted for opportunity costs associated with their different times of occurrence. The adjustment for opportunity cost, called "discounting of cash flows," allows converting the constant dollar cash flows occurring at different times to a time-equivalent lump-sum amount evaluated as of the beginning of the base year. This is accomplished by using an interest rate or "real discount rate" which reflects the opportunity cost apart from any change in the purchasing power of the dollar. Real discount rates do not include the rate of inflation or deflation since the cash flows are expressed in constant dollars. The real discount rate was obtained from appendix C of the OMB Circular No. A-94, revised February 1996. The discount rate identified in the circular for a study period of thirty years and beyond is 3%. This discount rate was applied to calculate the net present value (NPV). The NPVs of each of the economic alternatives were compared in order to identify the least-cost option.

The cost analysis includes all of the financial costs and benefits of the alternatives. These costs include both the direct budget allocations to the project and incremental costs to other activities such as permitting, monitoring, or other compliance costs. Costs cover the full scope of the project, including handling, packaging, storage, transportation, secondary waste management, decontamination, disposal, etc. Likewise, financial benefits include both the direct proceeds to the project through actions such as sale of recycled products, and benefits to other activities through reduced costs or improved schedules. Hidden costs in overhead accounts are extracted and assigned to the alternatives, as appropriate. In addition, future liabilities are included in the estimate.

For the Life-cycle Cost calculations, all costs are considered, including long-term costs and costs which are common to all alternatives. For example, the Life-cycle Cost for a recycle/reuse alternative will include not only the cost to perform recycling and secondary waste management activities, but also the total OSDF cost (minus the cost for placement of the recycled material), since the OSDF cost will be incurred whether or not recycling is implemented. The Life-cycle Cost gives more of a "Big Picture" look, indicating the relative impacts of the various disposition alternatives on the overall, long-term FEMP remediation scenario.

VI.2 Total Undiscounted Cost

This performance measure is the summation of all direct financial costs and benefits that are directly paid or received by the Department of Energy. Undiscounted total costs will be calculated through use of a zero discount rate in the analytical spreadsheet.

The Total Undiscounted Cost will be calculated and expressed in terms of Unit Cost, Incremental Cost, and Life-cycle Cost. For the Unit Cost calculation, costs which are common to all alternatives will not be included, because they will not affect the relative comparison of alternatives. Thus, the cost associated with implosion of Plant 4 will not be included since this cost was incurred regardless of the disposition alternative. The Unit Cost indicates the relative short-term costs (and benefits) of specific activities required solely to implement a specific alternative, expressed in terms of dollars per bank cubic feet.

The Incremental Cost of each alternative is similar to the Unit Cost, except Incremental Cost is expressed in terms of total dollars instead of dollars per bank cubic foot.

The Life-cycle Cost calculation for Total Undiscounted Cost will include the same cost elements as the NPV Life-cycle Cost calculation. However, for the Total Undiscounted Life-cycle Cost, a discount rate of zero will be used to express the cost of each alternative in terms of 1996 constant dollars.

VI.3 Schedule Impacts

Schedule impacts will be expressed as the amount of time, measured in months, required to complete each alternative, and also as the amount of time that implementing an alternative will reduce or lengthen the FEMP remediation schedule (i.e. the "10-year Plan"). Under limited funding scenarios, implementation of one alternative may prevent or delay progress in other areas of overall FEMP remediation. This performance measure incorporates factors such as the projected demolition schedules for OU3 structures, OSDF material placement schedules, availability of recycling services, and waste shipment and disposal schedules.

VI.4 Local Economic Impacts

This performance measure captures those economic factors that lie outside of the direct cost analysis performed for measures one and two. Some of these economic factors include local economic impacts on the surrounding community, employment effects, property values, and the impact of the recycled material on the larger market for scrap metal or contaminated scrap metal.

As money flows into and out of the economy of a region, an economic stimulus may arise over and above the direct amount of spending on the alternative. The economic impact will vary over time as the spending schedule changes. Each alternative will also have direct employment impacts: an increase or decrease in jobs will result with each alternative. The type of jobs created or lost will vary based on the skills required, employer, and the type of work involved. Direct manpower requirements and timing will flow from the financial analysis. Union involvement can be estimated based on the resultant job structure. Based on the effect of the alternative on economic impact and public acceptance, property values for the community may improve or decline. Finally, if an alternative includes the creation of a saleable product, then the impacts of that product on the market should be examined.

Because of the relatively small amount of metal considered in this study (even the 15,200 tons scenario would add only a small fraction to the total amount of steel recycled in the US each year), it is assumed that there will be no substantial impacts on the national or regional markets that the recycled material would enter. However, the impact on local markets would be more substantial, especially for the 15,200 tons scenario. For example, through an existing subcontract with a local scrap metal broker, approximately 220 tons of steel free-released through the FEMP MRF were sold over a period of several months. Free-release and sale of the 15,200 tons is projected to provide several years of business for local brokers/recyclers, which is considered to be a substantial impact.

To make it possible to direct the limited time and budget for this study to analysis of those performance measures that will likely play the larger roles in the decision-making, only a simple evaluation of local economic impacts was performed. This evaluation will be expressed qualitatively to indicate the relative projected impact of each alternative on the local economy, assigning a "value" of 1, 2, 3, 4, or 5, with "1" corresponding to the least benefit to the local economy and "5" corresponding to the greatest benefit.

VI.5 Institutional Preference

This performance measure addresses how consistent each alternative is with DOE and EPA policies. These can include such policies as preferences for recycle, resource conservation mandates, privatization, or obligations to utilize final rather than interim solutions to clean-up. This performance measure can also address the views of other federal, state, and local institutions such as regulatory agencies.

With privatization being considered for many DOE functions, it is critical to understand how private firms would play a part and how best to involve them. The performance measure will be the amounts and kinds of involvement, from traditional management and operations contracting to more entrepreneurial arrangements. This will be analyzed based on past experience with similar ventures, as well as informal discussions with private firms and experts familiar with private company activities.

The analysis of institutional issues will be qualitative, and will rely largely on information provided by DOE officials, DOE program documentation, and formal comments submitted by USEPA and OEPA through the CERCLA process. The result of the analysis of this performance measure will be a simple qualitative assessment of how well the alternative adheres to these institutional preferences, assigning a "value" of 1, 2, 3, 4, or 5, with "1" indicating the lowest institutional preference and "5" indicating the highest institutional preference.

VI.6 Local Social Preference

This performance measure addresses the relative social preference for each alternative in the local area, the larger region, or nationwide. Although national and regional social preferences were considered in the analysis, the preferences of the local society received the most attention and had the most impact on the "value" assigned to each competing alternative.

On the national level, key social issues are public preferences concerning interstate shipment of radioactive waste and disposal of waste generated out-of-state. In the local area and region, some of the key social issues include public acceptance, impact on community services, and the legacy left for the community after the alternative is completed. Again, the preferences of the local society greatly outweigh those of the regional or national society for this analysis.

As with local economic and institutional preferences, the evaluation of social impacts is difficult to quantify. For this performance measure, public comments received through the CERCLA process, community outreach activities, public meetings, and other public input will be used to formulate a qualitative assessment of the social impacts of the alternatives. "Values" of 1, 2, 3, 4, or 5 will be assigned to the alternatives, with "1" indicating the least preferable and "5" indicating the most preferable.

VI.7 Protectiveness of the Environment

The environmental protectiveness performance measure addresses potential adverse (or beneficial) impacts on the environment, including physical degradation of surrounding or affected ecological systems and harmful effects on plants and animals . This performance measure is used to assess potential widespread, localized, and long- and short-term impacts on entire ecological systems or constituents. The performance measure is also used to describe impacts resulting in loss of use of natural resources such as land or water.

A key element of life cycle analysis is the study, not only of the immediate risks for each alternative, but the relative risks avoided (or benefits realized) by not pursuing other alternatives. For example, the direct financial benefit of recycle is already captured in the price received for the recycled material; the environmental benefits come through the lessened releases of hazardous materials during manufacture of virgin steel. These environmental benefits as well as the adverse impacts of the alternatives are included in the environmental performance measure. A qualitative analysis of the environmental protectiveness of the alternatives will be performed, assigning a "value" of 1, 2, 3, 4, or 5, with "1" indicating least protective and "5" indicating most protective.

VI.8 Public Health Impacts

The public health performance measure addresses the operational risk and avoided risk to off-site populations associated with each alternative. It addresses potential adverse impacts on the health and safety of the surrounding or affected off-site human population, for the DOE site, commercial disposal site, recycle facility, commercial decontamination facility, or the avoided steel making sites. This performance measure is used to assess potential health impacts to communities from accidents involving the release of radioactive or hazardous materials or the dangers of accidents during transportation on public roads.

A quantitative evaluation will be made of the public health impacts of the alternatives, expressed as the expected number of fatalities from all activities associated with the alternative. This will be based on the Recycle 2000 analyses, PEIS, RI/FS, and the ORNL analysis of Building K-31 in Oak Ridge.

VI.9 Worker Safety Impacts

The worker safety performance measure addresses potential adverse impacts and avoided impacts on the health and safety of personnel inside the site boundary or any worker associated with the avoided virgin metal production. This measure includes the potential impact from release of hazardous and radioactive materials and conventional industrial accidents.

A quantitative evaluation will be made of the worker safety impacts of the alternatives, expressed as the expected number of fatalities for workers from all activities associated with the alternative. This will be based on the Recycle 2000 analyses, PEIS, RI/FS, and the ORNL analysis of Building K-31 in Oak Ridge.

VII. Analysis of Alternatives

VII.1 Analysis of Alternative 1: Placement in On-Site Disposal Facility (OSDF)

This alternative would result in the metals being dispositioned in the OSDF. The evaluation of each of the nine performance measures is described below for alternative 1.

VII.1.a Net Present Value

Life-cycle cost elements are as follows:

- Engineering and design.
- Construction of facility, roads, etc.
- Utilities interface.
- Radiological and safety oversight.
- Roads and storm water maintenance.
- Environmental monitoring and compliance.

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- Sampling and analysis.
- Baseline groundwater monitoring.
- On-property transport to disposal.
- Material placement in OSDF.
- Long-term monitoring and maintenance (200 years post closure).

For the NPV calculation, the life-cycle cost for the 150 tons scenario was approximately **$159 million**, and for the 15,200 tons scenario the NPV was approximately **$159 million**. (See Attachment 1 for details of the cost estimate.)

VII.1.b Total Undiscounted Cost

For the life-cycle estimate of total undiscounted cost, the calculation described above was repeated using a discount rate of zero. The estimate for the 150 tons scenario was approximately **$190 million**, and the 15,200 tons scenario was approximately **$190 million**. (See Attachment 1 for details of the cost estimate.)

The incremental cost component of total undiscounted cost for placement of 150 tons of steel in the OSDF is **$6,000** , and for the 15,200 tons the incremental cost of steel placement is **$600,000** .

For the unit cost component of total undiscounted cost of placement of steel in the OSDF, the estimate for both the 150 and 15,200 tons scenarios was **$14.63 per bank cu.ft.** (See Attachment 1 for details of the cost estimate.)

VII.1.c Schedule Impacts

For the 150 tons scenario, the estimated time to place the steel in the OSDF is **less than 1 week**, assuming a full crew. The corresponding impact on the 10-year Plan is **neutral**.

For the 15,200 tons scenario, the estimated time required for the full crew to place the steel is **about 3 months**. Assuming that the 10-year Plan includes this time for placement of the steel in the OSDF, the impact of this alternative is **neutral**.

VII.1.d Local Economic Impacts

For the 150 tons scenario, the anticipated impact on the local economy of placing the steel in the OSDF is negligible because of the relatively small quantity of material being evaluated resulting in a "value" of 3.

For the 15,200 tons scenario, the impact is more pronounced. Placement of the steel in the OSDF will have a slight negative impact on the local economy, relative to some of the other alternatives, because this alternative will prevent the influx of relatively large quantities of a saleable product (scrap steel) into the local market. Based on the anticipated schedule for demolition of OU3 structures, scrap steel will be generated at a rate of roughly 1,000 to 2,000 tons per year. Several local scrap metal recycling and brokerage firms have contacted FDF to express interest in buying the scrap metal. As with the other disposition alternatives, placement of the steel in the OSDF will negatively impact the local scrap market. The rating for this alternative for impacts to the local economy is 2.

VII.1.e Institutional Preference

The institutional preference rating for the 150 tons scenario is 3 due to the relatively small amount of material being considered.

For the 15,200 tons scenario, implementation of this alternative rates a 2 for institutional preference because disposal of structural steel does not meet DOE policies for recycle and privatization. In addition, the EPA waste minimization hierarchy specifies that waste management approaches should first attempt to reduce the volume generated, reuse or recycle if source reduction is not feasible (as is the case with FEMP scrap steel), and utilize disposal options only as a last resort. As with other disposition alternatives, OSDF placement of structural steel is less favored than recycling/reuse alternatives in terms of institutional preference.

VII.1.f Local Social Preference

Although the public stakeholders have expressed a clear preference for recycle/reuse alternatives over disposal alternatives, the social impact for the 150 tons scenario is negligible (3) due to the small amount of material under consideration.

For the larger case of 15,200 tons, this alternative has the lowest public acceptance of all alternatives because the local community wishes to minimize the amount of LLW material placed in the OSDF. On the national level, onsite disposal is preferable to offsite disposal due to the perceived risks of cross-country transport of radioactive materials and the resistance of some communities to accept wastes generated out-of-state. However, disposal alternatives in general are much less preferred by the public than recycle/reuse alternatives. Furthermore, despite engineering calculations to the contrary, the public has expressed their perception that placement of steel in the OSDF increases the potential for eventual OSDF failure. Coupled with the siting of the OSDF directly above the aquifer, this alternative adds to the long-term legacy for the Fernald community. The result of analysis of this alternative for local social preference is 1.

VII.1.g Protectiveness of the Environment

As with the other qualitative performance measures for the 150 tons scenario, the rating for environmental protectiveness is 3 due to the relatively small quantity of material.

For the 15,200 tons scenario, this alternative has some positive environmental impacts because it prevents direct access to the contaminants on the steel by placement in the OSDF. Implementation of this alternative would mitigate the potential migration of contaminants from the steel to the surrounding environment thereby reducing risks to off-site residents and environmental systems.

Institutional controls maintained for the OSDF for the 200-1,000 year design life include continued federal ownership of that portion of the FEMP to preclude homesteading, intrusive actions, or facility degradation; deed restrictions; and passive access controls (e.g. fencing) around the facility to prevent unauthorized access or use of the land.

The long-term effectiveness and permanence of this alternative for containing the contamination remaining on the metals would depend primarily on the physical integrity of the OSDF. The facility will be designed to ensure protectiveness for a minimum of 200 years to a maximum goal of 1,000 years. Some degree of uncertainty concerning the ability of the federal government (or another entity or society as a whole) to maintain long-term (i.e., up to 1,000 years) institutional controls and the long-term performance of the engineered system does exist. However, based on available engineering data and computer modeling, the long-term effectiveness and permanence of the disposal facility would be supported.

In the general comparison of disposal vs. recycle alternatives, there is a considerable difference in environmental impacts because the recycling alternatives eliminate the environmental impacts associated with production of new (virgin) steel. Mining and foundry operations negatively impact air quality, water quality and aquatic ecology, and land use.

For air quality impacts, considerable emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), hydrocarbons, and particulate matter result from mining of iron ore, limestone, and coal, shipping these materials via barge, rail, or truck, burning coal to produce electricity, and smelting operations. For each ton of virgin steel produced, approximately 11.8 pounds of SO_2 are released to the environment, compared to about 8.8 pounds per ton of steel recycled. For SO_2 alone, disposal alternatives for the 15,200 tons scenario indirectly result in the emission of approximately 45,600 pounds more of SO_2 than recycling alternatives. (Similar estimates for emissions of other air pollutants and impacts on water quality/aquatic ecology and land use may be calculated for future applications of the Methodology.)

In the overall analysis of environmental impacts, the positive effect of isolating the contaminated steel in the OSDF is outweighed by the potential negative effects discussed above, resulting in a rating of 2 for this performance measure.

VII.1.h Public Health Impacts

For the 150 tons scenario, the expected number of fatalities for the public is 3×10^{-5}.

For the 15,200 tons scenario, the expected number of fatalities for the public is 1×10^{-4}.

VII.1.i Worker Safety Impacts

For the 150 tons scenario, the expected number of fatalities for the work force is 3×10^{-5}.

For the 15,200 tons scenario, the expected number of fatalities for the work force is 3×10^{-3}.

VII.2 Analysis of Alternative 2: Off-Site Disposal at Nevada Test Site (NTS)

This alternative would result in the steel being packaged at Fernald and shipped by truck to NTS for disposal. The evaluation of the nine performance measures is described below for alternative 2.

VII.2.a Net Present Value

Life-cycle cost elements are as follows:

- Container preparation (including container purchase price).
- Container packaging.
- Container staging prior to shipment.
- Container shipping.
- Container burial at NTS.
- Disposal at NTS.
- OSDF life-cycle cost (minus steel placement cost).

For the NPV estimate, the life-cycle cost of the 150 tons scenario was approximately **$159 million**, and for the 15,200 tons scenario it was approximately **$177 million**. (See Attachment 2 for cost estimate details.)

VII.2.b Total Undiscounted Cost

For the life-cycle estimate of total undiscounted cost, the calculation described above was repeated using a discount rate of zero. The estimate for the 150 tons scenario was approximately **$191 million**, and for the 15,200 tons scenario it was **$212 million**. (See Attachment 2 for cost estimate details.)

For the incremental cost component of total undiscounted cost, the estimate for 150 tons is **$232,000**, and for 15,200 tons it is **$22 million**.

For the unit cost component of total undiscounted cost of disposal of the steel at NTS, the estimate for the 150 tons scenario was **$378 per bank cu.ft.**, and for the 15,200 tons scenario it was **$368 per bank cu.ft.** (See Attachment 2 for details of the cost estimate.)

VII.2.c Schedule Impacts

For the 150 tons scenario, the time required to ship the steel to NTS is about **2 weeks**, resulting in a **neutral** impact on the 10-year Plan.

For the 15,200 tons scenario, the NTS shipping schedule is limited by the availability of material per the OU3 facilities demolition schedule. Based on current estimates, the last of the OU3 steel would not be available for about 6 years. The impact of shipping the steel offsite as it becomes available would be to reduce the 10-year Plan by 3 months. Further 10-year Plan reductions could be realized through scheduling of labor for steel shipment during the annual period when the OSDF is not accepting material and the expeditious removal of steel piles from OU3 to make the underlying soils more readily accessible for excavation and OSDF placement. These potential additional schedule reductions have not been quantified.

VII.2.d Local Economic Impacts

Analysis of alternative for local economic impacts is very similar to the analysis for alternative 1 (See Section VII.1.d), resulting in a rating of 1 for the 150 tons scenario, and 2 for the 15,200 tons scenario. Offsite disposal could have a slightly positive impact on the local economy over onsite disposal through revenues to local transportation firms for cross-country transport to NTS. However, this positive impact is outweighed by the negative impact of preventing the scrap steel from entering the local market.

VII.2.e Institutional Preference

Since this alternative does not meet DOE or EPA policies for recycle and privatization (See Section VII.1.e for a more thorough discussion), it is rated the same as alternative 1 for this performance measure (3 for the 150 tons scenario and 2 for the 15,200 tons scenario).

VII.2.f Local Social Preference

Public acceptance of this alternative is higher than for onsite disposal but lower than for any of the recycle/reuse alternatives. (See Section VII.1.f for a more thorough discussion.) Therefore, the social impact of this alternative is rated as 1 for the 150 tons scenario and 2 for the 15,200 tons scenario.

VII.2.g Protectiveness of the Environment

Impacts to the environment would be similar to those identified for alternative 1 (See Section VII.1.g), with the following differences. NTS is located in an area with considerably less human population than the FEMP area, the NTS region is arid, and the NTS facility is not sited directly above a sole-source aquifer. These factors would make the NTS alternative slightly preferable to the OSDF alternative with respect to environmental impacts.

However, because of the negative environmental impacts associated with the production of virgin steel (made necessary because disposal options prevent the scrap steel from entering the recycling market), the overall analysis for this performance measure results in a rating of 3 for the 150 tons scenario, and 2 for the 15,200 tons scenario.

VII.2.h Public Health Impacts

For the 150 tons scenario, the expected number of fatalities for the public is 7×10^{-4}.

For the 15,200 tons scenario, the expected number of fatalities for the public is 6×10^{-2}.

VII.2.i Worker Safety Impacts

For the 150 tons scenario, the expected number of fatalities for the work force is 3×10^{-5}.

For the 15,200 tons scenario, the expected number of fatalities for the work force is 3×10^{-3}.

VII.3 Analysis of Alternative 3: Off-Site Commercial Disposal Facility (Envirocare)

This alternative would result in the steel being packaged in gondola cars in combination with dried pit waste from OU1 and shipped by rail to Envirocare for disposal. The evaluation of the nine performance measures is presented below for this alternative.

VII.3.a Net Present Value

Life-cycle cost elements are as follows:

- Container lease/purchase and preparation for packaging.
- Container packaging.
- Container staging prior to shipment.
- Container shipment.
- Disposal of steel at Envirocare.
- Container return shipment.
- Container maintenance.
- OSDF life-cycle cost (minus steel placement cost).

For the NPV calculation, the life-cycle cost for the 150 tons scenario was approximately **$159 million**, and for the 15,200 tons scenario it was approximately **$161 million**. (See Attachment 3 for cost estimate details.)

VII.3.b Total Undiscounted Cost

For the life-cycle estimate of total undiscounted cost, the calculation described above was repeated using a discount rate of zero. The estimate for the 150 tons scenario was approximately **$190 million**, and for the 15,200 tons scenario it was **$193 million**. (See Attachment 3 for cost estimate details.)

The incremental cost for this alternative is **$58,000** for 150 tons of steel, and **$3 million** for 15,200 tons.

For the unit cost component of total undiscounted cost of disposal of steel at Envirocare, the estimate for 150 tons is **$94 per bank cu.ft.**, and for 15,200 it is **$65 per bank cu.ft.** (See Attachment 3 for cost estimate details.)

VII.3.c Schedule Impacts

Schedule impacts for the Envirocare disposition alternative are essentially the same as for the NTS disposal alternative. For the 150 tons scenario, the 2 weeks required for shipment would have a neutral impact on the 10-year Plan.

For the 15,200 tons scenario, the shipment schedule would be spread over 6 years based on material availability and the impact on the 10-year Plan would be a reduction of 3 months (with potential additional reductions as discussed in Section VII.2.c).

VII.3.d Local Economic Impacts

Impacts to the local economy for this alternative are the same as for alternative 2 (See Section VII.2.d). Therefore, the rating for this performance measure is 3 for the 150 tons scenario, and 2 for the 15,200 tons scenario.

VII.3.e Institutional Preference

The institutional impacts of this alternative are the same as for alternative 2 (See Section VII.2.e). Therefore, the rating for this performance measure is 3 for the 150 tons scenario, and 2 for the 15,200 tons scenario.

VII.3.f Local Social Preference

The social impacts of this alternative are the same as for alternative 2 (See Section VII.2.f). Therefore, the rating for this performance measure is 3 for the 150 tons scenario, and 2 for the 15,200 tons scenario.

VII.3.g Protectiveness of the Environment

Since the Envirocare facility is located in a desert region similar to the NTS region, the environmental impacts of this alternative are the same as for alternative 2 (See Section VII.2.g). Therefore, the rating for this performance measure are 3 for the 150 tons scenario and 2 for the 15,200 tons scenario.

VII.3.h Public Health Impacts

For the 150 tons scenario, the expected number of fatalities for the public is 3×10^{-5}.

For the 15,200 tons scenario, the expected number of fatalities for the public is 2×10^{-4}.

VII.3.i Worker Safety Impacts

For the 150 tons scenario, the expected number of fatalities for the work force is 3×10^{-5}.

For the 15,200 tons scenario, the expected number of fatalities for the work force is 3×10^{-3}.

VII.4 Analysis of Alternative 4: On-Site Unrestricted Release (FEMP MRF)

This alternative would result in the steel being decontaminated in the FEMP MRF using existing systems and sold to a local dealer as clean scrap. The evaluation of the nine performance measures is described below for alternative 4.

VII.4.a Net Present Value

The life-cycle cost elements are as follows:

- Transportation of steel to the MRF.
- Decontamination of steel by abrasive blasting.
- Free-release surveying.
- Loading and transportation of clean steel to RIMIA.
- Scrap value of clean steel.
- Disposal of secondary waste at NTS.
- OSDF life-cycle cost (minus steel placement cost).

For the NPV calculation, the life-cycle cost for the 150 tons scenarion was **$159 million**, and for 15,200 tons it was approximately **$164 million**. (See Attachment 4 for cost estimate details.)

VII.4.b Total Undiscounted Cost

For the life-cycle estimate of total undiscounted cost for processing steel through the onsite MRF, the calculation described above was repeated using a discount rate of zero. The estimate for the 150 tons scenario was approximately **$191 million**, and the 15,200 tons scenario was approximately **$197 million**. (See Attachment 4 for details of the cost estimate.)

The incremental cost for 150 tons is **$82,000**, and for 15,200 tons it is **$7 million**.

For the unit cost component of total undiscounted cost for onsite MRF processing of the steel, the estimate for the 150 tons was **$134 per bank cu.ft.**, and for the 15,200 tons scenario it was **$132 per bank cu.ft.** (See Attachment 4 for cost estimate details.)

VII.4.c Schedule Impacts

For the 150 tons scenario, onsite MRF activities would require approximately **10 weeks**, resulting in a **neutral** impact on the 10-year Plan.

For the 15,200 tons scenario, onsite MRF activities would require approximately 21 years, resulting in an impact to the 10-year Plan of approximately +11 years. (These estimates are based on published production rates for the existing MRF abrasive blasting system assuming a normal one shift per day, 40 hour work week with a blasting crew of two workers, and manual free-release surveying methods. The total time estimate of 21 years would be significantly reduced by incorporating improved decontamination capabilities, automated surveying techniques, increased crew size, or added work shifts. However, the cost estimates would then need to be modified accordingly.)

VII.4.d Local Economic Impacts

The positive impact of the 150 tons scenario on the local economy would be slight due to the relatively small amount of material being evaluated. Therefore, the rating for the 150 tons scenario is 3.

However, as discussed in Section VII.1.d, the recycle/reuse alternatives generate a saleable product (clean scrap steel) so they generally have a favorable economic impact as compared to the disposition alternatives. The onsite MRF alternative provides an additional stimulus to the local economy because it provides meaningful work for the local labor force (decontamination activities) and the scrap steel would likely enter the local scrap market rather than the market near an offsite MRF. Therefore, for the 15,200 tons scenario, the rating for this performance measure is 4.

VII.4.e Institutional Preference

Due to the relatively small amount of steel in the 150 tons scenario, the institutional impact of this alternative is rated as 3.

However, as discussed in Section VII.1.e, the recycle/reuse alternatives are preferable to the disposal alternatives in terms of DOE and EPA policies and guidelines. Therefore, the rating for this performance measure for the 15,200 tons scenario is 4.

VII.4.f Local Social Preference

Due to the relatively small amount of material in the 150 tons scenario, the rating for this performance measure is 3.

However, as discussed in Section VII.1.f, public comments indicate a very strong preference for recycle/reuse alternatives over disposal alternatives. Therefore, the rating for this alternative for the 15,200 tons scenario is 4.

VII.4.g Protectiveness of the Environment

Due to the relatively small amount of material in the 150 tons scenario, the rating for this performance measure is 3.

However, as discussed in Section VII.1.g, the recycle/reuse alternatives are preferable to the disposal alternatives because the environmental benefits of isolating contaminants through disposal are outweighed by the environmental detriments associated with virgin metal production. Therefore, the rating for this performance measure for the 15,200 tons scenario is 4.

VII.4.h Public Health Impacts

For the 150 tons scenario, the expected number of fatalities for the public is **7×10^{-6}**.

For the 15,200 tons scenario, the expected number of fatalities for the public is **2×10^{-3}**.

VII.4.i Worker Safety Impacts

For the 150 tons scenario, the expected number of fatalities for the work force is **5×10^{-5}**.

For the 15,200 tons scenario, the expected number of fatalities for the work force is **4×10^{-3}**.

VII.5 Analysis of Alternative 5: Vendor Decontamination and Free-release (Vendor MRF)

VII.5.a Net Present Value

Life-cycle cost elements are as follows. (See Attachment 5 for details of the cost estimates.)

- Container purchase and preparation.
- Container packaging and staging prior to shipment.
- Container shipping to vendor MRF.
- Container unloading.
- Steel decontamination.
- Surveying for free-release.
- Market value of scrap steel.
- Shipment of empty containers and secondary waste back to FEMP.
- Secondary waste disposal at NTS.
- OSDF life-cycle cost (minus steel placement cost).

For the NPV calculation, the life-cycle cost for the 150 tons scenario was approximately **$159 million**, and for the 15,200 tons the NPV was approximately **$186 million**.

VII.5.b Total Undiscounted Cost

For the life-cycle estimate of total undiscounted cost for the vendor (offsite) MRF, the calculation described above was repeated using a discount rate of zero. The estimate for the 150 tons scenario was approximately **$191 million**, and for the 15,200 tons it was approximately **$222 million**.

The incremental cost for 150 tons is **$330,000**, and for 15,200 tons it is **$32 million**.

For the unit cost component of total undiscounted cost, the estimate for the 150 tons is approximately **$538 per bank cu.ft.**, and for the 15,200 tons scenario it is approximately **$535 per bank cu.ft.**

VII.5.c Schedule Impacts

For the 150 tons scenario, the time required to implement this alternative is **16 weeks**, resulting in a **neutral** impact to the 10-year Plan.

For the 15,200 tons scenario, assuming the same vendor production rate as for the Plant 7 steel recycling subcontract, the time to implement this alternative is **15 years**, with a corresponding impact to the 10-year Plan of an **additional 6 years**. (Significant decreases to the 15 year implementation time would likely result from more efficient vendor operations, as compared to the Plant 7 subcontract. Vendor MRF activities would be administered through subcontracts in which faster throughput requirements could be dictated. Also, Basic Ordering Agreements (BOAs) for vendor steel recycling services could be established through which steel from several OU3 facilities would be processed by multiple vendors simultaneously, thereby bringing the total time required to implement this alternative in line with the 6 year OU3 facilities demolition schedule. These measures could result in reductions to the 10-year Plan schedule similar to those discussed in Section VII.2.c.)

VII.5.d Local Economic Impacts

As discussed previously, the positive economic impacts of the recycling/reuse alternatives would be slight for the 150 tons scenario due to the small amount of material being considered. Therefore, the rating for this performance measure for the 150 tons scenario is 3.

The positive economic impacts of the 15,200 tons scenario would be more pronounced. However, the offsite vendor alternatives would result in the scrap steel entering markets far removed from the Fernald area (probably in Pennsylvania or Tennessee), as opposed to the onsite MRF alternative through which the scrap would enter the local market. Therefore, the impact on the local economy of offsite MRF processing for the 15,200 tons scenario is 2.

VII.5.e Institutional Preference

Due to the relatively small amount of steel in the 150 tons scenario, the positive institutional impact of this alternative is slight. Therefore, the rating for this performance measure is 3.

However, as discussed previously, the impact for the 15,200 tons scenario would be more pronounced. Since recycle/reuse alternatives are preferable to disposal alternatives in terms of meeting DOE and EPA policies and guidelines on waste minimization, recycling, and privatization, the rating for this performance measure for the 15,200 tons scenario is 4.

VII.5.f Local Social Preference

Due to the relatively small amount of steel in the 150 tons scenario, the positive social impact of this alternative is slight. Therefore, the rating for this performance measure is 3.

However, the positive social impact of the recycle/reuse alternatives would be more pronounced for the 15,200 tons scenario. The rating for this performance measure for the 15,200 tons scenario is 4.

VII.5.g Protectiveness of the Environment

Because of the relatively small amount of material for the 150 tons scenario, the positive environmental impacts of this alternative would be slight, resulting in a rating of 3.

However, as discussed in Section VII.1.g, the recycle/reuse alternatives are preferable to disposal alternatives because the environmental benefits of isolating contaminants through disposal are outweighed by the environmental detriments associated with virgin metal production. Therefore, the rating for this performance measure is 4.

VII.5.h Public Health Impacts

For the 150 tons scenario, the expected number of fatalities for the public is 9×10^{-6}.

For the 15,200 tons scenario, the expected number of fatalities for the public is 2×10^{-3}.

VII.5.i Worker Safety

For the 150 tons scenario, the expected number of fatalities for the work force is 5×10^{-5}.

For the 15,200 tons scenario, the expected number of fatalities for the work force is 5×10^{-3}.

VII.6 Analysis of Alternative 6: Melt of Metal and Box Fabrication (Recycle 2000)

VII.6.a Net Present Value

The life-cycle cost elements are as follows. (See attachment 6 for cost estimate details.)

- Container purchase and preparation for packaging.
- Container packaging and staging.
- Container shipment to the metal melt facility.
- Melt steel and fabricate containers.
- Transport fabricated boxes and secondary waste to FEMP.
- Secondary waste disposal at NTS.
- Value of the boxes produced.
- OSDF life-cycle cost (minus steel placement cost).

For the NPV estimate, the life-cycle cost for the 150 tons scenario is approximately **$159 million**, and for the 15,200 tons it is approximately **$189 million**.

VII.6.b Total Undiscounted Cost

For the life-cycle estimate of total undiscounted cost for the Recycle 2000 alternative, the calculation described above was repeated using a discount rate of zero. The estimate for 150 tons is approximately **$191 million**, and for 15,200 tons it is approximately **$225 million.**

The incremental cost for 150 tons is **$362,000**, and for 15,200 tons it is **$35 million.**

For the unit cost component of total undiscounted cost, the estimate for the 150 tons scenario is approximately **$590 per bank cu.ft.**, and for 15,200 tons it is approximately **$586 per bank cu.ft.**

VII.6.c Schedule Impacts

For the 150 tons scenario, the time required for implementation of this alternative is **5 weeks**, with a corresponding **neutral** impact to the 10-year Plan.

For the 15,200 tons scenario, the schedule impacts would be dependent upon the availability of steel per the OU3 facilities demolition schedule and would therefore be essentially the same as discussed in Section VII.2.c. The time required to implement this alternative is **6 years** with a corresponding **decrease to the 10-year Plan of 3 months.**

VII.6.d Local Economic Impacts

The impacts on the local economy for the relatively small 150 tons scenario would be minimal, resulting in a rating of **3**.

For the 15,200 tons scenario, the economic impacts would be more pronounced, although the positive impacts would not be felt in the local marketplace. Therefore, the rating for this performance measure for the 15,200 tons scenario is **2**.

VII.6.e Institutional Preference

The rating for this performance measure for the 150 tons scenario is **3** because of the relatively small amount of material being considered.

However, for the larger case of 15,200 tons, the positive institutional impact would be more pronounced. As discussed previously, recycle/reuse alternatives generally rate higher than disposal alternatives for this performance measure. This particular alternative has the added advantage of specifically supporting the DOE Recycle 2000 initiative, resulting in a rating of **5**.

VII.6.f Local Social Preference

Due to the relatively small volume of material in the 150 tons scenario, the rating is **3**.

As discussed previously, public stakeholders definitely favor the recycling/reuse alternatives to the disposal alternatives. This particular alternative is favored over the other recycle/reuse alternatives because the public is somewhat concerned about DOE's ability to ensure that all free-released materials are 100% "clean." Therefore, for the 15,200 tons scenario, the rating for this performance measure is **5**.

VII.6.g Protectiveness of the Environment

Because the amount of material in the 150 tons scenario is relatively small, the rating for this performance measure is 3.

However, as discussed previously, recycle/reuse alternatives outperform disposal alternatives in terms of environmental impact due to the pollution prevention benefits of avoided virgin steel production. Therefore, the rating for this performance measure for the 15,200 tons scenario is 4.

VII.6.h Public Health Impacts

The expected number of fatalities for the public for the 150 tons scenario is 9×10^{-5}.

For the 15,200 tons scenario, the expected number of fatalities for the public is 2×10^{-3}.

VII.6.i Worker Safety Impacts

For the 150 tons scenario, the expected number of fatalities for the work force is 3×10^{-5}.

For the 15,200 tons scenario, the expected number of fatalities for the work force is 2×10^{-3}.

VII.7 Analysis of Alternative 7: Vendor-operated FEMP MRF (Privatized FEMP MRF)

VII.7.a Net Present Value

Life-cycle cost elements are as follows. (See Attachment 7 for cost estimate details.)

- Load steel onto trailers and transport to on-site MRF.
- Decontaminate steel.
- Survey steel for free-release.
- Load clean steel onto trailers and move to RIMIA.
- Scrap value of clean steel.
- Secondary waste disposal at NTS.
- OSDF life-cycle cost (minus steel placement cost).

For the NPV estimate, the life-cycle cost to process steel through the privatized MRF for the 150 tons scenario is approximately **$159 million**, and for 15,200 tons it is approximately **$172 million**.

VII.7.b Total Undiscounted Cost

For the life-cycle estimate of total undiscounted cost, the calculation described above was repeated using a discount rate of zero. The estimate for 150 tons is approximately **$191 million**, and for the 15,200 tons scenario it is approximately **$206 million**.

The incremental cost for 150 tons is **$170,000**, and for 15,200 tons it is **$16 million.**

For the unit cost component of total undiscounted cost, the estimate for 150 tons is approximately **$276 per bank cu.ft.**, and for 15,200 tons it is approximately **$275 per bank cu.ft.**

VII.7.c Schedule Impacts

Implementation of the privatized onsite MRF alternative would have the same schedule impacts as the offsite vendor operated MRF (See Section VII.5.c).

For the 150 tons scenario, the time to implement this alternative is **16 weeks**, with a corresponding **neutral** impact to the 10-year Plan.

For the 15,200 tons scenario, the time to implement is **15 years**, with a corresponding impact to the 10-year Plan of an **additional 6 years**.

Again, as discussed in Section VII.5.c, the time to implement this alternative could be brought more in line with the 6-year OU3 demolition schedule through appropriate subcontract requirements.

VII.7.d Local Economic Impacts

The local economic impacts for this alternative are essentially the same as for alternative 4. The rating for this performance measure for the 150 tons scenario is **3**; and for the 15,200 tons scenario, the rating is **4**.

VII.7.e Institutional Preference

For the 150 tons scenario, the rating for this performance measure is **3** dut to the relatively small amount of material being considered.

For the 15,200 tons scenario, the impact is more pronounced. This alternative carries all the same institutional benefits of alternative 4, with the added benefit of supporting DOE's privatization initiative. Therefore, the rating for this performance measure for the 15,200 tons scenario is **5**.

VII.7.f Local Social Preference

The social impacts of this alternative are essentially the same as for alternative 4. The ratings for this performance measure are **3** for the 150 tons scenario, and **4** for the 15,200 tons scenario.

VII.7.g Protectiveness of the Environment

Again, since this alternative is essentially the same as alternative 4 in terms of environmental impacts, the ratings for this performance measure are **3** for the 150 tons scenario, and **4** for the 15,200 tons scenario.

VII.7.h Public Health Impacts

The expected number of fatalities for the public is 7×10^{-5} for the 150 tons scenario.

For the 15,200 tons scenario, the expected number of fatalities for the public is 2×10^{-3}.

VII.7.i Worker Safety Impacts

For the 150 tons scenario, the expected number of fatalities for the work force is 5×10^{-6}.

For the 15,200 tons scenario, the expected number of fatalities for the work force is 4×10^{-3}.

VIII. Summary

The information presented in this document and in the corresponding Disposition Summary Matrix tables is a compilation of the best data currently available and may be used as a tool to aid decision makers in arriving at an ultimate conclusion on the question of how best to disposition the structural steel from Plt. 4 and throughout the FEMP. This information comprises the analysis phase of the Fernald Metals Disposition Methodology as it applies to the cases of 150 tons of steel from Plt. 4 and 15,200 tons of steel from OU3.

However, as stated previously, the "Fernald Metals Disposition Methodology" was designed to be a "living" document which may be modified and revised as conditions change. Much of the information presented is based on best estimates rather than data generated from completed projects and activities. As the physical work of remediation projects is undertaken and "hard" data and better information become available, the Disposition Summary Matrix tables willd be updated to reflect changes which could significantly impact the comparison of alternatives. Additionally, as new technologies and approaches become available in the future, they will be evaluated and included in the Disposition Summary Matrix tables, as appropriate.

IX. Recommendations/Path Forward

The information presented in the Matrix tables, and the corresponding text, will be used as the focal point for a dialogue between DOE decision makers, FERMCO, the regulators, and stakeholder groups to discuss the issues surrounding disposition of scrap steel from OU3 remediation. In some cases, particularly for the qualitative performance measures, group discussions should facilitate the views of some participants being expressed more clearly. The Matrix will be updated to incorporate a better understanding of stakeholder preferences, DOE policies, or EPA requirements.

During the discussion of the results reported in the Matrix, it may become obvious that one or more alternatives are clearly inferior or unacceptable. These alternatives should be deleted from the Matrix and not be considered during the decision phase of the Methodology, as described below.

For the final decision phase, several standard, structured methods are available to analyze the tradeoffs between competing disposition alternatives. The most prominent methods available for this analysis include multiattribute value theory (MAVT), multiattribute utility theory (MAUT), and the analytical hierarchy approach (AHP), which are described in greater detail in Section 5 of the actual Methodology document. These methods are tools to be used by the decision makers to help rank and choose among alternatives, but are not intended to replace the decision makers.

Based on the quantity and quality of the information used to generate the Matrix tables for this particular application of the Methodology, MAVT appears to be the most suitable method for completing the decision phase. MAVT is probably the most widely used tool for analyzing multiattribute problems. MAVT includes the following operational steps:

- Evaluating each alternative separately for each performance measure (scaling).
- Assigning weights or ranking factors to each performance measure.
- Aggregating the performance measure weights and the scaling evaluations to obtain an overall measure of worth (additive or multiplicative value function).
- Conducting sensitivity analyses and making final recommendations.

TABLE A

Disposition Summary Matrix for the 150 Tons Scenario

TABLE A
Disposition Summary Matrix
150 Tons Scenario

ALTERNATIVES		1 OSDF	2 NTS	3 ENVIROCARE	4 FEMP MRF	5 VENDOR MRF	6 RECYCLE 2000	7 PRIVATIZED FEMP MRF
A. NET Present Value	LC	159M	159M	159M	159M	159M	159M	159M
B. Total Undiscounted Cost	LC	190 M	191 M	190 M	190 M	191 M	191 M	191 M
	Incre mental	$6000	$232, 000	$58,000	$82,000	$330,000	$362,000	$170,000
	Unit	$15/ bcf	$378 bcf	$94/bcf	$134/bcf	$538/bcf	$590/bcf	$276/bcf
C. Schedule Impacts	Total	< 1wk	2wks	2wks	10 wks	16 wks	5 wks	16 wks
	10 year plan	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
D. Local Economic Impacts		3	3	3	3	3	3	3
E. Institutional Preference		3	3	3	3	3	3	3
F. Local Social Preference		3	3	3	3	3	3	3

ALTERNATIVES	1 OSDF	2 NTS	3 ENVIROCARE	4 FEMP MRF	5 VENDOR MRF	6 RECYCLE 2000	7 PRIVATIZED FEMP MRF
G. Protectiveness of the Environment	3	3	3	3	3	3	3
H. Public Health Impacts (Fatalities)	$3X10^{-5}$	$7X10^{-4}$	$3X10^{-5}$	$7X10^{-5}$	$9X10^{-5}$	$9X10^{-5}$	$7X10^{-5}$
I. Worker Safety Impacts (Fatalities)	$3X10^{-5}$	$3X10^{-5}$	$3X10^{-5}$	$5X10^{-5}$	$5X10^{-5}$	$3X10^{-5}$	$5X10^{-5}$

TABLE B

Disposition Summary Matrix for the 15,200 Tons Scenario

TABLE B
Disposition Summary Matrix
15,200 Tons Scenario

ALTERNATIVES		1 OSDF	2 NTS	3 ENVIROCARE	4 FEMP MRF	5 VENDOR MRF	6 RECYCLE 2000	7 PRIVATIZED FEMP MRF
A. NET Present Value	LC	159M	177M	161M	164M	186M	189M	172M
B. Total Undiscounted Cost	LC	190 M	212 M	193M	197 M	222 M	225 M	206 M
	Incre mental	$600, 000	22M	3M	7M	32M	35M	16M
	Unit	$15/ bcf	$368 bcf	$65/bcf	$132/bcf	$535/bcf	$586/bcf	$275/bcf
C. Schedule Impacts	Total	1wk	6yrs (availa bility)	6yrs (availability)	21 yrs	15 yrs	6yrs (based on availabilty)	15 yrs
	10 year plan	Neutral	-3mos	-3mos	+ 12 yrs	+ 6 yrs	-3mos	+ 6 yrs
D. Local Economic Impacts		2	2	2	4	2	2	4
E. Institutional Preferences		2	2	2	4	4	5	5
F. Local Social Preference		1	2	2	4	4	5	4

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ALTERNATIVES	1 OSDF	2 NTS	3 ENVIROCARE	4 FEMP MRF	5 VENDOR MRF	6 RECYCLE 2000	7 PRIVATIZED FEMP MRF
G. Protectiveness of the Environment	2	2	2	4	4	4	4
H. Public Health Impacts (Fatalities)	$1X10^{-4}$	$6X10^{-2}$	$2X10^{-4}$	$2X10^{-3}$	$2X10^{-3}$	$2X10^{-3}$	$2X10^{-3}$
I. Worker Safety Impacts (Fatalities)	$3X10^{-3}$	$3X10^{-3}$	$3X10^{-3}$	$4X10^{-3}$	$5X10^{-3}$	$2X10^{-3}$	$4X10^{-3}$

ATTACHMENT 1

Cost Estimate Details for Alternative 1:
Placement in On-Site Disposal Facility (OSDF)

Alternative 1 - On-site Disposal Cell

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,188,285	$2,521,527	$13,709,812	1998	$0	$1,671,443	$1,671,443	2021
$10,052,014	$2,737,326	$12,789,340	1999	$0	$1,671,443	$1,671,443	2022
$13,007,338	$2,603,940	$15,611,278	2000	$0	$1,671,443	$1,671,443	2023
$9,439,876	$2,657,101	$12,096,977	2001	$0	$1,671,443	$1,671,443	2024
$17,857,591	$2,707,244	$20,564,835	2002	$0	$1,671,443	$1,671,443	2025
$14,736,874	$2,707,244	$17,444,119	2003	$0	$1,671,443	$1,671,443	2026
$17,350,449	$2,715,601	$20,066,050	2004	$0	$1,671,443	$1,671,443	2027
$9,199,228	$1,999,221	$11,198,450	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$117,415,660	$72,965,012	$190,380,672	TOTAL

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Alternative 1 - On-site Disposal Cell

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,188,285	$2,521,527	$13,709,812	1998	$0	$1,671,443	$1,671,443	2021
$10,052,014	$2,737,326	$12,789,340	1999	$0	$1,671,443	$1,671,443	2022
$13,007,338	$2,603,940	$15,611,278	2000	$0	$1,671,443	$1,671,443	2023
$9,439,876	$2,657,101	$12,096,977	2001	$0	$1,671,443	$1,671,443	2024
$17,857,591	$2,707,244	$20,564,835	2002	$0	$1,671,443	$1,671,443	2025
$14,736,874	$2,707,244	$17,444,119	2003	$0	$1,671,443	$1,671,443	2026
$17,350,449	$2,715,601	$20,066,050	2004	$0	$1,671,443	$1,671,443	2027
$9,199,228	$1,999,221	$11,198,450	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$101,288,973	$57,707,145	$158,996,119	NPV

Alternative 1 - On-site Disposal Cell

$190,380,672

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	CONSTRUCTION DURATION YEARS											
				FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2035
		DISPOSAL FACIULITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,826,902	$1,960,203	$2,083,238	$2,499,973	$2,236,508	$2,236,508	$2,235,508	$2,235,508	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,672	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,698	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$82,374,000	-	-	-	$8,326,879	$6,633,694	$10,899,499	$8,816,900	$16,622,083	$12,501,366	$16,080,064	$6,594,613	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$63,666	$731,043	$18,164	$90,819	-	-	$28,209	$298,636	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$591,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266					-	-			
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-		$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,766,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$60,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$167,353,689	$0	$0	$14,918,851	$13,709,812	$12,591,119	$15,413,057	$11,898,756	$20,366,616	$17,246,898	$19,867,830	$11,198,450	$60,143,303

16,200 TONS	LOAD AND HAUL STEEL FROM CONSTR SITE TO OSDF	$1,189,324	-	-	-	-	$198,221	$198,221	$198,221	$198,221	$198,221	$198,221	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,596
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,666,062

ATTACHMENT 2

Cost Estimate Details for Alternative 2:
Off-Site Disposal at Nevada Test Site (NTS)

Alternative 2A - Nevada Test Site Disposal

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,773,969	$12,825,389	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,640,583	$15,646,930	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,693,745	$12,133,000	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,743,888	$20,600,057	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,743,888	$17,479,624	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,752,245	$20,101,321	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$117,408,160	$73,184,875	$190,593,035	TOTAL

Alternative 2A - Nevada Test Site Disposal

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,773,969	$12,825,389	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,640,583	$15,646,930	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,693,745	$12,133,000	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,743,888	$20,600,057	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,743,888	$17,479,624	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,752,245	$20,101,321	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$101,282,637	$57,894,257	$159,176,894	NPV

Alternative 2A - Nevada Test Site Disposal

$190,593,035

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	CONSTRUCTION DURATION YEARS											
				FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2205
		DISPOSAL FACIILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,825,902	$1,960,203	$2,083,238	$2,499,973	$2,235,508	$2,235,508	$2,235,508	$2,235,508	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,572	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,698	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$82,366,500		-	-	$8,325,121	$6,632,999	$10,698,507	$6,816,280	$15,620,660	$12,500,228	$15,078,691	$6,694,013	
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$63,656	$731,043	$18,164	$90,819	-	-	$28,209	$298,536	
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$691,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266					-	-			
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-		$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,766,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$60,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$187,346,189	$0	$0	$14,918,861	$13,709,064	$12,690,624	$16,412,066	$11,898,136	$20,365,192	$17,244,760	$19,866,457	$11,197,849	$60,143,303

160 TONS	PREP, PACKAGE, STAGE, & SHIP STEEL TO NTS	$231,600	-	-	-	-	$38,600	$38,600	$38,600	$38,600	$38,600	$38,600	-	-
16,050 TONS	LOAD AND HAUL STEEL FROM CONSTR SITE TO OSDF	$1,177,688	-	-	-	-	$196,265	$196,265	$196,265	$196,265	$196,265	$196,265	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,696
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,658,062

Alternative 2B - Nevada Test Site Disposal

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$6,373,922	$16,379,837	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$6,240,536	$19,170,972	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$6,293,697	$15,685,475	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$6,343,840	$24,091,208	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$6,343,840	$20,992,510	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$6,352,197	$23,596,247	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$116,834,460	$94,784,587	$211,619,048	TOTAL

Alternative 2B - Nevada Test Site Disposal

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$6,373,922	$16,379,837	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$6,240,536	$19,170,972	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$6,293,697	$15,685,475	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$6,343,840	$24,091,208	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$6,343,840	$20,992,510	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$6,352,197	$23,596,247	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$100,797,916	$76,276,413	$177,074,329	NPV

Alternative 2B - Nevada Test Site Disposal

$211,619,048

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2205
				CONSTRUCTION DURATION YEARS											
		DISPOSAL FACILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,692,832	-	-	$1,692,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,826,902	$1,960,203	$2,083,238	$2,499,973	$2,235,508	$2,235,508	$2,235,508	$2,235,508	-
	2CCR4	ROAD TITLE III DESIGN	$229,687	-	-	$229,687	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,672	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$152,722	-	-	$152,722	-	-	-	-	-	-	-	-	-
	2CUP8	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,698	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,667,919	-	-	$7,667,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$81,792,800	-	-	-	$8,267,135	$6,487,496	$10,822,697	$6,768,803	$16,611,859	$12,413,161	$14,973,665	$6,548,084	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$53,656	$731,043	$18,164	$90,819	-	-	$28,209	$298,535	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,529,700	-	-	-	$938,349	$591,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266	-	-	-	-	-	-	-	-	-
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-	-	$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,680	-	-	$92,680	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$88,766,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$50,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$186,772,489	$0	$0	$14,918,861	$13,681,068	$12,646,020	$16,336,166	$11,850,658	$20,266,391	$17,167,693	$19,761,431	$11,161,920	$50,143,303

16,200 TONS	PREP, PACKAGE, STAGE, & SHIP STEEL TO NTS	$23,008,900	-	-	-	-	$3,834,817	$3,834,817	$3,834,817	$3,834,817	$3,834,817	$3,834,817	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,696
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,668,062

ATTACHMENT 3

Cost Estimate Details for Alternative 3:
Off-Site Commercial Disposal Facility (Envirocare)

Alternative 3A - Envirocare Disposal

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,744,986	$12,796,405	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,611,600	$15,617,946	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,664,761	$12,104,017	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,714,905	$20,571,074	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,714,905	$17,450,641	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,723,262	$20,072,338	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$117,408,160	$73,010,975	$190,419,135	TOTAL

Alternative 3A - Envirocare Disposal

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,744,986	$12,796,405	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,611,600	$15,617,946	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,664,761	$12,104,017	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,714,905	$20,571,074	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,714,905	$17,450,641	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,723,262	$20,072,338	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$101,282,637	$57,746,261	$159,028,898	NPV

Alternative 3A - Envirocare Disposal

$190,419,135

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2205
				CONSTRUCTION DURATION YEARS											
		DISPOSAL FACILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,826,902	$1,960,203	$2,083,238	$2,499,973	$2,235,608	$2,235,608	$2,235,608	$2,235,608	-
	2CCR4	ROAD TITLE III DESIGN	$229,687	-	-	$229,687	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,572	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP5	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,698	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$82,366,600	-	-	-	$8,326,121	$6,532,999	$10,898,507	$6,816,280	$15,620,660	$12,600,228	$15,078,691	$6,594,013	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$53,556	$731,043	$18,164	$90,819	-	-	$28,209	$298,535	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$691,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266	-	-	-	-	-	-	-	-	-
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,037,296	-	-	-	$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,680	-	-	$92,680	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,766,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$50,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$187,346,189	$0	$0	$14,918,851	$13,709,054	$12,590,524	$16,412,065	$11,898,136	$20,366,192	$17,244,760	$19,866,457	$11,197,849	$50,143,303

150 TONS	PREP, PACKAGE, STAGE, & SHIP STEEL TO ENVIROCARE	$67,700	-	-	-	-	$9,617	$9,617	$9,617	$9,617	$9,617	$9,617	-	-
15,050 TONS	LOAD AND HAUL STEEL FROM CONSTR SITE TO OSDF	$1,177,588	-	-	-	-	$196,265	$196,265	$196,265	$196,265	$196,265	$196,265	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,696
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,665,062

Alternative 3B - Envirocare Disposal

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$3,216,605	$13,222,520	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$3,083,219	$16,013,655	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$3,136,380	$12,528,158	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$3,186,524	$20,933,891	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$3,186,524	$17,835,193	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$3,194,881	$20,438,931	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$116,834,460	$75,840,687	$192,675,148	TOTAL

080000

Alternative 3B - Envirocare Disposal

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$3,216,605	$13,222,520	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$3,083,219	$16,013,655	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$3,136,380	$12,528,158	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$3,186,524	$20,933,891	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$3,186,524	$17,835,193	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$3,194,881	$20,438,931	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$100,797,916	$60,154,452	$160,952,367	NPV

Alternative 3B - Envirocare Disposal

$192,675,148

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	CONSTRUCTION DURATION YEARS											
				FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006 - FY2205
		DISPOSAL FACIILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,825,902	$1,960,203	$2,083,238	$2,499,973	$2,235,608	$2,235,608	$2,235,608	$2,235,608	-
	2CCR4	ROAD TITLE III DESIGN	$229,687	-	-	$229,687	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,868	$70,672	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$152,722	-	-	$152,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,598	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$81,792,800	-	-	-	$8,267,135	$6,487,496	$10,822,597	$6,768,803	$16,611,859	$12,413,161	$14,973,665	$6,548,084	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$53,656	$731,043	$18,164	$90,819	-	-	$28,209	$298,535	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,529,700	-	-	-	$938,349	$591,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266					-	-			-
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-		$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,765,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$50,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$188,772,489	$0	$0	$14,918,851	$13,651,068	$12,646,020	$16,336,156	$11,850,658	$20,256,391	$17,167,693	$19,761,431	$11,151,920	$50,143,303

16,200 TONS	PREP, PACKAGE, STAGE, & SHIP STEEL TO ENVIROCARE	$4,065,000	-	-	-	-	$677,500	$677,500	$677,500	$677,500	$677,500	$677,500	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,596
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,555,062

ATTACHMENT 4

Cost Estimate Details for Alternative 4:
On-Site Unrestricted Release (FEMP MRF)

473

000083

Alternative 4A - FEMP Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,749,053	$12,800,472	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,615,667	$15,622,013	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,668,828	$12,108,083	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,718,972	$20,575,140	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,718,972	$17,454,708	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,727,328	$20,076,404	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$117,408,160	$73,035,375	$190,443,535	TOTAL

480000

Alternative 4A - FEMP Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,749,053	$12,800,472	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,615,667	$15,622,013	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,668,828	$12,108,083	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,718,972	$20,575,140	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,718,972	$17,454,708	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,727,328	$20,076,404	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$101,282,637	$57,767,027	$159,049,663	NPV

Alternative 4A - FEMP Material Release Facility

$190,443,535

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	CONSTRUCTION DURATION YEARS FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2205
		DISPOSAL FACILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,826,902	$1,960,203	$2,083,238	$2,499,973	$2,235,508	$2,235,508	$2,235,508	$2,235,508	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$8,437	$32,183	-	-	$6,668	$70,572	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$152,722	-	-	$152,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,598	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$62,366,600	-	-	-	$6,325,121	$6,532,999	$10,898,507	$6,816,280	$15,620,660	$12,600,228	$15,078,691	$6,594,013	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$53,556	$731,043	$18,164	$90,819	-	-	$28,209	$298,535	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$591,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266	-	-	-	-	-	-	-	-	-
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-	-	$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,766,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$50,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$187,346,189	$0	$0	$14,918,861	$13,709,064	$12,590,524	$16,412,066	$11,898,135	$20,365,192	$17,244,760	$19,866,457	$11,197,849	$50,143,303

160 TONS	HAUL, DECONTAMINATE & RELEASE, & SECONDARY WASTE DISPOSAL AT NTS	$82,100	-	-	-	-	$13,683	$13,683	$13,683	$13,683	$13,683	$13,683	-	-
15,050 TONS	LOAD AND HAUL STEEL FROM CONSTR SITE TO OSDF	$1,177,588	-	-	-	-	$196,265	$196,265	$196,265	$196,265	$196,265	$196,265	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,596
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,655,062

Alternative 4B - FEMP Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$3,909,888	$13,915,804	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$3,776,502	$16,706,938	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$3,829,663	$13,221,442	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$3,879,807	$21,627,174	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$3,879,807	$18,528,477	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$3,888,164	$21,132,214	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$116,834,460	$80,000,387	$196,834,848	TOTAL

Alternative 4B - FEMP Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$3,909,888	$13,915,804	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$3,776,502	$16,706,938	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$3,829,663	$13,221,442	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$3,879,807	$21,627,174	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$3,879,807	$18,528,477	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$3,888,164	$21,132,214	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$100,797,916	$63,694,511	$164,492,426	NPV

Alternative 4B - FEMP Material Release Facility

$196,834,848

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2205
				CONSTRUCTION DURATION YEARS											
		DISPOSAL FACILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,826,902	$1,960,203	$2,083,238	$2,499,973	$2,235,508	$2,235,508	$2,235,508	$2,235,508	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,672	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,698	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$81,792,800	-	-	-	$6,267,135	$6,487,496	$10,822,597	$6,768,803	$16,611,859	$12,413,161	$14,973,666	$6,648,084	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$53,656	$731,043	$18,164	$90,819	-	-	$28,209	$298,636	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$691,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266	-	-	-	-	-	-	-	-	-
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-	-	$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,765,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$50,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$186,772,489	$0	$0	$14,918,851	$13,661,068	$12,646,020	$15,336,156	$11,850,658	$20,266,391	$17,167,693	$19,761,431	$11,151,920	$50,143,303
15,200 TONS		HAUL, DECONTAMINATE & RELEASE, & SECONDARY WASTE DISPOSAL AT NTS	$8,224,700	-	-	-	-	$1,370,783	$1,370,783	$1,370,783	$1,370,783	$1,370,783	$1,370,783	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,696
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,655,062

ATTACHMENT 5

Cost Estimate Details for Alternative 5:
Vendor Decontamination and Free-release (Vendor MRF)

Alternative 5A - Vendor Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,790,369	$12,841,789	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,656,983	$15,663,330	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,710,145	$12,149,400	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,760,288	$20,616,457	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,760,288	$17,496,024	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,768,645	$20,117,721	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$117,408,160	$73,283,275	$190,691,435	TOTAL

Alternative 5A - Vendor Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,790,369	$12,841,789	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,656,983	$15,663,330	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,710,145	$12,149,400	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,760,288	$20,616,457	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,760,288	$17,496,024	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,768,645	$20,117,721	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$101,282,637	$57,977,999	$159,260,636	NPV

Alternative 5A - Vendor Material Release Facility

$190,691,435

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2205
				CONSTRUCTION DURATION YEARS											
		DISPOSAL FACILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,825,902	$1,960,203	$2,083,238	$2,499,973	$2,235,508	$2,235,508	$2,235,508	$2,235,508	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,572	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,698	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$82,366,500	-	-	-	$6,325,121	$6,532,999	$10,698,507	$6,816,280	$15,620,660	$12,600,228	$15,078,691	$6,694,013	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$53,656	$731,043	$18,164	$90,819	-	-	$28,209	$298,636	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$591,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266					-	-			
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-		$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,766,687	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$60,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$187,346,189	$0	$0	$14,918,851	$13,709,064	$12,590,524	$15,412,065	$11,898,135	$20,365,192	$17,244,760	$19,866,457	$11,197,849	$60,143,303

150 TONS	HAUL, DECONTAMINATE & RELEASE, & SECONDARY WASTE DISPOSAL AT NTS	$330,000	-	-	-	-	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000	-	-
15,050 TONS	LOAD AND HAUL STEEL FROM CONSTR SITE TO OSDF	$1,177,588	-	-	-	-	$196,265	$196,265	$196,265	$196,265	$196,265	$196,265	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,596
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,665,062

Alternative 5B - Vendor Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$8,111,938	$18,117,854	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$7,978,552	$20,908,988	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$8,031,713	$17,423,492	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$8,081,857	$25,829,224	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$8,081,857	$22,730,527	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$8,090,214	$25,334,264	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$116,834,460	$105,212,687	$222,047,148	TOTAL

Alternative 5B - Vendor Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$8,111,938	$18,117,854	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$7,978,552	$20,908,988	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$8,031,713	$17,423,492	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$8,081,857	$25,829,224	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$8,081,857	$22,730,527	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$8,090,214	$25,334,264	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$100,797,916	$85,151,113	$185,949,029	NPV

000094

Alternative 5B - Vendor Material Release Facility

$222,047,148

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2205
				CONSTRUCTION DURATION YEARS											
		DISPOSAL FACILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,826,902	$1,960,203	$2,083,238	$2,499,973	$2,235,508	$2,235,508	$2,235,508	$2,235,508	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,672	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,698	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$81,792,800	-	-	-	$8,267,135	$6,487,496	$10,822,697	$8,768,803	$16,511,859	$12,413,161	$14,973,665	$6,648,084	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$53,556	$731,043	$18,164	$90,819	-	-	$28,209	$298,636	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$591,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266	-	-	-	-	-	-	-	-	-
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-	-	$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,765,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$50,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$186,772,489	$0	$0	$14,918,851	$13,651,068	$12,645,020	$16,336,155	$11,850,658	$20,256,391	$17,167,693	$19,761,431	$11,161,820	$50,143,303
16,200 TONS		HAUL, DECONTAMINATE & RELEASE, & SECONDARY WASTE DISPOSAL AT NTS	$33,437,000	-	-	-	-	$5,572,833	$5,572,833	$5,572,833	$5,572,833	$5,572,833	$5,572,833	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,696
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,666,062

ATTACHMENT 6

Cost Estimate Details for Alternative 6:
Melt of Metal and Box Fabrication (Recycle 2000)

Alternative 6A - Recycle 2000

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,795,736	$12,847,155	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,662,350	$15,668,696	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,715,511	$12,154,767	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,765,655	$20,621,824	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,765,655	$17,501,391	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,774,012	$20,123,088	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$117,408,160	$73,315,475	$190,723,635	TOTAL

Alternative 6A - Recycle 2000

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,795,736	$12,847,155	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,662,350	$15,668,696	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,715,511	$12,154,767	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,765,655	$20,621,824	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,765,655	$17,501,391	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,774,012	$20,123,088	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$101,282,637	$58,005,402	$159,288,039	NPV

Alternative 6A - Recycle 2000

$190,723,635

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2205
				CONSTRUCTION DURATION YEARS											
		DISPOSAL FACIILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,826,902	$1,960,203	$2,083,238	$2,499,973	$2,235,508	$2,235,508	$2,235,508	$2,235,508	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,672	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,698	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$82,366,500	-	-	-	$8,325,121	$6,632,999	$10,898,507	$6,816,280	$16,620,660	$12,600,228	$15,078,691	$6,594,013	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$53,666	$731,043	$18,164	$90,819	-	-	$28,209	$298,636	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$691,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266	-	-	-	-	-	-	-	-	-
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,298	-	-	-	$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$88,766,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$60,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$187,346,189	$0	$0	$14,918,861	$13,709,064	$12,690,624	$16,412,065	$11,898,136	$20,365,192	$17,244,760	$19,866,457	$11,197,849	$60,143,303

150 TONS	HAUL, MELT, CAST, ROLL, & FAB BOXES. SEND 2NDARY WASTES NTS VIA FE	$362,200	-	-	-	-	$60,367	$60,367	$60,367	$60,367	$60,367	$60,367	$60,367	-	-
16,050 TONS	LOAD AND HAUL STEEL FROM CONSTR SITE TO OSDF	$1,177,588	-	-	-	-	$196,265	$196,265	$196,265	$196,265	$196,265	$196,265	$196,265	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,596
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,655,062

Alternative 6B - Recycle 2000

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$8,642,605	$18,648,520	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$8,509,219	$21,439,655	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$8,562,380	$17,954,158	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$8,612,524	$26,359,891	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$8,612,524	$23,261,193	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$8,620,881	$25,864,931	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$116,834,460	$108,396,687	$225,231,148	TOTAL

Alternative 6B - Recycle 2000

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$8,642,605	$18,648,520	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$8,509,219	$21,439,655	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$8,562,380	$17,954,158	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$8,612,524	$26,359,891	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$8,612,524	$23,261,193	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$8,620,881	$25,864,931	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$100,797,916	$87,860,815	$188,658,731	NPV

Alternative 6B - Recycle 2000

$225,231,148

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2205
				CONSTRUCTION DURATION YEARS											
		DISPOSAL FACILITY													
1.1.1.1.2.3.6	2CC08	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,825,902	$1,960,203	$2,083,238	$2,499,973	$2,235,608	$2,235,608	$2,235,608	$2,235,608	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,672	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,698	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$81,792,800	-	-	-	$8,267,135	$6,487,496	$10,822,597	$6,768,803	$15,511,869	$12,413,161	$14,973,665	$6,548,084	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$63,566	$731,043	$18,164	$90,819	-	-	$28,209	$298,535	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,529,700	-	-	-	$938,349	$591,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266					-	-			-
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-		$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,766,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$60,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$186,772,489	$0	$0	$14,918,851	$13,661,068	$12,546,020	$16,336,166	$11,850,658	$20,266,391	$17,167,693	$19,761,431	$11,161,920	$60,143,303

16,200 TONS	HAUL, MELT, CAST, ROLL, & FAB BOXES. SEND 2NDARY WASTES NTS VIA FE	$36,621,000	-	-	-	-	$6,103,500	$6,103,500	$6,103,500	$6,103,500	$6,103,500	$6,103,500	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,596
2041-2205	OSDF POST MONITORING & MAINTENANCE	$1,655,062

ATTACHMENT 7

Cost Estimate Details for Alternative 7:
Vendor-operated FEMP MRF (Privatized FEMP MRF)

Alternative 7A - Privatized FEMP Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,763,636	$12,815,055	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,630,250	$15,636,596	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,683,411	$12,122,667	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,733,555	$20,589,724	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,733,555	$17,469,291	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,741,912	$20,090,988	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$117,408,160	$73,122,875	$190,531,035	TOTAL

Alternative 7A - Privatized FEMP Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,187,527	$2,521,527	$13,709,054	1998	$0	$1,671,443	$1,671,443	2021
$10,051,419	$2,763,636	$12,815,055	1999	$0	$1,671,443	$1,671,443	2022
$13,006,346	$2,630,250	$15,636,596	2000	$0	$1,671,443	$1,671,443	2023
$9,439,255	$2,683,411	$12,122,667	2001	$0	$1,671,443	$1,671,443	2024
$17,856,168	$2,733,555	$20,589,724	2002	$0	$1,671,443	$1,671,443	2025
$14,735,736	$2,733,555	$17,469,291	2003	$0	$1,671,443	$1,671,443	2026
$17,349,076	$2,741,912	$20,090,988	2004	$0	$1,671,443	$1,671,443	2027
$9,198,628	$1,999,221	$11,197,849	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$101,282,637	$57,841,493	$159,124,129	NPV

Alternative 7A - Privatized FEMP Material Release Facility

$190,531,035

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	CONSTRUCTION DURATION YEARS FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2206
		DISPOSAL FACILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,692,832	-	-	$1,692,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,826,902	$1,960,203	$2,083,238	$2,499,973	$2,236,608	$2,236,608	$2,236,608	$2,236,608	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,833	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,668	$70,572	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,448	-	-	-	$44,598	$29,850	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,567,919	-	-	$7,567,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$82,366,600	-	-	-	$8,325,121	$6,532,999	$10,898,607	$6,816,280	$15,620,660	$12,600,228	$16,078,691	$6,594,013	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$63,566	$731,043	$18,164	$90,819	-	-	$28,209	$288,535	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$591,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266					-	-			
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-		$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,766,667	-	-	-	$2,089,315	$2,089,315	$2,089,315	$2,131,102	$2,181,244	$2,181,244	$2,189,603	$1,671,443	$50,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$187,346,189	$0	$0	$14,918,851	$13,709,064	$12,590,524	$15,412,066	$11,898,135	$20,366,192	$17,244,760	$19,666,457	$11,197,849	$50,143,303

150 TONS	HAUL, DECONTAMINATE & RELEASE, & SECONDARY WASTE DIPOSAL AT NTS	$169,600	-	-	-	-	$28,267	$28,267	$28,267	$28,267	$28,267	$28,267	-	-
16,050 TONS	LOAD AND HAUL STEEL FROM CONSTR SITE TO OSDF	$1,177,588	-	-	-	-	$196,265	$196,265	$196,265	$196,265	$196,265	$196,265	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,596
2041-2206	OSDF POST MONITORING & MAINTENANCE	$1,655,062

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Alternative 7B - Privatized FEMP Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$5,403,305	$15,409,220	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$5,269,919	$18,200,355	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$5,323,080	$14,714,858	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$5,373,224	$23,120,591	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$5,373,224	$20,021,893	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$5,381,581	$22,625,631	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$1,655,062	$1,655,062	2041-2205
				$116,834,460	$88,960,887	$205,795,348	TOTAL

Alternative 7B - Privatized FEMP Material Release Facility

Life-Cycle Cost Analysis

Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year	Construction Cost	O&M Cost	Annual Cash Flow	Cash Flow Year
$0	$0	$0	1996	$0	$1,671,443	$1,671,443	2019
$14,584,004	$334,846	$14,918,851	1997	$0	$1,671,443	$1,671,443	2020
$11,129,541	$2,521,527	$13,651,068	1998	$0	$1,671,443	$1,671,443	2021
$10,005,915	$5,403,305	$15,409,220	1999	$0	$1,671,443	$1,671,443	2022
$12,930,436	$5,269,919	$18,200,355	2000	$0	$1,671,443	$1,671,443	2023
$9,391,778	$5,323,080	$14,714,858	2001	$0	$1,671,443	$1,671,443	2024
$17,747,367	$5,373,224	$23,120,591	2002	$0	$1,671,443	$1,671,443	2025
$14,648,669	$5,373,224	$20,021,893	2003	$0	$1,671,443	$1,671,443	2026
$17,244,050	$5,381,581	$22,625,631	2004	$0	$1,671,443	$1,671,443	2027
$9,152,699	$1,999,221	$11,151,920	2005	$0	$1,671,443	$1,671,443	2028
$0	$1,671,443	$1,671,443	2006	$0	$1,671,443	$1,671,443	2029
$0	$1,671,443	$1,671,443	2007	$0	$1,671,443	$1,671,443	2030
$0	$1,671,443	$1,671,443	2008	$0	$1,671,443	$1,671,443	2031
$0	$1,671,443	$1,671,443	2009	$0	$1,671,443	$1,671,443	2032
$0	$1,671,443	$1,671,443	2010	$0	$1,671,443	$1,671,443	2033
$0	$1,671,443	$1,671,443	2011	$0	$1,671,443	$1,671,443	2034
$0	$1,671,443	$1,671,443	2012	$0	$1,671,443	$1,671,443	2035
$0	$1,671,443	$1,671,443	2013	$0	$36,519	$36,519	2036
$0	$1,671,443	$1,671,443	2014	$0	$36,519	$36,519	2037
$0	$1,671,443	$1,671,443	2015	$0	$36,519	$36,519	2038
$0	$1,671,443	$1,671,443	2016	$0	$36,519	$36,519	2039
$0	$1,671,443	$1,671,443	2017	$0	$36,519	$36,519	2040
$0	$1,671,443	$1,671,443	2018	$0	$55,168,740	$55,168,740	2041-2205
				$100,797,916	$71,320,228	$172,118,144	NPV

Alternative 7B - Privatized FEMP Material Release Facility

$205,795,349

WBS NO.	COST A/C	DESC.	TOTAL BUDGET	FY95	FY96	1 FY97	2 FY98	3 FY99	4 FY2000	5 FY2001	6 FY2002	7 FY2003	8 FY2004	9 FY2005	10 FY2006-FY2285
				CONSTRUCTION DURATION YEARS											
		DISPOSAL FACILITY													
1.1.1.1.2.3.6	2CCD8	OSDF TITLE III DESIGN	$1,592,832	-	-	$1,592,832	-	-	-	-	-	-	-	-	-
	2CD00	OSDF TITLE III DESIGN SERVICES	$17,311,349	-	-	-	$1,826,902	$1,960,203	$2,083,238	$2,499,973	$2,236,508	$2,236,508	$2,236,508	$2,236,508	-
	2CCR4	ROAD TITLE III DESIGN	$229,587	-	-	$229,587	-	-	-	-	-	-	-	-	-
	2CC00	ROAD TITLE III DESIGN SERVICES	$321,033	-	-	-	-	$205,973	$6,437	$32,183	-	-	$6,868	$70,572	-
	2CSE6	ENG STUDIES OSDF BARRIER	$13,142	-	-	$13,142	-	-	-	-	-	-	-	-	-
	2CUP1	UTILITIES INTERFACE DESIGN - PHASE I	$128,899	-	-	$128,899	-	-	-	-	-	-	-	-	-
	2CUP2	UTILITIES INTERFACE DESIGN - PHASE II	$162,722	-	-	$162,722	-	-	-	-	-	-	-	-	-
	2CUP6	UTILITIES INTERFACE TITLE III - PHASE I	$84,977	-	-	$84,977	-	-	-	-	-	-	-	-	-
1.1.1.1.2.3.7	2CU00	UTILITIES INTERFACE DESIGN	$74,449	-	-	-	$44,669	$29,860	-	-	-	-	-	-	-
	2CC11	OSDF CONSTR. & RAD/SAFETY MGMT.	$7,667,919	-	-	$7,667,919	-	-	-	-	-	-	-	-	-
	2CD01	OSDF CONSTRUCTION	$81,792,800	-	-	-	$8,267,136	$8,487,496	$10,822,597	$6,768,803	$16,511,869	$12,413,161	$14,973,666	$6,648,084	-
	2CR11	HAUL ROAD CONSTR & PROJ MGMT	$1,804,047	-	-	$1,804,047	-	-	-	-	-	-	-	-	-
	2CR12	NORTH ENTRANCE ROAD CONSTR & PROJ MGMT	$778,833	-	-	$778,833	-	-	-	-	-	-	-	-	-
	2CR00	ROAD CONSTRUCTION PHASE II	$1,220,327	-	-	-	$53,658	$731,043	$19,164	$90,819	-	-	$28,209	$298,636	-
	2CUC1	UTILITIES INTERFACE CONSTRUCTION	$2,023,421	-	-	$2,023,421	-	-	-	-	-	-	-	-	-
	2CUO1	UTILITIES INTERFACE CONSTRUCTION PHASE II	$1,629,700	-	-	-	$938,349	$591,351	-	-	-	-	-	-	-
1.1.1.1.2.4	2DSU1	ROAD/STORMWATER MAINTENANCE	$242,266	-	-	$242,266	-	-	-	-	-	-	-	-	-
	2DS00	ROAD/STORMWATER MAINTENANCE	$2,837,296	-	-	-	$432,212	$449,790	$316,404	$327,778	$327,778	$327,778	$327,778	$327,778	-
1.1.1.1.2.6.1	2FP11	OSDF MONITORING & COMPLIANCE	$118,701	-	-	$118,701	-	-	-	-	-	-	-	-	-
	2FP12	SAMPLING & TESTING	$88,924	-	-	$88,924	-	-	-	-	-	-	-	-	-
	2FP13	BASELINE G.WTR. MON.	$92,580	-	-	$92,580	-	-	-	-	-	-	-	-	-
	2FP00	OSDF POST MONITORING & MAINTENANCE	$66,765,887	-	-	-	$2,089,316	$2,089,316	$2,089,316	$2,131,102	$2,181,246	$2,181,246	$2,189,603	$1,671,443	$50,143,303
		TOTAL LCC OSDF - 1996 CONSTANT DOLLARS By FY	$186,772,489	$0	$0	$14,918,861	$13,681,068	$12,648,020	$15,336,166	$11,650,658	$20,266,391	$17,167,693	$19,761,431	$11,161,920	$50,143,303
16,200 TONS		HAUL, DECONTAMINATE & RELEASE, & SECONDARY WASTE DIPOSAL AT NTS	$17,186,200	-	-	-	-	$2,864,200	$2,864,200	$2,864,200	$2,864,200	$2,864,200	$2,864,200	-	-

2036-2040	OSDF POST MONITORING & MAINTENANCE	$182,596
2041-2206	OSDF POST MONITORING & MAINTENANCE	$1,655,062

Decision Methodology for Fernald Scrap Metal Disposition Alternatives

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May 1994

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EXECUTIVE SUMMARY

This document outlines a methodology that has been developed to help a decision maker or makers to compare and select among competing proposals for the disposition of radioactive scrap metal at the Fernald Environmental Management Project. The methodology developed takes into consideration both quantitative and qualitative factors in three categories: direct costs and benefits; socio-economic issues; and environmental, safety, and health impacts. The methodology includes both the analytical requirements to develop defensible values for a comprehensive set of performance measures, and the structure for using the performance measures to compare and rank alternative proposals.

A decision on metal disposition alternatives should be based on two categories of information: 1) the possible impacts of choosing each of the candidate alternatives; and 2) the values used in evaluating these impacts. Correspondingly, the methodology is divided into two phases: the life cycle analysis phase in which the possible impacts of each of the candidate alternatives are assessed; and the decision phase. In the first phase, the objectives and program scope are defined, the metal disposition alternatives are identified, performance measures are specified, and the impacts of the alternatives are described in terms of the performance measures. In the second phase, the decision phase, the methodology will aid the decision maker (or makers) in the comparison of alternatives and selection of the most desirable alternative.

1. INTRODUCTION

1.1 PURPOSE

The purpose of this document is to outline a methodology that will help a decision maker or makers to compare and select among competing proposals for the disposition of radioactive scrap metal at the Fernald Environmental Management Project (FEMP). The methodology developed takes into consideration both quantitative and qualitative factors in three categories: direct costs and benefits; socio-economic issues; and environmental, safety, and health impacts. The methodology includes both the analytical requirements to develop defensible values for a comprehensive set of performance measures, and the structure for using the performance measures to compare and rank alternative proposals.

A decision on scrap metal disposition alternatives should be based on two categories of information: 1) the possible impacts of choosing each of the candidate alternatives: and 2) the values used in evaluating these impacts. Correspondingly, the methodology is divided into two phases: the life cycle analysis phase in which the possible impacts of each of the candidate alternatives are assessed: and the decision phase. In the first phase, the objectives and program scope are defined, the metal disposition alternatives are identified, performance measures are specified, and the impacts of the alternatives are described in terms of the performance measures. In the second phase, the decision phase, the methodology will aid the decision maker (or makers) in the comparison of alternatives and selection of the most desirable alternative.

It is important to note that the methodology presented in this document does not provide a "cookbook" approach. A more specific and detailed analytical procedure for the FEMP decision problem will be developed after the initial applications of this methodology are made and an assessment can be made on the quantity and quality of available data and other information. The ultimate objective of this follow-on exercise will be to identify the analytical approaches that result in the most defensible analyses given available data and time and budget allowances.

1.2 OUTLINE OF REPORT

A general description of the methodology is presented in Section 2. Section 3 outlines the scope of the project, presents key assumptions, and discusses candidate metal disposition alternatives. Section 4 provides a description of the proposed performance measures and outlines analytical methods that may be used to describe the impacts of the alternatives in terms of the performance measures. Section 5 outlines decision methods that can be used to support decision makers in the comparison and selection of metal disposition alternatives. Attachment 1 is a definition of terms, and Attachment 2 provides an example application of the methodology.

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2. DESCRIPTION OF DECISION METHODOLOGY

The proposed methodology is illustrated in Figure 2.1. It consists of two distinct phases: in Phase 1 a life cycle analysis is performed for FEMP scrap metal disposition alternatives; Phase 2 is the decision phase that will aid the decision maker(s) in using the information generated in Phase 1 to formulate a decision.

The overall decision process for scrap metal disposition is divided into the following seven steps:

Life Cycle Analysis Phase:

1. Define Nature of Decision and Program Scope
2. Specify Objectives and Performance Measures
3. Identify Alternatives
4. Define Analytical Methods
5. Assess the Impacts of the Alternatives
6. Summarize Results

Decision Phase:

7. Compare Alternatives

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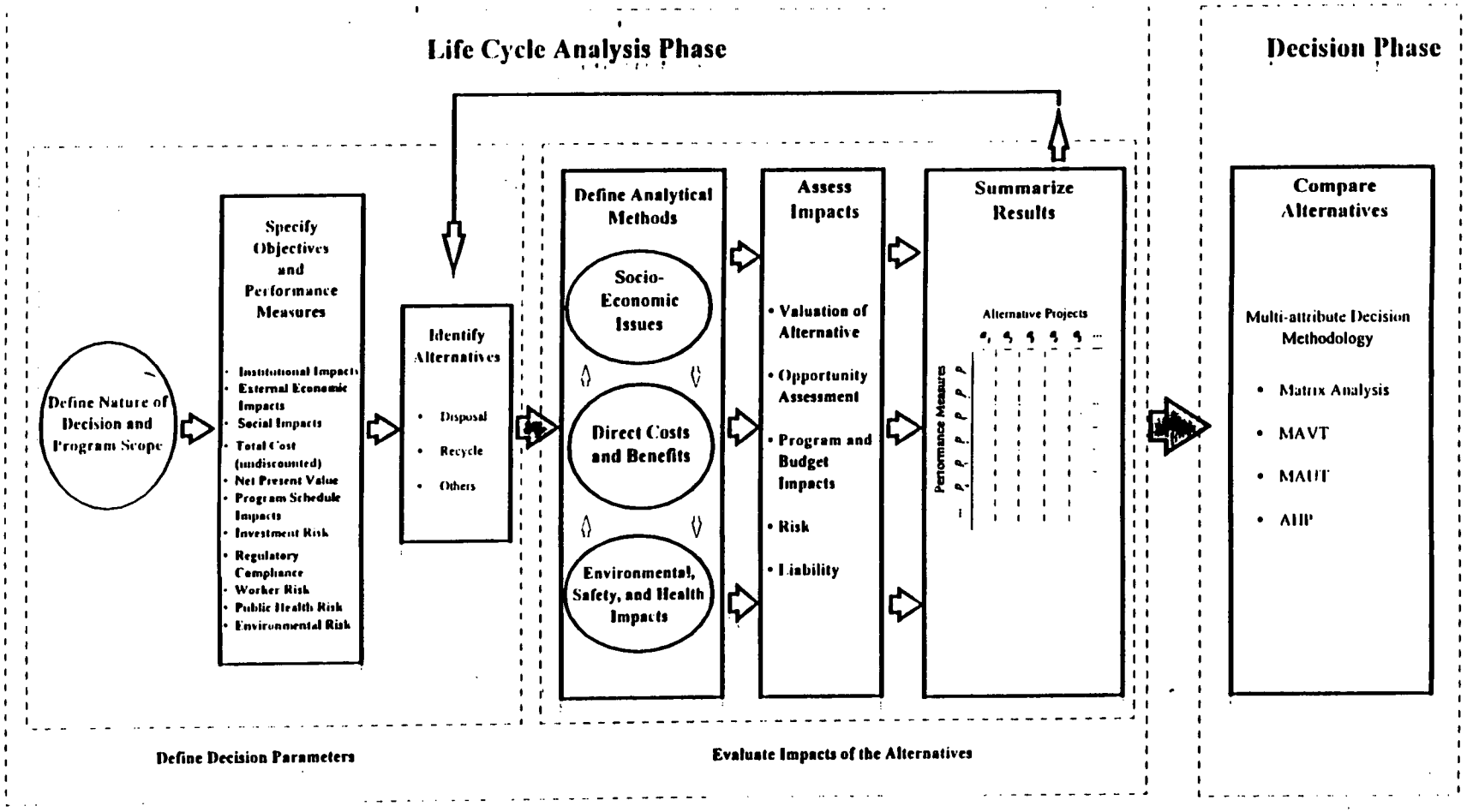
The first six steps comprise the life cycle analysis phase. The life cycle analysis phase is summarized in Section 2.1 and is described in more detail in Sections 3 and 4. The last step, which is the decision phase of the methodology, involves synthesizing the information obtained in the life cycle analysis phase to compare the alternatives. The decision phase is summarized in Section 2.2 and further described in Section 5. Attachment 2 presents an example application of the entire methodology.

2.1 LIFE CYCLE ANALYSIS PHASE

Life cycle analysis is the process of identifying and assessing all categories of benefits and costs that result from a course of action over the entire period of time affected by the action, quantifying those benefits and costs where possible, and providing results that promote sound decision-making. A life cycle analysis provides a logical approach to the comprehensive assessment of alternatives which is mandated by the uncertain, hidden, and at times counterintuitive costs and benefits of alternative proposals. The elements of a life cycle analysis depend on the purpose of the analysis and the availability of specific data. In general, however, elements of a life cycle analysis consist of direct costs and benefits, which derive from the outlays that DOE would expend; socio-economic issues; and environmental, safety, and health impacts. The following outlines the steps that make up the life cycle analysis phase of this methodology.

Figure 2.1 FEMP Decision Process for Scrap Metal Disposition



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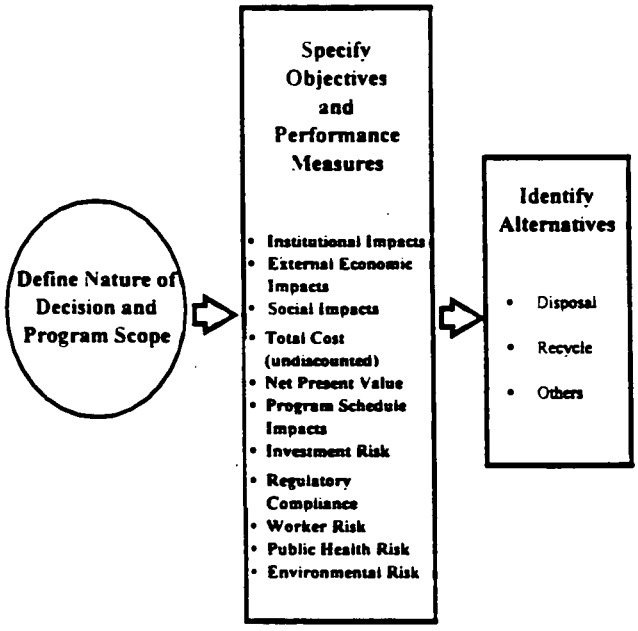
2.1.1 Definition of Decision Parameters

The life cycle analysis phase begins with the definition of decision parameters. This part consists of three steps:

- Define Nature of Decision and Program Scope;
- Specify Objectives and Performance Measures; and
- Identify Alternatives.

Figure 2.2 Define Decision Parameters



Define Nature of Decision and Program Scope. A clear statement is needed of the current system and the nature of the decision that is required. This establishes the boundaries for which viable alternatives can be defined. It also defines the scope for which impact analysis is required. Finally, it helps in identification of possible decision-aiding approaches for use in the decision phase. This step also includes a preliminary assessment of the quality of the information available to perform the analysis: identification of the criteria for the quality and efficacy of the analysis: and a preliminary identification and inventory of assets and resources.

Specify Objectives and Performance Measures. To conduct an effective analysis. it is required that a clear statement be made of the program objectives. so that the intents and reasoning behind the program is well understood by the analysts. the decision makers. and the stakeholders who will have a say in the final decision. This is the stage of the methodology where the decision maker identifies programmatic objectives and defines the specific performance measures that will be used to compare alternatives. This is an important step. because the performance measures defined in

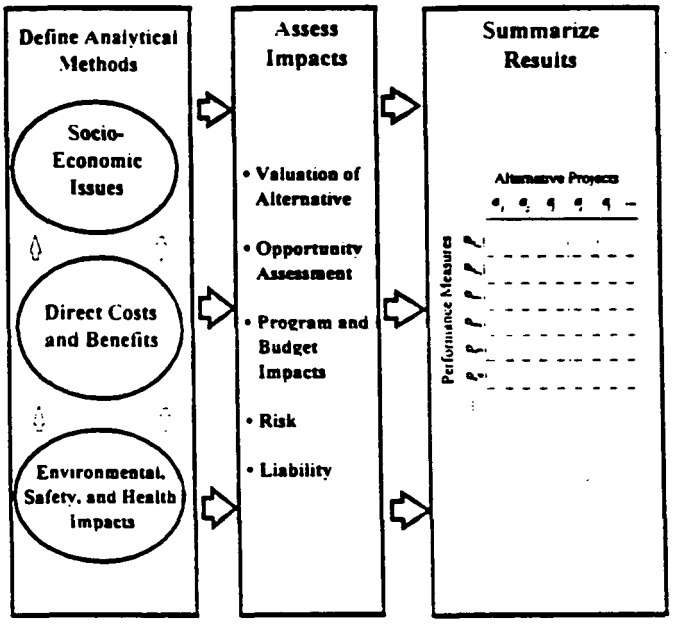
this step determine the specific analytical approaches that will be taken in subsequent steps of the methodology and constitutes the input to the decision phase. A preliminary set of FEMP performance measures is presented in Section 4.

Identify Alternatives. This is the step in the methodology where the specific alternatives to be considered are defined. This step forces the decision maker to think through the specific alternatives and identify the specific potential impacts of each proposed alternative.
This step also includes a generic description of the system of activities (the general process) that are involved in carrying out a particular alternative. For example, in a metal melt option, the key steps of metal extraction, packaging and shipment to a smelter would be outlined, as well as the key decisions and other issues that might be faced in carrying out that alternative.

2.1.2 Evaluation of Impacts of the Alternatives

In this stage of the life cycle analysis, the analytical approach is defined for each of the performance measures and their value is calculated for each alternative. These components of the analysis are inter-linked and are described below.

Figure 2.3 Evaluate Impacts of the Alternatives



Define Analytical Methods. In this step the analytical models and tools are defined that will be used to evaluate the alternatives on the performance measures. For simplicity, the tools are divided into three categories, however there are substantial interactions between the models in the different categories:

- Direct Costs and Benefits

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- Socio-economic Issues
- Environmental, Safety, and Health Impacts

Assess the Impacts of the Alternatives. In this step of the life cycle analysis, the analytical tools developed are used to evaluate the impacts of the alternatives on the performance measures. At this stage, the opportunity exists to re-assess the initial assumptions, objectives, and scope that were developed in the Define Decision Parameters stage. Although the entire methodology is an iterative process at every step, we indicate a feedback mechanism at the end of this step to indicate that performance measures may be further refined, the system definition and process flow model revised, new strategic alternatives identified, and additional analyses performed.

Summarize Results. This step of the analysis summarizes the results of the analysis for use by the decision-maker(s). With the data and models developed through the life cycle analysis process, the results can be presented in any form desired by the decision-maker(s) for use in their own decision support system. Table 2.1 illustrates the product of the life cycle analysis phase.

2.2 DECISION PHASE

The output of the life cycle analysis phase is a matrix listing the alternatives along the top and the performance measures along the side, as illustrated in Table 2.1. Within each cell of the matrix will be the value of the performance measure for that alternative. In some cases it will be a numerical value, such as total cost, and in others it may be a qualitative discussion, such as the institutional issues raised by the alternative. This matrix alone will provide the essential information needed for negotiations and decision making. It will help in making the discussions more concrete and allow the key issues to be brought into the open. Discussions can center on the relative importance of one factor versus another rather than the alternatives as a whole. Oftentimes, based on the results reported in the matrix, one alternative will stand out as the best or some alternatives will be seen to be clearly inferior.

It can be expected that not all performance measures will favor one alternative. When there is no clearly superior alternative, it rests upon the decision maker or decision makers to decide upon which performance measures are most important and what is the relative value to assign achievement on different performance measures. Much work has been done to develop structured approaches for analyzing tradeoffs between competing objectives. Section 5 provides a description of the bases behind these methods. These methods can help inform the decision makers on their choices, but they must be recognized solely as tools to assist the decision makers, not replace them.

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Table 2.1 Illustrative Example of a Decision Matrix

PERFORMANCE MEASURES	ALTERNATIVES			
	Decontamination For Unrestricted Release	Metal Melt for Restricted Use	On-Property Disposal	Others
DIRECT COST PMs:				
Net Present Value				
Undiscounted Total Cost				
Program Schedule				
SOCIO-ECONOMIC PMs:				
Local Economic				
Institutional				
Social				
ENVIRONMENT, SAFETY, & HEALTH PMs:				
Public Health				
Environment				
Worker Safety				

3. SYSTEM DEFINITION AND DEFINITION OF ALTERNATIVES

3.1 DEFINE NATURE OF DECISION AND PROGRAM SCOPE

The first step in the decision process is to define the problem scope. The general rule for deciding whether or not a consideration should be included in evaluating metal disposition alternatives is whether or not that inclusion could have a significant impact on the evaluations of alternatives. As an example, if all alternatives being considered fully comply with all laws and regulations, then regulatory compliance could be eliminated from the comparative analysis of metal disposition alternatives. However, regulatory compliance would be relevant in deciding whether or not to include an alternative in the analysis. Similarly, if the aesthetic impacts were considered to be equivalent for all alternatives, this could be omitted in a comparative consideration. This general rule allows us to eliminate many considerations from the study.

Some of the key assumptions include:

- An on-site disposal facility will be built at the FEMP. The on-site disposal facility will not be operated during the winter months because of frost conditions.
- Recycle activities are not affected by frost conditions and so can be conducted throughout the entire year.
- All alternatives considered will be feasible given current technology.
- Only metal disposition alternatives that fully comply with all applicable laws, regulations, and DOE Orders will be considered.

3.2 SPECIFY PROGRAM OBJECTIVES

The development of a methodology to quantify the benefits of alternative activities begins with the determination of programmatic objectives to be considered when evaluating alternatives. In order to estimate how well alternatives perform against the identified objectives, measures are needed to quantify that performance. Thus, the next step in the methodology is to translate the identified objectives into attributes and corresponding measurement scales (performance measures) that relate descriptions of impact levels to quantitative scores. The general attributes identified for evaluating alternatives are presented in Figure 3.1. Section 4 presents the performance measures used to describe achievement of the objectives.

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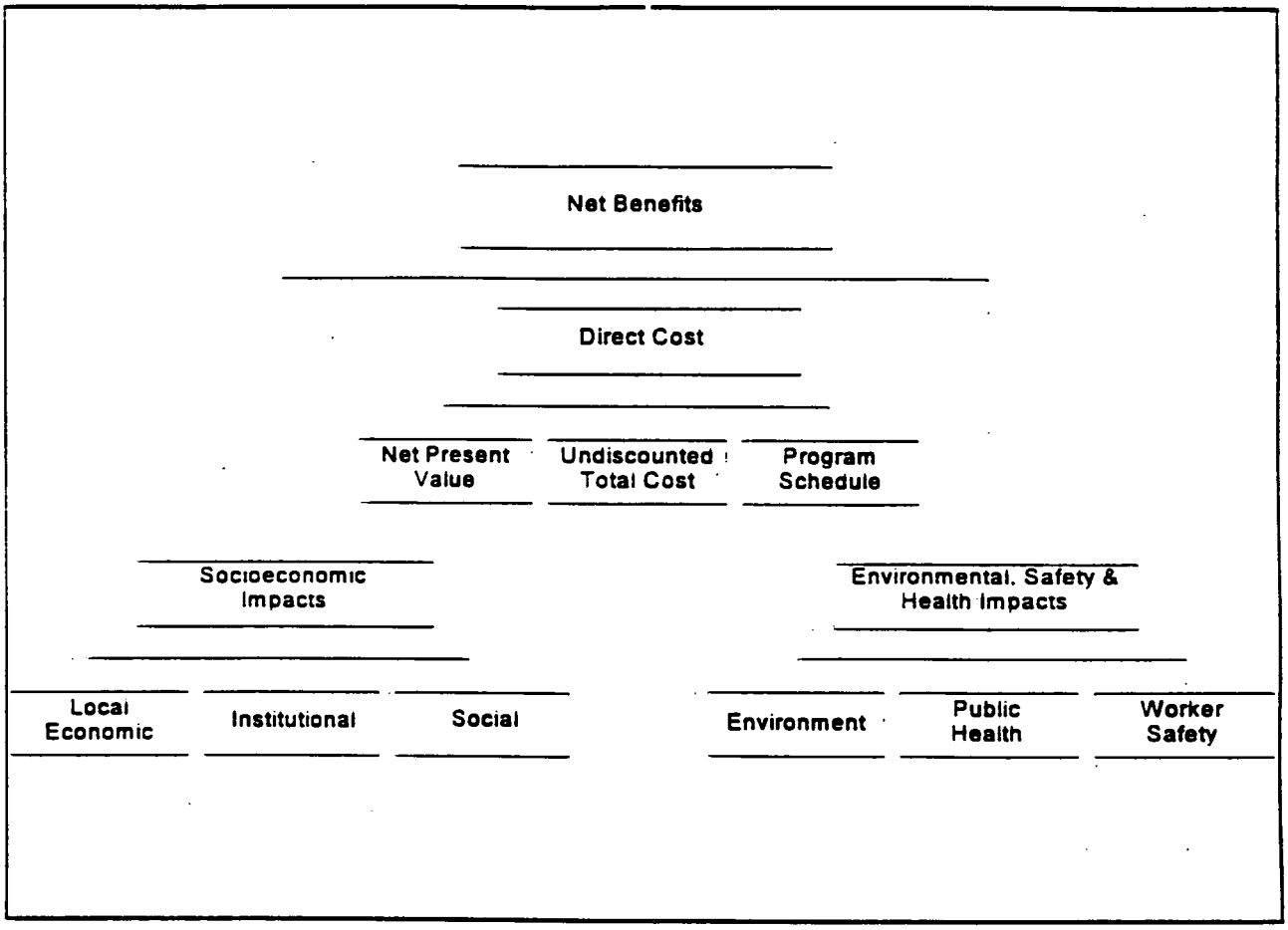
Figure 3.1 General Attributes Identified for Evaluating Alternatives



3.3 IDENTIFY ALTERNATIVES

Selection of alternatives is a crucial step for any decision-aiding approach, because the comparison of alternatives is obviously limited to the alternatives identified. The process of generating alternatives for evaluation should be done in an iterative manner, with DOE as the principal decision maker, and the alternatives should be refined as the understanding of the decision problem deepens.

A large number of potential alternatives currently exist for the disposition of the radioactive scrap metal at the FEMP. These alternatives include, at the extremes, total disposal and total recycle. The optimal alternative may prove to be some partial recycle alternative, in which some metal is recycled and the remaining metal is disposed. There are many different types of metals present in Operable Unit 3 (OU3), and it may prove desirable to treat the different types of metals in different ways.

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In practice, one must reduce the number of possible alternatives to a manageable group of candidate alternatives, which will then be compared with each other. Based on this initial analysis, new, improved alternatives should be defined and evaluated. This process requires the balancing of the time and effort required to evaluate additional alternatives against the likelihood that a more cursory evaluation will inadvertently eliminate some of the best alternatives.

To understand the large number of possible disposition alternatives for the FEMP, we consider the varieties of metals present at the site, and the possible options for disposition of each type of metal. The FEMP OU3 corresponds to the former production facilities, structures, equipment, and waste and product inventories remaining from site activities. OU3 metals consists of four categories of material, defined as follows:

- Accessible Metals: approximately 15,200 tons. An OU3 material category comprised of structural steel and steel decking which has large accessible surface areas and thickness greater than 1/4 inch. The surface of accessible metals can be decontaminated using surface decontamination techniques.

- Inaccessible Metals: approximately 25,700 tons. An OU3 material category comprised of non-process piping, equipment in non-process areas, decontaminated process equipment, conduit/wire, electrical fixtures, miscellaneous electrical items, doors, and other miscellaneous metals. These materials have surfaces which cannot be easily decontaminated or surveyed and are thus considered inaccessible.

- Process-related Metals: approximately 3,370 tons. An OU3 material category comprised of process equipment, electrical equipment not included in the Inaccessible Metals category, and process piping, which are assumed to be highly contaminated and to contain holdup material.

- Painted Light-gauge Metals: approximately 1,360 tons. An OU3 material category comprised of ductwork, louvers, metal wall and roof panels, sheet lead, and other painted metals less than 1/8 inch thick. Metals in this category are assumed to be painted with lead-based paint or, in the case of lead sheeting, to be made of lead themselves.

Some of the different options for disposition of OU3 metals are as follows. Note that not all of these options are necessarily applicable to each type of OU3 metal.

- On-site disposal facility. Burial in the FEMP permanent on-site disposal cell.

- Nevada Test Site. Packaging and transportation of materials to the DOE Nevada Test Site low level waste repository, and subsequent burial.

- On-property unrestricted release. Release of material from the FEMP radiologically controlled area, with no restrictions on end use, after documenting that residual radioactivity meets the guidelines of DOE Order 5400.5. Material handling, size reduction, decontamination, radiological monitoring, and other activities for this disposition alternative are performed by FERMCO personnel. The decontamination method includes removal of

the radionuclides and other contaminants from the surface of the metal using a combination of blasting and chemical decontamination technologies.

- Vendor facility unrestricted release. Containerization and shipment of materials from the FEMP to a commercial decontamination facility, where the material is decontaminated, surveyed, and documented to meet DOE Order 5400.5 residual radioactivity guidelines. The material is then released with no restrictions on end use. The decontamination method includes removal of the radionuclides and other contaminants from the surface of the metal using a combination of blasting and chemical decontamination technologies.

- Melt of metal and fabrication of restricted use products. The metal is transported to an off-site commercial facility, melted, and fabricated into end products such as B-25-type containers for DOE use.

- Commercial disposal facility. Packaging and transportation of material to an off-site commercial LLW disposal facility.

- Restricted release. Reutilization of a contaminated material or item for its originally intended purpose (e.g., reuse of a FEMP storage tank at another DOE facility), within a radiologically controlled environment.

The disposition of the secondary wastes generated as a result of the decontamination processes and the metal-melt process must also be considered.

The alternatives may include a combination of the options defined above reflecting the different metal types as well as variations in program schedules. Strategic alternatives will be formulated by considering appropriate disposition options for each category of OU3 metal. In addition to reflecting different metal types, the timing of metal disposition may be an important factor in the development of alternatives. For example, it might be desirable to recycle the steel from the first building (because the disposal cell is soil poor), but later in the process when there is ample soil, it might prove desirable to dispose of some metal. The optimal alternative may well prove to be a phased, hybrid approach, rather than a "total disposal" or "total recycle" option. The methodology presented here will facilitate the consideration of such phased, hybrid approaches.

4. DESCRIPTION OF PERFORMANCE MEASURES

Performance measures fall into three major areas. The first area is the direct financial costs and benefits. This includes the more common analyses performed for decision making but takes into account only those costs and benefits that are directly paid or received by the decision making party. The second area is socioeconomic impacts. This relates to the economic, cultural, political, and social issues involved in most major public decisions. The third area, environmental, safety, and health impacts, addresses impacts on the environment and human health. Some issues, such as regulations, will have impacts in more than one area.

The set of performance measures should be decided upon in consultation with all stakeholders. The most important criteria for the set of performance measures is that collectively, the set of performance measures should capture all of the things that the stakeholders care about. They should be mutually exclusive and collectively exhaustive.

In this section a working list of performance measures and the means for their analysis is presented. Several possible performance measures have been eliminated from the set of performance measures because they were considered not to differentiate among the alternatives under consideration in this analysis. However it is entirely appropriate for the set of performance measures to be refined as further information is developed and as the analysis proceeds. As stated in Section 2, life cycle analysis is an iterative process in which the analysis is continually refined and improved.

4.1 DIRECT FINANCIAL COST PERFORMANCE MEASURES

All major government decisions require a cost analysis. Depending on the scope of the analysis, the performance measures can be a summation of all costs, or the time value of money can be included through discounting. Guidance from the Office of Management and Budget requires the use of discounting. Many other factors intertwine with the financial cost: schedule changes can drive costs up or down, regulatory requirements may add costs to an alternative, market prices for product will influence the net cost of an alternative.

There are three performance measures for direct financial costs described below. Benefits and costs for four alternatives (two recycle and two disposal) are presented in Table 4.1. Actual values have not been calculated: these only serve to show the format of the way performance measure results would be displayed. If sensitivity cases are run, these can either be shown in separate tables or as uncertainty bounds around the expected values. Attachment 2 presents an example application of the methodology . The example includes a decision matrix which shows the direct cost performance measures in conjunction with the other performance measures used in the analysis.

Table 4.1 Direct Cost Analysis Example

Performance Measure	Recycle 1	Recycle 2	Disposal 1	Disposal 2
Net Present Value	$5M	$7M	$6M	$5.5M
Total Cost Undiscounted	$9M	$13M	$11M	$10M
Program Schedule	9.2 years	11.1 years	10.5 years	10.1 years

4.1.1 Net Present Value

The standard criterion for deciding whether a government program can be justified on economic principles is *net present value* -- the discounted monetized value of expected net benefits (i.e., benefits minus costs). Net present value is computed by assigning monetary values to benefits and costs, discounting future benefits and costs using an appropriate discount rate, and subtracting the sum total of discounted costs from the sum total of discounted benefits. Discounting benefits and costs transforms gains and losses occurring in different time periods to a common unit of measurement.

The cost analysis must fully include all of the financial costs and benefits of the recycle and disposal alternatives. These costs include both the direct budget allocations to the project and incremental costs to other activities such as permitting, monitoring, or other compliance costs. Costs must cover the full scope of the project, including packaging, storage, transportation, secondary waste treatment, et cetera. Likewise, financial benefits include both the direct proceeds to the project through such actions as sale of recycled products, and benefits to other activities through reduced costs or improved schedules. Uncertainties and potential liabilities should be addressed in any financial analysis through various means such as sensitivity studies, probabilistic risk assessment, or changing discount rates.

Analysis of the direct financial costs requires a number of steps. First, the necessary data must be found or generated if not already available. The cost will be computed based on all costs associated with management of the metals, including disassembly, handling, processing, and disposal. The calculation will also include any monies recovered from recycling. Hidden costs in overhead accounts must be extracted and assigned to the alternatives, as appropriate. In addition, future liabilities will be included in the estimate. For example, the disposal cell has some probability for failure and with metal present there may be some increase in the probability of failure. Also, the cost of repair may be different with metal present in the cell. Thus there may be some incremental expected cost for repair of the on-site disposal cell with metal present.

In addition, the cost impacts of the different work schedules under the alternatives will be included in the cost estimates for the alternatives. For example, the cost estimate will reflect the more efficient scheduling of labor under the recycle alternatives, made possible by the scheduling of recycle work during the winter months when the cell is not operated.

To perform the financial cost analysis, a spreadsheet model must be developed to facilitate estimating costs for a wide variety of alternatives rapidly and efficiently. The spreadsheet model will include a user interface so that it can easily be used to analyze a variety of alternatives and sensitivities to different parameters. The spreadsheet will estimate costs by time period and will facilitate analysis of schedule impacts. Such factors as inflation and discount rates would be included in the financial spreadsheet based upon the Office of Management and Budget directives.

4.1.2 Total Undiscounted Costs

Undiscounted total costs can be studied through use of a zero discount rate in the analytical spreadsheet. This can be important for people concerned with the issues such as inter-generational equity or the potential for large costs after the project is completed. By not discounting these future costs, the later high costs are highlighted.

4.1.3 Schedule Impacts

The recycle and disposal alternatives may result in different program schedules. The impact on program schedule as a performance measure will capture schedule delays or accelerations under the alternatives. For example, recycle alternatives may accelerate the project schedule because of the more efficient use of labor during the winter months when the on-site disposal cell cannot be operated. The costs associated with schedule impacts are included in the two performance measures above, but schedule impacts in and of themselves are often important to decision makers.

4.2 SOCIOECONOMIC PERFORMANCE MEASURES

This section describes the major socioeconomic factors that should be considered, the performance measures that can be used to measure them, and some of the analytical tools used to calculate values for the performance measures.

In Table 4.2 we show a sample of the performance measures and the results for two recycle and two disposal options. Actual values have not been calculated: these only serve to show the format of the way performance measure results would be displayed. Note that while some attributes will have numeric results, others will have textual observations. Although the table only shows a few words, more explicit descriptions could be included as backup in the actual analysis. Attachment 2 includes a summarized form of these attributes in its matrix in conjunction with the results from the other areas of analysis.

Table 4.2 Socioeconomic Analysis Example

Performance Measures	Recycle 1	Recycle 2	Disposal 1	Disposal 2
Local Economic Impact	$15M	$14M	$12M	$14M
Employment	60 jobs	45 jobs	30 jobs	50 jobs
Property Values	Up 5%	Down 3%	No change	Up 3%
Market Demand for Product	Strong	Weak	–	–
DOE Policy Issues	Meets recycle, resource conservation policies	Meets recycle policies	Multi-state transport concerns	Local transport only
Privatization	Assists industry development	Lack of private participation	Private transportation used	Lack of private participation
Public Acceptance	Public prefer recycle	Public prefer recycle	Public prefer removal from site	Public prefer least cost
Legacy	Only less risky material left at site	Only less risky material left at site	Only less risky material left at site	Small amount of steel is little concern

4.2.1 Market and Economic Issues

While most economic factors are already captured in the direct cost analysis, some economic factors lie outside of the basic internal cost and benefit analysis. Some of those include local economic impacts on the surrounding community, employment effects, property values, and the impact of the recycled material in the larger market for scrap metal or contaminated scrap metal.

Local economic impact – As money flows into and out of the economy of a region, an economic stimulus may arise over and above the direct amount of spending on the alternative. There are multiple measures of economic impact, including household income, business sales, and net government revenues. The economic impact will vary over time as the spending schedule changes.

A simple method to analyze the impacts of economic inflows into a community is through an economic "multiplier". A more complex method used to study local economic impacts is an Input/Output model, such as the Oak Ridge Social Accounting Matrix (SAM). It characterizes and allows for the financial flows among major sectors of a regional economy. A SAM is an extension of the traditional Input/Output inter-industry model.

Employment – An increase or decrease in jobs will result with each alternative. The type of jobs created or lost will vary based on skills required, employer, and type of work involved. Direct

manpower requirements and timing may flow from the financial analysis while regional impacts can come from the SAM. Union involvement can be estimated based on the resultant job structure.

Property values – Based on the effect of the alternative in other parameters such as economic impact, public acceptance, and aesthetics, property values for the community may improve or decline. Property value analysis can be conducted through surveys of property values near similar facilities and control points of property in a similar economic region but without such facilities nearby.

Market demand for product – If an alternative includes the creation of a saleable product, then the market for that product must be examined to determine the resulting price and quantity that could be sold. The performance measure is the size of the market this material represents and the price that can be obtained. The results feed into the direct cost analysis through determination of revenues. Market demand issues are analyzed through research on the size and prices for the markets that the recycle material will enter.

4.2.2 Institutional Issues

Major decisions by DOE of necessity involve a number of institutions, not the least is DOE itself. DOE has numerous policies and directives with varying degrees of importance, some of which may conflict. These can include such directives as preferences for recycle, resource conservation mandates, privatization, or obligations to utilize final rather than interim solutions to clean-up. Alternatives can vary in how consistent they are with the different DOE policies. One performance measure is how well each alternative adheres to DOE policies. Another can be the feasibility of different alternatives within the DOE structure. Various DOE officials can provide this information, as can documentation such as DOE regulations. Other federal, state, and local institutions become involved through regulations, permitting requirements, or as stakeholders in the decision. The complexity of the interactions and their view of the alternatives can be recognized through a performance measure.

With privatization being considered for many DOE functions, it is critical to understand how private firms would play a part and how best to involve them. The performance measure will be the amounts and kinds of involvement, from traditional management and operations contracting to more entrepreneurial arrangements. These arrangements can in turn influence the direct cost analysis both by changing the total cost of an alternative and the timing of when the costs are incurred. This can be analyzed through several mechanisms, including publishing formal expressions of interest to informal discussions with either private firms or experts familiar with private company activities. Past experience with similar ventures would also provide information.

These alternatives occur in a larger context of the eventual clean-up of the entire DOE complex, as well as other contaminated facilities. New industries may develop for recycling of scrap material just as a large industry has already evolved for environmental remediation and restoration. The potential contributions of each alternative to industrial growth and competitiveness should be adjudged.

4.2.3 Social Issues

Most major decisions of the Department of Energy have a large impact on society, either that of the local area, the larger region, or nationwide. These social issues often become the key driver for the decision, more so than the economics or direct costs alone. Some of the key social issues are: public acceptance, impact on community services, and the legacy left for the community following clean-up. Lack of public acceptance has foreclosed many options or transformed them to be more in line with what people want. An alternative might change the nature of a community against the wishes of the current residents. A large influx of people may strain the capabilities of the local community to accommodate them, requiring additional expenditures and changing the atmosphere of the community. Alternatives can be judged on the social impact of what is left long-term for the community to deal with after the project is completed.

Societal concerns that are not fully addressed in the economics, regulations, or institutional issues may be studied through sociological and comparative value studies. Focus groups or local leaders can be used to identify issues, assess their significance, and recommend solutions.

4.3 ENVIRONMENT, SAFETY AND HEALTH PERFORMANCE MEASURES

The environment, safety and health performance measures address the operational risk and avoided risk associated with each alternative. The risks associated with each alternative to the local workers, outside public, and environment as a whole play an increasing role in DOE decision making and federal laws require its analysis.

Data must be gathered to understand the human health and environmental risks from the alternatives. Much of the information for local impacts is likely available as a result of the RI/FS and the corresponding Record of Decision. If there is not sufficient information, and the potential differences between cases suggest the need for further analysis, there are standard approaches available for calculating the impacts to human health and the environment. Below we summarize the information into three performance measures: environment, worker safety, and public health, but the actual analysis could involve studying specific impacts within each attribute, such as air emissions, water emissions, land-use, soil contamination, pathways of contaminants to people, and resulting damage to health.

A key element of life cycle analysis is the study, not only of the immediate risks from each alternative, but the risks avoided by not pursuing other alternatives. For example, the direct financial benefit of recycle is already captured in the price received for the recycled material; the environmental and health benefits come through the lessened releases of hazardous materials and occupational hazards created during initial manufacture. These environmental, safety, and health benefits as well as the adverse impacts of the alternatives are included in the environment, safety, and health performance measures. Care must be taken in this process to avoid double counting.

In Table 4.3 we show a sample of the performance measures and the results for two recycle and two disposal alternatives. Actual values have not been calculated; these only serve to show the

format of the way performance measure results would be displayed. Note that while some parameters have numeric results, others have textual observations. Although the table only shows a few words, more explicit descriptions could be included as backup in the actual analysis. Attachment 2 includes these parameters in its matrix in conjunction with the results from the other areas of analysis.

Table 4.3 Environment, Safety and Health Analysis Example

Performance Measures	Recycle 1	Recycle 2	Disposal 1	Disposal 2
Public Health	10^{-5} risk of fatality	10^{-4} risk of fatality	10^{-4} risk of fatality	10^{-5} risk of fatality
Environmental	Low damage to ecological systems	Moderate damage to ecological systems	Moderate damage to ecological systems	Low damage to ecological systems
Worker Safety	10^{-4} risk of injury	10^{-3} risk of injury	10^{-3} risk of injury	10^{-4} risk of injury

4.3.1 Public Health

The public health performance measure addresses the operational risk and avoided risk to off-site populations associated with the alternative. It addresses potential adverse impacts on the health and safety of the surrounding or affected off-site human population, for the DOE site, commercial disposal site, recycle facility, commercial decontamination facility, or the avoided steelmaking sites. This performance measure is used to assess potential health impacts to communities from accidents involving the release of radioactive or hazardous materials or the dangers of accidents during transportation on public roads.

4.3.2 Environment Protection

The environmental protection performance measure addresses potential adverse impacts on the environment, including physical degradation of surrounding or affected ecological systems and harmful effects on plants and animals. The environmental protection performance measure is used to assess potential widespread, localized, and long- and short-term impacts on entire ecological systems or constituents. The performance measure is also used to describe impacts resulting in loss of use of natural resources such as land or water.

4.3.3 Worker Safety

The worker safety performance measure addresses potential adverse impacts on the health and safety of personnel inside the site boundary or any worker associated with the avoided virgin metal production. The attribute includes the potential impact from release of hazardous and radioactive material. The release would require a transport pathway so that one or more persons on-

site could be exposed to contaminants at levels sufficient to cause injury. In addition. the performance measure covers the potential for physical danger including injury(ies) incurred by conventional industrial accidents (e.g., catastrophic fa lure of equipment or components. personnel caught in rotating or moving machinery, roof/structural failure. personnel falling from high locations. and personnel exposed to high-temperature or high-pressure fluid releases).

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5. DECISION PHASE

5.1 PRESENTATION OF LCA RESULTS FOR DECISION MAKING

As discussed earlier, the typical financial or benefit/cost framework is modified under a life-cycle analysis to include costs and benefits external to the direct out-of-pocket financial costs and revenues. These external effects generally include local, regional and global environmental impacts; health and safety impacts; socio-economic impacts; and institutional impacts and regulatory effects. The values of each performance measure are assessed over the complete life-cycle of the disposition alternative. For each direct financial and external effect performance measure values can be presented and summarized in a matrix with the disposition alternative along the top row of the matrix and the values of the performance measures along the side (Table 5.1).

Within each cell of the matrix will be the value of the performance measure for that particular disposition alternative. This "value" can be a monetized value, such as financial costs and revenues expressed in dollars, a numerical value expressed in some non-dollar metric, such as tons of pollutant or number of injuries, or this value can be a qualitative statement, such as the institutional and regulatory issues raised by the alternative. It can be expected that not all performance measures will favor one alternative. When there is no clearly superior alternative across all performance measures, it rests upon the decision makers to decide which parameters are most important and what is the relative value for the differences among the alternatives. Much work has been done to develop structured approaches for measuring and commensurating the values between dissimilar performance measures. The following section briefly discusses some approaches that can be used by decision makers to help rank and choose among alternatives.

5.2 STRUCTURED MULTIATTRIBUTE DECISION MAKING APPROACHES

For direct financial analysis the decision problem reduces to a single economic criterion. But with life cycle analyses the external effects must either be translated into economic terms or some method must be used to systematically compare among the different performance measures. Translating the external effects into dollars would effectively reduce the multiattribute decision problem back down into a single economic criterion. Damage function approaches have received the most attention by analysts in this area. However, applying damage functions can be difficult and costly especially if there are many different performance measures. Analysts usually recommend identifying only the priority external effects for quantification and monetization.

Table 5.1 Multi-attribute Decision Matrix

PERFORMANCE MEASURES	ALTERNATIVES			
	Decontamination For Unrestricted Release	Metal Melt for Restricted Use	On-Property Disposal	Others
DIRECT COST PMs:				
Net Present Value				
Undiscounted Total Cost				
Program Schedule				
SOCIO-ECONOMIC PMs:				
Local Economic				
Institutional				
Social				
ENVIRONMENT, SAFETY, & HEALTH PMs:				
Public Health				
Environment				
Worker Safety				

In the multiattribute problem. external effects are explicitly quantified. but no attempt is made at monetization. For example. a simple problem could include two criteria. say cost and environmental impact. Typically. these criteria are conflicting meaning that the attainment in one criterion. say lower cost. necessarily means the reduction of the other criterion. higher environmental impact. Because the criteria are conflicting, choosing among alternatives is impossible unless the decision maker(s) indicates some preference or willingness to trade-off the attainment of one criterion for another.

The manner in which decision maker preferences are elicited and incorporated into the solution process (e.g., derivation of weights) distinguishes the many multiattribute methods. Two general solution approaches -- prior and progressive articulation of preferences -- have been used by analysts to handle problems involving choice among a set of alternatives. The choice of technique also depends. in large part. on the characteristics of the particular problem and how well the problem is defined. For example, the choice of method might depend on whether the number of alternatives are few or numerous; whether the number of criteria are few or numerous; whether the values of the criteria are known or unknown: whether the alternatives are completely known in advance or not; and whether the criteria are explicitly or implicitly defined.

Methods based on prior articulation of preferences require the decision maker to specify a value (utility) function (judgement). This value (utility) function is used to rank order the alternatives. Basically, attribute weights are assessed before the model is solved and remain fixed. Prior articulation of preference methods are particularly relevant in contexts where full justification and rationale for decisions are required. such as in public decision problems. These also tend to be more applicable to well-defined problems (i.e.. the alternatives and criteria are completely known).

With progressive methods. decision maker responses to specific questions are used by the analyst to guide the solution process toward an optimal or most preferred solution. In brief, preferences (i.e., criteria weights) are reassessed as the solution proceeds interactively. These methods allow the decision maker to explore solutions without having to specify prior preferences. As such. these methods require less of the decision maker in terms of preference structures. However. these methods are more open to manipulation and are less defensible when decisions or solutions have to be justified and defended. For multiattribute problems that are not well-defined (either the alternatives or the criteria are not known completely in advance), interactive search methods may be appropriate.

Given the manner in which decision maker preference information can be elicited and used as well as the characteristics of the problem. it is not surprising that the number of specific methods that have been developed is large. However. there are a number of fundamental or more prominent methods that are particularly relevant to the asset disposition problem. These methods include multiattribute value theory (MAVT), multiattribute utility theory (MAUT), and the analytical hierarchy process (AHP).

MAVT is the most widely used method for dealing with and solving multiattribute problems. A number of specific techniques have evolved. but they all share the following operational steps:

- Defining alternatives and criteria.
- Evaluating each alternative separately on each criterion (scaling).
- Assigning weights to the criteria.
- Aggregating the criterion weights and the single-criterion evaluations of the alternatives to obtain an overall measure of value or worth (e.g., additive or multiplicative value function).
- Conducting sensitivity analyses and making recommendations.

The principle differences among the specific techniques lie in the choice of procedures used to scale. weight. and aggregate. MAUT is distinguished from MAVT by the incorporation of

decision maker risk attitudes in single attribute utility functions and aggregation rule -- additive or multiplicative. Operationally, MAUT procedures are similar to that of MAVT with scaling, weighting, and aggregating. AHP differs fundamentally from MAVT and MAUT. AHP is built around three general principles: constructing hierarchies (decomposition), establishing priorities (comparative judgements), and ensuring logical consistency (synthesis of priorities). AHP is an extremely popular method. Simplicity, ease of use, ability to handle large numbers of criteria, and use of a linguistic scale to quantify difficult criteria are some of the features of the method. However, there are many analysts that have criticized AHP for being fundamentally flawed because it produces inconsistent results.

6. SUMMARY AND NEXT STEPS

This document outlines a methodology that has been developed to help a decision maker or makers to compare and select among competing proposals for the disposition of radioactive scrap metal at the FEMP. The goal of this effort was to develop a generic methodology for the analysis of disposition of radioactive scrap metal. Although the methodology may be applicable for a building-specific case at the FEMP, it is recommended that the methodology be applied for the entire FEMP site in order to take advantage of economies of scale. Indeed, the methodology is applicable, and ideally should be applied, for the entire DOE complex in order to take advantage of complex-wide economies of scale.

The methodology developed takes into consideration both quantitative and qualitative factors in three categories: direct costs and benefits; socio-economic issues; and environmental, safety, and health impacts. The methodology includes both the analytical requirements to develop defensible values for a comprehensive set of performance measures, and the structure for using the performance measures to compare, and possibly rank, alternative proposals.

A decision on scrap metal disposition alternatives should be based on two categories of information: 1) the possible impacts of choosing each of the candidate alternatives; and 2) the values used in evaluating these impacts. Correspondingly, the methodology is divided into two phases: the life cycle analysis phase in which the possible impacts of each of the candidate alternatives are assessed; and the decision phase. In the first phase, the objectives and program scope are defined, the metal disposition alternatives are identified, performance measures are specified, and the impacts of the alternatives are described in terms of the performance measures. In the second phase, the decision phase, the methodology will aid the decision maker (or makers) in the comparison of alternatives and selection of the most desirable alternative.

The methodology presented in this document does not provide a "cookbook" approach. Detailed guidelines for conducting the FEMP evaluation will be developed after the initial applications of this methodology are made and an assessment can be made on the quantity and quality of available data and other information. The ultimate objective of this follow-on implementation exercise will be to identify the analytical approaches that result in the most defensible analyses given available data and time and budget allowances.

ATTACHMENT 1 -- DEFINITION OF TERMS

- AHP: Analytical hierarchy process. AHP is a multiattribute decision technique using an additive value function in which both the attribute values for the alternatives and the weights are chosen by a ratio questioning procedure and eigenvector analysis.

- CERCLA: Comprehensive Environmental Response. Compensation. and Liability Act of 1980. as amended (Public Law 96-510).

- Discount rate: The interest rate used to adjust future costs and benefits to reflect the change in the value of money over time. A fixed sum is worth less in the future than in the present because of the interest that can be accrued if it is invested. Note that interest is not the same as inflation. Discount rates can be "real", which means inflation has been removed or "nominal" which means they include inflation.

- DOE-FN: Fernald Area Office of the Department of Energy.

- FEMP: Fernald Environmental Management Project.

- FERMCO: Fernald Environmental Restoration Management Corporation.

- Free Release: the release of materials. for unrestricted use, from DOE control to a non-DOE controlled environment. Free released materials must meet the radiological release criteria set forth in NRC Regulatory Guide 1.86 and DOE Order 5400.5

- LCA: Life cycle analysis. Life cycle analysis is the process of identifying and assessing all categories of benefits and costs that result from a course of action over the entire period of time affected by the action. quantifying those benefits and costs where possible. and providing results that promote sound decision-making.

- MAUT: Multiattribute utility theory. MAUT is a class of method for solving multiattribute decision problems. MAUT is distinguished from MAVT by incorporation of decision maker risk attitudes in its rescaled attributes and amalgamation procedure (either additive or multiplicative).

- MAVT: Multiattribute value theory. MAVT is used to describe a general category of technique for addressing multiattribute decision problems that involves the scaling of attributes using deterministic methods. choosing of criteria weights by non-lottery methods (e.g., rating), and use of an additive value function for amalgamation.

- NPV: Net present value. Net present value is the discounted monetized value of expected net benefits (i.e.. benefits minus costs). Discounting benefits and costs transforms gains and losses occurring in different time periods to a common unit of measurement.

- Opportunity cost: The cost of foregoing one investment option for another. If money is spent rather than saved. for instance. the interest that may have been earned is an opportunity cost associated with the expenditure.

- OSDF: On Site Disposal Facility.

- OU: Operable Unit: an area, facility, or group of facilities within the FEMP defined based on several criteria. including geographical location, the potential for similar technologies to be applied to remediation similar media types. and similar contamination types and levels.

- OU3: Operable Unit 3: the former production facilities. structures. equipment. and waste and product inventories remaining from site activities.

- ROD: Record of Decision. A document which specifies the remedy selected for environmental restoration of an Operable Unit. as approved by the Environmental Protection Agency.

ATTACHMENT 2 -- APPLICATION EXAMPLE

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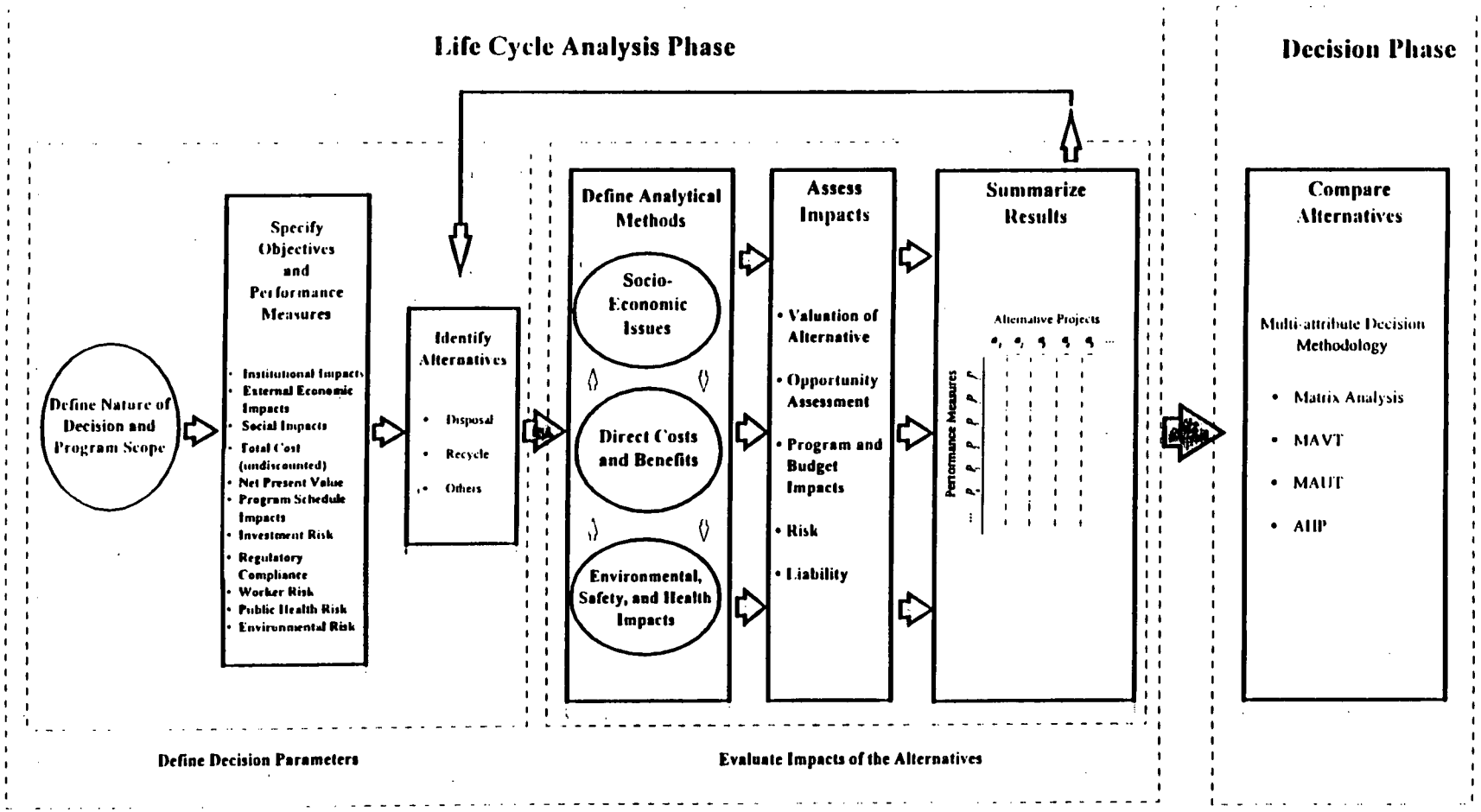
LIFE CYCLE ANALYSIS FOR DISPOSITION OF FEMP MATERIAL


Life Cycle Analysis Phase
Decision Phase
Define Nature of Decision and Program Scope
Specify Objectives and Performance Measures
Institutional Impacts
External Economic Impacts
Social Impacts
Total Cost (undiscounted)
Net Present Value
Program Schedule Impacts
Investment Risk
Regulatory Compliance
Worker Risk
Public Health Risk
Environmental Risk
Identify Alternatives
Disposal
Recycle
Others
Define Analytical Methods
Socio-Economic Issues
Direct Costs and Benefits
Environmental, Safety, and Health Impacts
Assess Impacts
Valuation of Alternative
Opportunity Assessment
Program and Budget Impacts
Risk
Liability
Summarize Results
Alternative Projects
Performance Measures
Compare Alternatives
Multi-attribute Decision Methodology
Matrix Analysis
MAVT
MAUT
AHP
Define Decision Parameters
Evaluate Impacts of the Alternatives

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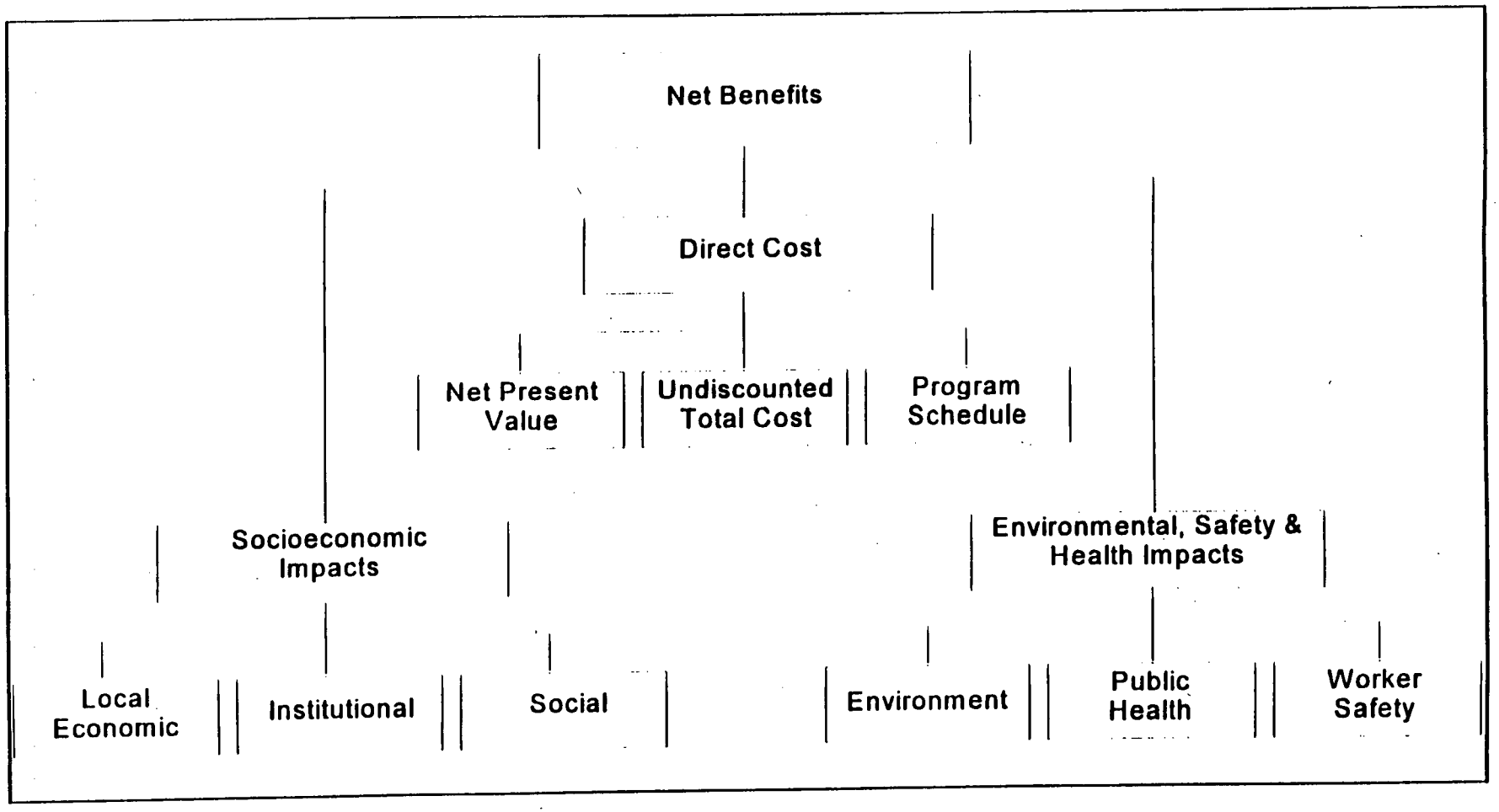
Define Decision Parameters

- Define Nature of Decision and Program Scope
  - Stakeholders
  - Existing Facility and Materials
  - Scope of Decision
- Specify Objectives and Performance Measures
  - Main Objective
  - Categorize Attributes of Objective into Major Areas
  - Establish Performance Measures within each Category
- Identify Alternatives
  - Create manageable list of alternatives
  - Ensure identified concerns will be addressed by alternatives considered

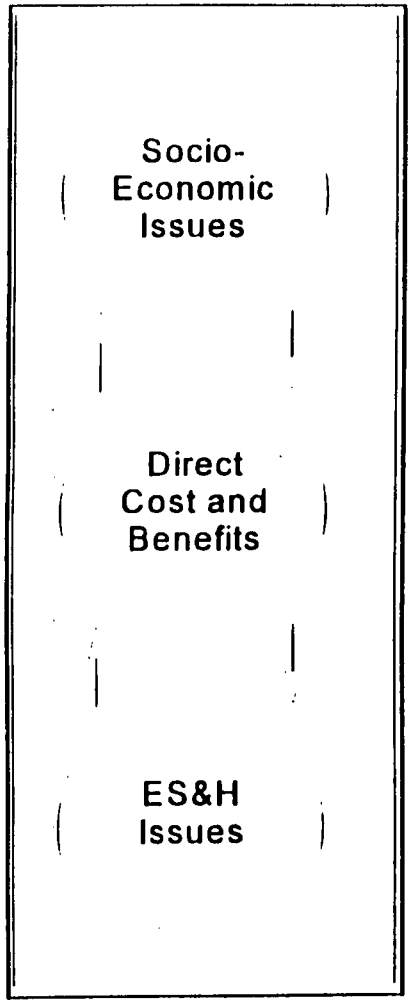
Attributes Used to Evaluate Alternatives



Identify Alternatives

- Four Classes of Metal:
  - Accessible
  - Process-Related
  - Inaccessible
  - Painted Light-gauge
- Seven Options for Disposition:
  - On-Site Disposal Facility
  - Nevada Test Site Disposal
  - On-Property Restricted
  - Vendor Facility Treatment
  - Melt of Metal
  - Commercial Disposal
  - Restricted Release
- Alternatives may include a combination of options reflecting metal types, and program schedules.

Assess Impacts



For Each Area of Analysis:

- **Decide Upon Tools**
- **Gather Data**
- **Evaluate Impacts**

Analyses are integrated through shared data and results.

Direct Financial Analysis

- Develop material flow and associated schedules
- Calculate cost for each component of alternative
- Include revenues from sale of product
- Conduct sensitivity studies on uncertainties:
  - Cost
  - Schedule
  - Potential incidents during and after project

Socio-Economic Analysis

- Local economic issues are studied through analysis of inflows and outflows of funds in the local economy.
- Employment issues are studied through local economic impact and specific work schedules of each alternative.
- Institutional issues are studied through analysis of DOE orders and directives, and through state and local official responses.
- Social issues are studied through focus groups, interviews with area leaders, or newspaper content analysis.

Environment, Safety & Health Analysis

- Public Health is studied through analysis of releases throughout the life cycle of the alternative and their potential for impact on health.
- Environmental effects are studied through impacts of releases or operations on the ecological system.
- Worker safety is studied through potential for disabling injuries or exposures to personnel involved in all steps of the alternative.
- Avoided releases, damages, injuries, or exposures because recycled material displaces virgin production should be credited to the recycle options.

Summarized Example Output

	Recycle 1	Recycle 2	Disposal 1	Disposal 2
Direct Cost Parameters				
Net Present Value	$5M	$7M	$6M	$5.5M
Total Cost Undiscounted	$9M	$13M	$11M	$10M
Program Schedule	9.2 years	11.1 years	10.5 years	10.1 years
Socio-Economic Parameters				
Local Economic	$15M	$14M	$12M	$14M
Institutional	Meets recycle, resource conservation, privatization policies	Meets recycle, privatization policies	Multi-state transport concerns	Local transport only, no privatization
Social	Public prefer recycle	Public prefer recycle	Public prefer removal of material	Public prefer least cost
Environment, Safety & Health Parameters				
Public Health	10^{-5} risk of fatality	10^{-4} risk of fatality	10^{-4} risk of fatality	10^{-5} risk of fatality
Environmental	Low damage to ecological systems	Moderate damage to ecological systems	Moderate damage to ecological systems	Low damage to ecological systems
Worker Safety	10^{-4} risk of injury	10^{-3} risk of injury	10^{-3} risk of injury	10^{-4} risk of injury

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