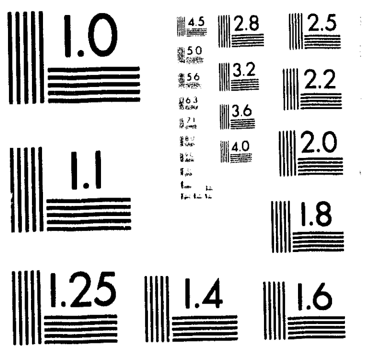
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ES/ER/TM-92

Environmental Restoration Program Pollution Prevention Checklist Guide for the Evaluation of Alternatives Project Phase

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MARTIN MARIETTA ENERGY SYSTEMS, INC.
managing the
Oak Ridge K-25 Site
Oak Ridge Y-12 Plant
Oak Ridge National Laboratory
under contract DE-AC05-84OR21400
Paducah Gaseous Diffusion Plant
Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-76OR00001
for the
U.S. DEPARTMENT OF ENERGY

CONTENTS

ACRONYMS

CAA	Clean Air Act
CERCLA	Comprehensive Environnmental Response, Compensation, and Liability Act
D&D	decontamination and decommissioning
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
EV	evaluation of alternatives
HAZWOPER	Hazardous Waste Operations
LLW	low-level waste
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PP/WM	pollution prevention/waste minimization
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
TRU	transuranic

1. PURPOSE

Evaluation of alternative studies determine what decontamination and decommissioning (D&D) alternatives are presented to regulators for facility and site cleanup. A key consideration in this process is the waste to be generated. Minimizing the volume and toxicity of this waste will ultimately contribute to the selection of the best clean-up option.

The purpose of this checklist guide is to assist the user with incorporating pollution prevention/waste minimization (PP/WM) in all Evaluation of Alternatives (EV) phase projects of the Environmental Restoration (ER) Program. This guide will assist users with documenting PP/WM activities for technology transfer and reporting requirements. Automated computer screens will be created from the checklist data to help users implement and evaluate waste reduction. Users can then establish numerical performance measures to measure progress in planning, training, self-assessments, field implementation, documentation, and technology transfer. Cost savings result as users train and assess themselves, eliminating expensive process waste assessments and audit teams.

2. APPLICABILITY

This checklist guide applies to all ER Program participants performing EV phase projects for all sources of pollution including air emissions, water, and solid waste. This guide is intended to serve three primary audiences:

- Site project managers and others on the project team engaged in activities focusing on or ultimately serving the process of incorporating PP/WM in the EV phase project;

- ER PP/WM specialists—for use as a general overview to help ensure that PP/WM criteria are being applied whenever possible in all EV phase projects; and

- ER Technology Development and Application specialists—for use as a tool for providing new and effective technology information to the site project managers.

Although this checklist guide may be used by a number of individuals as indicated above, it is incumbent on the ER Program to ensure that the projects select and apply technologies that not only result in the smallest quantities of waste with the least toxicity, but also minimize environmental releases during remediation. Minimizing waste generation should be considered along with the capital, maintenance, and operating costs to implement liabilities and any potential threat to human health and the environment.

3. INTRODUCTION

ER activities differ significantly from routine production facilities. While the focus for PP/WM for production operations is often on source reduction and recycling, those techniques are not readily adaptable to ER projects. Opportunities for source reduction and recycling are limited for clean-up activities since ER inherits contaminated waste sites from previous production processes, where ongoing process operations generally do not exist. Although treatment is not a preferred alternative per the U.S. Environmental Protection Agency (EPA) hierarchy, the nature of ER activities is generally such that clean up of the site by the application of some treatment technology is often the only alternative. The fact that the waste exists cannot be changed.

The greatest impact on the minimization of waste from the standpoint of the overall ER Program would be the selection of the clean-up option for remediation at a site. The EV phase will generate the alternatives from which the selection of the best clean-up option will be determined.

The success of incorporating PP/WM in the EV phase project will be determined ultimately on how well the volume and toxicity of the waste generated are minimized. However, the evaluation of options and selection of the most appropriate treatment technology for a facility/site (when treatment is deemed appropriate) can be a fairly complex undertaking when the many variables and issues during the remedy selection process are considered. This guide will be useful during the process of how PP/WM is incorporated when treatment technologies are evaluated. Therefore, all efforts contributing to the selection of the best clean-up option and treatment technology will effectively achieve the objcctives of PP/WM.

4. USE OF THIS CHECKLIST GUIDE FOR THE EV PROJECT PHASE

The document guide is organized in three sections. The first section of the checklist guide contains general questions about the generator's general pollution prevention program. The second section of the checklist guide entails questions concerning the pollution prevention program as it applies to the EV phase. The third section of the guide is more waste stream specific and contains questions concerning contaminants and media. The generator is also asked to give their rationale on their evaluation of applicable technologies analysis and how they would incorporate pollution prevention.

5. INSTRUCTIONS FOR EV PROJECT PHASE USERS CHECKLIST

The following are the steps used to simplify this guide.

5.1 PROJECT INFORMATION

Complete the project information as requested in Sect. 1 of the EV Project Phase Checklist (Fig. 1, p. 4).

5.2 FACILITY/SITE DESCRIPTION

Complete the facility/site description as requested in Sect. 1 of the EV Project Phase Checklist (Fig. 1). Provide attachments if necessary.

5.3 GENERAL QUESTION INFORMATION

Complete the general questions as requested in Sect. 1 of the EV Project Phase Checklist (Fig. 1).

5.4 EV PHASE-SPECIFIC QUESTION INFORMATION

Complete the EV phase-specific questions shown in Sect. 2 of the EV Project Phase Checklist (Fig. 1).

5.5 WASTE STREAM INFORMATION

Refer to the Example Waste Stream Information (Fig. 2, p. 13). Then complete the waste stream information as requested in Sect. 3 of the EV Project Phase Checklist (Fig. 1). For additional details on D&D technologies, refer to the Oak Ridge K-25 Site Technology Logic Diagram document located at the Information Resource Center, Oak Ridge, Tennessee.

SECTION 1. GENERAL QUESTION INFORMATION

Project Name:
Phase: EV

Project Manager:
Project Location:

Facility/Site Description: ______________________________

____

____

	YES	NO
1. Is there a PP/WM Site Plan on site?	____	____
2. Have those who report to management been trained in:		
• Site general employee radiation training?	____	____
• 24-hr SARA/OSHA (HAZWOPER) with 8-hr annual refresher?	____	____
• RCRA hazardous waste generator?	____	____
• Pollution prevention and waste minimization?	____	____
3. Does the EV Site Plan have the following objectives and statements of scope?		
• A statement of pollution prevention scope and objectives developed and distributed to all project personnel?	____	____
• A statement of pollution prevention scope and objectives developed and distributed to all contractor personnel?	____	____
• A statement of pollution prevention scope and objectives developed and distributed to all safety and emergency response personnel?	____	____
• Specific numerical goals for pollution prevention for each project waste stream set and distributed or displayed to all project personnel?	____	____
• Specific numerical goals for pollution prevention for each project waste stream set and distributed or displayed to all contractor personnel?	____	____
• Specific numerical goals for pollution prevention for each project waste stream set and distributed or displayed to all safety and emergency response personnel?	____	____

Fig. 1. EV Project Phase Checklist.

	YES	NO
4. Have project managers or personnel initiated work and waste management plans for projects that are scheduled to start within 180 days or less from now?	____	____
• PP/WM incorporated in any of the project work/waste management plans?	____	____
• A section on PP/WM incorporated in at least one of the project work and waste management plans?	____	____
• A section on PP/WM in all the project work and waste management plans?	____	____
• A section on PP/WM in all the project work and waste management plans? Each section discusses at least three techniques to reduce or prevent waste generation?	____	____
5. Do project managers or personnel have the following data relating to site operations and waste streams so that pollution prevention opportunities can be identified?		
• Supply and distribution records (i.e., chemical inventories, chains-of-custody, and waste drum tracking information)?	____	____
• Maintenance records (i.e., inspection and preventive maintenance repair orders)?	____	____
• Supervision records [i.e., quality assurance (QA) audits, noncompliance, and personnel records]?	____	____
• Required permits and records (i.e., CAA, NPDES, and RCRA monitoring, RCRA accumulations facility inventories and manifests, CERCLA reportable quantity release, and sample waste analyses)?	____	____
• PP/WM Program documentation (i.e., all work/waste management plans for projects scheduled 180 days or less from now)?	____	____
• Design information (i.e., process flow diagrams and material balances)?	____	____
• Environmental information and reporting (i.e., sample waste analyses, RCRA/Tennessee Annual Report, EPA Biannual Report, and Pollution Prevention Act Tri-Report)?	____	____
• Raw material site information (i.e., material safety data sheets, contractor data logs, site operating procedures, and project schedules and milestones)?	____	____

Fig. 1 (continued)

	YES	NO
• Economic information (i.e., waste treatment, disposal, operating, maintenance and departmental and pollution prevention implementation costs)?	____	____
6. Have project managers or personnel had the PP/WM Program audited in the last 12 months?	____	____
Was the program audited in the following manner?		
• A periodic schedule for audit of activities was made?	____	____
• The audit was performed by those who have direct responsibility for performing the activities being audited?	____	____
• The audit was performed by those who do not have direct responsibility for performing the activities being audited?	____	____
• The audit was reviewed by responsible management?	____	____
• Follow-up action was taken as a result of the audit?	____	____
7. Have project managers or personnel insisted on assessment of the waste streams to reduce or prevent waste generation?	____	____
Have the following project waste assessment elements been performed?		
• Review of the PP/WM operations and waste management issues and targeted work sites that should be assessed?	____	____
• Development of flow diagrams and materials balances for each targeted work site?	____	____
• Identification of PP/WM opportunities and projects that address those opportunities?	____	____
• Evaluation and ranking of projects into a coordinated, long-range facility plan?	____	____
8. Do project managers or personnel have cost, schedule, and program contents specific to the PP/WM Program activities?	____	____
What kind of waste accounting is performed?		
• Are operating cost records kept?	____	____
• Are treatment cost records kept?	____	____
• Are disposal cost records kept?	____	____
• Are maintenance cost records kept?	____	____

Fig. 1 (continued)

	YES	NO
• Are life-cycle cost records kept?	____	____
• Are costs to implement pollution prevention activities kept?	____	____
• Are real-time cost savings since PP/WM plan implementations kept?	____	____
9. Have project managers or personnel evaluated the pollution prevention program to the numerical goal criteria in the last 12 months?	____	____
Are the following criteria used to evaluate the pollution prevention program?	____	____
• Number of numerical goals achieved?	____	____
• Number of cost reductions achieved?	____	____
• Number of noncompliances cited?	____	____
• Number of new technologies integrated?	____	____
• Number of noncompliances corrected?	____	____
10. Do project managers or personnel keep and organize records from pollution prevention activities for QA purposes?	____	____
Are the records from pollution prevention activities kept and organized in the following manner?		
• Records furnish documentary evidence from all pollution prevention activities kept and organized?	____	____
• Records are well-organized and are easy to assess?	____	____
• Records are protected against damage, deteriorations, or loss?	____	____
• Requirements and responsibilities for record transmittal, distribution, retention, maintenance, and dispositions are established and documented?	____	____
11. Is technology information available for comparison from other sites for pollution prevention assessment?	____	____
• Parameters and results of a material or ER activity?	____	____
• Impact of the project of implementing a new technology?	____	____
• Remedial ER activities and materials currently used?	____	____
• Remedial ER activities and materials under consideration?	____	____

Fig. 1 (continued)

	YES	NO
12. If new technology information is available from other sites, does the facility manager or personnel have a timetable, cost, schedule, and possible implementation procedures on the new technology?	____	____
13. Do facility managers or personnel implement mechanisms for quality improvement in PP/WM to prevent noncompliance?	____	____

How often does management assess the PP/WM Program to ensure that it is adequate and effectively implemented?

_____ a. Never.

_____ b. No regular schedule for assessing the PP/WM Program; occasionally performed.

_____ c. Regular schedule for assessing the PP/WM Program; performed every 2 years.

_____ d. Regular schedule for assessing the PP/WM Program; performed every year.

_____ e. Regular schedule for assessing the PP/WM Program; performed at least every 6 months.

14. Does the facility manager or personnel know who handles the waste generated?

_____ a. It is not known who handles the waste.

_____ b. The site waste management organization handles the waste.

_____ c. The site waste management organization handles the waste and provides some data to meet reporting requirements.

_____ d. The site waste management organization handles the waste and provides all data to meet reporting requirements.

Fig. 1 (continued)

SECTION 2. EV PHASE-SPECIFIC QUESTION INFORMATION

	YES	NO
1. Does the ER PP/WM Program adequately address EV?	____	____
2. Does the EV phase of the ER PP/WM Program include specific quantitative goals for reducing the volume and toxicity of each waste stream?	____	____
3. If specific numerical goals are not included for each waste stream, is a strategy outlined to arrive at numerical goals?	____	____
4. Does the EV phase of the ER PP/WM Program include programmatic goals for the evaluation of new technologies to reduce waste generation?	____	____
5. Does the EV phase of the ER PP/WM Program contain a budget for its waste minimization program?	____	____
6. Has the organization developed baseline data for the generation of waste from EV-phase activities?	____	____
7. Does the ER PP/WM Program explain how PP/WM principles are incorporated into the EV phase?	____	____
8. Does the EV phase of the ER PP/WM Program require that waste assessments be conducted on the waste streams?	____	____
9. Does the EV phase of the ER PP/WM Program identify research and development projects related to PP/WM?	____	____
10. Does the EV phase of the ER PP/WM Program describe any planned technology-transfer activities?	____	____
11. Does the EV phase of the ER PP/WM Program provide a procedure for self-evaluation?	____	____
12. Does the EV phase of the ER PP/WM Program explain how design principles that minimize waste generation are incorporated into new construction and options that involve new or modified processes?	____	____
13. Does the EV phase of the ER PP/WM Program include a method of accounting for the cost of PP/WM activities?	____	____
14. Does the EV phase of the ER PP/WM Program address the need for, and methods of, waste segregation as it affects PP/WM?	____	____
15. Does the EV phase of the ER PP/WM Program address the need for, and methods of, housekeeping as it affects PP/WM?	____	____

Fig. 1 (continued)

SECTION 3. WASTE STREAM INFORMATION

Facility/Site Description: ____

____

____

MATERIAL STREAM/CONTAMINANT/MEDIA IDENTIFICATION SUMMARY

Contaminant	Contaminant Group
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

APPLICABLE CONTAMINANT MATERIAL DISPOSITION TECHNOLOGY SUMMARY

Instructions:

Identify the material stream in the Summary of Contaminated Material Disposition Technology for Gaseous Diffusion Plants (Table 1, p. 16). Then identify any applicable existing or potential clean-up technologies.

Applicable Existing Technologies: ____

____

____

____

Applicable Potential Technologies: ____

____

____

____

Fig. 1 (continued)

TECHNOLOGY EVALUATION RATIONALE INCORPORATING PP/WM

1. Have any applicable treatment technologies been identified that reduce	___ Volume	___ Toxicity
	___ Radioactivity	___ Does Not Apply
2. Can any primary waste streams be prevented or reduced at the source?	___ Yes	___ No
3. Have any applicable treatment technologies been identified that immobilize contaminants?	___ Yes	___ No
4. Can any primary waste stream(s) be reused or recycled after treatment?	___ Yes	___ No
5. Can any primary waste stream(s) be returned to the area of contamination after treatment?	___ Yes	___ No
6. Can any primary waste stream(s) be exchanged for reuse after treatment?	___ Yes	___ No
7. Can any secondary waste stream(s) be reused or recycled?	___ Yes	___ No
8. Can any secondary waste stream(s) be reused or recycled?	___ Yes	___ No
9. Can any secondary waste stream(s) be returned to the facility?	___ Yes	___ No
10. Can any secondary waste stream(s) be exchanged for reuse after treatment?	___ Yes	___ No

Fig. 1 (continued)

TECHNOLOGY EVALUATION RATIONALE
INCORPORATING PP/WM

Technology Evaluation Rationale:

PP/WM Rationale:

Fig. 1 (continued)

WASTE STREAM INFORMATION

Facility/Site Description: The K-333 Building Facility equipment is internally contaminated with radionuclides such as uranium that form volatile fluorides. This facility was utilized as part of the gaseous diffusion process for uranium enrichment.

MATERIAL STREAM/CONTAMINANT/MEDIA IDENTIFICATION SUMMARY

Material Stream	Contaminant	Media
Ferrous Metal	Uranium	Solid Stainless Steel Metal

APPLICABLE CONTAMINANT MATERIAL DISPOSITION TECHNOLOGY SUMMARY

Instructions:

Identify the material stream in the Summary of Contaminated Material Disposition Technology for Gaseous Diffusion Plants (Table 1, p. 16). Then identify any applicable existing or potential clean-up technologies.

Applicable Existing Technologies: Recycle as is, remelt high-pressure water decontamination, standard cutting

Applicable Potential Technologies: (1) Melt and glass decontamination, (2) microwave heating, (3) induction heating, (4) ultra-high pressure water, (5) cryogenic pellet decontamination, (6) chemical decontamination, (7) electrochemical methods, and (8) gas-phase decontamination

Fig. 2. Example Waste Stream Information.

TECHNOLOGY EVALUATION RATIONALE INCORPORATING PP/WM

1. Have any applicable treatment technologies been identified that reduce	_X_	Volume	___	Toxicity
	___	Radioactivity	___	Does Not Apply
2. Can any primary waste streams be prevented or reduced at the source?	_X_	Yes	___	No
3. Have any applicable treatment technologies been identified that immobilize contaminants?	_X_	Yes	___	No
4. Can any primary waste stream(s) be reused or recycled after treatment?	___	Yes	_X_	No
5. Can any primary waste stream(s) be returned to the area of contamination after treatment?	_X_	Yes	___	No
6. Can any primary waste stream(s) be exchanged for reuse after treatment?	___	Yes	_X_	No
7. Can any secondary waste stream(s) be reused or recycled?	_X_	Yes	___	No
8. Can any secondary waste stream(s) be reused or recycled?	___	Yes	_X_	No
9. Can any secondary waste stream(s) be returned to the facility?	___	Yes	_X_	No
10. Can any secondary waste stream(s) be exchanged for reuse after treatment?	___	Yes	_X_	No

Fig. 2 (continued)

TECHNOLOGY EVALUATION RATIONALE INCORPORATING PP/WM

Technology Evaluation Rationale:

The metal cannot be recycled for unrestricted use in its present form because of the lack of *de minimus* standards. The volume of metal involved in this decommissioning and decontamination effort is so large that surface burial as waste is not an acceptable solution. High-pressure water has been shown to be effective for surface contamination, but this technology produces a secondary large waste stream from the water used in this system.

When evaluating the applicable potential technologies, the volume of metal is so large that technology number 1 will not be adequate or cost effective. Technology numbers 2 and 3 are in the very early stages of development; therefore not adequate to be applied to this system. Technology numbers 4, 5, and 6 exist and have been developed for decontamination. Consequently, technology number 5 has slow kinetics, while technology numbers 4 and 6 generate large secondary waste streams. Technology number 7 has a wide application and needs to be further tested for use in decontaminating a wide variety of metals. Technology number 8 is preferred for this material stream. This technology is cost-effective decontamination for intact gaseous diffusion process/separation facilities equipment contaminated internally with uranium radionuclides that form volatile fluorides and oxyfluorides. This decontamination technology is effective with the materials and geometry of the following:

- axial compressors,
- centrifugal compressors,
- converters,
- miscellaneous small converter parts,
- external gas-cooler parts,
- tube sheets,
- control and block valves, and
- pipe sections.

Effective decontamination of this equipment before (and possibly without) disassembly would alleviate criticality concerns, minimize the spread of contamination, reduce worker exposure to hazardous and radioactive materials, and reduce costs.

PP/WM Rationale:

Potentially all of the radionuclides in the gaseous diffusion process can be volatilized as fluorides. By using gas-phase decontamination, liquid wastes would be eliminated, solid wastes would be reduced by over 90%, and air emissions would be reduced to a minor problem. Wastes would be prevented at the source.

Fig. 2 (continued)

Table 1. Summary of Contaminated Material Disposition Technology for Gaseous Diffusion Plants

Material stream	Existing technology	Technologies with potential for development
Concrete rubble	Shallow land burial	Washing of rubble Volume reduction
Clean concrete	Sampling and chemical analysis	Analysis techniques to prove cleanliness
Concrete contaminated with radionuclides	High-pressure water decontamination Carbon dioxide decontamination	Microwave system Plasma system Chemical system
Ferrous metals	Recycling as is Remelting High-pressure water decontamination Standard cutting	Melt and glass decontamination Microwave heating Induction heating Gas-phase decontamination Ultrahigh-pressure water decontamination Cryogenic pellet decontamination Chemical decontamination Electrochemical methods
Nonferrous metals	Recycling as is Refining Remelting Chemical and electrochemical processing Testing Standard cutting	Gas-phase decontamination Ultrahigh-pressure water decontamination Cryogenic pellet decontamination Chemical decontamination Electrochemical methods
Protective clothing	Job planning	Reuse
Wood and combustible materials		Bulk decontamination methods
Asbestos	Automatic cutters and knives Wetting agent use Vacuum system	Water jet decontamination
PCBs—equipment	Solvent flushing/washing	
PCBs hydrocarbon liquids	Chemical treatment Incineration	

Table 1 (continued)

Material stream	Existing technology	Technologies with potential for development
PCBs—soil/sludge	Solidification Bioremediation Soil washing/extraction Transportable thermal treatment Vitrification thermal treatment Vitrification thermal separation	
PCBs—water	Chemical dechlorination Bioremediation Physical separation/carbon adsorption	
PCBs—buildings	Concrete shaving/shot blasting/ scarifying Paint stripping/high pressure water decontamination Surface chemical treatment Solvent/coating use	
Acids		
Contaminated waters	Filtration	Fluid recycling
Freon	Solvent cleaning	High-pressure cleanup equipment
Glass	Glass decontamination Volume reduction	
Mercury at Y-12	Storage	
Oils and organics		Biological methods Bulk decontamination methods Dry heat system
Enriched uranium	Recycling Reuse	
Transite siding	Automatic cutters and knives	
Returned sources		
Nickel	Storage	Refining
Copper wire	Storage	Contamination detection equipment
Assorted metals	Storage	High-speed segregation techniques Volume reduction

Table 1 (continued)

Material stream	Existing technology	Technologies with potential for development
Lead	High-pressure water decontamination Machining Decontamination of coatings Storage	Melt refining
Mixed waste	Thermal destruction of organics Chemical destruction of organics Grouting Filtering Evaporation Ion exchange Storage	Organic destruction Ion exchange Incineration Vitrification Separation technologies
Sludges	Cement Evaporation Vitrification Storage	In-tank evaporation Stabilization technology Sampling Volume efficiency of concrete Solidification Vitrification
Contaminated soil	Soil washing Packaging on ground Freeze grinding Reduction of TRU-LLW Air cleaning Soil compaction Leaching Biotreatment	Soil compaction Biotreatment Leaching Soil washing
TRU waste	Electropolishing	Nitric acid electrolytes

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