Return on Investment (ROI)

Proposal Preparation Guide

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examples of completed ROI forms. The intent is to assist waste generators in identifying projects that meet the criteria, provide information necessary to complete the ROI forms, and submit a proposal that is eligible to receive funding.

This guide accompanies the one-hour training workshop on how to prepare and submit an ROI proposal.

Section II:

Project Eligibility Requirements

Projects must meet certain minimum eligibility requirements to be considered for ROI funding. To obtain a quick determination of the likelihood of obtaining funding, evaluate your project against the following eligibility requirements and ranking criteria.

- ☒ **The ROI Program Funds Waste Reduction Projects**
- ☒ **Proposal Submission is an ongoing process, ROI Proposals may be submitted throughout the year.**
- ☒ **Preparing a Proposal**
 - Use the ROI Form/Format, Appendix C
 - Use the Standard Calculation Cost Guide to calculate cost data, Appendix A
- ☒ **Types of Projects Considered for Funding**
 - Source reduction
 - Recycling
 - Waste recovery
 - Volume reduction
 - Reduce mixed waste streams
 - Projects with supplemental leverage funds
 - Projects costing <\$500K
 - Projects supported by a Pollution Prevention Opportunity Assessment
- ☒ **Types of Projects Excluded**
 - Projects costing >\$500K
 - Disposal with no waste recovery or recycling
 - Routine maintenance
 - Routine equipment replacement
 - Evaluation of competing proposed options
 - Research and development activities
 - Projects that are already funded in current year baseline.
- ☒ **Selection Process**
 - RL Waste Minimization Team ranks proposals using weighted criteria; selects projects costing ≤\$50K
 - The RL Senior Management Board makes final selection of projects costing >\$50K
- ☒ **Need Assistance?**
 - Contact a P2 POC, <http://apsql05.rl.gov/polprev/contacts/contacts.htm>

Hanford employees can sign up for the one-hour ROI Proposal Preparation Training Workshop by contacting WMH Waste Minimization Group, via e-Mail or on 373-1125.

Return on Investment (ROI) Project/Eligibility Ranking Criteria

- ☒ **Ranking Criteria**
 - **Return on Investment**
 - 3 pts 77% or greater ROI
 - 2 pts 56-76% ROI
 - 1 pt 33-55% ROI
 - **Annual Cost Savings**
 - 3 pts >\$100,000
 - 2 pts \$50,001-\$100,000
 - 1 pt \$10,000-\$50,000
 - **Time to Implement with ROI >33%**
 - 3 pts 0 - 6 months
 - 2 pts 7 - 12 months
 - 1 pt 13 - 24 months
 - **Waste and Pollution Reduction, see Pollution Prevention Activity Focal Areas, Appendix D**
 - 4 pts Source reduction
 - 3 pts Recycling
 - 2 pts Segregation
 - 1 pt Volume reduction

Section III: Preparing the ROI Project Proposal

The ROI Proposal electronic form is available on the P2 Homepage (<http://apsql05.rl.gov/polprev/default.asp>) or contact a Waste Management Hanford (WMH) Waste Minimization point of contact (see the Pollution Prevention Contacts on P2 Homepage (<http://apsql05.rl.gov/polprev/contacts/contacts.html>)) to request a fax and or e-mail a copy of this form.

Hanford employees can sign up for the one-hour ROI Proposal Preparation Training Workshop by contacting WMH Waste Minimization Group, via e-Mail or on 373-1125.

An outline of the information required for the ROI Proposal form is provided below.

I. Proposal Cover Page, see Appendix C

The proposal cover page is intended to provide summary information regarding the date, revision number, project title, company, facility, ROI author, phone number, fax number, project point of contact, phone number, fax number, project type information e.g., source reduction, recycle/reuse (see Appendix D, P2 Activity Focal Areas), waste type e.g., LLW, MLLW etc., amount prevented per year, project duration (months), useful project life (years), total project funding requirements and projected ROI %.

1. Project Description:

Provide a description of the proposed activity and project. Provide information relative to how the activity and process will work. Limited background information is useful to provide some understanding of how the activity and process currently works. Provide specific information essential in identifying how and why this ROI proposal will enhance the activity and process.

Example:

Corrosion in Hanford's double-shell tanks is currently managed by strict adherence to a chemistry specification that is believed to provide adequate corrosion protection for the mild carbon steel tanks. Waste that enters the double-shell tanks meets this specification, however, once in the tanks, chemical reactions can consume the beneficial corrosion inhibitors added to reduce corrosion. The corrosion specifications are conservative in some areas and lacking in others. The DST 241-AN-107 has been operated for the past 10 years with insufficient corrosion inhibitor. The ongoing project to add sodium hydroxide inhibitor will over-correct waste composition with excess inhibitor for conservative continued operation of the tank.

This project will install an on-line corrosion probe in 241-AN-107 to determine the required end point for addition of inhibitor to control corrosion. The probe will be monitored during sodium hydroxide addition to determine when corrosion is at acceptable levels. After inhibitor addition is complete, the probe will be used to continuously monitor corrosion. A prototype probe has already been tested, so the performance of the probe system to achieve this benefit is not in question. This project would pay for acquisition and installation of the system.

U.S. DEPARTMENT OF ENERGY
HIGH LEVEL WASTE (HLW) POLLUTION PREVENTION PROJECT PROPOSAL

Date: _____ Revision #: _____

Project Title: _____

Company: _____ Facility: _____

ROI Author: _____ Phone #: _____ Fax #: _____

Project Point of Contact: _____ Phone #: _____ Fax #: _____

Project Type (Check applicable one)	Waste Type (Amount Prevented Per Year) (Specify Volume (Gallons of Waste))
Source Reduction	LLW
Recycle/Reuse	MLLW
Segregation	TSDF
Volume Reduction	TSDF

Project Duration (months): _____ Useful Project Life (years): _____

Total Project Funding Requirement: _____ Projected ROI: _____

1. Project Description

Provide a description of the proposed activity and project. Provide information relative to how the activity and process will work. Limited background information is useful to provide some understanding of how the activity and process currently works. Provide specific information essential in identifying how and why this ROI proposal will enhance the activity and process.

2. Description of Benefits

Provide a description of the benefits of the proposed activity and project. Provide information relative to how the activity and process will work. Limited background information is useful to provide some understanding of how the activity and process currently works. Provide specific information essential in identifying how and why this ROI proposal will enhance the activity and process.

3. Basis of Data Presented

Provide a description of the basis of data presented. Provide information relative to how the activity and process will work. Limited background information is useful to provide some understanding of how the activity and process currently works. Provide specific information essential in identifying how and why this ROI proposal will enhance the activity and process.

1. Project Description
Describe project activity/process

2. Description of Benefits
Describe the benefits of implementing this activity/process. Use identifying amount of waste reduction, amount of waste reduced by comparing chemical procurement savings, reduction of supplies, labor reduction, etc. Quantify the reduction and savings achieved. Explain the tangible and/or intangible benefits such as economic, operational, environmental and/or social benefits that could be derived from implementing this ROI proposal. Identify which waste minimization method will be achieved, source reduction, volume reduction, recycling, etc.

3. Basis of Data Presented
Describe which process was used to evaluate and assess this new activity and process, such as the performance of a pollution prevention opportunity assessment (P2OA), value engineering study, etc. Identify the completion date, waste stream information and other ideas that were considered.

2. Description of Benefit(s):

Describe benefits of implementing new activity and process e.g., identify amount of waste reduced by comparing chemical procurement savings, reduction of supplies, labor reduction, etc. Quantify the reduction and savings achieved. Explain the tangible and/or intangible benefits such as economic, operational, environmental and/or social benefits that could be derived from implementing this ROI proposal. Identify which waste minimization method will be achieved, source reduction, volume reduction, recycling, etc.

Example:

Installation of a corrosion probe in 241-AN-107 will allow in-tank monitoring of corrosive conditions. This will save money by reducing the number of samples required to be taken and will minimize waste by ensuring that chemistry is corrected only as much as necessary to control corrosion, not just to maintain a specification.

Current corrosion control involves addition of raw chemicals (sodium hydroxide) to DSTs when they are found to be operating outside the current corrosion specification. Direct monitoring of corrosion via on-line corrosion instrumentation will have the following benefits:

- 1) Reduces worker exposure by eliminating some sample requirements
- 2) Reduces number of samples required (\$50,000/sample savings)
- 3) Reduces waste immobilization fees (\$750,000/metric ton of sodium savings)
- 4) Reduces procurement of 30,000 gallons of sodium hydroxide (\$1.67/gallon of sodium hydroxide)
- 5) Reduces DST waste volumes
- 6) Reduces waste volumes processed through future evaporator campaigns
- 7) Reduces immobilized waste form long term storage mortgage expense
- 8) Improves DST reliability and availability (\$67M DST replacement)

3. Basis of Data Presented: Waste Minimization Assessment

Describe which process was used to evaluate and assess this new activity and process, such as the performance of a pollution prevention opportunity assessment (P2OA), value engineering study, etc. Identify the completion date, waste stream information and other ideas that were considered:

A P2OA is a systematic approach in identifying cost effective waste reduction opportunities. A P2OA is the preferred assessment method. However, other evaluation methods such as value engineering studies are also acceptable.

If you're interested in identifying opportunities to reduce waste in your workplace a four-hour Pollution Prevention Opportunity Assessment (P2OA) workshop can help. The P2OA process is an outstanding tool to identify opportunities for implementing pollution prevention initiatives. If you haven't already participated in P2OA training and would like to sign up, contact the WMH Waste Minimization Group at 373-1125.

Example:

A formal Pollution Prevention Opportunity Assessment has not been prepared for this proposal. Other alternatives considered for reducing the amount of sodium added to DSTs for corrosion control include the use of alternate forms of hydroxide solutions such as lithium hydroxide and potassium hydroxide. These alternatives are not as readily available as sodium hydroxide and sodium nitrate and they come with similar waste oxide loading issues as the sodium. Sodium nitrite is an effective alternative corrosion inhibitor to sodium hydroxide, however this alternative does not significantly reduce the volume of alkali metal added to the final waste form. Sodium hydroxide is the only approved inhibitor for use in the DST system.

ROI Proposal Preparation Guide

Direct monitoring of corrosion phenomena to provide a sound technical basis for not adding raw chemicals for corrosion control of double-shell tanks was found to be the most effective source reduction of this waste stream. There currently is no funding for this project, although the monitoring of a prototype corrosion probe installed in 241-AZ-101 in August, 1996, is continuing.

Reduction of sodium additions to DSTs provide astronomical costs benefits for immobilization fee reduction. The two estimates of \$750,000 and \$1.2 million per metric ton of sodium processed come directly from the Phase I immobilization proposals prepared by BNFL and LMAES. Since inclusion of these future cost reductions completely overwhelms the ROI calculations, a second ROI calculation is provided to show that this project more than pays for itself in the first year of operation, and all subsequent years, even without regard to immobilization fee reductions.

Key Assumptions:

1) Process Chemistry Sample Requirements

Baseline: Multiple waste samples will be taken from 241-AN-107 during and after sodium hydroxide addition. These samples are taken for safety screening, evaporator campaigns, and process chemistry and compatibility. At least two grab samples will be taken just for corrosion chemistry assessment in the year immediately following sodium hydroxide addition, and one sample will be taken annually thereafter. The ROI calculations were performed on the basis of eliminating two of the grab samples in the first year after sodium hydroxide addition and one sample per year in subsequent years. Grab samples are estimated to cost an average of \$50,000 each.

Proposal: Eliminate two waste samples in the first year after sodium hydroxide addition and one sample per year thereafter.

2 eliminated grab samples in first year = \$100,000 savings

1 eliminated grab sample in subsequent years = \$50,000/yr savings

Total savings for elimination of 6 samples = \$300,000

2) Source Reduction of Low Level Waste Form

Baseline: The 241-AN-107 low hydroxide remediation project will add approximately 60,000 gallons of 19 molar sodium hydroxide to this tank in fiscal year 1997 or 1998. This volume added is approximately a factor of two greater than required to achieve the compliance with the Operating Safety Document concentration limits for corrosion control. Moreover, the planned addition will provide approximately a factor of four greater concentration than theoretical estimations of concentrations actually required for corrosion control.

Proposal: Direct monitoring of corrosion will allow the volume of inhibitor to be reduced by 30,000 gallons (113 cubic meters, liquid) containing 51 metric tons (51,000 kg) of sodium. Although a significant amount of this volume can be reduced through evaporation, the sodium will remain until immobilized by the privatization contractor. With an estimated 25% waste oxide loading for immobilized sodium, this converts to 204 metric tons (204,000 kg) LLW waste form avoided for future disposal. The lowest estimated immobilization cost for double shell tank waste from the privatization contractor is \$750,000 per metric ton of sodium. Reducing sodium additions by 51 metric tons will reduce out year immobilization cost by at least \$38 million.

Total Reduction of LLW Glass: 204 metric tons

Total Reduction of Immobilization Costs: \$38 million

Annualized Reduction of LLW Glass: 41 metric tons

Annualized Reduction of Immobilization Costs: \$7.65 million

(Assume 5 year probe life)

3) Source Reduction of Inhibitor

Baseline: The 241-AN-107 low hydroxide remediation project will add approximately 60,000 gallons of 19 molar sodium hydroxide to this tank in fiscal year 1997 or 1998.

Proposal: Installation of a corrosion probe will allow a reduction of the amount of sodium purchased by 30,000 gallons. Large volumes of sodium hydroxide delivered to the Hanford site cost \$1.67 per gallon.

Total Reduction of Procurement Cost: \$50,000

A. System Process Flow Diagrams
Provides a visual and clear flow diagram of activities steps to implement new project and provide any

Example:

6. Project Schedule, Milestones, and Deliverables

3. Synthesis/Process Flow Diagrams

Provide a before and after flow diagram of activities to implement new process, provide any supplementary information to augment activity and process concepts. The intended purpose of the before and after flow diagram is a graphical representation of process and activity.

The information contained within the proposal serves as the basis for review of the proposed project and subsequent ranking for funding consideration. In order to ensure a degree of uniformity for review purposes, all proposals **must** be submitted using the ROI Project Proposal form and use the dollar amounts specified for waste related costs in their calculations. Because overhead, G&A, labor, and MPR rates vary among Hanford contractors it is recommended that you contact your respective financial analyst or the WMH Waste Minimization financial analyst on 372-1455.

Worksheet 1: Organizing & Maintaining Annual Recurring Costs		
Expense Category	Below \$50	Above \$50
1. Expenses:		
a. Personal Bank Statements and Supplies		
b. Personal Organization Costs		
Utility Costs		
Labor Costs		
Savings/Investment Costs		
Costs for Personal		
c. FF&E and Related Incentive/Labor/Supply Costs		
d. Water Management Costs		
Water Treatment Costs		
Treatment/Storage/Operational Costs		
Impervious/Compaction Costs		
e. Any/Other Costs:		
Material/Construction/Equipment/		
Permitting Costs		
Maintenance and Supply Costs		
a. Construction and Maintenance		
Labor Costs		
Material Costs for Excavating		
f. Administrative/Labor Costs		
Total Annual Costs		

This worksheet is intended to identify before and after annual costs comparison.

[illegible]

2. Itemized Project Funding Requirements:

6

Section IV: On-Line Help is Available

Pollution Prevention Information URL is:
<http://apsql05.rl.gov/polprev/default.asp>

The ROI Proposal form URL is:
http://apsql05.rl.gov/polprev/hroi/wordp/roi_form.wp5

The P2 Contacts list URL is:
<http://apsql05.rl.gov/polprev/contacts/contacts.htm>

Section V: Submittal and Selection

Call letters requesting ROI proposals are issued by RL to the Hanford prime contractors periodically. Proposals are accepted for review at any time. The proposal preparation process is depicted in Figure 1. Completed proposals are submitted to the RL Waste Minimization Program Manager. Electronic submittals are preferred.

It is recommended that PNNL, BHL, and FDH employee's contact their respective RL counterpart and communicate your intent to submit a ROI proposal. Also, Project Hanford Management Contract (PHMC) contractor employees should make their Fluor Daniel Hanford (FDH) counterpart aware of their ROI proposals. A listing of the RL Waste Minimization Pollution Prevention points of contact is available on the above URL.

ROI proposals are reviewed by the RL Waste Minimization team, which includes RL members from across the site. The RL Waste Minimization team ranks proposals using weighted criteria and can approve projects costing $\leq \$50,000$. Projects costing $> \$50,000$ are screened by the team and forwarded to the RL Senior Management Board for final evaluation. Following the selection process, individual project managers are notified of the results.

The WMH Waste Minimization group is available to assist Hanford contractors in preparing ROI proposals. Contact your respective P2 POC or Financial Analyst.

**Figure 1:
ROI Proposal Preparation and
Submittal Flow Diagram**

Section VI: Implementation

ROI Project Guidance

Upon ROI approval, the following two steps will be followed:

- 1) Resource loaded schedule shall be completed, see Table 1. Contact your respected Financial Analyst for assistance in completing the resource loaded schedule. This schedule will then be used for inputting into the PHMC financial system for cost tracking purpose.
- 2) Specific reporting procedures are required when your project receives ROI funding. These reporting requirements are described in this section. Approximately 1 to 2 hours per month is estimated to fulfill the reporting requirements; be sure to include this cost in Worksheet 2: Itemized Project Funding Requirements, Item #5 - Readiness Reviews/Management Assessment/Administrative Costs, when completing your ROI form. Reporting requirements include:
 - Monthly Reviews - generally a 15-minute telecon providing verbal status of project activities
 - Monthly Report - an electronic submittal documenting Accomplishments, Upcoming Activities, Milestone Status, Budget/Schedule, and Issues
 - Monthly Detailed Cost Reports - detailed costs by cost element for each project managed by PNNL and BHI; detailed costs by element for all other contractors will be obtained from the PHMC financial system by the WMH Waste Minimization group financial analyst
 - Close-Out: Year-End Reports; Requests for Carryover - specific forms to be completed once the project is complete, at fiscal year end, or when project activities will flow into the next fiscal year, see Worksheet, Section 5.
 - Documentation of Deliverables - any written documentation regarding: your project, examples include design reviews, case studies, procurement requisitions, specifications, contracts, etc.

SUMMARY

Appendix A

Standard

Calculations

Costs Information

Return on Investment Waste Cost Guide

This guide was updated to provide a simplified, up to date method to determine waste related costs to be used in calculating Return on Investment (ROI) for Pollution Prevention/Waste Minimization projects. Available life cycle cost information was researched to provide the generators with cost figures that can be used and supported.

The purpose and appropriate use of these cost figures is for ROI calculations for U.S. Department of Energy, Richland Operations (RL) proposals. These costs represent the life-cycle costs for waste related activities. It is appropriate to use these costs to estimate specific facility or site savings for ROI proposals, and annual waste reduction savings.

For each waste type a flow chart is provided. Each block has a related cost where available. Project Hanford contractor costs were used. These costs and sources are referenced. For other blocks, estimated costs are provided based on costs from other DOE sites or the breakdown of events of which that step is comprised. Some costs that are highly variable and depend on the individual generator are not added to these flow charts. Costs have been provided in Fiscal Year (FY) 1998 dollars per cubic meter of waste unless stated otherwise.

If a project prevents the generation of a waste, all avoidable costs related to that waste are eliminated and the sum of all avoidable costs for that type of waste would be used in your calculation. Table 1 provides the sum of avoidable costs for each waste type. There may be other projects that affect the costs related to some processes for a waste type, such as treatment or disposal. If this is the case, refer to the flow charts in Appendix B to determine which costs are eliminated.

Table 1:
Sum of Avoidable Costs by Waste Type

Waste Type	Average Life Cycle Disposal Costs
Low Level	<ul style="list-style-type: none"> • Non-Compacted Waste – \$2,000/m³ • Compacted Waste – \$4,400/m³
Mixed Low Level	<ul style="list-style-type: none"> • Without Treatment – \$9,050/m³ • Thermally Treatment – \$15,650/m³ • Non-Thermally Treatment with and without Debris – \$14,650/m³
Hazardous	<ul style="list-style-type: none"> • \$11,700/metric ton
TRU	<ul style="list-style-type: none"> • TRU Retrieved from Burial Ground to WRAP to WIPP – \$57,300/m³ • TRU Waste Retrieved from Storage to WRAP to WIPP – \$57,100/m³ • TRU Waste from Generator Direct to WIPP – \$47,300/m³
Solid Sanitary	<ul style="list-style-type: none"> • Compatible Waste - \$132/metric ton • Non-Compatible Waste - \$132/metric ton plus \$200 labor per shipment
Liquid Waste	<ul style="list-style-type: none"> • 200 Area ETF – \$0.25/gallon* • 200 Area TEDF – \$0.01/gallon • 300 Area TEDF – \$0.03/gallon • Double Shell Tank Costs – \$17.37/gallon**

* Secondary solid radioactive CERCLA waste shipped to ERDF for burial costs by ETF = \$550/m³

**Includes costs for transfer, storage, and treatment at the 242-A Evaporator.

The costs for pre-treatment of liquid effluents are variable depending on the facility. No attempt has been made to provide a general estimate of these overall costs. However, the specific costs for liquid wastes processing are listed in Table 1. These costs were obtained from the Hanford Liquid Effluent Decision Plan (RFSH-97).

Cost for low level, mixed low level, hazardous, and transuranic waste were received from generators that handled large amounts of waste. These numbers are considered an appropriate representation of average costs across the Hanford Site and are presented in Table 1. If it is necessary to determine personnel costs for individuals who handle and ship waste or perform other activities addressed in annual costs and savings, hourly labor rates for bargaining unit, exempt and non-exempt personnel should be obtained from the appropriate project or financial analyst.

Appendix B contains flow charts that represent the life cycle movement of wastes from generation to disposal. These flow charts are broken down into generation, treatment, storage, and disposal. Boxes that are dotted include planned treatment options that do not take place at this time.

Appendix A

Solid waste costs, for disposal and burial per cubic meter of waste, are determined by the outside dimensions of a container. To assist in determining the cost per cubic meter, Figure 1 identifies related waste conversions for various sized drums and containers. If additional volume conversions are required for drums or containers with other external dimensions, additional information can be obtained from, "Hanford's Commonly Used Containers: Treatment, Storage, and Disposal Volumes" (WHC-SD-WM-CSD-005, Revision 0, dated September 1996).

If it is necessary to determine standard utility cost for electrical, natural gas, steam, fuel oil, and or process water contact the appropriate utility organization.

To determine the appropriate costs per cubic meter it was necessary to convert information. The related waste conversions that were used are listed below.

Figure 1:
Related Waste Conversions

Drums - Volume Based on External Dimensions

8 Gallon Drum	= 0.04 Cubic Meters**
16 Gallon Drum	= 0.08 Cubic Meters**
30 Gallon Drum	= 0.1136 Cubic Meters**
55 Gallon Drum	= 0.26 Cubic Meters**
85 Gallon Drum	= 0.38 Cubic Meters**

Boxes - Volume Based on External Dimensions

2' X 2' X 6' Box	= 0.74 Cubic Meters
4' X 4' X 4' Box	= 2.92 Cubic Meters
4' X 4' X 8' Box	= 4.08 Cubic Meters

**The outside dimensions of the container determine the cost for handling and burial. These conversions should be used in determining avoidable costs rather than the internal capacity of the container.

References

- Aranda 98, CC:Mail, for Containerization and Assay Costs for TRU Waste, July 9, 1997, Waste Management Federal Services of Hanford, Inc., Richland, Washington.
- Baker 98, CC:Mail, Costs for Thermal Treatment of Low Level Waste, July 9, 1997, Waste Management Federal Services of Hanford, Inc., Richland, Washington.
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- Greager 97, Meeting Notes for Suspect TRU Retrieval Costs, July 29, 1997, Waste Management Federal Services of Hanford, Inc., Richland, Washington.
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- Penn 97, Costs for Non Destructive Assay and WRAP Repackaging, May 6, 1997, Waste Management Federal Services of Hanford, Inc., Richland, Washington.
- Penn 97-2, Costs for Shipment Preparation for TRU Waste, August 1, 1997, Waste Management Federal Services of Hanford, Inc., Richland, Washington.
- RFSH-97, Hanford Liquid Effluent Decision Plan, RFSH-9751400, February 1997, Rust Federal Services of Hanford Inc., Richland, Washington.
- Shehadeh 98, Meeting Notes, Disposal Costs for Low Level, Mixed Low Level, and Hazardous Waste, July 20, 1998, Waste Management Federal Services of Hanford, Inc., Richland, Washington.
- WHC, Hanford's Commonly Used Containers: Treatment, Storage, and Disposal Volumes, WHC-SD-WM-CSD-005, Revision 0, September 1996.
- Wilde 98, Memorandum Fiscal Year 1998 Storage/Disposal Rates and Assessments, March 12, 1998, Waste Management Federal Services of Hanford, Inc., Richland, Washington.

Appendix B

Life Cycle Waste

Flow Charts

Flow Charts for Avoidable Waste Costs Low Level Waste

Generation

Treatment
Compaction**

After compaction - 4+5+6 = \$2,400/m³ or
\$400/m³ pre-compacted (Shehadeh 98)

7 Acceptance/Verification

2+7 for Non-Compactable = \$1,100/m³ (Shehadeh 98)
2+7 for Compactible = \$900/m³*** (Shehadeh 98)

Disposal*

8 Burial (Wilde 98)	
Category 1	\$500/m ³
Category 3 (Contact Handled)	\$1,900/m ³
Category 3 (Remote Handled)	\$2,800/m ³

Total Avoidable Costs:

Non-Compacted Waste = \$2,000/m³

Compacted Waste = \$4,400/m³ or \$733/m³ pre-compaction

*Item 1 for compacted waste is \$600 (6m³).

**Assume 6 to 1 compaction ratios.

***Containers used for shipping LLW for compaction are reused.

****These costs are representative of Low-Level Burial Grounds.

Mixed Low Level Waste

Generation

Storage

1+2 = \$5,850/m³ (Shehadeh 98)

4+5 = \$2,400/m³ (Wilde 98)

Treatment (Contracted)

Disposal

6+7a+8+9 for Thermal Treatment
= \$7,100/m³ (Baker 98)

6+6a+7b+8+9 for Non-Thermal Treatment Debris Waste
= \$5,600/m³ (Nester 98)

6+6a+7b+8+9 for Non-Thermal Treatment Non Debris Waste
= \$5,600/m³ (Nester 98)

Total Avoidable Costs = with Thermal Treatment = \$15,650/m³
 Non-Thermal Treatment with Debris and without Debris = \$14,650/m³
 Without Treatment = \$9,050/m³

Hazardous Waste

Generation

Total Avoidable Cost = \$11,700/mt

TRU Waste

Generation

Total Avoidable Cost

TRU Retrieved from Burial Grounds to WRAP: $9+10+5+7+8 = \$57,300/\text{m}^3$

TRU Waste Retrieved from Storage to WRAP to WIPP: $10+5+7+8 = \$57,100/\text{m}^3$

TRU Waste from Generator Direct to WIPP: $1+2+3+4+12+7+8 = \$47,300/\text{m}^3$

*FY 99 Startup Cost.

Solid Sanitary

Liquid Effluents

200 Area Effluent Treatment Facility (ETF)

300 Area Treated Effluent Disposal Facility (TEDF)

Generation

Treatment

200 Area ETF 5+6+7 = \$0.25/gallon

300 Area TEDF 6+7 = \$0.03/gallon

*Costs are variable depending on the generator and waste stream.

**Secondary solid radioactive CERCLA waste shipped to ERDF for burial by ETF = \$550 m³.

200 Area Treated Effluent Disposal Facility (TEDF)

Generation

Treatment

*Costs are variable depending on the generator and waste stream.

Tank Farms Waste Process Through Evaporator

Generation

Treatment

Total Avoidable Cost = \$17.37/gallon

*Costs are variable depending on the generator and waste stream.

Appendix C

ROI Form

Appendix C

U.S. DEPARTMENT OF ENERGY, RL

HIGH RETURN ON INVESTMENT (ROI)

POLLUTION PREVENTION

PROJECT PROPOSAL

Date: _____ Revision #: _____

Project Title: _____

Company: _____ Facility: _____

ROI Author: _____ Phone #: _____ Fax #: _____

Project Point of Contact: _____ Phone #: _____ Fax #: _____

Project Type
(Check applicable one)

Source Reduction: _____

Recycle/Reuse: _____

Segregation: _____

Volume Reduction: _____

Waste Type/Amount Prevented Per Year:
(Specify Volume/Unit of Measurement)

LLW: _____ SAN: _____

MLLW: _____ State: _____

TRU: _____ RCRA: _____

TRU/M: _____ TSCA: _____

HLW: _____ MTSCA: _____

Project Duration (months): _____ Useful Project Life (years): _____

Total Project Funding Requirements: _____ Projected ROI %: _____

1. Project Description

(Describe proposed activity/process)

2. Description of Benefit(s)

(Describe benefits of implementing new activity/process, i.e., identifying amount of waste reduced by comparing chemical procurement savings, reduction of supplies, labor reduction, etc.)

3. Basis of Data Presented

(Describe process used to evaluate/assess the new activity/process, i.e. pollution prevention opportunity assessment, value engineering study etc.)

4. Project Schedule, Milestones, and Deliverables

(Identify schedule of activities, milestones, and deliverables for project implementation)

5. System/Process Flow Diagrams

(Provide a before and after flow diagram of activities (steps) to implement new project and provide any supplementary information to augment activity/process concepts)

Worksheet 1: Operating & Maintenance Annual Recurring Costs

Expense Cost Items	Before (B) Annual Costs	After (A) Annual Costs
1. Equipment		
2. Purchased Raw Materials and Supplies		
3. Process Operation Costs: Utility Costs Labor Costs Routine Maintenance Costs for Processes		
4. PPE and Related Health/ Safety/Supply Costs		
5. Waste Management Costs: Waste Container Costs Treatment/Storage/Disposal Costs Inspection/Compliance Costs		
6. Recycling Costs Material Collection/Separation/ Preparation Costs a. Material and Supply Costs b. Operations and Maintenance Labor Costs Vendor Costs for Recycling		
7. Administrative/other Costs		
Total Annual Cost:		

Appendix C

Worksheet 2: Itemized Project Funding Requirements

(i.e., One Time Implementation Costs)

Category	Cost \$
<u>Initial Capital Investment</u>	
1. Design	
2. Purchase	
3. Installation	
4. Other Capital Investment (explain)	
Subtotal: Capital Investment = (C)	
<u>Installation Operating Expenses</u>	
1. Planning/Procedure Development	
2. Training	
3. Miscellaneous Supplies	
4. Startup/Testing	
5. Readiness Reviews/Management Assessment/ Administrative Costs (include 1-2 hrs/month for reporting requirements) ROI reporting	
6. Other Installation Operating Expenses (explain)	
Subtotal: Installation Operating Expense = (E)	
7. All company adders (G&A/PHMC Fee, MPR, GFS, Overhead, taxes, etc.) (if not contained in above items)	
Total Project Funding Requirements = (C + E)	
Useful Project Life = (L) ____ Years Time to Implement : ____ Months	
Estimated Project Termination/Disassembly Cost (if applicable) = (D) ____ (Only for Projects where L < 5 years; D = 0 if L > 5 years)	
<u>Return on Investment Calculation</u>	
Return on Investment (ROI) % =	
$\frac{(\text{Before} - \text{After}) - [(\text{Total Project Funding Requirements} + \text{Project Termination}) / \text{Useful Life}]}{[\text{Total Project Funding Requirements} + \text{Project Termination}]} \times 100$	
$\text{ROI} = \frac{(\text{B}-\text{A}) - [(C+E+D)/L]}{(C+E+D)} * 100 = \text{.....}\%$	
O&M Annual Recurring Costs:	Project Funding Requirements:
Annual Costs, Before = ____ (B)	Capital Investment = ____ (C)
Annual Costs, After = ____ (A)	Installation Op. Exp = ____ (E)
Net Annual Savings = ____	Total Project Funds = (C) + (E) ____
Estimated Project Termination/Disassembly Cost (if applicable) ____ (D) (only for Projects where L < 5 years; D = 0 if L > 5 years)	
Notes: Before (B) and After (A) are Operating & Maintenance Annual Recurring Costs from Worksheet 1.	

Appendix D

Completed ROI

Examples

Note:

The examples depicted in the ROI Proposal Preparation Guide do not necessarily reflect the current FY 1998 ROI Preparation Form and rates.

Successful ROI Project Proposals

Reference: P2 homepage URL is:

<http://apsq105.rl.gov/polprev/default.asp>

The format and cost information on some of them may differ slightly from the format and cost information currently used due to the change in guidance from DOE HQ and RL.

Examples of Approved ROI's

- Selection and Implementation of a Cost-Effective Parts Washer System
POC: Dennis Poor, DynCorp

Three parts washers (one microbial and two different petroleum distillate solvent systems) will undergo a 90-day evaluation at DynCorp's Vehicle Maintenance Shop. Following the evaluation period, three new parts washer were installed.

Download the Parts Washer submittal

- Sodium Minimization for 241-AN-107 Low Hydroxide Remediation
POC: Jim Nelson, LHMC

Double shell tank 241-AN-107 has been operated for the past 10 years with insufficient corrosion inhibitor. The addition of sodium hydroxide inhibitor will over-correct waste composition with excess inhibitor for conservative continued operation of the tank. An on-line corrosion probe will be installed to determine the required end point for the addition of inhibitor and to continuously monitor corrosion thereafter.

Download the Sodium Minimization submittal

- Portable Radiological Detection Instruments for Surveying of Contaminated Materials
POC: Conan Wade, BHI

Procurement of Eberline E-600 Survey Meters will allow Radiation Technicians to survey for both alpha and beta with a greater sensitivity using a 100 square centimeter probe. The accuracy of these meters will allow the release of more materials for reuse or recycling and result in a source reduction of low level waste.

Download the Rad Detection Instruments submittal

U.S. DEPARTMENT OF ENERGY, RL
HIGH RETURN ON INVESTMENT (ROI)
POLLUTION PREVENTION
PROJECT PROPOSAL

Project Title: Eliminate Solid Waste Stream with Treatment and Recycling

Facility Name: 300 TEDF/Hanford Site

We certify that the information provided herein is accurate to the best of our knowledge.

The Operations Office, and the above identified Facility, commit to operate the proposed project in the years following the original implementation period, so long as cost savings continue to be realized.

Responsible
for Project

Implementation: _____

Operations
Office WMin/PP

Coordinator: _____

Appendix D

U.S. DEPARTMENT OF ENERGY POLLUTION PREVENTION EXECUTIVE BOARD HIGH RETURN ON INVESTMENT POLLUTION PREVENTION PROJECTS

PROJECT SUMMARY DATA SHEET

Project Title: Eliminate Solid Waste Stream with Treatment and Recycling
Serial Number: _____ (HQ Assigned)

Location/Site: 300 TEDF/Hanford Site Implementing CSO: EM

Operations Office: Richland Operations Office (RL)

Site Contact: Kevin Hagerty, Rust Federal Services Hanford

Phone/Fax: 372-3133

Project Summary:

Provide 3-5 bullets to describe the project, including:

1. Statement of existing process/activity condition
2. Statement of proposed change to process/activity
3. Description of resulting waste/pollutant reductions

Oil-contaminated water and oil-water mixtures are not amendable for commercial use in fuel blending operations or other common recycling techniques because high water content (>90%) inhibits combustion. The effluent treatment facilities on the Hanford Site do not have the ability to treat these wastes so they are absorbed and disposed in a sanitary landfill. The current practice is to absorb oil-contaminated waste water in 55-gallon drums.

This proposal is to purchase, test, and install a piece of equipment which will separate the oil component from the water matrix. This equipment will be installed at the 300 Area Treated Effluent Disposal Facility (TEDF) to provide centralized treatment for this waste stream from the entire Hanford Site. The oil-free effluent from the oil separator will be treated at TEDF and discharged to the Columbia River under the existing NPDES permit. The oil recovered will be managed and recycled as used oil. A coalescing oil removal system will be selected to ensure an oil free effluent.

Project Duration (months): 2 Useful Project Life (Years): 20 (L)

Performance Indicators:

$$ROI = \frac{(B-A) - [(C+E+D)/L]}{(C+E+D)} \quad *100 = 99\%$$

O&M Annual Recurring Cost (i.e., Total Annual Operating Costs)	Project Funding Requirements: (i.e., On-Time Implementation Costs)
Annual Costs, Before = 6546 (B)	Capital Investment = 4135 (C)
Annual Costs, After = 1200 (A)	Installation Operating Expense = 1000 (E)
Net Annual Savings = 5089	Total Project Funds = (C) + (E) = 5135 (E)
Estimated Project Termination/Disassembly Cost (if applicable) 0 (D) (only for projects where L < 5 years; D = 0 if L > 5 years)	

Waste/Pollutant Quantity Reductions:

Prevented Waste: (List type and amount in kg or m³ per year)

15.6 metric tons sanitary waste (machine oil-water mixture)

Comments:

Use, as necessary, to qualify relevant aspects of the project not included above. Although source reduction would be the preferred method of minimizing this waste stream, most sources of this waste are in facilities which are undergoing deactivation and decommissioning. It is not cost effective to install state-of-the-art oilless equipment in facilities which are being shut down, so treatment and recycling are preferred over disposal.

ROI Project Title

1. Project Description:

This proposal is to purchase, test, and install a piece of equipment which will separate the oil component from the water matrix. This equipment will be installed at the 300 Area Treated Effluent Disposal Facility (TEDF) to provide centralized treatment for this waste stream from the entire Hanford Site. A coalescing oil removal system will be selected to ensure an oil free effluent. The oil-free effluent from the oil separator will be treated at TEDF and discharged to the Columbia River under the existing NPDES permit. The oil recovered will be managed and recycled as used oil.

2. Description of Benefit(s):

This project will recover a pollutant (used oil) which is currently being disposed of in the environment and will make it available for reuse through used oil recycling.

This project will decrease the overall volume of sanitary waste from the Hanford Site. Reduction of this waste stream is a Secretary of Energy waste reduction goal.

3. Basis of Data Presented (PPOAs):

To determine how much reduction would occur, it was assumed that a 0.21 m³ drum (55-gallon) of water contaminated with oil contains 1% oil by volume. It is also assumed that absorbing the liquid would generate three volumes, or 0.62 m³ (165 gallons) of solid waste. Absorbing and packaging would require a similar volume of absorbent material and three metal drums.

The 209E Facility annually processes approximately 18 drums of oily waste through an oil skimmer. The processed water still contains oil and is absorbed and sent to the sanitary landfill. A minimum of two other oily waste streams have also been identified. Based on this level of generation, an oil/water separator with variable capacity of 1 to 10 gpm was selected. This project will provide an acceptable treatment rate for the sources identified and will allow capacity for other sources.

4. Project Schedule, Milestones, and Deliverables:

Assume start date of 10/1/97.

	<u>Date</u>
Purchase oil separator and associated equipment	8/1/97
Install oil separator	9/1/97
Begin operation of oil separator	10/1/97

5. System/Process Flow Diagrams:

1. Oil-water waste accumulated at generator facility
2. Generator characterizes oily waste
 - process knowledge (MSDSs for oil, etc.)
 - analytical data if necessary
3. Generator ships containerized oily waste to TEDF
4. Oily waste containers staged at TEDF
5. Oily waste pumped into coalescing filter unit
6. Oil-free effluent collected in verification tank
 - effluent verified oil-free before discharged to TEDF
7. Recovered oil accumulated at TEDF
 - generator's data used to characterize recovered oil
 - analytical data if necessary
8. Recovered oil shipped to off-site recycler
9. Empty containers returned to generator for reuse

Appendix D

Worksheet 1: Operating & Maintenance Annual Recurring Costs

Expense Cost Items	Before (B) Annual Costs	After (A) Annual Costs
1. Equipment		
2. Purchased Raw Materials and Supplies		
3. Process Operation Costs: Utility Costs Labor Costs Routine Maintenance Costs for Processes		1200
4. PPE and Related Health/ Safety/Supply Costs		
5. Waste Management Costs: Waste Container Costs Treatment/Storage/Disposal Costs Inspection/Compliance Costs	6546	
6. Recycling Costs Material Collection/Separation/ Preparation Costs a. Material and Supply Costs b. Operations and Maintenance Labor Costs Vendor Costs for Recycling		
7. Administrative/other Costs		
Total Annual Cost:	Before (B) = 6546	After (A) = 1200

Worksheet 2: Itemized Project Funding Requirements

(i.e., One Time Implementation Costs)

Category	Cost \$
Initial Capital Investment	
1. Design	4135
2. Purchase	
3. Installation	
4. Other Capital Investment (explain)	
Subtotal: Capital Investment = (C)	
4135	
Installation Operating Expenses	
1. Planning/Procedure Development	1000
2. Training	
3. Miscellaneous Supplies	
4. Startup/Testing	
5. Readiness Reviews/Management Assessment/Administrative Costs (include 1-2 hrs/month for reporting requirements) ROI reporting	
6. Other Installation Operating Expenses (explain)	
Subtotal: Installation Operating Expense = (E)	
1000	
7. All company adders (G&A/PHMC Fee, MPR, GFS, Overhead, taxes, etc.) (if not contained in above items)	
Total Project Funding Requirements = (C + E)	
5135	
Useful Project Life = (L) <u>20</u> Years Time to Implement : <u>2</u> Months	
Estimated Project Termination/Disassembly Cost (if applicable) = (D) <u>0</u>	
(Only for Projects where L < 5 years; D = 0 if L > 5 years)	
Return on Investment Calculation	
Return on Investment (ROI) % =	
$\frac{(\text{Before} - \text{After}) - [(\text{Total Project Funding Requirements} + \text{Project Termination}) / \text{Useful Life}]}{[\text{Total Project Funding Requirements} + \text{Project Termination}]} \times 100$	
$\text{ROI} = \frac{(B-A) - [(C+E+D)/L]}{(C+E+D)} \times 100 = 99\%$	
O&M Annual Recurring Costs:	Project Funding Requirements:
Annual Costs, Before = ____ (B)	Capital Investment = ____ (C)
Annual Costs, After = ____ (A)	Installation Op. Exp = ____ (E)
Net Annual Savings = ____	Total Project Funds = (C) + (E) _____
Estimated Project Termination/Disassembly Cost (if applicable) ____ (D)	
(only for Projects where L < 5 years; D = 0 if L > 5 years)	
Notes: Before (B) and After (A) are Operating & Maintenance Annual Recurring Costs from Worksheet 1.	

U.S. DEPARTMENT OF ENERGY, RL
HIGH RETURN ON INVESTMENT (ROI)
POLLUTION PREVENTION PROJECT PROPOSAL

Project Title: Automated Acid Dilution for ETF Ion Exchange

Location/Site: 200 Area Effluent Treatment Facility (ETF)

Operations Office: Richland Operations Office (RL)

Site Contact: Lilly Lin/Barry Place

Company Name: Waste Management Federal Services of Hanford, Inc. (WMH)

Phone: 372-2759/372-1372 Fax: 372-2089/373-0743

Date: 6/10/98

Appendix D

ROI Project Title: Automated Acid Dilution for ETF Ion Exchange

Project Summary:

This is a proposal to install an automatic acid dilution system in the ETF to supply acid used to regenerate the ion exchange resin. The automatic system will replace operating activities which are currently performed manually. The manual procedure is not self-correcting and requires continuous attendance. It results in excessive chemical use and waste generation.

1. Project Description

Acid Dilution Problem

The 200 Area Effluent Treatment Facility (ETF) treats waste water by removing radioactive and hazardous constituents, by removing ammonia, and by destroying organics. The treatment process includes pH adjustment, filtration, ultraviolet oxidation (UV/Ox), reverse osmosis, and ion exchange. Treated effluent is discharged to a state approved land disposal site. The secondary waste is concentrated by evaporation and dried to a powder, then packaged in drums for disposal as solid waste.

The ion exchange or "Polisher system" uses two mixed-bed ion exchange columns in series to remove any remaining dissolved solids. A third column is provided which is either undergoing regeneration of the resin or in standby. Spent ion exchange resin is regenerated using caustic (sodium hydroxide) and acid (sulfuric acid). Sulfuric acid is also used elsewhere in the ETF for pH adjustment. When the ETF is treating "hard water" (such as UP-1 groundwater) which contains significant amounts of calcium carbonate, the acid must be diluted to 2 wt% before it can be used to regenerate the ion exchange resin. More concentrated acid would cause solid calcium sulfate to form that would irreversibly foul the resin particles. To regenerate the resin, the caustic is first started and allowed to flow to the Secondary Waste Receiving Tank. The acid is then diluted by mixing with water and manually adjusting the flows. The diluted acid is sampled and the specific gravity measured using a hydrometer. This is a trial and error process during which the acid and caustic continue to flow to the Secondary Waste Receiving Tank.

The ion exchange resin is regenerated an average of 4 times per month. The acid dilution step takes 30 minutes each time; with setup and housekeeping this requires 8 hours/month. Approximately 4,430 gal/month of liquid waste is generated and treated in the ETF, which produces 1,484 lb/month of solid powder waste that is sent to disposal at either the CWC or the ERDF.

Proposed Project

This project will enable the acid to be automatically diluted to the desired concentration from the ETF control room. The automatic dilution system will continuously monitor and control acid addition and avoid the addition of unnecessary quantities of acid associated with the current manual system. The changes to the system are shown in the attached markup of the P&ID for the Polisher system (See "Proposed Upgrade for ETF Polisher System", page 10).

The acid and water will come together in a new mixing tee. A downstream conductivity analyzer will measure the resulting acid concentration. The flow control valve will adjust the water flow to achieve proper dilution. An air-operated valve will provide on-off control. All operations will be monitored and controlled through the distributed control system. The total cost of the project is \$72,845.

2. Description of Benefit(s)

Annual costs savings of \$37,240/yr will be achieved by implementing this project. The volume of solid waste will be reduced by 9.8 m³/yr. The volume of liquid waste will be reduced by 201 m³/yr. The detailed calculations are provided below. The unit conversions in the *ROI Proposal Preparation Guide* were used.

The manual acid dilution procedure is prone to errors which could irreversibly foul the ion exchange resin. Should this occur, the spent resin would have to be replaced. Resin cost alone is \$8,000 per column, and the solid waste disposal cost would be \$33,200. A minimum of 200 hr labor would be required to change out the resin, costing an additional \$10,000. None of these costs are included in the ROI calculation since this type accident has not occurred in the short operating life of the ETF. However, they should be considered in evaluating the overall merits of this project.

Solid Waste Volume Reduction

Manual acid dilution generates 1,484 lb/mo of solid powder waste. Drums of solid powder waste weigh 473 lb/drum. The solid waste volume reduction will be:

$$1,484 \text{ lb/mo} \times 12 \text{ mo/yr} \times 1 \text{ drum}/473 \text{ lb} \times 0.26 \text{ m}^3/\text{drum} = 9.8 \text{ m}^3/\text{yr}$$

Liquid Waste Volume Reduction

Manual acid dilution generates 4,430 gal/mo of liquid waste. The liquid waste volume reduction will be:

$$4,430 \text{ gal/mo} \times 12 \text{ mo/yr} \times 1 \text{ m}^3/264 \text{ gal} = 201 \text{ m}^3/\text{yr}$$

Labor Cost Reduction

The labor required for manual acid dilution is approximately 8 hr/mo. Operating labor costs \$50/hr including adders. The cost savings for labor will be:

$$8 \text{ hr/mo} \times 12 \text{ mo/yr} \times \$50/\text{hr} = \$4,800/\text{yr}$$

Waste Container Cost Reduction

Manual acid dilution generates 1,484 lb/mo of solid powder waste. Drums of solid powder waste weigh 473 lb/drum. Drums cost \$70 each. The cost savings for waste containers will be:

$$1,484 \text{ lb/mo} \times 12 \text{ mo/yr} \times 1 \text{ drum}/473 \text{ lb} \times \$70/\text{drum} = \$2,635/\text{yr}$$

Appendix D

Solid Waste Disposal Cost Reduction

Manual acid dilution generates 9.8 m³/yr of solid waste. The solid waste is split 25% RCRA and 75% CERCLA. Storage of RCRA mixed waste at the CWC costs \$68.32/ft³ and disposal in the Mixed Waste Trench without further treatment costs \$13.76/ft³, for a total cost of \$82.08/ft³. Disposal of CERCLA waste at the ERDF costs \$1.40/ft³. Sampling, characterization, and transportation of solid waste costs \$500/m³. The cost savings for solid waste disposal will be:

$$9.8 \text{ m}^3/\text{yr} \times 25\% \times 35.31 \text{ ft}^3/\text{m}^3 \times \$82.08/\text{ft}^3 = \$7,101/\text{yr}$$

$$9.8 \text{ m}^3/\text{yr} \times 75\% \times 35.31 \text{ ft}^3/\text{m}^3 \times \$1.40/\text{ft}^3 = \$363/\text{yr}$$

$$9.8 \text{ m}^3/\text{yr} \times \$500/\text{m}^3 = \$4,900/\text{yr}$$

$$\$7,101/\text{yr} + \$363/\text{yr} + \$4,900/\text{yr} = \$12,364/\text{yr}$$

Liquid Waste Disposal Cost Reduction

Manual acid dilution generates 4,430 gal/mo of liquid waste. Treatment of liquid waste in the ETF costs \$0.25/gal. The cost savings for liquid waste disposal will be:

$$4,430 \text{ gal/mo} \times 12 \text{ mo/yr} \times \$0.25/\text{gal} = \$13,290/\text{yr}$$

Raw Materials and Supplies Cost Reduction

Manual acid dilutions uses an extra 816 lb/mo of sulfuric acid and 668 lb/mo of sodium hydroxide. Sulfuric acid (92 wt%) costs \$0.95/gal and has a specific gravity of 1.83. Sodium hydroxide (50 wt%) costs \$1.56/gal and has a specific gravity of 1.51. Other supplies cost about \$500/yr. The cost savings for raw materials will be:

$$816 \text{ lb/mo} \times 12 \text{ mo/yr} / (1.83 \times 8.33 \text{ lb/gal} \times 92\%) \times \$0.95/\text{gal} = \$663/\text{yr}$$

$$668 \text{ lb/mo} \times 12 \text{ mo/yr} / (1.51 \times 8.33 \text{ lb/gal} \times 50\%) \times \$1.56/\text{gal} = \$1,988/\text{yr}$$

$$\$663/\text{yr} + \$1,988/\text{yr} + \$500/\text{yr} = \$3,151/\text{yr}$$

3. Basis of Data Presented (Pollution Prevention Opportunity Assessments)

A Pollution Prevention Opportunity Assessment is not available for this activity.

4. Project Schedule, Milestones, and Deliverables

- Design modifications (1 month)
- Procure components (1 month)
- Install hardware/modify system (1 month)
- Test modifications (1 week)
- Conduct training (1 week)

5. System/Process Flow Diagrams

The process flowsheet for the ETF is attached ("ETF Process Flowsheet", page 9). The ETF treatment process is flexible and alternate configurations are possible depending on the characteristics of the waste stream. The liquid waste from regenerating the ion exchange resin is routed from the Polishers to the Secondary Waste Receiving Tanks. A sketch is attached showing the proposed changes to the Polisher system. A detailed cost estimate is also attached.

6. Project Duration (months): 3

Useful Project Life (years): 10 (L)

7. Performance Indicators:

ROI = 41 % (from Worksheet 2)

8. Waste/Pollutant Quantity Reductions:

- 9.8 m³/yr of solid low level waste, of which 2.5 m³/yr is RCRA regulated and 7.3 m³/r is CERCLA regulated.
- 201 m³/yr of liquid waste.

Appendix D

Worksheet 1: Operating & Maintenance Annual Recurring Costs

Expense Cost Items	Before (B) Annual Costs	After (A) Annual Costs
1. Equipment		
2. Purchased Raw Materials and Supplies	3,151	0
3. Process Operation Costs: Utility Costs Labor Costs Routine Maintenance Costs for Processes	4,800	0
4. PPE and Related Health/ Safety/Supply Costs	1,000	0
5. Waste Management Costs: Waste Container Costs Treatment/Storage/Disposal Costs Inspection/Compliance Costs	2,635 25,654	0 0
6. Recycling Costs Material Collection/Separation/ Preparation Costs a. Material and Supply Costs b. Operations and Maintenance Labor Costs Vendor Costs for Recycling		
7. Administrative/other Costs		
Total Annual Cost:	\$37,240 (B)	\$0 (A)

Worksheet 2: Itemized Project Funding Requirements

(i.e., One Time Implementation Costs)

Category	Cost \$
Initial Capital Investment	
1. Design	14,920
2. Purchase	10,700
3. Installation	31,573
4. Other Capital Investment (explain)	15,652
Subtotal: Capital Investment = (C)	72,845
Installation Operating Expenses	
1. Planning/Procedure Development	
2. Training	
3. Miscellaneous Supplies	
4. Startup/Testing	
5. Readiness Reviews/Management Assessment/Administrative Costs (include 1-2 hrs/month for reporting requirements) ROI reporting	
6. Other Installation Operating Expenses (explain)	
Subtotal: Installation Operating Expense = (E)	0
7. All company adders (G&A/PHMC Fee, MPR, GFS, Overhead, taxes, etc.) (if not contained in above items)	
Total Project Funding Requirements = (C + E)	72,845
Useful Project Life = (L) 10 Years Time to Implement : 3 Months Estimated Project Termination/Disassembly Cost (if applicable) = (D) 0 (Only for Projects where L < 5 years; D = 0 if L > 5 years)	
Return on Investment Calculation	
Return on Investment (ROI) % = 41%	
$\frac{(\text{Before} - \text{After}) - [(\text{Total Project Funding Requirements} + \text{Project Termination}) / \text{Useful Life}]}{[\text{Total Project Funding Requirements} + \text{Project Termination}]} \times 100$	
$\text{ROI} = \frac{(B-A) - [(C+E+D)/L]}{(C+E+D)} \times 100 = 41\%$	
O&M Annual Recurring Costs:	Project Funding Requirements:
Annual Costs, Before = 37,240 (B)	Capital Investment = 72,845 (C)
Annual Costs, After = 0 (A)	Installation Op. Exp = 0 (E)
Net Annual Savings = 37,240	Total Project Funds = (C) + (E) = 72,845
Estimated Project Termination/Disassembly Cost (if applicable) (D) (only for Projects where L < 5 years; D = 0 if L > 5 years)	
Notes: Before (B) and After (A) are Operating & Maintenance Annual Recurring Costs from Worksheet 1.	

ETF PROCESS FLOWSHEET

19409005.1

PROPOSED UPGRADE FOR ETF POLISHER SYSTEM

Notes For Proposed Upgrade:

Expected flow rate for new water line is 15-20 gpm. The combined flow rate (after new mixing "T") is 35-40 gpm.

Control of new air-operated valve (AOV) and new flow control valve (FCV) will be done remotely from Control Room.

Instrumental signals from conductivity analyzer are to be transmitted to Control Room via existing DCS.

Modification of existing piping will be necessary to accommodate new equipment. It may be necessary to relocate FCV-65C-148 and PT-65C-148.

Material for conductivity instrument shall be compatible with 4% sulfuric acid. The instrument shall provide conductivity readings of 92 and 175 mS/cm with better than 1% accuracy.

New piping shall be 1-1/2 in Sch 80 PWC, approx 100 ft.

Consider use: Century diaphragm valve (air open/close) for new AOV, Century flow control valve for new FCV, Rosemount flow indicator controller (FIC), Badger flow orifice, and Rosemount conductivity instrument.

Appendix D

Cost Estimate for 200 Area ETF Polisher Upgrade Project

Proposed Major Work Activity	Estimated Cost
WMH Project Administration: Project mgmt: 40 hr	\$2,050
Project engineering: 40 hr	\$2,050
Financial admin, safety, contracting, mgmt oversight, admin: 40 hr	\$2,050
WMH Facility Support: Work Control, facility personnel support: 80 hr	\$4,100
Material Procurement: Materials include - Flow limiting orifice, air operated valve, flow control valve, mixing "tee", conductivity analyzer, associated electronic controllers/transmitters. Approx 100 ft of 1-1/2 in. Sch 80 piping.	\$10,000
Material handling fee on Services Contracts/Materials @ 7%	\$700
Material Installation: Labor to install piping and appertances, connect to plant air, electrical and Distributed Control System, program logic changes, etc.: 250 hr x \$83/hr	\$20,750
FDNW fee @ 5%	\$1,038
PHMC equipment adder @ 7%	\$1,525
Acceptance testing, training, procedure mods, etc. 80 hr x \$52/hr	\$4,160
FDNW project/construction management, design, safety, financial admin, contracting, mgmt oversight, engineering, admin, etc.: 160 hr x \$83/hr	\$13,280
FDNW fee @ 5%	\$664
PHMC equipment adder @ 7%	\$976
Subtotal	\$63,343
Hanford Site G&A adders @ 15%	\$9,502
Total	\$72,845

Pollution Prevention Activity Focal Areas

Appendix E

Glossary

Appendix E

Hazardous Waste:

A solid waste, or combination of wastes, that because of its quantity, concentration, or physical, chemical, or infectious characteristics, may (a) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness, or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

High-Level Radioactive Waste:

Irradiated reactor fuel, liquid wastes resulting from operation of the first cycle solvent extraction system or equivalent, and the concentrated wastes from subsequent extraction cycles or equivalent in a facility for reprocessing irradiated reactor fuel, and solids into which such liquid wastes have been converted. (10 CFR 60.2)

Low-Level Radioactive Waste:

Radioactive waste not classified as high-level waste, transuranic waste, spent nuclear fuel, or byproduct material (specified as uranium or thorium tailings and waste in accordance with DOE Order 5820.2A).

Mixed Waste:

Waste that contains both radioactive and hazardous components, as defined by the Atomic Energy Act, Toxic Substances Control Act, or Resource Conservation and Recovery Act. Mixed waste is further defined here as transuranic mixed, low-level mixed, and Toxic Substances Control Act regulated hazardous mixed.

MTSCA:

Radioactive waste mixed with TSCA waste.

Pollution Prevention:

Preventing or reducing the generation of pollutants, contaminants, hazardous substances, or wastes at the source, or reducing the amount for treatment, storage, and disposal through recycling.

Recycling/Reuse:

The use, reuse, or reclamation of waste materials.

Resource Conservation and Recovery Act (RCRA) regulated:

Solid waste, not specifically excluded from regulation under 40 CFR 261.4, or delisted by petition, that is either a listed hazardous waste (40 CFR 261.30 - 261.33) or exhibits the characteristics of a hazardous waste (40 CFR 261.20 - 261.24).

Return-On-Investment (ROI) Pollution Prevention Projects:

Specific pollution prevention projects that rapidly pay for themselves (preferably in two years or fewer) through reducing future pollutant generation.

Sanitary Waste:

Wastes, such as garbage, that are generated by normal housekeeping activities and are not hazardous or radioactive.

Segregation:

The practice of separating or isolating contaminated materials from non-contaminated materials, or the separation/isolation of one waste type from another in an attempt to minimize the amount of the more noxious (and costly) material for disposal.

Source Reduction:

Equipment or technology selection or modification, process, or procedure modification; reformulation or redesign of products; substitution of raw materials; and improvements in housekeeping, maintenance, training, or inventory control. Increased efficiency in the use of raw materials, energy, water, or other resources, including affirmative procurement. Protection of natural resources by conservation.

State Regulated:

Any other hazardous waste not specifically regulated under RCRA, which may be regulated by State or local authorities, such as used oil.

Toxic Substances Control Act (TSCA) Regulated:

Individual chemical wastes (both liquid and solid), such as polychlorinated biphenyls, which are regulated by the Toxic Substances Control Act.

Transuranic Waste:

Waste that is contaminated with alpha-emitting radionuclides with an atomic number greater than 92 (heavier than uranium), half-lives greater than 20 years, and concentrations greater than 100 nanocuries per gram of waste.

Treatment/Volume Reduction:

Any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous, radioactive, or sanitary wastes, so as to neutralize, recover energy or material resources from the waste; to render the waste nonhazardous, safer to transport, store, or dispose; to render the waste amenable for recovery or storage; or to reduce its volume.

URL:

Uniform Resource Locator.

Waste Minimization:

An action that economically avoids or reduces the generation of waste by source reduction, reducing the toxicity of hazardous waste, improving energy usage, or recycling. This action will be consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

Waste Stream:

A waste or group of wastes with similar physical form, radiological properties, Environmental Protection Agency waste codes, or associated Land Disposal Restriction treatment standards. The waste or group of wastes may be the result of one or more processes or operations.

Waste Type:

Definition of waste based on physical properties or characteristics (e.g., high-level, transuranic, low-level radioactive, low-level mixed, hazardous, or sanitary).

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