PADUCAH GASEOUS DIFFUSION PLANT
SITE SPECIFIC ADVISORY BOARD

Chartered under the Federal Advisory Committee Act

CO-CHAIRS

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mdonham@igc.org

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1131 Hamburg Road
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jonesvw@ornl.gov

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Edward Duff
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Paducah, KY, 42003

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Metropolis, Illinois 62960

Rev. Gregory Waldrop
4141 Buckner Lane
Paducah, Kentucky 42001

MEMORANDUM
SITE SPECIFIC ADVISORY BOARD

TO: SSAB Members
Ex Officio Members

FROM: Mark Donham
Vicki Jones

DATE: January 5, 1998

SUBJECT: **MEETING REMINDER**

The special meeting of the SSAB scheduled for January 8, 1998, has been canceled. The next SSAB meeting will be January 15, 1998, at 5:00 p.m. in the Van Buren Room at the Executive Inn. The following is the tentative agenda and action items:

Tentative agenda for the January 15, 1998, meeting:
Administrative Plans for the Board - 5:00 p.m. - 6:30 p.m.
Minutes
Information (Handouts)
EMEF Project Updates
Review of the SSAB Draft Work Plan
WAG 22
Waste Management
Waste Transportation
Strategies for Effective & Meaningful Public Input Report
Vortec Environmental Assessment (if it is out by the January 15, 1998, meeting)
Media Contact Discussion

Action Items

1. Provide board with copies of the 1996 NESHAP report. **COMPLETE**
2. Provide the board with a list of environmental contractors/subcontractors associated with DOE.
3. Carlos will check on the issue date of the Vortec EA.
4. The SSAB requested that a Vortec EA update be added to the EMEF project updates.
5. Carlos Alvarado will check to see if DOE will be able to keep the comment period open on the EA so that the SSAB will have sufficient time to receive a presentation and have a chance to review and comment on the EA.

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6. A subcommittee was formed of Bill Tanner, Gregory Waldrop, Ray McLennan and Carlos Alvarado to work on pursuing options for an off-site office and meeting space for the SSAB.
7. DOE will provide the board with a list of clerical support people who are not attached to contractors.
8. Jacobs will provide a revised estimate for clerical help at 30 hours charged to the task per month.
9. DOE (Carlos Alvarado & Jimmie Hodges) will pursue direct contracting options for clerical support.
10. The SSAB approved by consensus a proposal to develop and distribute a survey on hunters' concerns at the WKWMA to include a request for opinions on a public meeting in April and outline SSAB contact points. Gregory Waldrop will develop the survey in December and the DOE Site Office clerical staff will assist in its preparation. The hunters' concerns survey will be distributed to the board for review before the survey is distributed.
11. The SSAB approved by consensus the need for a special meeting on January 8, 1998, with invitations extended to local Congressional representatives to discuss budget issues. The tentative location for the meeting is the Information Age Park at a conference room to be determined. The board agreed to pay for the meeting room out of SSAB funds. **The absolute drop dead date for this to go in the Federal Register is December 23, 1997.**
12. Steve Kay proposed for the January 15, 1998, that the board have a special meeting to re-evaluate its internal functions and resolve issues that have come up during the first year of the board's operation.
13. The SSAB was invited and accepted the invitation to the next DOE prioritization board meeting in Oak Ridge. The Paducah Site Office will inform the SSAB of the next meeting date in enough time to plan their attendance.
14. The proposal was made and agreed to by consensus to hold a one day session to go through the Paducah project prioritization ranking process. The SSAB approved by consensus the establishment of a prioritization subcommittee. The meeting was scheduled for December 9, 1997, in the DOE conference room. The agenda is to be determined. DOE will inform the board of the time for the meeting.
15. For the January 15, 1998, meeting agenda 5:00 p.m. - 6:30 p.m. is SSAB procedural issues, then back to the formal agenda which includes the usual standing items and 6 items held over from the November agenda. The Vortec EA is tentatively included on the January agenda, assuming it comes out by the date of the SSAB meeting.
16. Provide board with the number of radionuclide wastestreams at Paducah.

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Informal Meeting Minutes

January 15, 1998

The January 15, 1998, Site Specific Advisory Board (SSAB) informal meeting took place in the Van Buren Room at the Executive Inn at 5:00 p.m.

The following board members were present: Nola Courtney, Edward Duff, Vicki Jones, Lynn Lane and Bill Tanner. Ex Officio members present were: Wayne Davis, Carl Froede, Jimmie Hodges, Tuss Taylor, and John Volpe. Facilitator Present: Steve Kay. Also present were: Todd Adams, Carlos Alvarado, Patricia Barnhill, Jeannie Brandstetter, Steve Davis, Teresa Fields, Shelley Hawkins, Dennis Hill, Richard Kuehn, Sam Leone, Ross Miller, and Greg Shaia.

Because the board did not have a quorum present, Steve Kay suggested that topics discussed during this meeting should serve as recommendations during the next meeting.

Administrative plans was the first item on the agenda. Bill Tanner presented the information he had developed to the board on meeting locations. All buildings presented were based on approximately 400 to 500 square feet. The first option was the Ritz Hotel. The cost was $450 per month with utilities and janitorial services not included. The second option was the Katterjohn Building. The first-floor room was $8.50 per square foot and the second-floor room was $7.50 per square foot (on an annual lease). This estimate included all utilities, but maintenance services were separate. The third option was the Information Age Park, which cost $10 to $13 per square foot. It included utilities and janitorial services. This worked out to about $8,000 a year. The final option was the Environmental Information Center (EIC) at the Jacobs Building. The only expense for this location would be the phone line at approximately $20 per month. All facilities needed would be provided, including a computer. The Jacobs estimate which included administrative support at approximately 40-50 hours a month was $16,000 per year.

Bill Tanner also contacted employment agencies and the average cost per hour for administrative support was $11. Bill stated the criteria he used in obtaining estimates on administrative support stated that the administrative person would attend meetings, provide clerical support, distribute meeting minutes and other information to the board, and perform public relations activities. Bill stated that while obtaining the estimates it was suggested to him that the board write specific duties for the administrative support so that there will be no question of intended functions. Carlos Alvarado said that he acted on an action item from the November meeting by contacting Jacobs and getting a cost estimate for administrative support at 30 hours per week using a location other than Jacobs. The estimate was approximately $6,400 per year and included travel to and from the specified location. The board was given copies of the Jacobs proposal on office equipment and team member bibliographies.

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Bill Tanner said that the Jacobs proposal would give the board more resources; however, the location may not be comfortable for some members. He said that his personal feeling was that having it at Kevil gives the board the most resources and people who understand what is going on in the program. Patricia Barnhill also conveyed that the board would have access to the EIC at the Kevil location. Nola Courtney asked if the EIC was available on Sundays and was told that it was available by appointment on any day. Bill Tanner said that if the SSAB chose a location other than the EIC, there would probably not be much access by the public. Nola Courtney stated that Jacobs was a good location for her and several of the other board members but she did not feel comfortable speaking for the other board members. Nola also stated that she would like to see a total cost estimate for all of the other locations.

Steve Kay said that the issue on obtaining administrative support seemed to be having the SSAB perceived as separate from the Department of Energy (DOE). Vicki Jones said that she did not vision the mission and scope of the SSAB as having detachment from DOE. Jones said she did not see a problem with Jacobs. Nola Courtney said that DOE has funded the board in direct response to citizens at large and she can understand the concern of attachment. Courtney said the scope is to represent something over and above the contractors. Nola said that it would be helpful for the board to have the total annual costs for each option presented next month. Steve Kay suggested that the costs should be comparable on an annual or monthly basis and that this issue be discussed at the next meeting with the full board; however, it should be limited to one comment per member with a vote to taken after everyone comments.

Steve Kay said that the February meeting for the 19th was scheduled on the date for the public meeting on the Programmatic Environmental Impact Statement (PEIS) for Depleted Uranium Hexafluoride (UF_6). Dennis Hill said that the PEIS meeting is from 5:00 p.m. to 9:00 p.m. in the Eisenhower Room and that Ched Bradley, the project manager for depleted UF_6 has offered to talk to the board if the meeting is simultaneous with the PEIS meeting. Steve Kay asked the board if the meeting for next month should be rescheduled. Vicki Jones said that she felt that it would be a good opportunity to participate in both. Nola Courtney agreed with Vicki. Dennis said that the PEIS meeting would be informal until 7:00 p.m. when the conference with Ched Bradley is scheduled. Steve Kay suggested the board meet at 5:00 p.m. and break at 7:00 p.m. to go to the conference then reconvene at 8:00 p.m. Carlos then referred to a note he had from Myrna Redfield which was an offer from Wilson McGinn for one of the SSAB members to attend the prioritization meeting, which was also on February 19. Steve Kay said that according to the board procedures, Jimmie Hodges was the only one who could reschedule a meeting date once it has been set. Jimmie Hodges stated that he would not exercise that prerogative very freely. Jimmie stated that there would have to be something very extraordinary such as there not being a quorum present. He also stated that he would entertain any recommendations that the board makes. Jimmie felt that it was important to poll the entire board. Steve stated that he had informed Mark Donham that Jimmie was the final authority when it came to changing meeting dates. Jimmie stated that there are always going to be conflicts. Nola, Vicki, and Bill all suggested that the meeting date stay the same. The meeting date will stay February 19.

The next item on the agenda was agenda time frames. Steve suggested that the board allocate time to specific agenda items. This would prevent meetings from running over and that the board could allocate more time to items if it was needed. Vicki Jones said that she thought they all agreed that this was needed. Steve said this is helpful to groups who tend not to be as precise in discussions or presentations. Bill Tanner said that he would like to see a summary of information with

presentations. Nola Courtney said that a summary is nice in some cases; however, she was not sure it would be a good idea to limit time. Steve Kay asked if it would be helpful if the board received summaries of presentations before the meetings. The general consensus was that this would not be helpful and that they preferred to receive the information at the meeting. Jimmie Hodges suggested that presentations run in the format of approximately 10-15 minutes for a presentation and 10-15 minutes for questions.

The next item on the agenda was activity between meetings. Steve Kay addressed the flow of e-mail and said he would like to hold most of his comments until more board members were present. Jimmie Hodges made the general comment that sometimes e-mail is not always productive and it distracts people who are trying to be productive. Jimmie felt that it was fine for asking questions. Steve said he was interested in having the issues that face the board brought to the entire board together at the board meetings instead of e-mail. He said he is interested in seeing the tone of any communications be subject to the same guidelines we follow at our meetings, some basic civility.

Dennis Hill spoke about the status of the Community Relations Plan (CRP). He said that the final document is ready; however, it must be certified by Jimmie Hodges and Jimmy Massey before it is released to the public. He said that he might have copies of the CRP at the January 22, 1998, public meeting. The meeting was adjourned until 6:30 p.m.

Steve Kay called the meeting to order and informed everyone that this was an informal meeting due to the lack of a quorum. Steve asked if there were any questions on the Environmental Management and Enrichment Facilities (EMEF) project updates. There were no questions. He suggested that the review of the SSAB workplan be held until the February meeting.

A presentation on Waste Area Grouping (WAG) 22 was made by Ross Miller, Lockheed Martin Energy Systems, Inc. (LMES). Ross said the WAG 22 Feasibility Study had been recently released and discussed the alternatives represented in the study. He said the cost of the project ranged from $40 to $70 million. He said the WAG 22 Record of Decision (ROD) is scheduled to be issued in November 1998, and for signature in March 1999. The public review period is scheduled for September 1998. Ross said that he would get a handout of the cost of alternatives to the board.

The next item on the agenda was a presentation on Waste Management by Steve Davis, LMES. He presented a handout which was an action item from the last meeting on radionuclides and waste streams. He said the principal contaminant is uranium. John Volpe asked if the wastestreams Steve was talking about were legacy waste. Steve stated that it is legacy waste. John said that he was curious about the amount of thorium-230. Jimmie Hodges explained that thorium-230 is part of the decay process of uranium. Jimmie said that it is not common to see very much. He said that cesium-137 has typically not been found in the plant's process. John Volpe asked what the waste disposal options are. Steve Davis stated that the plant uses Envirocare, Hanford and there are other options they are working on presently. Sam Leone said that waste management is shipping liquid waste to the Toxic Substances Control Act (TSCA) Incinerator in Oak Ridge and some of the waste to the Idaho National Engineering Laboratory (INEL). Jimmie Hodges stated that legacy waste is waste that has been generated since the plant began operation up to the time that DOE leased it to USEC for their operation and that the majority of that waste is stored on site. He said that it is costing money to keep the waste on site and they are looking at options to ship and treat the waste. Waste transportation was part of this presentation.

The next item on the agenda was strategies for effective public input. Dennis Hill addressed the status of the Vortec Environmental Assessment (EA). He said that it had not been released yet since it is still in draft form; however, it should be released in the first quarter of 1998 and suggested that the topic stay on the agenda. Dennis also discussed media contact. He said that he has contacted the local media and they have agreed to coverage; however, he is waiting for direction from the board on the format and time for this media contact. Dennis asked if the board wanted to have the next meeting at the Executive Inn. The SSAB members present agreed.

Steve Kay presented agenda items for the next meeting. Bill Tanner said he would like to see the board resolve the administrative issues at the next meeting. Jimmie Hodges suggested that the board may want to hear about the Management and Integration (M&I) Contract. Dennis Hill thought it might be a good agenda item for the March meeting since the new contractor will begin work in April. Carlos Alvarado said that a public meeting for Phase I of the Oil, Chemical, & Atomic Workers (OCAW) Former Worker's Health Study will be held at the end of February. Jimmie Hodges said that the report was the result of the OCAW Union being tasked and funded by DOE to do a former-worker health study. He said that the main purpose of the Phase I project was to see if there was enough evidence to warrant a Phase II. Steve asked if the board wanted to invite the person from the study to do a presentation at the next meeting. The members agreed. **(Since the meeting, DOE has been informed that the OCAW representative would be unable to attend the meeting.)**

The next meeting will be held February 19, 1998 in the McKinley Room at the Executive Inn. The meeting was adjourned.

Tentative agenda for the February 19, 1998, meeting:
Administrative Plans for the Board - 5:00 p.m. - 6:30 p.m.
- Office Location
- Administrative Support
- Meeting Schedule
- Agenda Time Frames
- Policy on Presentations
- Activity between meetings
- Board Evaluation

Adjourn to attend PEIS for Depleted Uranium 7:00 p.m. - 8:00 p.m.
Minutes
Information (Handouts)
EMEF Project Updates
OCAW Health Study (Canceled)
Review of the SSAB Draft Work Plan
WAG 6
WAG 22 (If regulatory comments have been received)
Vortec EA (If available)

Action Items
Provide SSAB members with Feasibility Study Summary for Solid Waste Management Unit (SWMU) 2 of WAG 22 - COMPLETE

MEMORANDUM
SITE SPECIFIC ADVISORY BOARD

TO: Distribution

FROM: Mark Donham
Vicki Jones

DATE: January 27, 1998

SUBJECT: **JANUARY 15, 1998, INFORMAL MEETING MINUTES**

Attached are the subject meeting minutes. The next meeting will be held February 19, 1998, in the McKinley Room at the Executive Inn, at 5:00 p.m. Please review and provide comments or changes at the February meeting.

SSAB Distribution List
Nola Courtney
Mark Donham
Edward Duff
David Fuller
Eddie Gray II
W. G. Harvey, Sr.
Vicki Jones
Ronald Lamb
Lynn Lane
Linda Long
Ray McLennan
Craig Rhodes
Connie J. Sykes
Bill Tanner
Gregory Waldrop

Ex Officio Distribution List
Wayne Davis
Carl Froede, Jr.
Jimmie C. Hodges
Tuss Taylor
John A. Volpe

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January 15, 1998

DRAFT

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The next meeting will be held February 19, 1998 in the McKinley Room at the Executive Inn. The meeting was adjourned.

Tentative agenda for the February 19, 1998, meeting:

Administrative Plans for the Board - 5:00 p.m. - 6:30 p.m.
- Office Location
- Administrative Support
- Meeting Schedule
- Agenda Time Frames
- Policy on Presentations
- Activity between meetings
- Board Evaluation

Adjourn to attend PEIS for Depleted Uranium 7:00 p.m. - 8:00 p.m.
Minutes
Information (Handouts)
EMEF Project Updates
OCAW Health Study (Canceled)
Review of the SSAB Draft Work Plan
WAG 6
WAG 22 (If regulatory comments have been received)
Vortec EA (If available)

Action Items

Provide SSAB members with Feasibility Study Summary for Solid Waste Management Unit (SWMU) 2 of WAG 22 - COMPLETE

PGDP
Site Specific Advisory Board
January 15, 1998

Proposed topics for initial agenda item: Administrative Plans for the Board

- Office location
- Administrative support
- Meeting schedule
- Agenda time frames
- Policy on presentations
  - Length
  - Written information
  - Scheduling
- Activity between meetings

PADUCAH GASEOUS DIFFUSION PLANT SITE SPECIFIC ADVISORY BOARD
U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL MANAGEMENT & ENRICHMENT FACILITIES
PROJECT UPDATES
JANUARY 15, 1998

Northwest Plume Interim Remedial Action Pilot Plant
More than 230 million gallons of water have been treated at the Northwest Plume Groundwater Treatment Facility since operations began Sept. 1, 1995. The facility operates to contain a high contamination zone of the degreaser trichloroethylene and the man-made radionuclide technetium-99.

Northeast Plume Interim Containment System
The Northeast Plume project includes extraction wells in the northeast quadrant of DOE property with an underground pipeline running to the existing PGDP cooling towers as part of the containment system.

Routine operations began in March 1997, with more than 77 million gallons of groundwater treated to date.

Lasagna demonstration
The Lasagna soil remediation technology tested at PGDP works by using buried electrodes to move water through contaminated soil. Applied current drives the water an inch a day from a positive to a negative electrode. Along the way, the water picks up contaminants from the soil which are removed by treatment zones containing iron filings.

Phase IIA installation was completed in August 1996 and the process was operational through Feb. 26, 1997, with post-demonstration sampling completed the week of March 3, 1997. DOE EM-50 granted the Lasagna consortium another extension of the Phase IIA project, allowing it to operate through August 1997. The DOE now plans to propose its preferred remedial measures for SWMU 91, which is advancement into Phase IIB, full-scale remediation.

The project now includes a revised Feasibility Evaluation rather than the earlier proposed Feasibility Study. The proposed public comment period for the Proposed Remedial Action Plan is Feb. 23 — April 8, 1998. The following have been tentatively scheduled around those dates:

Feb. 22 — Public notice of availability in Paducah Sun
March 24 — public meeting (if requested by March 16)
March 22— cancellation notice in Paducah Sun if no meeting requested.

If full-scale remediation is undertaken, the remediation will be funded by EM-40 (the office of the Deputy Assistant Secretary for Environmental Restoration), which funds the remainder of Paducah's Environmental Restoration and Waste Management program.

Waste Area Groups 1 & 7/C-746-K Landfill, Kentucky Ordnance Works
WAG 1 consists of a fire training area, the plant sewage treatment facility and a known trichloroethylene spill site inside the PGDP security fence. WAG 7 consists of five underground storage tanks at the plant water treatment facility, and an inactive sanitary landfill outside the security fence. Three SWMUs are connected with the former Kentucky Ordnance Works (KOW) and are located on the DOE reservation. They are the KOW sewage treatment facility, a known Toluene spill site and a burn area.

The current proposed plan includes continued controlled access, groundwater monitoring and deed restrictions in the preferred alternative. Warning signs were installed around the landfill on Oct. 15,

action on Sept. 8, 1997. The Action Memo was transmitted to EPA for their information, but will not be signed by the agency. DOE signed the Action Memo on Sept. 12, 1997. The focus of this removal action is the elimination of risk to workers from contact with soil. The final disposition of the soil would be determined at a later date, consistent with applicable laws and regulations.

A continuing issue is the disagreement between the Commonwealth and DOE on the PCB clean-up level.

Waste Area Group 27/Potential trichloroethylene sources
WAG 27 consists of potential or known sources of TCE on the west side of the Paducah Gaseous Diffusion Plant. A second draft Remedial Investigation/Feasibility Study Work Plan was submitted to regulatory agencies in June.

On Oct. 27, the Kentucky Division of Waste Management approved the early implementation of two scopes of work that are to be performed as part of the Waste Area Group 23 removal action.

Field work is expected to begin in February 1998.

Vortec Vitrification Project
DOE is currently conducting an Environmental Assessment (EA) before continuing construction on the project. Argonne National Laboratory (ANL), which conducted a site visit in August, is preparing the EA. DOE chose ANL because DOE believes they will produce an unbiased document. ANL has no knowledge of the Vortec system or Paducah's waste management program. DOE plans to release the EA for public review during the first quarter of 1998.

PLEASE SIGN IN

Paducah Gaseous Diffusion Plant
Site Specific Advisory Board

NAME	AFFILIATION
Lynn Lane	Ballard Co Clerk
Vicki Jones	SSAB
DENNIS HILL	LMES
Carlos Alvarado	DOE
Patricia Barnhill	Jacobs
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Carl Froede	EPA
John Volpe	Rad. Cont. Branch
Wayne Davis	Fish & Wildlife
Edward Duff	SSAB

January 15, 1998

DOE/OR/06-1667&D1

Integrated Waste Management Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

December 1997

Cleared for Public Release

DOE/OR/06-1667&D1

Integrated Waste Management Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

December 1997

Prepared by
Jacobs EM Team
175 Freedom Boulevard • Kevil, KY 42053
Under Contract DE-AC05-93OR22028

Prepared for
United States Department of Energy
Remediation Management Group

ACKNOWLEDGMENT

Jacobs Engineering Group Inc., under prime contract to the United States Department of Energy, developed this document with the assistance of the Jacobs Environmental Management Team members:

Geraghty and Miller, Inc.
Lockwood Greene Technologies, Inc.
PAI Corporation
Solutions To Environmental Problems
United Science Industries
University of Tennessee

Additional support was provided to the team by Lockheed Martin Energy Systems, Inc.

PREFACE

This *Integrated Waste Management Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1667&D1, was prepared under Work Breakdown Structure 1.4.12.7.6 (Activity Data Sheet Number 5201). This document meets the objectives of the task by providing waste management support for hazardous, radioactive, Toxic Substances Control Act, and mixed wastes. It provides the United States Department of Energy (DOE) and Lockheed Martin Energy Systems, Inc., with a summary of the management of wastes at the Paducah Gaseous Diffusion Plant as required by DOE Order 5820.2A.

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ACRONYMS AND ABBREVIATIONS

^{90}Sr	strontium-90
^{99}Tc	technetium-99
^{125}I	iodine-125
^{126}I	iodine-126
^{129}I	iodine-129
^{131}I	iodine-131
^{133}I	iodine-133
^{223}Ra	radium-223
^{224}Ra	radium-224
^{226}Ra	radium-226
^{227}Ac	actinium-227
^{228}Ra	radium-228
^{228}Th	thorium-228
^{230}Th	thorium-230
^{231}Pa	protactinium-231
^{232}Th	thorium-232
^{232}U	uranium-232
^{235}U	uranium-235
^{238}U	uranium-238
ACO	Administrative Order by Consent
AEA	Atomic Energy Act of 1954
Al	aluminum
Btu	British thermal unit
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
C.F.R.	*Code of Federal Regulations*
cm	centimeter(s)
cm^2	square centimeter(s)
Cu	copper
D&D	decontamination and decommissioning
DMSA	DOE Material Storage Areas
DOE	United States Department of Energy
DOT	United States Department of Transportation
dpm	disintegrations per minute
EF	Enrichment Facilities
EMEF	Environmental Management and Enrichment Facilities Program
EPA	United States Environmental Protection Agency
ER	environmental restoration
ERWM	Environmental Restoration and Waste Management
ETTP	East Tennessee Technology Park
Fe	iron
Fed. Reg.	*Federal Register*
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Agreement
FFC Act	Federal Facility Compliance Act
ft	foot (ft)
ft^2	square foot (ft)
ft^3	cubic foot (ft)
FY	fiscal year
g	gram(s)

gal	gallon
gpm	gallons per minute
GSA	Generator Staging Areas
ha	hectares
HEPA	high-efficiency particulate air
HOC	halogenated organic compound
HQ	headquarters
hr	hour
HSWA	Hazardous and Solid Waste Amendments of 1984
IDW	investigation-derived waste
ITO	incentive task order
IWMP	integrated waste management plan
K.A.R.	Kentucky Administrative Regulations
KDAQ	Kentucky Department for Environmental Protection, Division for Air Quality
KDEP	Kentucky Department for Environmental Protection
KDOW	Kentucky Department for Environmental Protection, Division of Water
KDWM	Kentucky Department for Environmental Protection, Division of Waste Management
kg	kilogram(s)
km	kilometers
KPDES	Kentucky Pollutant Discharge Elimination System
l	liter(s)
lb	pound(s)
LDR	land disposal restrictions
LLW	low-level waste
LMES	Lockheed Martin Energy Systems, Inc.
LMUS	Lockheed Martin Utility Services, Inc.
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
M&I	management and integration
M&O	management and operation
mrad	millirad
MSC	Manufacturing Sciences Corporation
NaF	sodium fluoride
Ni	nickel
nm	nanometer
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
ORO	Oak Ridge Operations
ORR	Oak Ridge Reservation
PCB	polychlorinated biphenyl
pCi	picocurie(s)
PGDP	Paducah Gaseous Diffusion Plant
pH	logarithm of the reciprocal of the hydrogen-ion concentration
PPE	personal protective equipment
ppm	parts per million
PSC	potentially surface contaminated
RAD	radioactive
RCRA	Resource Conservation and Recovery Act of 1976
RD&D	research, development, and demonstration
RFD	request for disposal
RR	railroad

sec	second
SS	stainless steel
STP	site treatment plan
SWMU	solid waste management unit
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TRU	transuranic
TSCA	Toxic Substances Control Act of 1976
TSD	treatment, storage, and disposal
TSDF	treatment, storage, and disposal facility
TWA	Task Work Agreements
U.S.C.	*United States Code*
U.S.C.A.	*United States Code Annotated*
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
USEC	United States Enrichment Corporation
UST	underground storage tanks
VDC	vacuum dust collector
VOC	volatile organic compound
WAC	waste acceptance criteria
WAG	waste area group
WIPP	Waste Isolation Pilot Plant
WITS	Waste Information Tracking System
WM	waste management
yd	yard
yd^3	cubic yard(s)
°C	degrees Celsius
°F	degrees Fahrenheit

CONVERSIONS

Conversion Table		
Multiply	**By**	**To Obtain**
Btu/lb	0.556	kg-Calorie/kg
ft	0.305	m
ft^2	0.093	m^2
ft^3	0.028	m^3
gal	0.0038	m^3
inch	2.54	cm
ton	907.185	kg
yd^3	0.7646	m^3
°F - 32	5/9	°C
°C	9/5 (then add 32)	°F

EXECUTIVE SUMMARY

The Paducah Gaseous Diffusion Plant (PGDP), owned by the United States Department of Energy (DOE), is located in western Kentucky in McCracken County. The principal site process is the separation of uranium isotopes through gaseous diffusion. In October 1992, congressional passage of the Energy Policy Act established the United States Enrichment Corporation (USEC). In accordance with the Energy Policy Act, the USEC leases and operates the uranium enrichment facility at the PGDP. As a result of this change in operators, the DOE's mission at this location now focuses on environmental restoration (ER) and disposal of legacy wastes, which will facilitate eventual reindustrialization of the site.

As part of the DOE's mission to manage wastes through Environmental Management and Enrichment Facilities (EMEF) activities, DOE Order 5820.2A requires development of an integrated waste management plan (IWMP). The purpose of the IWMP is not to describe daily and/or routine operations but to compile and consolidate an annual report on programmatic waste management (WM) operations, identify what facilities are being used to manage wastes, describe environmental issues that are acting to change current WM systems, describe future plans, and provide recommendations. By preparing this IWMP, the DOE's ability to review its WM program in its entirety, manage waste costs effectively, and identify treatment and disposition strategies is greatly enhanced.

WASTE MANAGEMENT

Wastes managed by the DOE include legacy wastes that were generated prior to the leasing of production facilities to the USEC July 1, 1993, wastes generated from EMEF activities, wastes generated from remedial activities, and wastes generated from decontamination and decommissioning programs. These wastes can be categorized into five major categories including

(1) Radioactive (RAD);

(2) Mixed [Resource Conservation and Recovery Act (RCRA)/RAD and Toxic Substances Control Act (TSCA)/RCRA/RAD];

(3) TSCA and TSCA/RAD;

(4) Solid Waste; and

(5) RCRA.

In addition to discussing these waste categories, the IWMP includes separate chapters for waste water and scrap metal. The following information is provided for all sections:

- Waste description;
- Waste stream inventory and projections;
- Waste stream treatment, storage, and disposal capability; and
- Issues and recommendations.

The waste stream information identified in Appendix A (volumes) was downloaded from the Lockheed Martin Energy Systems, Inc., (LMES) WM database June 10, 1997. Therefore, the information discussed in this IWMP will be a "snapshot" in time and any changes to the database that occur after this date will not be reflected in this IWMP. The information presented herein, however, will be a sufficient representation of WM activities throughout the year.

TASK WORK AGREEMENTS

During the past several years, the DOE established the incentive task order (ITO) process to complete various projects. The ITO process provided incentives to the management and operation (M&O) contractor to complete negotiated work at a rate below a target cost without sacrificing safety or quality; if the work was completed below the target cost, the contractor then received a portion of the savings as profit. During fiscal year (FY) 1997, approximately 95% of the WM program was operated as an ITO; however, the ITO process was replaced by the Task Work Agreements (TWAs) in July 1997. The TWAs are two-year contracts, approved for FY 1997 and FY 1998 WM activities, that include a scope of work, baseline, cost, and method of accomplishment. The DOE Paducah Site Office signs the TWAs and copies are then sent to Oak Ridge, Tennessee, for filing and information purposes.

MANAGEMENT AND INTEGRATION CONTRACT

The TWAs are DOE work authorization documents that may be adopted by the new management and integration (M&I) contractor once they have replaced the existing contractor. The new M&I contractor is scheduled to replace the existing contractor by April 1, 1998. The TWAs were approved by the DOE for the entire FY 1998 and will have to be renegotiated for another two years thereafter. The M&I process is the DOE's method to privatize operations and share the risk and responsibilities of daily operations. The M&I process will be comprised of a series of subcontractors to conduct specific tasks with the M&I contractor having oversight responsibility.

WASTE MANAGEMENT ACCOMPLISHMENTS

For FY 1997, the DOE WM operations have undergone many improvements and accomplished many objectives. A description of some of these objectives follows.

- Completed an United States Environmental Protection Agency (EPA) milestone for the Toxicity Characteristic Leaching Procedure (TCLP) Federal Facilities Compliance Agreement (FFCA) of completing all required sampling and analysis plans three months ahead of the EPA deadline of December 31, 1997.

- Completed 21 sampling events comprised of 788 drums during FY 1997. This accomplishment keeps the project on track to complete the EPA milestone of finishing all characterization for the approximate 14,000 drums in the project by December 31, 1999, as required by the TCLP FFCA.

- Performed volume reduction of approximately 85.0 m^3 (3,000 ft^3) of intact fluorescent light bulbs into approximately 5.04 m^3 (178 ft^3) using a RCRA-permitted crushing unit. This action was taken in preparation for disposal of the bulbs in FY 1998.

- Completed sampling events comprised of 2,900 containers of legacy waste amenable to processing by the Vortec Vitrification Demonstration Project. Characterization was performed that provides information that can be utilized for determining disposition at Vortec or the PGDP C-746-U Solid Waste Landfill.

- Operated the C-746-U Solid Waste Landfill, including disposal of 2751.2 metric tons (3,033 tons) of solid waste in the first eight months of operation.

- Disposed of approximately 420 m^3 (14,830 ft^3) of containerized waste in the C-746-U Solid Waste Landfill, representing approximately 4% of the current inventory of containerized waste.

- Coordinated, staged, and processed 73 drums of aerosol cans, which reduced the RCRA inventory for ignitable wastes and also reduced the fire loading in Building C-733.

- Achieved 13.2% reduction in waste storage areas.

- Completed upgrades and consolidated all DOE fissile waste in the C-746-Q RCRA Waste Storage Facility.

- Coordinated, characterized, staged, and shipped over 133,333 kg (294,000 lbs) of waste to the Oak Ridge Reservation East Tennessee Technology Park TSCA Incinerator.

- Initiated operation of the C-752-A Environmental Restoration Storage Facility.

- Treated 37,850 liters (10,000 gals) of waste water at the C-752-A Environmental Restoration Storage Facility.

- Coordinated the relocation of 184.05 m^3 (6,500 ft^3) of DOE low-level waste (LLW) from USEC leased space to DOE storage areas.

- Reduced the waste storage footprint in C-337 by over 1,000 drums.

- Processed approximately 1,100 Field Work Requests.

- Initiated implementation of the Waste Information Tracking System.

- Completed 22 characterization events for the land disposal restrictions FFCA/Federal Facility Compliance Act/Site Treatment Plan.

- Completed off-site treatment/disposal of 30 m^3 (1,059 ft^3) of RCRA waste, which represents approximately 4% of RCRA inventory.

- Completed the fifth consecutive annual Kentucky Department for Environmental Protection Division of Waste Management (KDWM) RCRA inspection without any notice of violations.

- Issued a draft version of *A Study of Metals Reclamation and Associated Site Remediation for the Paducah Gaseous Diffusion Plant*, KY/EM-238.

- Issued draft and presented overview of the *Off-Site Shipment Management Review Guide.*

- Completed the cleaning and relocation of approximately 4,000 aluminum ingots.

- Completed all regulatory milestones as scheduled.

ISSUES OF CONCERN

A forecast of the environmental issues of concern for 1998 include the following:

- Negotiating a polychlorinated biphenyl-contaminated soil cleanup level of 25 ppm (40 C.F.R. 761) with the KDWM and LMES ER;

- Completing the construction of the Vortec vitrification system and obtaining all regulatory approvals to operate the system to treat mixed LLW at the PGDP;

- DOE material storage areas may have RCRA/mixed waste issues or noncompliances;

- Kentucky Department for Environmental Protection's (KDEP's) approving a *de minimus* uranium waste acceptance criteria (WAC) for nonradioactive waste at the C-746-U Solid Waste Landfill;

- Achieving a smooth transition from the M&O contractor to the new M&I contractor for WM and other activities; and

- Completing and submitting for DOE Oak Ridge Operations (ORO) approval the volumetric package to allow shipments of RCRA and TSCA wastes with no RAD added to commercial treatment, storage, and disposal facilities.

MILESTONES FOR FISCAL YEAR 1998

Milestones forecasted for 1998 include the following:

- Completion of the TWAs;

- Completion of the milestones as identified in the FFCA; and

- Completion of the construction of the Vortec vitrification system.

RECOMMENDATIONS

The recommendations for 1998 are as follows:

- Implementing an aggressive waste minimization and pollution prevention plan;

- Negotiating and reaching an agreement with the KDWM to determine a *de minimus* level for radioactive material that can be safely disposed of in the

- Developing and aggressively implementing an investigation-derived waste (IDW) minimization procedure for LMES ER. This procedure should include measures to reduce IDW at the source and requirements for returning soil to the area of concern and/or solid waste management unit. This procedure should be PGDP site specific and reflect current regulations, guidance, and EPA and KDEP agreements.

Based on reviews of current reports, regulations, and interviews with LMES WM personnel, additional recommendations for WM operations for FY 1998 include the following items.

- Completing the demonstration of the Vortec vitrification system and utilizing the treatment process to its full extent within the limited time permitted under the research, development, and demonstration permit.

- Identifying those waste streams that cannot be processed by the Vortec vitrification system and determining treatment or disposal options using current available technologies.

- Completing and submitting for DOE ORO approval the volumetric package allowing shipments of RCRA and TSCA wastes with no RAD added to commercial TSDFs.

- Completing an accurate estimate of solid waste to be generated for a period of five years and projecting a realistic life span of the C-746-U Solid Waste Landfill.

- Using process knowledge to characterize waste, thereby reducing the WM cost. In addition, reducing the number of sample parameters for those wastes to be disposed of offsite by targeting characterization activities to the off-site treatment, storage, and disposal facilities WAC.

- Implementing *A Study of Metals Reclamation and Associated Site Remediation for the Paducah Gaseous Diffusion Plant*, KY/EM-238.

- Completing and implementing WM risk-based deposition strategy for treatment and disposal of DOE waste.

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1. INTRODUCTION

This document is an integrated waste management plan (IWMP) for the Paducah Gaseous Diffusion Plant (PGDP), owned by the United States Department of Energy (DOE). This IWMP has been prepared pursuant to DOE Order 5820.2A and will be updated annually. Wastes that are managed by the DOE and Lockheed Martin Energy Systems, Inc., (LMES) through Environmental Management and Enrichment Facilities (EMEF) activities include those that were generated prior to the leasing of production facilities to the United States Enrichment Corporation (USEC) in July 1993, those generated from remedial activities, and those generated from decontamination and decommissioning (D&D) programs. These wastes can be classified into five categories including the following:

(1) Radioactive (RAD);

(2) Mixed [Resource Conservation and Recovery Act (RCRA)/RAD and Toxic Substances Control Act (TSCA)/RCRA/RAD];

(3) TSCA and TSCA/RAD;

(4) Solid waste; and

(5) RCRA.

These waste categories are addressed in Sections 2 through 5 and 7. Due to the uniqueness of the waste streams and the volumes generated, waste water and scrap metal are addressed in Sections 6 and 8.

The following sections provide a statement of purpose, a facility description, an environmental overview, and a description of the organizations involved with managing DOE waste at the PGDP.

1.1 STATEMENT OF PURPOSE

The primary purpose of this document is to compile and consolidate an annual report on how waste management (WM) activities are conducted, list what facilities are being used to manage wastes, describe what forces are acting to change current WM systems, identify future plans, and provide recommendations.

By consolidating this information into one document, the DOE is able to review the WM program in its entirety, determine a clear and workable path forward for the cost-effective management of PGDP-stored waste, and identify the treatment and disposition strategies for future DOE-generated waste.

1.2 FACILITY DESCRIPTION

The PGDP is located in McCracken County in western Kentucky, approximately 5.6 km (3.5 miles) south of the Ohio River and 32.2 km (20 miles) east of the confluence of the Ohio and Mississippi rivers. Paducah, Kentucky, is approximately 16.1 km (10 miles) east of the plant. Several small communities (including Heath and Grahamville to the east and Kevil to the southwest) are within a five-mile radius of DOE property boundaries.

Although construction of the plant began in 1951 and start-up occurred in 1952, full production of enriched uranium for commercial and national defense reactors was not achieved at the facility until 1955. Since beginning operation, the PGDP has generated and disposed of hazardous, nonhazardous, RAD, polychlorinated biphenyl (PCB), and mixed wastes.

In October 1992, congressional passage of the Energy Policy Act (Public Law No. 102-486, 106 Stat. 2776, codified in scattered sections of 42 U.S.C.A.) established the USEC (42 U.S.C.A. § 2297b). Effective July 1, 1993, the DOE leased the plant production facilities to the USEC. Martin Marietta Utility Services, Inc., was created as a subsidiary of Martin Marietta Corporation to operate the leased facilities for USEC under the prior operating contract. Martin Marietta Utility Services, Inc., is now known as Lockheed Martin Utility Services, Inc., (LMUS) due to the merger of Lockheed with Martin Marietta. Lockheed Martin Energy Systems, Inc., (LMES) manages the Environmental Restoration (ER) and the WM programs for the DOE and is the retaining manager and co-operator of facilities not leased to the USEC.

The USEC is responsible for process wastes generated after July 1, 1993, and TSCA waste, as defined in the lease agreement. The DOE is responsible for waste stored prior to that date (i.e., legacy wastes) and wastes generated through EMEF activities. In addition, according to Article VII of the TSCA Federal Facility Compliance Agreement (FFCA) "TSCA Compliance Agreement," the DOE remains fully responsible for the TSCA FFCA and remains the owner of PCB waste that is governed by the TSCA Agreement and generated at the gaseous diffusion plants, including the leased premises.

1.3 ENVIRONMENTAL OVERVIEW

Although the bulk of the waste in storage at the PGDP was generated during uranium enrichment activities (i.e., prior to July 1993), the main generator of waste associated with DOE activities at present is the DOE ER program. For informational purposes, an overview of the DOE ER program and a brief description of the DOE environmental permits follows.

1.3.1 Environmental Restoration Overview

Ground-water samples collected from residential wells north of the PGDP during July 1988 indicated trichloroethene (TCE) and technetium-99 (^{99}Tc) contamination. The DOE and the United States Environmental Protection Agency (EPA) entered into an Administrative Order by Consent (ACO) effective November 23, 1988, pursuant to Sections 104 and 106 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C.A. § 9601 *et seq.*). The primary purpose of the ACO was to formalize requirements for determining the nature and extent of off-site contamination and to ensure that appropriate actions were taken to mitigate any immediate risks that have been posed to human health and the environment. To date, a series of site investigations and interim actions have been initiated under the ACO (e.g., the Phase I and Phase II Site Investigations).

Because the investigations conducted pursuant to the ACO revealed the presence of widespread contamination at the PGDP, the EPA placed the PGDP on the National Priorities List (NPL) May 31, 1994 (effective June 30, 1994). The NPL is a list of sites across the nation that have been designated by the EPA as high priorities for site remediation under the CERCLA. Section 120 of the CERCLA requires federal facilities listed on the NPL to enter into an Interagency Agreement [in the case of the PGDP, it is

referred to as the Federal Facility Agreement (FFA)] with the appropriate regulatory agencies, in this instance the EPA and the Kentucky Department for Environmental Protection (KDEP). The purpose of the FFA is to provide a set of comprehensive requirements for remediation of the PGDP. The FFA has been drafted and revised several times and the draft final FFA (Draft Final #11) was cleared for public release April 1997. Once finalized, the CERCLA ACO will be terminated and activities currently conducted pursuant to the ACO will be continued under the FFA.

In addition to the CERCLA, the DOE also is regulated by the RCRA (42 U.S.C.A. § 3001 *et seq.*) through the KDEP-issued Hazardous Waste Management permit (KY 8890008982) and the EPA's Hazardous and Solid Waste Amendments (HSWA) permit (also KY 8890008982), which contains corrective action requirements. This overlapping jurisdiction occurred because the KDEP did not have HSWA authority at that time. The KDEP now has HSWA authority; however, KDEP enforcement of the PGDP's HSWA permit will not become effective until the EPA's HSWA permit expires in 2001. While the CERCLA and RCRA Corrective Action Programs may have similar objectives, the procedural requirements under the two statutes differ to some degree. In the case of federal facilities, an FFA typically contains provisions to coordinate the cleanup processes of the RCRA and the CERCLA into a set of comprehensive requirements for site remediation, thereby eliminating the inefficiencies and the duplication of effort that can result from two separate cleanup programs operating independently at the same site. Additional information has been provided on RCRA corrective action authority in the following section.

1.3.2 Resource Conservation and Recovery Act Permits

The RCRA requirements for the PGDP are contained in two separate but related permits. These include a Hazardous Waste Management permit, which is issued and administered by the Commonwealth of Kentucky, and the HSWA permit, which is issued and administered by the EPA. Both permits were issued July 16, 1991, and they constitute the RCRA permits for the PGDP. The EPA's HSWA permit is limited to the HSWA provisions of the RCRA including corrective action requirements for solid waste management units (SWMUs). The Kentucky Hazardous Waste Management permit contains regulatory provisions for treatment, storage, and disposal (TSD) units permitted under the RCRA Base Program (pre-HSWA). The Commonwealth's permit also contains corrective action provisions requiring corrective action for SWMUs. While Kentucky has been authorized by the EPA to exclusively administer the RCRA Base Program for permitted TSD units, it did not have authorization to administer the provisions in lieu of the EPA at the time the permits were issued. Due to this situation, individual permit requirements for corrective action are necessary under both state and federal law. The RCRA permits currently contain a schedule of compliance specifying timetables for the DOE to conduct a series of RCRA facility investigations for SWMUs.

1.3.3 Water Discharges

The Clean Water Act applies to all nonradiological discharges to navigable surface waters. At the PGDP, the regulations are applied through a Kentucky Pollutant Discharge Elimination System (KPDES) permit for effluent discharges to Bayou and Little Bayou creeks. The Kentucky Department for Environmental Protection, Division of Water (KDOW) issued KPDES Permit No. KY0004049 to the DOE in September 1992. This permit became effective November 1, 1992, and is enforced by the KDOW. The KDOW added USEC as a joint operator on the permit in June 1993. At the request of the Paducah site, the Commonwealth of Kentucky granted a stay of permit limits for pH, metals, and temperature in October 1992. The DOE entered into an Agreed Order

with the KDOW April 5, 1996, to establish the final effluent limits for these parameters. All other conditions stated in the permit are in effect. Discharge to surface waters from the C-746-U Solid Waste Landfill will be regulated under KPDES Permit No. KY0100072.

1.3.4 Air Emissions

Authority for enforcing compliance with the Clean Air Act (CAA) (42 U.S.C.A. §§ 7401 to 7642) and subsequent amendments resides with the EPA and the Kentucky Department for Environmental Protection, Division for Air Quality (KDAQ). The EPA generally enforces rules resulting from Title VI (Stratospheric Ozone Protection) of the CAA and regulates airborne radionuclide emissions under the National Emission Standards for Hazardous Air Pollutants rule. Although DOE activities at the PGDP do not constitute a major air pollution source (i.e., a Title V permit is not required), the DOE must comply with general standards of performance (401 K.A.R. Chapter 63, which includes Kentucky air toxics). The DOE and LMES have an ongoing program to maintain compliance with all federal and state rules resulting from the CAA and its amendments. At present, the DOE has obtained four construction and operating permits from the KDAQ.

1.4 WASTE MANAGEMENT ORGANIZATIONAL STRUCTURE

1.4.1 United States Department of Energy Oak Ridge Operations Office

The DOE Oak Ridge Operations Office is responsible for implementing the requirements of DOE Order 5820.2A for all waste generated by its programs until the waste is transferred to another DOE site or a licensed commercial storage and disposal site. For all contaminated facilities under its jurisdiction, the DOE is responsible for assuring that programmatic decisions include WM considerations, as appropriate, and for implementing the requirements of other applicable DOE Orders for WM programs.

1.4.2 United States Department of Energy Site Office

The DOE PGDP Site Office is responsible for activities that affect the treatment, storage, or disposal of waste in facilities under its jurisdiction. In addition, it is responsible for assuring that day-to-day WM and facility operations at its site are conducted in compliance with DOE Order 5820.2A and with all applicable federal, state, and local regulations. An organizational chart for the DOE site office is shown in Figure 1-1.

1.4.3 Lockheed Martin Energy Systems, Inc.

Lockheed Martin Energy Systems, Inc., is responsible for EMEF activities under the EMEF Organization, compliance with DOE Orders and regulations through the Environmental Management Organization, engineering activities through the Site Engineering Organization, and EMEF activities through the WM program. The organizational chart for LMES is provided in Figure 1-2.

1.4.4 Lockheed Martin Utility Services, Inc.

Lockheed Martin Utility Services, Inc., is responsible for operating and maintaining the leased portion of the PGDP for the USEC. It is also the responsibility of LMUS and the USEC to manage the wastes they generate.

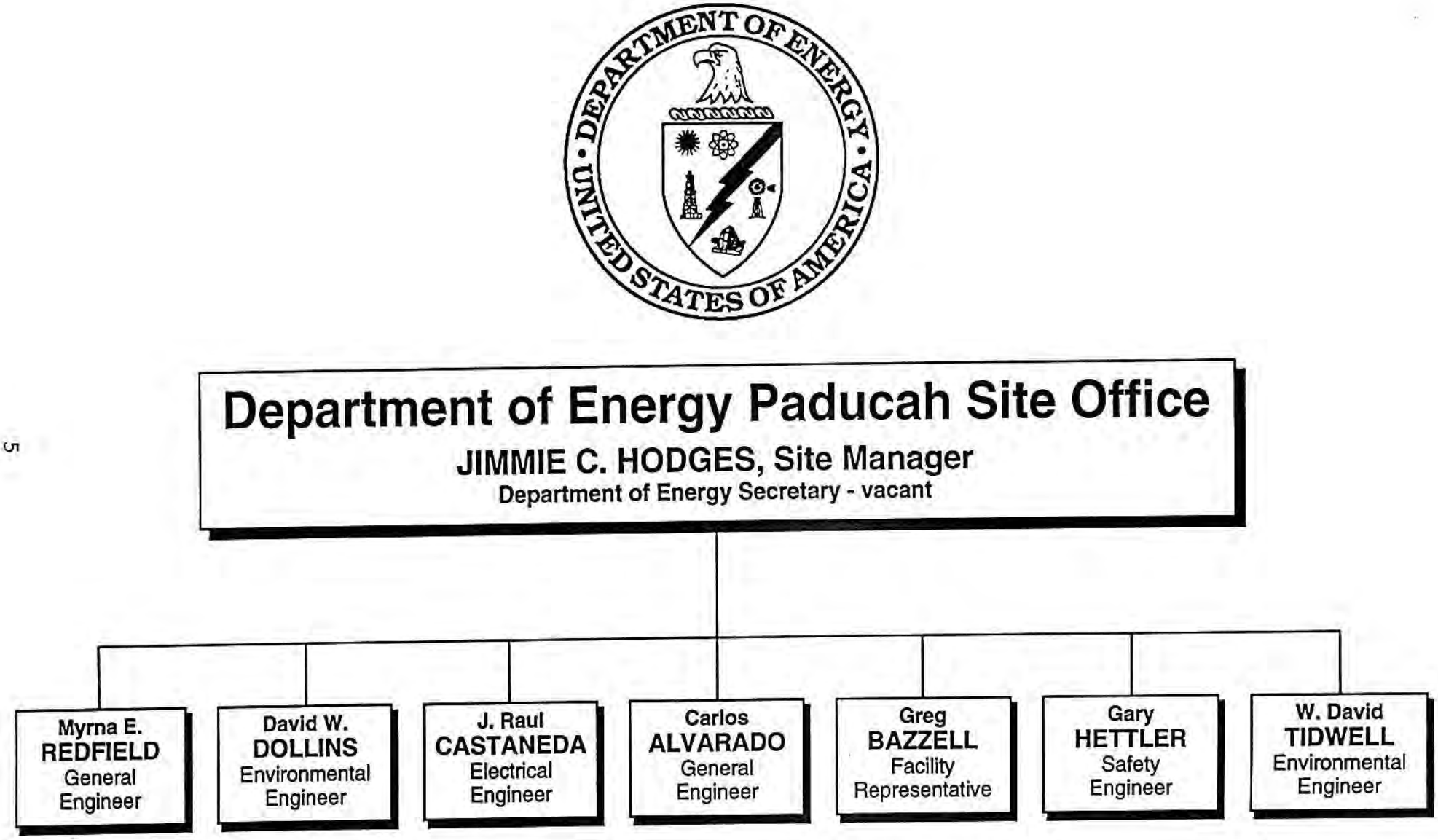

Figure 1-1. Organizational Chart for Department of Energy Paducah Site Office

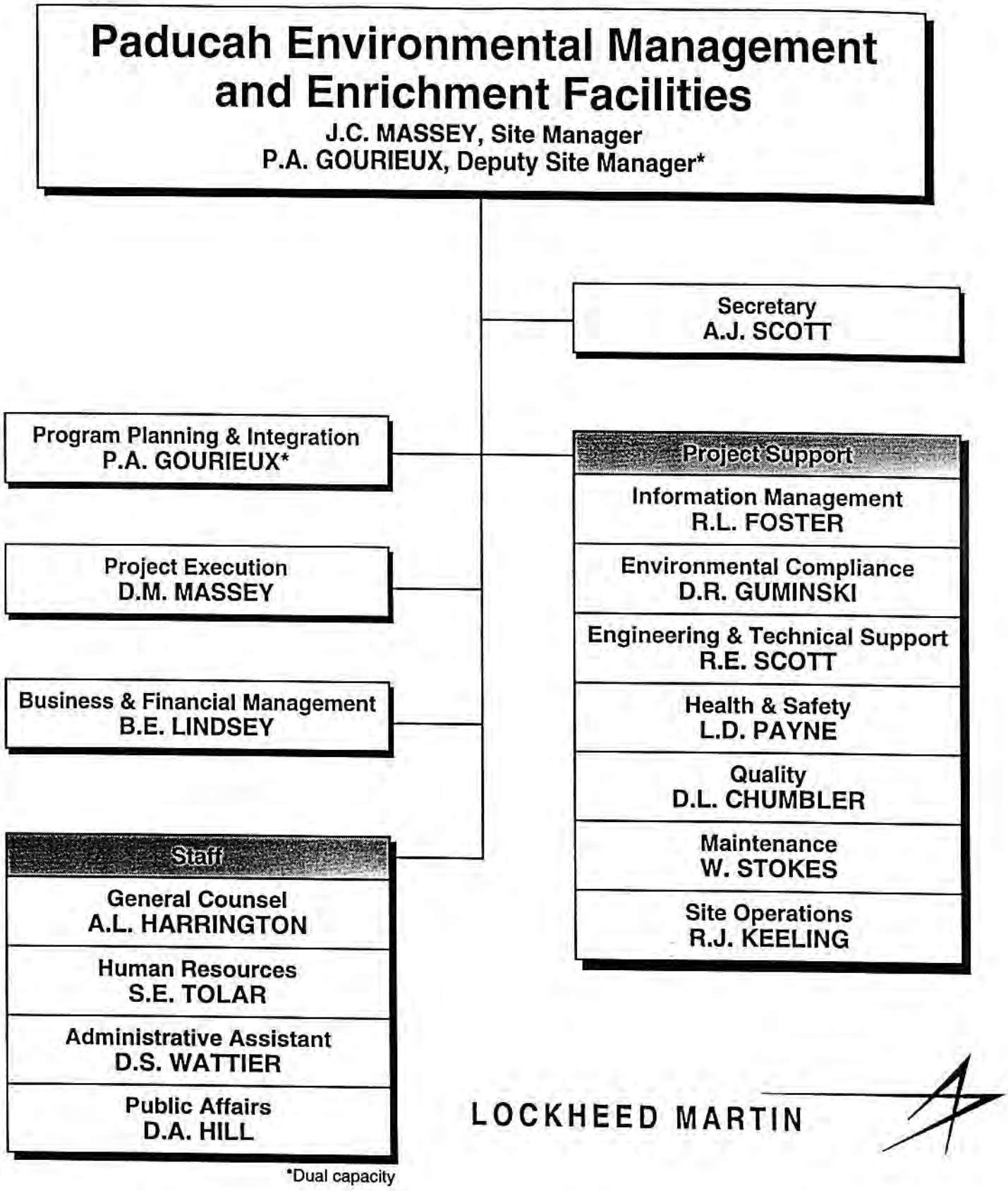

Figure 1-2. Organizational Chart for Lockheed Martin Energy Systems, Inc.

1.5 MANAGEMENT AND INTEGRATION CONTRACT

The new management and integration (M&I) contractor is scheduled to replace the existing contractor by April 1, 1998. The M&I process is the DOE's method to privatize operations and share the responsibility of doing business. The M&I process will be comprised of a series of subcontracts with subcontractors conducting specific activities as specified by the DOE with the M&I contractor having oversight responsibility to ensure that the tasks have been completed as specified. The entire M&I process could have a significant impact on the DOE's WM operations.

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2. RADIOACTIVE WASTE

Radioactive waste includes high-level, transuranic (TRU), low-level waste (LLW), and spent nuclear fuel. Currently, the PGDP does not generate, store, treat, or dispose of high-level or spent nuclear fuel waste onsite. This section will focus on LLW currently being generated, which is stored in large volumes onsite. The DOE does have a small quantity of TRU waste that is contaminated with RCRA constituents; therefore, this waste is discussed in Section 3. All waste-water waste streams, including those contaminated with radionuclides, are addressed in Section 6. Due to the large volume of radionuclide-contaminated scrap metal and the fact that metal potentially can be recycled and not discarded as a waste, scrap metal is addressed in Section 8. Section 8 also includes a discussion of scrap metal classified as LLW.

The DOE manages LLW under the authority delegated to it by the Atomic Energy Act (AEA) Subsection 110(a) [42 U.S.C. § 240(a), 1992]. The DOE is responsible for conducting and/or overseeing RAD material operations at its contractor-operated facilities and for protecting its employees and the public from radiation hazards. The DOE executes these responsibilities by meeting the requirements of DOE Order 5400.5. These DOE requirements are generally similar to regulations promulgated by the Nuclear Regulatory Commission (NRC) for commercial facilities licensed to manage RAD waste. The DOE's primary LLW management order is DOE Order 5820.2A, "Radioactive Waste Management."

2.1 WASTE DESCRIPTION AND CHARACTERIZATION

Operations at the PGDP have generated a variety of LLWs. The principal RAD contaminant is uranium. Other radionuclides of concern are ^{99}Tc, thorium-230, neptunium-237, americium-241, and plutonium-239. Solid LLW at the PGDP exists in a variety of waste streams such as concrete, drill mud, personal protective equipment (PPE), powders, sludges, soils, loose trash, and miscellaneous debris. No gaseous LLW, naturally occurring RAD waste, or accelerator-produced material is generated or stored at the PGDP (MMES, 1990). Low-level wastes stored at the PGDP are primarily legacy materials that have not been categorized sufficiently (i.e., specific identification of container contents) and characterized (i.e., analyses have not been performed to establish the concentrations of RAD constituents) to determine if the waste is acceptable for treatment and/or disposal.

2.1.1 Current Inventory

The majority of LLW at the PGDP is stored in 208.2-liter (55-gal) containers. When exposed to the elements, these 208.2-liter (55-gal) containers deteriorate and must be packed in 321.7-liter (85-gal) plastic or metal overpacks, accounting for about 0.32 m^3 (11.4 ft^3) of storage space. Other containers used at the PGDP include roll-off bins, which require approximately 630 ft^3 of storage space; B-25 metal boxes, which require about 2.7 m^3 (96 ft^3) of storage space; and 7A Type A metal boxes, which require about 2.5 m^3 (87 ft^3) of storage space.

Approximately 60 different LLW streams are currently stored at the PGDP, which are listed in Appendix A. The database information was obtained from LMES in June 1997. Based on a review of Appendix A, the total amount of LLW in storage is 5,225,616 kg (11,522,484 lbs) or 7,033 m^3 (248,358 ft^3).

When analyzing the LLW streams by volume, four waste streams were identified as making up 45% of the total LLW volume at the PGDP. These waste streams, which are presented in Table 2-1, include dirt (8%), soil (15.2%), cleanup debris (8.5%), and autosampler trash (13.5%). Other significant waste streams identified in Appendix A include asbestos, 536 m^3 (18,939 ft^3); plastic/dirt, 158 m^3 (5,587 ft^3); PPE/plastic, 237.4 m^3 (8,384 ft^3); scrap metal, 1,018 m^3 (35,957 ft^3), trap media, 87.9 m^3 (3,105 ft^3); uranium precipitate, 146.7 m^3 (5,180 ft^3); and wood, 163.6 m^3 (5,778 ft^3). These waste streams account for an additional 33% of the waste stored at the PGDP.

Table 2-1. Major Low-Level Waste Streams at the Paducah Gaseous Diffusion Plant

Waste Streams	Number and Types of LLW Containers	Approximate Weight (lb)	Approximate Volume (ft^3)
Dirt (including rock and dirt, excavated dirt, and dirt/concrete)*	2,680 55-gal drums and 3 85-gal overpacks	1,624,465	19,799
Soil (including ER auger cuttings, autosampler and pH temperature)	5,019 55-gal drums, 10 85-gal overpacks, 8 5-gal drums	3,279,117	37,870
Cleanup Debris	2,591 55-gal drums, 17 5-gal drums, 3 30-gal drum, 10 85-gal overpacks, six 7A Type A metal boxes, and 10 145-ft^3 containers	1,721,388	21,275
Autosampler Trash	4,010 55-gal drums, 65 30-gal drums, 21 2.5-gal drums, 3 15-gal drums, 41 85-gal overpacks, 10 7A Type A metal boxes, 22 B-25 metal boxes, and 4 miscellaneous items such as wood tables, shelves, etc.	687,828	33,485
Total of major waste streams		**7,312,798**	**112,429**

*These numbers were compiled from the LMES WM and ER databases in June 1997.

A simple analysis of the waste streams in Appendix A has been performed to aid in seeing the overall picture at the PGDP and to simplify treatment, disposal, and storage options presented in subsequent sections. This analysis was conducted by combining similar waste streams (i.e., similar waste matrixes) into groups. Once combined, the waste group volume was compared to the total volume in storage. Two major groups were identified and are discussed in greater detail in the following paragraphs.

Assuming all "earth-based" materials will be treated and disposed of in the same manner, the drill mud group, dirt, and soil waste streams were combined and found to be the largest group comprising 23% of the total LLW in storage. This waste group is primarily homogeneous and, therefore, requires limited media categorization. Most of the drill mud and over 10,000 drums of soil have been characterized in FY 1995 and FY 1996. Much of the generation of this material can be traced to relatively few major projects. For example, approximately 55% of the material represents excavated soil

collected from ditches during either the pH and temperature control project or the autosampler project (Smith, 1996). A project is underway by LMES WM to dispose of approximately 8,000 drums of this material in the C-746-U Solid Waste Landfill.

The second largest grouping by volume of waste streams currently stored at the PGDP is trash and debris. When combined, this group accounts for 22% of all waste stored at the PGDP. This waste stream is a combination of several items that may have contacted radioactivity during use or storage, such as tacky mats, rags, and wood. Trash is one of the most difficult waste streams to treat and/or dispose of due to inconsistencies in previous categorizations and/or characterizations and its inherent heterogeneity. Proper characterization of trash must be accomplished due to the likelihood of hot spots (concentrated sources of contamination). It is noted that PPE is similar to this group, but it was not added. However, PPE has been successfully characterized by using waste characterization data and process knowledge from ER and engineering projects.

2.1.2 Low-Level Waste Generation Projections

Waste generation projections for FYs 1998 through 2000, which were obtained from LMES Project Planning and Integration, are included in Table 2-2. Since the USEC still operates the production facilities at the PGDP, D&D waste projections are minimal. A total of 1,616 m^3 (57,070 ft^3) or the equivalent of 7,712 drums of LLW is expected to be generated at the PGDP from FY 1998 through FY 2000.

Table 2-2. Low-Level Waste Generation Projections

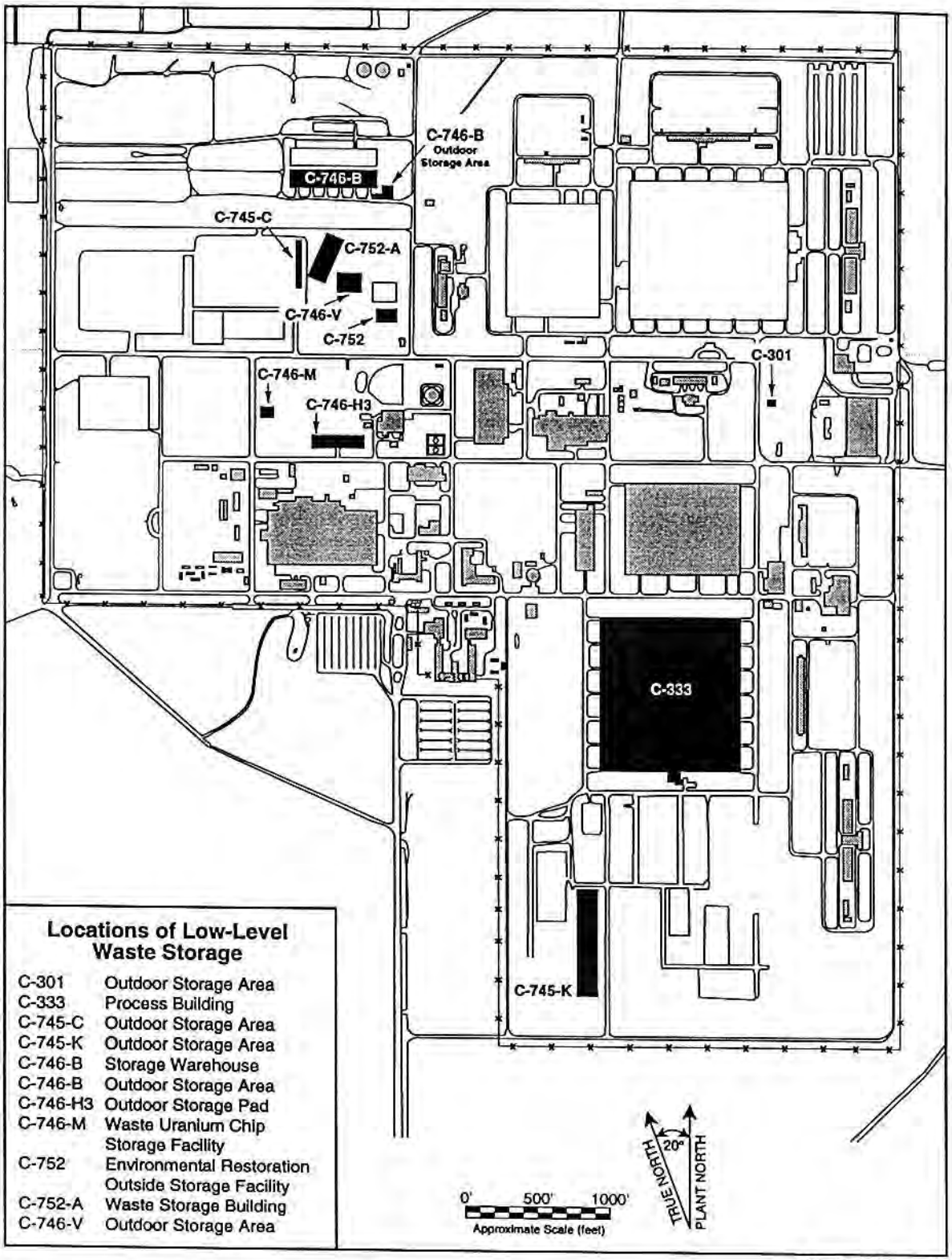
Waste Type	Source	FY 1998	FY 1999	FY 2000
Low-Level Waste	WM (Legacy)	22,344 ft^3	8,107 ft^3	989 ft^3
	ER	2,171 ft^3	360 ft^3	20,867 ft^3
	Enrichment Facilities	370 ft^3	370 ft^3	370 ft^3
	D&D	744 ft^3	744 ft^3	744 ft^3
	Total	**25,629 ft^3**	**9,581 ft^3**	**22,970 ft^3**

2.2 LOW-LEVEL WASTE STORAGE

Storage requirements are not specified in DOE Order 5820.2A. Instead, the Order outlines performance objectives, which require pathway analyses to ensure compliance with radiation exposure limits for personnel and prevention of ground-water contamination. The following sections provide information on storage capacity, including buildings used at the PGDP for the storage of LLW, and future projected needs. A discussion of "discrete" LLW storage areas identified as Generator Staging Areas (GSAs) and DOE Material Storage Areas (DMSAs) is included in Sections 2.2.2 and 2.2.3.

2.2.1 Low-Level Waste Storage Facilities

The following information provides capacity and volume information for the LLW storage buildings and facilities at the PGDP. The location of these storage facilities is shown in Figure 2-1.



Jacobs EM Team, 1997

Figure 2-1. Paducah Gaseous Diffusion Plant Facilities Currently Used for Low-Level Waste Storage

- **C-301 Outdoor Storage Area.** This area was originally a fire training building that was later converted to a storage pad. Current storage information indicates approximately 79% or 351.5 m^3 (12,415 ft^3) of its capacity is in use, leaving approximately 92.5 m^3 (3,265 ft^3) of additional storage space. All of the DOE waste stored in this area is considered legacy waste.

- **C-333 Process Building Storage Area.** This area has a storage capacity of 1,221 m^3 (43,123 ft^3). Available storage information indicates approximately 98.5% or 1,202 m^3 (42,475 ft^3) of the building's storage capacity is in use, leaving approximately 18.4 m^3 (648 ft^3) of available storage space. All the DOE waste stored in this building is considered legacy waste.

- **C-745-C Outdoor Storage Area.** This LLW facility has an operational capacity of 268.2 m^3 (9,472 ft^3). Currently, approximately 83% or 222.7 m^3 (7,865 ft^3) is being used, leaving about 45.5 m^3 (1,607 ft^3) of remaining storage space. All waste stored in this area is considered legacy waste.

- **C-745-K Outdoor Storage Area.** This area is used for double-stacked LLW drums. The drums are stored on pallets that are placed on graded gravel areas. Because this area is outside, drums are exposed to all local weather conditions. The design capacity for this area is 2,102 m^3 (74,237 ft^3). Current approximations indicate that this area is at about 99% of its capacity (the area currently stores about 2,095 m^3 (73,982 ft^3) of LLW), leaving approximately 7.2 m^3 (255 ft^3) of available storage space. All of the waste in this area is considered legacy waste.

- **C-746-V Outdoor Storage Area.** This area has been constructed during the past year and consists of a gravel storage pad. The dimension of the gravel storage pad is 45.7 m x 45.7 m (150 ft x 150 ft), which covers an area of 2,090 m^2 (22,500 ft^2).

- **C-746-B Storage (outside).** This gravel-paved waste storage area collectively occupies two areas near C-746-B and provides approximately 2,265.6 m^3 (80,000 ft^3) of storage space. Currently, 695.9 m^3 (24,574 ft^3) of waste is stored, which accounts for about 31% of capacity.

- **C-746-B Storage Warehouse.** The design capacity of this area is 330 m^3 (11,662 ft^3). Data indicates that 155.6 m^3 (5,496 ft^3) or 47% of the storage has been utilized, leaving approximately 174.6 m^3 (6,166 ft^3) of remaining storage space. This area contains ER and legacy waste.

- **C-746-H3 Outdoor Storage Pad and Clamshells Facilities.** This concrete pad, which had originally been used to store building materials, was converted for storage of ER waste. Storage capacity is estimated at 1,041.1 m^3 (36,763 ft^3). Data indicates that 79% or 814.6 m^3 (28,765 ft^3) of storage space has been utilized, leaving about 226.5 m^3 (7,998 ft^3) of remaining storage space.

- **C-746-M Waste Uranium Chip Storage Facility.** This facility is a diked, totally enclosed drum storage area of approximately 6.1 m^3 (217 ft^3). Currently, 19 nonhazardous LLW 321.7 liters (85-gal) drums [i.e., 19 (11.4 ft^3) overpacks] are stored in this area. Estimates indicate that 98% or 6.0 m^3 (213 ft^3) of the space has been used, leaving about 0.11 m^3 (4 ft^3) of additional storage space.

- **Other.** Any of the WM storage facilities may be utilized for temporary storage of LLW either awaiting characterization or further categorization.

A brief summary of the waste streams in the LLW storage facilities is provided in Table 2-3.

2.2.2 Generator Staging Areas

Generator Staging Areas are local collection points for LLW, TSCA, and nonhazardous wastes. These areas typically are found to be contaminated with radionuclides and characterization has not yet been performed. After a drum has been filled or a determination has been made that material must be removed, a Request for Disposal (RFD) is completed and submitted to LMES Site Operations.

Depending on funding, LLW in GSAs may be either characterized for disposal or remain at the GSA. The volume of LLW in GSAs is not included in Appendix A. Specific volumes and weights for "unworked" RFDs have not been determined by LMES; however, they are estimated to encompass approximately 3,256.8 m^3 (115,000 ft^3) of storage space (Kuehn, 1995). During FY 1996, approximately 437.4 m^3 (15,443.2 ft^3) of waste was removed from these areas (Ellington, 1997). During the time period of August 1996 through August 1997, 759 drums or 159.1 m^3 (5,617 ft^3) were moved into low-level storage areas. Lockheed Martin Energy Systems, Inc., plans to continue processing RFDs as resources (e.g., funding, personnel, and storage space) are made available.

2.2.3 United States Department of Energy Material Storage Areas

As discussed in Section 1, the USEC leases enrichment facilities from the DOE and these are regulated by the NRC. Since DOE also utilizes some space in the process areas, overlapping authority issues regarding the storage of LLW historically have existed since the formation of USEC. On December 31, 1996, a supplement to the lease agreement between the DOE and the USEC titled *DOE Material Storage Areas (DMSAs) at the Paducah and Portsmouth Gaseous Diffusion Plants* was issued (LMES, 1996). This document established a plan for complying with the NRC regulations by having the DOE accept certain areas of the buildings and outside areas (deleasing). In addition to identifying the DMSAs, the document also outlined the activities to be completed pursuant to a Memorandum of Agreement. Although the areas are defined, no information is available on the quantity of waste.

2.2.4 Low-Level Waste Storage Projected Needs

Figure 2-2 and Table 2-2 present forecasting information up to FY 2000 and a bar chart depicting LLW in storage during the past seven months. Based upon review of the forecast, during the next three years it is anticipated that approximately 8,000 drums of LLW will be generated. Since there is an extremely small amount of indoor LLW storage space available, future storage concerns were identified. However, after a discussion with LMES Site Operations, it was explained that approximately 8,000 drums of LLW are being reclassified and will be disposed of in the PGDP's C-746-U Landfill (Leone, 1997).

Since inventory is being reduced and LMES WM continues to develop its program to ship LLW offsite, no immediate storage needs have been identified for this revision of the IWMP.

Table 2-3. Low-Level Waste Storage Summary for the Paducah Gaseous Diffusion Plant

Location	Contents	Volume being stored (ft^3)
C-301	Absorbent media, asbestos, cleanup debris, floor sweepings, miscellaneous, scrap metal waste, sludge/solutions, trash, wood, and Zorball	12,194
C-333	Absorbent media, asbestos, asbestos vacuum, burnout waste, cardboard drums, chair pads, chairs, cleanup debris, collection, collection drums, concrete, concrete/dust, concrete wash sludge, debris, dirt, empty drum overpacks, filters, air filters, heater filters, high-efficiency particulate air filters, floor sweepings, floor sweepings/rags, graphite crucibles, insulation, miscellaneous, nickel cakes, oil sludge, rock, rock and dirt, sand, scrap metal waste, slag, sludge, sludge-alkali, sludge/solutions, NaF, soil/pH temperature, sweeper brush, thorium fluoride, trap mix, trap mix-alumina/NaF, trap mix-alumina, trap mix-NaF, trap mix/miscellaneous, trash, empty uranium hexafluoride cylinders, uranium compounds, uranium precipitate, vacuum dust, water, wood, wood pallets, Zorball, and Zorball/trash	37,562
C-745-C	Absorbent media, asbestos, trash, nickel dust, scrap metal, cleanup debris, miscellaneous compounds, sludge solution, hypalon, magnesium, vermiculite, floor sweepings, and soil	832
C-745-K	Absorbent media, asbestos, chair pads, cleanup debris, collection, concrete, cylinder rust, dirt/chlorine and temperature control, dirt/concrete, drum pumps, excavated dirt, filters, floor sweepings, insulation, miscellaneous compounds, scrap metal waste, sludge/solutions, soil, soil/autosampler, soil/pH temperature, trash, trash/auto sampler, wood, and Zorball	71,874
C-746-V	Currently empty	0
C-746-B (Outside)	Soil, PPE, trash, asbestos	Not Available
C-746-B (Warehouse)	Asbestos, classified waste, cerium hydrate, cleanup debris, concrete, cylinder wash sludge, drill mud, empty drums, empty overpacks, filters, filters/ NaF/powder, floor sweepings, grout, laboratory waste, miscellaneous, plastic/dirt, PPE/plastic, scrap metal waste, sludge, sludge/solutions, NaF, soil, spray bath sludge, trap mix, trash, uranium compounds, uranium precipitate, vacuum dust, vacuum dust collector, water, wood, and Zorball	35,351
C-746-H3	Drill mud, empty drums, grout, miscellaneous, PPE/plastic, plastic/dirt, and soil	35,427
C-746-M	Uranium chips	216
	Grand Total	206,033

Note: This information was compiled from the LMES WM Database as of June 10, 1997. Since considerable information was not available in the database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

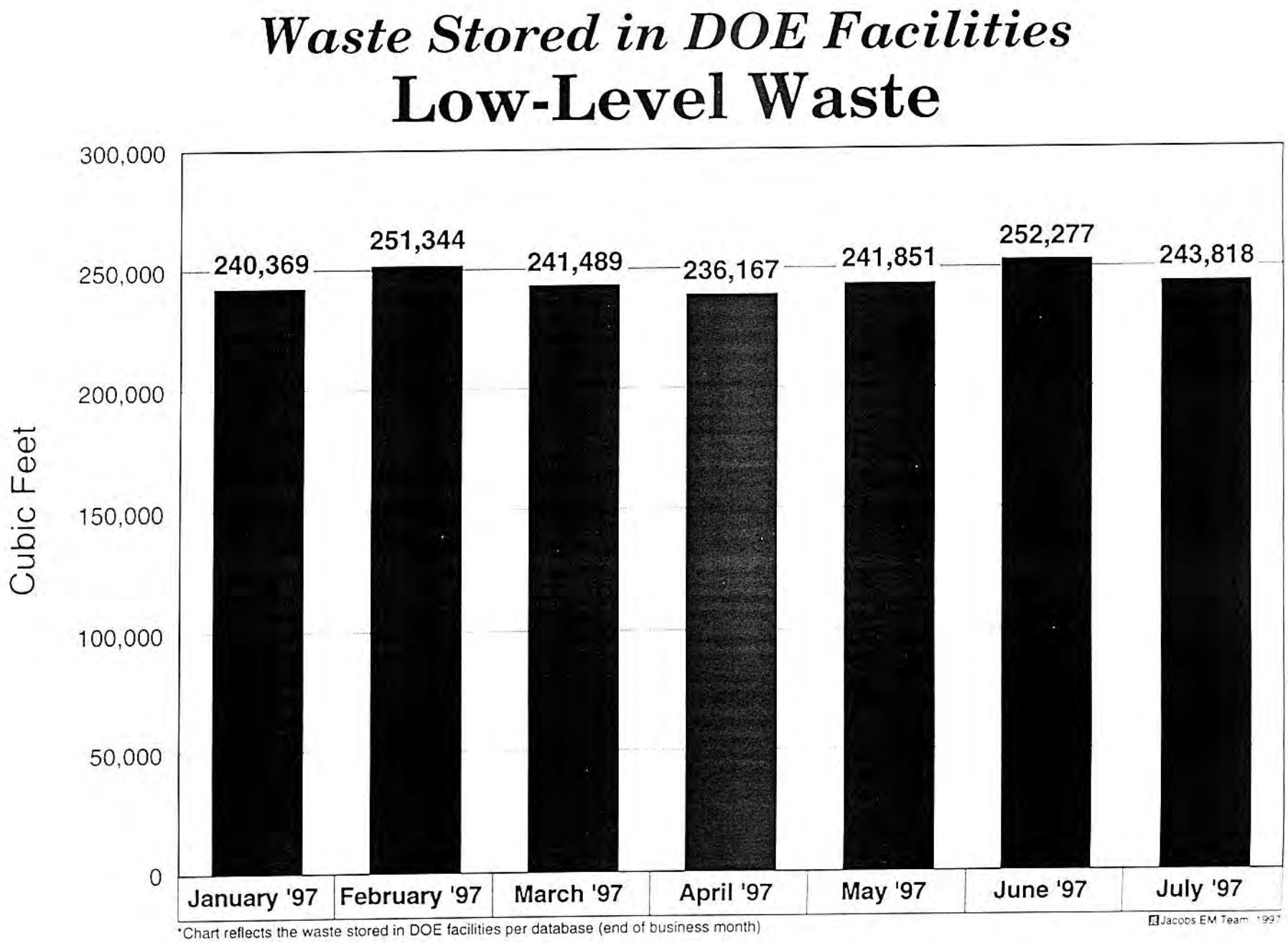


Figure 2-2. Low-Level Waste Storage Capacity

2.3 TREATMENT

The following sections provide information regarding the PGDP's current and potential capability to treat LLW.

2.3.1 Paducah Gaseous Diffusion Plant Low-Level Waste Treatment Capability

The DOE currently does not have treatment capability for solid LLW at the PGDP. However, the Vortec vitrification system currently is being constructed. When it is complete and operable in early FY 1999, the PGDP will have the ability to treat RAD and mixed wastes. The vitrification system treats wastes by destroying organic contaminants and chemically bonding the inorganic contaminants, including radionuclides, in an inert, glass-like vitrified matrix. The system consists of a melting device designed to provide process conditions that will allow the destruction of the volatile organic compounds (VOCs) and the formation of the glass product. It is estimated that as much as 56% of the LLW (soil, drill cuttings, mud) could be vitrified using Vortec.

2.3.2 Off-Site Low-Level Waste Treatment Capability

The DOE Oak Ridge Reservation (ORR) East Tennessee Technology Park (ETTP) TSCA Incinerator is currently the only facility able to accept and incinerate liquid LLW containing PCB and/or RCRA waste.

2.3.3 Low-Level Waste Treatment Projected Needs

Projected needs for the DOE are complicated considering the Vortec vitrification system is being constructed and a new M&I contractor is being selected. Based on the current wastes generated and the construction of Vortec, no immediate treatment needs were identified.

2.4 LOW-LEVEL WASTE DISPOSAL

The only practical method for reducing the radiation hazard from LLW is to isolate it from the public and the environment until the radioactivity has decayed. Isolation is achieved, in varying degrees, by disposal methods (EPA, 1994). At present, the PGDP does not currently operate a LLW disposal facility; therefore, all LLW at the PGDP must be stored onsite or shipped offsite to a treatment, storage, and disposal facility (TSDF).

2.4.1 Capability to Dispose of Low-Level Waste

The C-746-U Solid Waste Landfill, which became operational in FY 1997, allows for the on-site disposal of solid wastes. Radiological disposal criteria in the operating permit are being negotiated with KDEP. Depending on the disposal level, some wastes that are currently classified as LLW may be able to be landfilled. Recently, the KDEP has required waste streams that have levels of radioactive elements at near-background levels to be approved by the Kentucky Department for Environmental Protection Division of Waste Management (KDWM) on a case-by-case basis. This ability by KDEP to regulate radionuclides is being legally challenged. As identified in the 1996 IWMP, if a value of 30 pCi/g uranium can be set, LMES WM may be able to dispose of 60% of LLW and save the DOE approximately $160 million (Leone, 1996).

2.4.2 Off-Site Low-Level Waste Disposal Capability

At present, no contracts are in place for disposal of LLW.

2.4.3 Low-Level Waste Disposal Projected Needs

Projected needs for LLW for off-site disposal include DOE approval of plans and procedures for the release of off-site waste and funding to support containerization, categorization, characterization, shipping, and disposal. This issue, commonly referred to as the DOE "moratorium," is discussed in greater detail in Section 3.6.

Although LMES WM and ER are separate groups, their support of the DOE is interrelated. Identification of remedial alternatives during development of the feasibility studies for SWMUs and areas of concern typically includes excavation and disposal as an alternative. Although the alternatives are eliminated based on the cost of disposal of waste offsite, an economic study for a on-site LLW disposal cell should be conducted to approach remediation from a sitewide perspective. Such a facility has the potential to greatly enhance WM capability through its ability to dispose of LLW, including those generated through D&D, ER, and enrichment facilities (EF) activities.

2.5 LOW-LEVEL WASTE ISSUES AND RECOMMENDATIONS

Although separate sections have been developed, Sections 2.5, "Issues and Recommendations," and 2.6, "Path Forward," interrelate since they affect each other. It is noted that in most cases, the recommendations identified currently are recognized by the DOE and LMES. In addition, many recommendations have been provided by LMES staff and management. The purpose of this section is to consolidate these issues into one programmatic document.

The FY 1996 IWMP made several recommendations and suggested actions for improving the WM program at the PGDP. Many of these were provided by DOE, LMES, and Jacobs WM staff and are applicable to this year's IWMP. These include developing and implementing the Waste Information Tracking System (WITS), developing and implementing procedures to dispose of waste offsite (i.e., disposal procedures for waste contaminated in volume), constructing and demonstrating Vortec, determining radionuclide limits for the C-746-U Solid Waste Landfill, and requiring the ER program to more aggressively pursue waste minimization. Although many of these are being implemented, they are not complete or fully operational. Therefore, implementation of these actions is still recommended for FY 1997.

During this revision of the FY 1997 IWMP, additional issues and recommendations include the development of plans to meet the FY 1998 and 1999 milestones identified in the Accelerated Cleanup Plan (transfer responsibility for newly generated waste and the necessary funding to the generator). It is emphasized that since a new DOE prime contractor will assume responsibility for M&I in April 1998, meeting this milestone will be challenging to the WM program. In addition, in FY 1999, the generator will be responsible for funding in their project the cost of generation, storage, treatment and disposal of their project wastes.

No specific recommendations for storage of LLW at the PGDP were identified. Future generation of waste is significant (approximately 8,000 drums). However, the waste to be generated will be offset by the reduction in LLW inventory during FY 1997 and 1998.

Since the Vortec Vitrification Facility is being constructed, treatment of LLW may begin in the near future (early FY 1999). In order to meet the Accelerated Cleanup Plan, efforts should continue to identify treatment and/or disposal alternatives for waste streams that cannot be vitrified.

Disposal of LLW during remedial cleanup is identified as the most costly item to the DOE since LLW is the largest waste stream encountered at the PGDP. Engineering estimates typically show that the cost to dispose of LLW during remedial excavation projects are 70% of the total project cost. Although off-site commercial disposal is available, on-site alternatives should be explored. Such alternatives may include constructing an on-site LLW disposal cell. If constructed, such a cell would help meet the DOE's Accelerated Cleanup Plan for both WM and ER programs and support D&D. Such cells have been successfully constructed at other DOE sites (e.g., Weldon Springs, Missouri).

2.6 PATH FORWARD

Fiscal year 1998 will be a challenging year for DOE and its contractors since a new M&I contractor will be selected. The current path forward and direction from DOE Oak Ridge Operations (ORO) is the Accelerated Cleanup Plan, which emphasizes treatment and disposal. Table 2-4 identifies the milestones and the calendar year in which they must be implemented.

Table 2-4. Milestones for Waste Management

Milestone	Year
In FY 1999, the generators will be responsible for budgeting for management of newly generated waste, while WM will continue to be responsible for management of legacy wastes.	1999
Reduce LLW legacy waste by greater than 95% of current inventory.	2006
Treatment and disposal of mixed low-level waste completed.	2006
Treatment and disposal of remote-handled TRU waste sludge completed.	2006
Complete treatment and disposal of TRU waste.	2006

Source: DOE (Ten Year Plan)

As previously mentioned, as a result of the M&I contract situation, the structure of the M&I is difficult to determine for this revision of the IWMP. The structure of the M&I and subcontractors significantly will affect the WM program and how business is being conducted. The 1998 IWMP will reflect the new structure of waste management.

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3. MIXED WASTE

As defined by the Federal Facility Compliance Act [42 U.S.C.A. § 6903 (41)], mixed waste is a waste containing both a hazardous waste subject to RCRA and a source, special nuclear, or byproduct material, subject to the AEA (42 U.S.C. § 2011 *et seq.*). The following sections provide information regarding the PGDP's management of mixed wastes.

3.1 TOXIC SUBSTANCES CONTROL ACT/RESOURCE CONSERVATION AND RECOVERY ACT/RADIOACTIVE WASTE

Polychlorinated biphenyls are not regulated as a hazardous waste under the RCRA. However, if PCBs are mixed with those hazardous wastes listed in 40 C.F.R. § 261.31 to § 261.33 (e.g., spent TCE that was used to clean electrical equipment), the mixture is subject to RCRA hazardous waste regulations. Similarly, if PCBs are mixed with other wastes and the resulting mixture exhibits one or more of the hazardous characteristics identified in 40 C.F.R. § 261.21 to § 261.24 (i.e., ignitability, corrosivity, reactivity, or toxicity), the mixture must be managed as hazardous waste until the waste no longer exhibits the characteristic. Polychlorinated biphenyl-contaminated soil or sediment that is also contaminated with listed waste or exhibits a hazardous characteristic must be managed as hazardous waste until the contaminated media no longer contains the listed waste (determined by the EPA regional office) or no longer exhibits the hazardous characteristic. Sections 3.2 through 3.6 address the agreements and issues that affect the DOE WM program.

3.2 TOXICITY CHARACTERISTIC LEACHING PROCEDURE FEDERAL FACILITIES COMPLIANCE AGREEMENT

In March 1990, the EPA promulgated the Toxicity Characteristics Revisions, which replaced the Extraction Procedure Toxicity leachate test with the Toxicity Characteristic Leaching Procedure (TCLP) [55 Fed. Reg. 11798 (March 29, 1990) and 40 C.F.R. § 261.24]. The TCLP test added 25 organic chemicals to the list of toxic constituents of concern and established regulatory levels for these organic chemicals based on health-based concentration thresholds and a dilution and attenuation factor that was developed using a fate and transport model. After the effective date of the Toxicity Characteristics Revisions, September 25, 1990, any waste that exhibited a toxicity characteristic pursuant to the TCLP became a RCRA-characteristic hazardous waste.

The DOE first sampled the sludge pursuant to the TCLP in the C-616-E Sludge Lagoon in April 1991. The lagoon is part of a treatment process for cooling water used to remove excess heat from the gaseous diffusion process. At that time, chromium was used in the towers to reduce fouling and control corrosion. The DOE received analytical results from a sampling event indicating that the sludge in the lagoon may exhibit a toxicity characteristic pursuant to the TCLP in June 1991. Since the revised RCRA Part A permit did not include the C-616-E Sludge Lagoon as a RCRA TSD facility, the DOE potentially was in violation of the RCRA. A FFCA for the TCLP was promulgated and signed in March 1992 (DOE, 1992a). Since that time, the sludge was resampled and determined to pass the TCLP and, therefore, was nonhazardous under the RCRA. At that time, the lagoon was determined to be no longer subject to the TCLP FFCA.

Current plans include the TCLP FFCA implementation of 55 sampling plans and approximately 14,000 drums in storage pursuant to the TCLP FFCA.

3.3 FEDERAL FACILITIES COMPLIANCE AGREEMENT FOR STORAGE OF RADIOACTIVE MIXED WASTE SUBJECT TO LAND DISPOSAL RESTRICTIONS

The HSWA of 1984 (42 U.S.C.A. § 6901 *et seq.*) prohibits the disposal of RCRA hazardous wastes that have not been pretreated to standards established by the EPA. These prohibitions are commonly referred to as the land disposal restrictions (LDRs) and apply to all hazardous waste components of RAD mixed wastes containing LDR waste. The LDR wastes were divided into five classifications: solvents and dioxins, the "California List" wastes, the first third, the second third, and the third third wastes, which were published in June 1990. After the LDR deadlines were established, restricted wastes had to be treated to meet LDR treatment standards before land disposal could be considered. The LDR FFCA was developed to extend the effective date of the LDR prohibitions for RAD mixed wastes (EPA, 1992). As a result, the DOE was to identify the treatment strategy for wastes to meet the LDR treatment standards, including a schedule for the prioritization, implementation, and completion of such treatment.

3.4 FEDERAL FACILITIES COMPLIANCE ACT OF 1992

As a result of a Supreme Court ruling in 1992, Congress was compelled to affirm its real intent that federal facilities should fall under the same legal regulatory jurisdictions as others by passing the Federal Facility Compliance Act (FFC Act). The FFC Act expressly waives sovereign immunity from RCRA-based civil fines by the states and provides a three-year waiver for mixed (RCRA/RAD) waste not subject to any existing agreements. The delay may extend beyond three years if the DOE enters into and complies with a state enforcement order. The FFC Act also stipulates a six-month time frame for the DOE to develop plans for treatment technologies and storage and disposal capacity in each state. In addition, a mixed-waste inventory report and an inventory of treatment technologies and capacities was required from the DOE for submission to the EPA and the states within 180 days. This submission was the inception of the Site Treatment Plan (STP) for the PGDP. The LDR FFCA was superseded in part by the FFC Act, which incorporates elements from the LDR FFCA. Another provision to this Act includes the requirement that the EPA or RCRA-authorized states must now conduct an annual environmental inspection of federal facilities. The FFC Act amendments to the RCRA effectively relieve the EPA of any perceived responsibility for developing and promulgating treatment standards for the radiological component of mixed wastes where the radiological constituent would otherwise be regulated under the AEA.

3.5 SITE TREATMENT PLAN

As required by Section 3021(b) of the RCRA, the DOE has prepared STPs describing the development of treatment capacities and technologies for treating mixed waste. The DOE published a notice April 6, 1993, 58 Fed. Reg. 17875, describing the proposed process for developing the STPs in three phases: (1) a conceptual STP, (2) a draft STP, and (3) a proposed STP. The Kentucky Natural Resources Cabinet has reviewed the proposed STP, modified its terms, and approved the STP (DOE, 1995a). Furthermore, the Cabinet has issued a Unilateral Order, which the DOE has appealed because of disagreements concerning the language of the residual management contingency plan and funding sections. The DOE is complying with all substantive requirements of the STP. All milestones in the STP have been met.

3.6 DEPARTMENT OF ENERGY "MORATORIUM"

Some of the information presented below is not applicable to RCRA and mixed wastes. However, for clarification, the information has been presented in its entirety.

In early 1991, it was discovered that waste containing small quantities of RAD material had been shipped from DOE facilities to commercial TSDFs that were not licensed by the NRC or an agreement state. As a result, the DOE headquarters (HQ) Office of Environmental Restoration and Waste Management (ERWM) issued correspondence May 17, 1991, directing DOE facilities to "cease the shipment to commercial facilities not licensed by the NRC or an agreement State of any RCRA-hazardous or TSCA-regulated waste originating in a radiologically controlled area until further notice" (DOE, 1991). This correspondence also required facilities to submit to the office for approval information that describes the criteria used, the basis for the criteria, and the methods used for measuring the waste for comparison to the criteria. Finally, the DOE requested information be submitted describing how a facility assures that sanitary waste (originating in a radiological controlled area and sent to an off-site landfill or a publicly owned treatment works) is controlled.

3.6.1 Issuance of Performance Objectives

The DOE ERWM office issued "Performance Objective for Certification of Non-Radioactive Hazardous Waste," signed by Jill Lytle, Deputy Assistant Secretary for ERWM, October 16, 1991. This document described the criteria that DOE facilities must meet before their programs to ship RCRA and TSCA waste would be approved. The "Performance Objective for Certification of Non-Radioactive Hazardous Waste" was reissued February 17, 1995 (DOE, 1995b).

3.6.2 Requirements for Nonhazardous/Nontoxic Substances Control Act Solid Waste

The DOE HQ ERWM office issued an update to the "moratorium" February 4, 1992 (DOE, 1992b). Specifically, it required that the as-low-as-reasonably-achievable philosophy be incorporated into the unconditional release of surface contaminated materials and wastes. This correspondence by Jill Lytle also stated, "While the 'moratorium' does not apply to non-hazardous, non-TSCA solid waste and non-waste materials, the same release criteria apply. Therefore, all wastes, except for wastes for which the radioactivity is covered by a law or regulation (e.g., the Clean Air Act, Safe Drinking Water Act), must meet the same standards prior to unconditional release. I recommend augmenting procedures now in preparation that will be used to lift the shipping 'moratorium' to address the management of potentially radioactive solid waste." Lee Stevens, Director of the Division of Regulatory Compliance, ERWM, again emphasized that criteria used by some sites was not consistent with the DOE policy (as described in the February 4, 1992, correspondence) on release criteria for solid wastes (DOE, 1993a).

Key criteria for waste determinations for all waste include the definition of "radiologically controlled areas" and "potential for contamination." Correspondence with clarification on this issue is provided by the DOE Office of Program Support, ERWM, July 6, 1993 (DOE, 1993b).

3.6.3 Partial Approval to Ship Surface-Contaminated Resource Conservation and Recovery Act and Toxic Substances Control Act Wastes

Jill Lytle partially lifted the "moratorium" for shipment of RCRA and TSCA wastes from radiologically controlled areas at the PGDP June 30, 1995 (DOE, 1995b). This correspondence stated, "The partial lifting means only that those hazardous/toxic waste determined to be non-radioactive by virtue of process knowledge and surface smear surveys are included in this authorization. This authorization does not include determinations of the absence of RAD contamination for bulk or volume materials."

3.6.4 The "No Radioactivity Added Program" at the Paducah Gaseous Diffusion Plant

In accordance with the DOE letter partially lifting the "moratorium," LMES can only ship potentially surface contaminated (PSC) wastes that are deemed to be non-RAD contaminated through process knowledge and surface smear analysis. Procedures for shipment of RCRA and TSCA wastes containing bulk or volume radionuclide contamination have not been adequately completed by LMES and, therefore, have not been approved by the DOE HQ office. A draft Paducah Volumetric Package is currently out for review and approval.

In order to meet the performance objectives for PSC waste, LMES has devised plans and procedures for the implementation of a "No Radioactivity Added Program." These plans and procedures describe how the PGDP assures that hazardous waste shipped to a commercial TSDF is nonradioactive, or, if RAD, shipped to a receiving facility specifically licensed to manage RAD wastes. In addition, LMES and LMUS procedures are utilized to meet performance objective criteria. To ensure the services provided by LMUS are in accordance with the DOE performance objective, a letter of commitment to LMES was written.

Before a PSC candidate can be released from the site, four conditions must be met: (1) the item must be a PSC waste as determined and approved by the Offsite Waste Release Board, (2) the surfaces of the item have been surveyed by Health Physics personnel and meet the release limits of DOE Order 5400.5 and Table 3-1, (3) recommendation by Paducah's Off-Site Shipment Management Review Committee and approval by the Paducah Site Manager, and (4) concurrence and approval of LMES Environmental Compliance.

Waste candidates for disposal include capacitors, transformers, potential devices (electrical equipment containing a capacitor), compressed gas cylinders, light bulbs, thermometers, batteries, light ballasts, aerosol cans, toner cartridges, circuit boards, bullets and brass shell casings, and containers with the original lid seals.

Currently, LMES's plans and procedures for volume contaminated wastes to ensure shipment of the wastes to NRC-licensed TSDFs are out for review and approval. During the past year, LMES contracted the assistance of the Argonne National Laboratory to review site documents and develop decision-making procedures; however, the plan was not completed as required by the DOE. A new plan was to be delivered to the DOE for their review by September 30, 1997, but finally was issued on October 16, 1997. The DOE Paducah Site Office has delivered this plan to DOE ORO for their review.

As a result of the DOE "No Radioactivity Added" policy, all TSCA/RCRA waste streams discussed in this section are considered TSCA/RCRA/RAD wastes (i.e., TSCA/RCRA wastes containing a RAD component).

Table 3-1. Allowable Total Residual Surface Contamination (dpm/100 cm^2)[1]

Radionuclides[2]	Average[3,4]	Maximum[4,5]	Removal[4,6]
Transuranics, ^{125}I, ^{129}I, ^{226}Ra, ^{227}Ac, ^{228}Ra, ^{228}Th, ^{230}Th, ^{231}Pa	100	300	20
Th-Natural, ^{90}Sr, ^{126}I, ^{131}I, ^{133}I, ^{223}Ra, ^{224}Ra, ^{232}U, ^{232}Th	1,000	3,000	200
U-Natural, ^{235}U, ^{238}U, and associated decay product alpha emitters	5,000	15,000	1,000
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission), except ^{90}Sr, and others noted above.[7]	5,000	15,000	1,000

[1] As used in this table, dpm (disintegrations per minute) means the rate of emission by RAD material as determined by the counts per minute measured by an appropriate detector for background efficiency and geometric factors associated with the instrumentation.

[2] Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exist, the limits established for alpha and beta-gamma radionuclides should apply independently.

[3] Measurements of average contamination must not be averaged over an area of more than 1 m^2. For objects of less surface area, the average must be derived for each object.

[4] The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters must not exceed .02 mrad/hr and 1.0 mrad/hr, respectively at 1 cm.

[5] The maximum contamination level applies to an area of not more than 100 cm^2.

[6] The amount of removable material per 100 cm^2 of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of RAD material on the wiping with an appropriate instrument of known efficiency. When removable contamination on objects of less than 100 cm^2 is determined, the activity per unit area must be based on the actual area and the entire surface area should be wiped. It is not necessary to use wiping techniques to measure removable contamination levels if directed scan surveys indicate that residual surface contamination levels are within the limits for removable contamination.

[7] This category of radionuclides includes mixed fission products, including the ^{90}Sr that is present in them. It does not apply to ^{90}Sr that has been separated from other fission products or mixtures where the ^{90}Sr has been enriched.

3.6.5 Plans for Treatment and Disposal of Mixed Waste for Fiscal Year 1998

Plans for FY 1998 include completing the treatment/disposal of aerosol cans, fluorescent light bulbs, cyanide, chromates, lead debris, RCRA soft solids, acid waste with high RAD, corrosives, fixer solution, activated carbon, paint waste, liquid RCRA/TSCA/RAD liquid to ETTP TSCA Incinerator, and other small miscellaneous RCRA waste streams.

3.7 STORAGE

The PGDP stores mixed (RCRA/RAD) and RCRA/TSCA wastes in RCRA-permitted facilities. The requirements of these facilities are identified in the PGDP's Hazardous Waste Management Permit issued by the KDEP. In addition to RCRA requirements, mixed waste containing PCBs from sources ≥ 50 ppm must be stored at a facility that meets the requirements of 40 C.F.R. § 761.65(b). The TSCA FFCA requires that all PCB waste storage areas meet several storage area requirements in accordance with 40 C.F.R. § 761.65, including requirements for labeling, marking, and containment. The EPA concurred with removing curbing from the requirements for solid wastes (Smith, 1996).

3.7.1 Current Inventory and Capacity

Information on storage capacity was provided by the LMES Site Operations department. The PGDP primarily stores mixed waste in standard 208.2-liter (55-gal) drums or 321.7-liter (85-gal) overpacks. Four standard 208.2-liter (55-gal) drums are placed on a 1.2 m x 1.2 m (4 ft x 4 ft) wooden pallet that requires 1.5 m^2 (16.2 ft^2), or 0.19 m^2 (2 ft^2) per double-stacked drum. In the case of the overpack, a 1.52 m x 1.52 m (5 ft x 5 ft) pallet is used to store four 321.7-liter (85-gal) overpacks and requires 2.3 m^2 (25 ft^2) of floor space, or 0.29 m^2 (3.125 ft^2) per double-stacked drum.

Table A-2 in Appendix A provides a summary of the mixed wastes stored at the PGDP. The PGDP currently stores TSCA/RCRA/RAD waste in five on-site storage facilities, which are depicted in Figure 3-1. Table 3-2 provides a description of the storage facilities, the waste streams within each facility, and the volume of waste currently occupying each facility. The C-752-A facility became operational in FY 1997 and provides additional mixed waste storage capacity. The C-746-R RCRA Storage Pad will be closed under RCRA during FY 1998. In addition, Figure 3-2 depicts waste in storage versus remaining capacity.

3.7.2 Transuranic Waste

The PGDP facility has a small amount of TRU and greater than Class C waste stored in Building C-746-Q RCRA Waste Storage Facility, which is classified as mixed. Transuranic waste is also stored in the C-746-A facility. The TRU waste resulted from reprocessing spent nuclear fuel where the fission products (TRUs) were introduced in the gaseous diffusion process. The DOE addresses TRU waste in the STP and will maintain compliance with the FFC Act by disposing of the waste at the Waste Isolation Pilot Plant (WIPP) located in New Mexico. Table 13 in the appendix of the STP lists the DOE PGDP TRU wastes proposed for shipment to the WIPP.

3.7.3 Generation Estimates

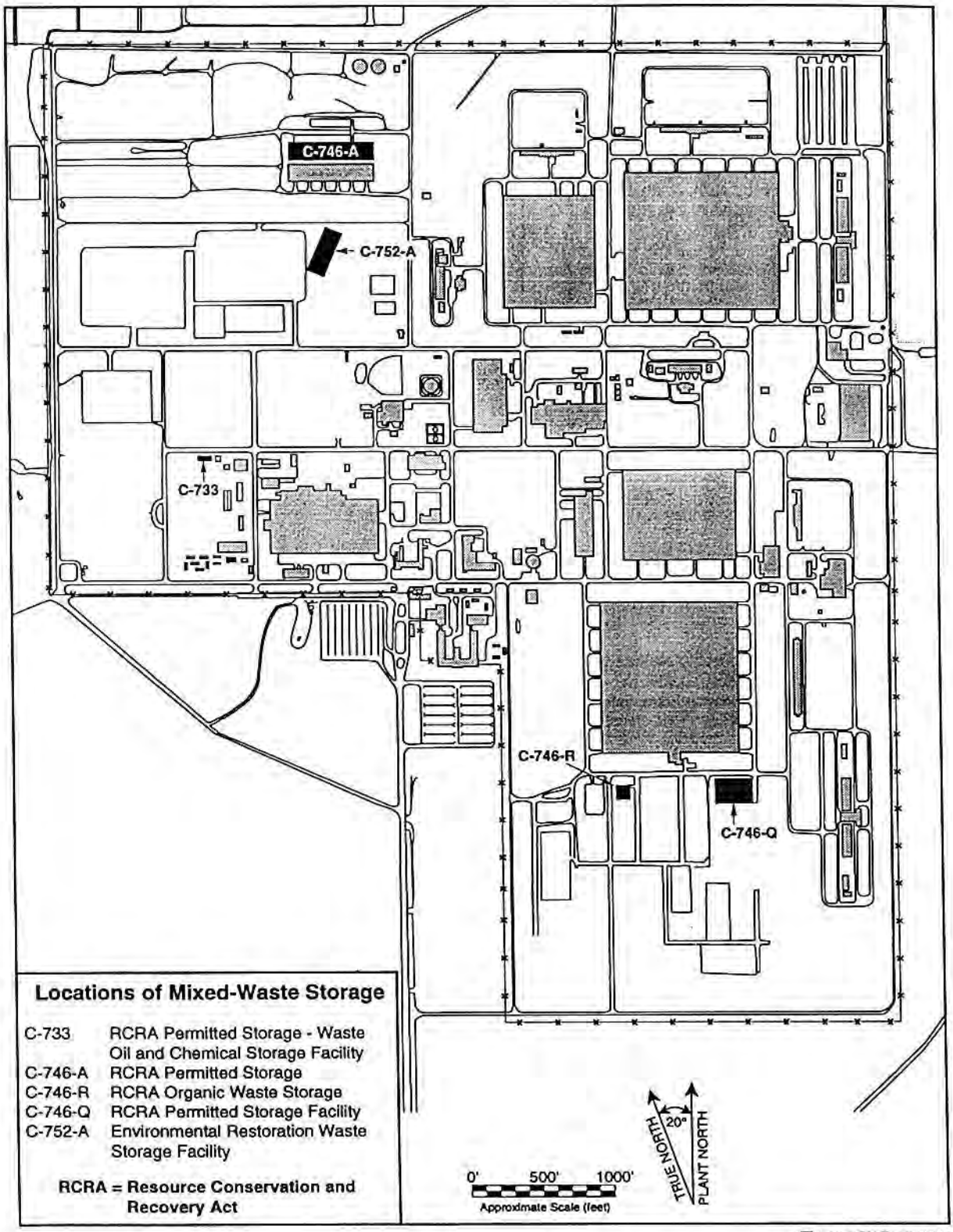
Mixed waste generation forecasts that were provided by LMES are shown in Table 3-3. Table 3-3 shows current mixed-waste generation estimates projected to FY 2000.

3.7.4 Projected Needs

With the completion of the C-752-A Environmental Restoration Storage Facility, total storage space at the PGDP has increased by 3,901.8 m^2 (42,000 ft^2). Considering that the Vortec vitrification system is being constructed, an additional undetermined amount of mixed-waste storage capacity will become available. Based on estimated projections to the year 1998, the PGDP should have adequate mixed-waste storage space.

3.7.5 Need for Prioritization Based on Factors in Addition to Compliance (Mixed-Waste Drum Incident)

An overpacked drum containing a radioactive nitric acid waste mixture, estimated to have been in storage for approximately 30 years, ruptured inside the C-746-Q RCRA Waste Storage Facility. These conditions were discovered the morning of September 15, 1997. A RCRA inspection was conducted at C-746-Q on September 12, 1997, and conditions appeared normal at that time. The drum was one of 16 with similar contents. The other 15 appear to be intact with no bulging.



Jacobs EM Team, 1997

Figure 3-1. Paducah Gaseous Diffusion Plant Facilities Currently Used for Mixed-Waste Storage

Table 3-2. Mixed-Waste Facility Summary for the Paducah Gaseous Diffusion Plant

Facility	Description	Mixed-Waste Storage Capacity (ft^2)	Waste Streams Stored in Facility	Volume of Mixed Waste Occupying Facility (ft^3)
C-733	This facility is permitted for RCRA and currently is used for storage of PCB/RCRA and ignitable waste. It is inspected daily for RCRA waste and biweekly for TSCA waste.	4,224	Sludge, waste oil, waste water, laboratory waste	2,332
C-746-A	This facility is permitted for RCRA waste and currently is used for storage of PCB/RCRA waste. It is inspected daily for RCRA waste and biweekly for TSCA waste.	41,376	Scrap metal, laboratory waste, leachate, liquids, sludge, waste oil, absorbents, miscellaneous debris, general salvage, valves	2,227
C-746-Q	This facility currently is permitted for RCRA waste and is used for storage of PCB/RCRA waste. It is inspected daily for RCRA biweekly for TSCA.	33,165	Ash receivers, batteries, laboratory waste, sludge, liquids, miscellaneous debris, uranium-contaminated oils, pentachlorophenol wastes, trash	5,243
C-746-R	This facility is permitted for ignitable RCRA waste and currently is used for storage of PCB/RCRA waste. It is inspected daily for RCRA waste and biweekly for TSCA waste. The C-746-R RCRA Storage Pad will be closed under RCRA during FY 1998.	600	Clean and waste oils, TCE, machine coolants, paint wastes, propylene glycol.	1,687
C-752-A	This facility is permitted for RCRA waste and is used currently for storage of PCB/RCRA waste. It is inspected daily for RCRA waste and biweekly for TSCA waste.	42,000	Activated carbon, miscellaneous equipment, paper/plastic/ wood scrap, PPE, sludge, waste water.	0
Total		**121,365**		**11,490**

*Information compiled from the LMES WM database as of June 10, 1997. Waste management database values appear inconsistent with other data received from Site Operations.

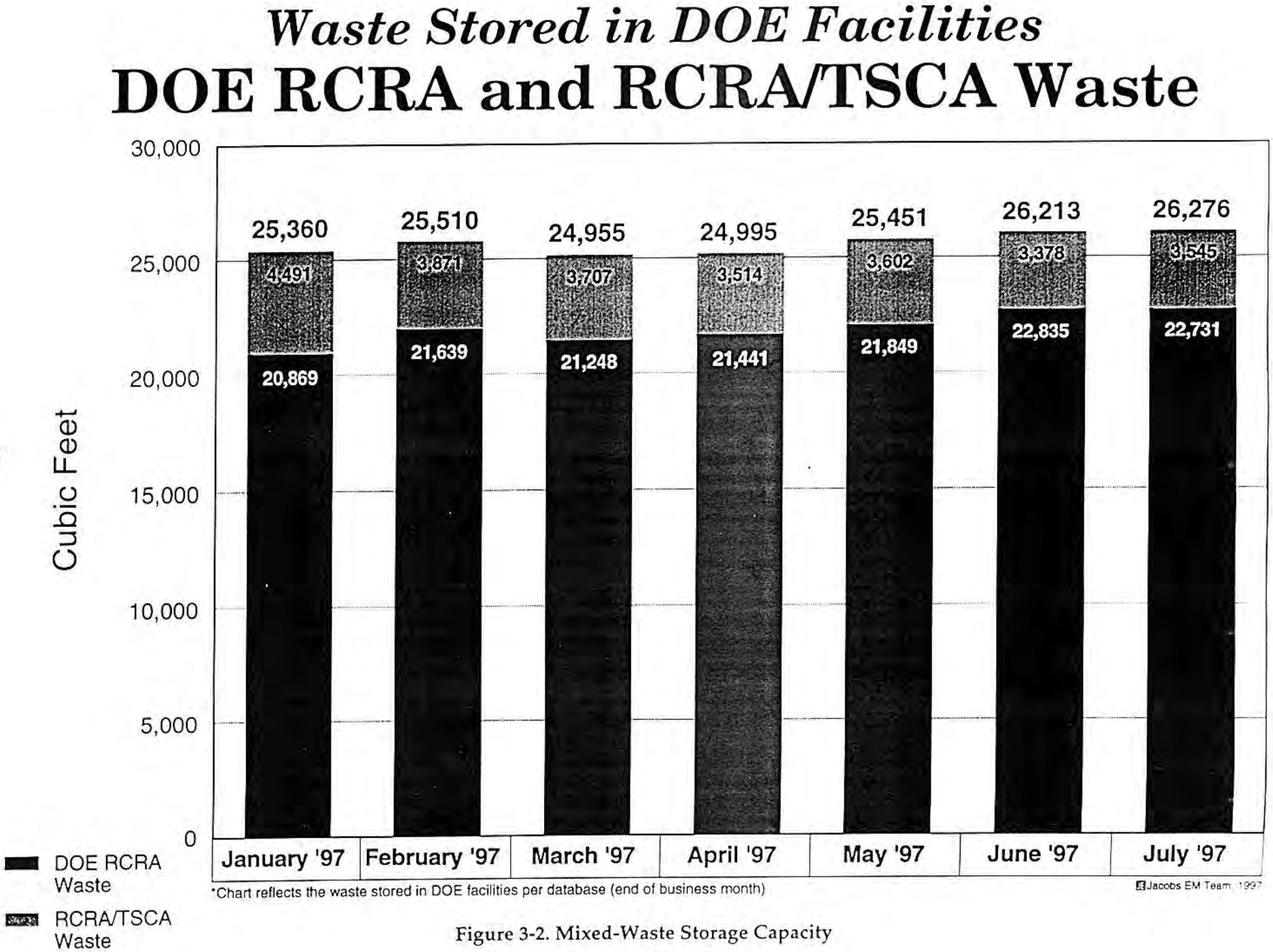


Figure 3-2. Mixed-Waste Storage Capacity

Table 3-3. Mixed-Waste Generation Estimates*

Source	FY 1998	FY 1999	FY 2000
Legacy	3,800 ft^3	3,800 ft^3	3,800 ft^3
ER	3,590 ft^3	626 ft^3	670 ft^3
D&D	7 ft^3	7 ft^3	7 ft^3
Enrichment Facilities	30 ft^3	30 ft^3	30 ft^3
Total	**7,427 ft^3**	**4,463 ft^3**	**4,507 ft^3**

* Wastes generated from TCLP Program.

The waste in the drum was a concentrated nitric acid mixture and also contained uranium, ^{99}Tc and TRU materials, although quantities are too low to be classified as TRU waste. The waste is thought to have been generated in the 1960s and placed in a 208.2-liter (55-gal) container consisting of a polyethylene inner bottle surrounded by a metal casing. This container had been overpacked in 1990 into an unlined 321.7-liter (85-gal) steel drum. In 1994, a polylined 416.4-liter (110-gal) steel drum was used to overpack the 321.7-liter (85-gal) drum. The original 1960s waste container (polyethylene in metal casing) was determined to be unsuitable for long-term storage of this type of waste, as was the 321.7-liter (85-gal) metal overpack. The polylined 416.4-liter (110-gal) metal drum was also unsuitable for long-term storage.

The waste had been sampled in July 1997, without removal from the 416.4-liter (110-gal) overpack. The 416.4-liter (110-gal) package had been moved in August 1997, to rearrange other drums in the same bay. It is believed that during the sampling or subsequent movements, the polyethylene container failed and the nitric acid leaked into the outer metal containers.

Reaction of the nitric acid with the iron in the metal is believed to have generated nitrogen dioxide gas, dinitrogen tetroxide gas, and hydrogen gas. This resulted in a pressure buildup, blowing the lid off the 416.4-liter (110-gal) drum and propelling the 321.7-liter (85-gal) overpack, now bottomless, approximately 4.6 m (15 ft) away.

The lessons learned on this incident are that polyethylene and polypropylene containers may become brittle over time when used to store wastes consisting of concentrated strong acids (nitric, sulfuric, hydrochloric, perchloric, hydrobromic, and hydroiodic) and other oxidizers. "Legacy" wastes in storage for long periods in the original containers are a particular concern. The original containers may not have been suitable for long-term storage. Additionally, they may have been overpacked, which prevents observation of deterioration. Movement of the containers, or even minor impact, may cause a brittle container to fail. If the contents spill into unlined metal containers, chemical reactions may result. The containers may overpressurize, potentially resulting in rupture and violent release of contents. Stainless steel containers, pressure relief valves, restricting the use of overpacks, or other measures could have been used to prevent this incident from occurring.

3.8 DISPOSAL

Disposal of mixed waste is difficult considering the stringent regulations and requirements imposed on it. The RCRA regulations state that liquid hazardous waste containing ≥ 50 ppm but < 500 ppm of PCBs must either be incinerated in a TSCA incinerator or a high-efficiency boiler. The "California List" also regulates the disposal of hazardous waste containing halogenated organic compounds (HOCs) when present

in concentrations > 1,000 ppm. The HOC list includes seven specific Aroclors and "PCBs not otherwise specified." The presence of other restricted hazardous waste in PCB-contaminated soil and sediment also subjects the media to applicable LDRs. Disposal capabilities and options for mixed waste are discussed in greater detail in the following sections.

3.8.1 Disposal Capabilities

Currently, the PGDP does not have disposal capability onsite. For off-site disposal, the PGDP is currently using the DOE ORR ETTP TSCA Incinerator for the treatment of liquid RCRA/RAD and liquid TSCA/RCRA/RAD wastes. The ORR ETTP TSCA Incinerator also has the capability to incinerate soft solids. Soft solids are those waste streams that can be burned easily, including PPE, paper, cardboard, and plastic. Paducah is currently scheduled to ship soft solids to the ORR ETTP TSCA Incinerator in FY 1999. All other solids, such as contaminated soil, debris, and sludge, cannot be incinerated at the ORR ETTP TSCA Incinerator.

Although the PGDP does not have the current capability to treat solid mixed waste, extensive work has been conducted to address this issue. The Vortec vitrification system, which is presently under construction at the PGDP, will enable the DOE to treat solid mixed waste. Demonstration of the Vortec process is scheduled to begin in January 1999. Additional information on Vortec is presented in Section 2.

As a result of the C-746-Q drum incident, LMES is investigating the use of an outside commercial contractor to treat their acid wastes. Lockheed Martin Energy Systems, Inc., currently has approximately 40 drums of acid wastes with elevated levels of radioactivity. Lockheed Martin Energy Systems, Inc., will hire a commercial contractor to come onsite to neutralize and precipitate these acid wastes, then solidify (stabilization) them to meet the LDR treatment technology standards, and finally prepare the drums for shipment to Envirocare for disposal. This action is pending and is expected to be completed in the near future.

3.8.2 Disposal Options

At present, all TSCA/RCRA/RAD solid waste material is stored onsite. Since no DOE or commercial disposal facilities can accept TSCA/RCRA/RAD contaminated waste for disposal, either the RAD or TSCA component has to be treated or removed before disposal. The Hanford, Washington, and Envirocare, Utah, facilities can accept RCRA/RAD-contaminated wastes for disposal. The DOE can also dispose of mixed waste at Diversified Scientific Services, Inc., and treatment at Rust/Oil and Hazardous Materials Remedial Services as well as the Idaho National Environmental Engineering Laboratory.

As identified in the DOE's STP, disposal and treatment options have been identified for PGDP mixed wastes. These options include incineration, treatment at C-400-D, commercial recycling, commercial stabilization, macroencapsulation, and vitrification (LMES, 1997a). This STP has established compliance dates for the treatment and disposal of the PGDP's mixed waste.

3.8.3 Projected Needs

Current off-site mixed-waste disposal options are very limited; however, with the construction of Vortec, the treatment of waste should begin sometime during FY 1999. Consideration should be given to disposal options for waste streams that cannot be treated by Vortec.

3.9 MIXED-WASTE ISSUES AND RECOMMENDATIONS

During the revision of this document, several mixed-waste issues were identified that affect the DOE WM program. Many issues are similar to those identified in Section 2.5 for LLW; however, they are presented here again since they relate to the disposal of mixed waste.

The construction of the Vortec vitrification system has created an opportunity for the DOE to treat mixed wastes that have previously had no disposal options. Since the duration of the permit is limited, it will be imperative to complete the construction of the Vortec unit and operate within the schedule identified in the research, development, and demonstration (RD&D) permit.

As identified in Section 3.2, until plans and procedures for wastes "contaminated in volume" are submitted to the DOE HQ for approval, RCRA, or RCRA/TSCA wastes with no RAD added, cannot be shipped offsite. Therefore, it is recommended to complete the information as expeditiously as possible to progress toward off-site disposal and the eventual disposal of all waste by the year 2006.

As identified earlier, several problems exist with the Waste Information Tracking System (WITS) database that compiles information used to manage mixed waste. Research should be conducted to either upgrade or replace the current system. The LMES Site Operations is aware of the problems associated with the current database and is in the process of converting their current Teamup database to WITS, a multisite database system, to standardize database management and alleviate the concerns with the existing system.

As a result of the drum incident that occurred in the C-746-Q RCRA Waste Storage Facility, several recommendations can be made. The LMES Site Operations department should consider these for all wastes, not just mixed wastes, as this is an issue that applies to every item that is placed in storage. Consideration should be given not only to environmental compliance, but also to the risks associated with long-term storage.

- Assess all stored waste to identify potential incompatibility hazards and identify high-risk systems.

- Develop a strategy to manage, treat, stabilize, and dispose of, if possible, the other containers from the same waste stream and other waste identified as high-risk systems. Minimize any movement of the original containers until the waste has been treated and stabilized.

- Perform comprehensive hazard analyses for all routine waste management activities. Include the mitigating actions from the comprehensive hazard analyses in the procedures that govern those activities.

- Train/provide instruction to appropriate personnel on the mitigating actions from the comprehensive hazard analyses and revise procedures.

- Issue Paducah Site Operations Waste Acceptance Criteria with an acceptable pH range for newly generated acidic/basic waste and criteria to address acceptable containers for typical newly generated waste streams.

- Develop and implement a risk-based, long-term strategy for waste treatment and disposal.

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4. TOXIC SUBSTANCES CONTROL ACT AND TOXIC SUBSTANCES CONTROL ACT/RADIOACTIVE WASTE

Congress enacted the TSCA to direct the EPA to control the manufacture, process, commercial distribution, use, disposal, and labeling of toxic substances, including PCBs. Before implementing controls on the production and use of PCBs, they were used extensively as dielectric fluids in electrical transformers and capacitors. Today, PCBs are regulated in 40 C.F.R. § 761, which has been divided into several subparts, including storage and disposal requirements. Controls apply not only to the PCB chemicals themselves, but also to items that have been in contact with PCBs. (Appendix B presents specific regulatory definitions.)

As a result of the DOE "No Radioactivity Added" policy, all TSCA waste streams discussed in this section are considered TSCA/RAD wastes (i.e., TSCA wastes containing a RAD component). Upon complete characterization, wastes currently under the TSCA/RAD group may be categorized as one of the following: TSCA or TSCA/RAD.

4.1 TOXIC SUBSTANCES CONTROL ACT FEDERAL FACILITIES COMPLIANCE AGREEMENT

As mentioned previously, the TSCA regulates PCBs, including their manufacture, use, distribution in commerce, decontamination, spill cleanup, treatment, storage, and disposal (see 40 C.F.R. § 761). In order to establish a plan to bring the DOE's uranium enrichment plants, including the PGDP, into compliance with the TSCA regulations, the DOE entered into a TSCA FFCA with the EPA (MMES, 1992). The TSCA FFCA establishes committed milestones for compliance with the TSCA. The DOE developed a TSCA Implementation Plan for the PGDP to ensure that the milestones in the TSCA FFCA were implemented on schedule at the facility. Both the TSCA FFCA and the PGDP Implementation Plan provide requirements pertaining to PCB waste at the PGDP.

One area of the TSCA FFCA and Implementation Plan that is particularly relevant to TSCA and TSCA/RAD waste at the PGDP is storage. The TSCA storage requirements for PCBs specify that PCBs and PCB-containing items from sources > 50 ppm must be disposed of within one year after being placed in storage for disposal [40 C.F.R. § 761.65(a)]. Because of the "No Radioactivity Added" policy, the PGDP must store PCB wastes for a period exceeding one year. The TSCA FFCA provides for the storage of PCB/RAD wastes over the one-year time limit specified in the TSCA. Complete disposal of all TSCA wastes must be achieved by December 31, 2015.

4.2 WASTE DESCRIPTION/CHARACTERIZATION

The TSCA and TSCA/RAD waste streams at the PGDP are composed of liquids and solids. According to *The Annual Document of Polychlorinated Biphenyls (PCBs) at the Paducah Gaseous Diffusion Plant* (LMES, 1997b), the sources of the waste streams include ventilation duct gasket leaks, water from various plant operations, sewage treatment sludge, contaminated waste oil, general debris and trash, concrete, rock and soil from spill cleanup, asbestos, C-710 Laboratory waste, scrap metal, light ballasts, capacitors, transformers, and empty damaged drums. Waste streams also result from materials generated through ER, D&D, and EF activities; during maintenance and disposal of PCB items; and the cleanup of spills and leaks.

4.2.1 Current Inventory

The PGDP uses several types of containers for TSCA waste, including open-top drums for solids, closed-top drums for liquids, and various other drums for larger concentrated wastes in which a damaged or breached 208.2-liter (55-gal) metal drum is placed. These container types account for the majority of TSCA waste storage at the PGDP. In addition, the PGDP uses United States Department of Transportation (DOT) Type A steel boxes and 4,542-liter (1,200-gal) poly tanks for containerization of TSCA wastes.

Twenty-eight different solid PCB waste streams are present at the PGDP and are listed in Appendix A, Table A-3. Table 4-1 presents the largest waste streams by percent by volume. The major waste streams utilize approximately 66% of the solid PCB inventory. The sediment and rock and soil waste streams were primarily associated with the pH and temperature control and the autosampler projects conducted for Ditch 011 in the early 1990s. In addition, material from the C-333-A, C-337-A, and KPDES Ditch 011 spill cleanups contributed a large volume of material (Smith, 1996).

Table 4-1. Summary of the Ten Major Polychlorinated Biphenyl Waste Streams at the Paducah Gaseous Diffusion Plant*

Waste Streams	Weight (lb)	Volume (ft^3)	Percent of Total Volume
Absorbents	399,156	15,299	8.4
Concrete	1,178,769	18,088	9.9
Debris	380,141	5,300.7	2.8
Dirt	107,282	111[1]	NA[2]
Ditch Sediment	902,282	14,911.2	8.2
Gravel	396,561	5,605.8	3.1
Rock and Soil	2,251,929	27,683.8	15.1
Scrap Metal	91,846	3,417.27	1.9
Sludge	789,166	14,584.2	8.0
Trash	310,729	16,396.3	9.0
Total of Major Waste Streams	6,807,861	121,398	66
Grand Total of All PCB Waste Streams	8,857,370	182,923	

* Includes wastes that have detectable PCBs but are not TSCA-regulated. Values extracted from WM database on June 10, 1997.

[1] Volume listed in WM database appears inaccurate.

[2] Value of percent of total volume not available due to inconsistent waste volumes.

Also included in Appendix A, Table A-3 are PCB liquids. According to the database, PCB liquids require 2,205.6 m^3 (77,880 ft^3) of storage space. The major PCB liquids include PCB waste oil, sludge/water, and waste water. The largest of these three is waste oil at 266.3 m^3 (9,403.5 ft^3). Articles such as transformers, capacitors, and other electrical equipment account for approximately 10% by volume of all PCB waste streams. Information to prepare the breakdown of PCB inventory was obtained from the LMES WM database June 10, 1997.

4.2.2 Waste Generation Forecast

The most current waste generation estimates (April 29, 1996) were obtained from the LMES Site Operations. The TSCA waste projections over the next two years are

associated with plant maintenance of PCB items, cleanup of spills and leaks from PCB items (Table 4-2), and the retirement or conversion of PCB items. Additional sources of TSCA waste include light ballasts, trash, debris, laboratory waste, asbestos insulation, and sludges. Wastes associated with ER projects will be primarily in the form of soil and waste water from the investigation of spill and disposal areas.

According to *The Annual Document of Polychlorinated Biphenyls (PCBs) at the Paducah Gaseous Diffusion Plant*, several PCB items are currently in service in various buildings throughout the PGDP (LMES, 1997b). Table 4-3 presents a summary of PCB items in service as of December 31, 1995.

Table 4-2. Projected Paducah Gaseous Diffusion Plant Toxic Substances Control Act Solids Waste Generation

Waste Stream	FY 1998 (ft^3)	FY 1999 (ft^3)	FY 2000 (ft^3)
Legacy	3,800	3,800	3,800
ER	74	15	15
D&D	15	15	15
Enrichment Facilities	0	0	0
Total	3,889	3,830	3,830

Note: In addition to the estimated generation included in this table, large amounts of PCB-contaminated soil could be generated from ER projects such as WAG 23, which includes nine PCB spill sites (Massey, 1995).

Table 4-3. Summary of Polychlorinated Biphenyl Items in Service at the Paducah Gaseous Diffusion Plant

Type	Number in Service	Volume (gal)	Weight of PCBs (kg)
PCB transformers	67	96,686	281,280
PCB-contaminated transformers	24	7,649	4.3
PCB-contaminated electrical equipment	18	4,704	5.0
PCB open systems	3	235	10.9
PCB capacitors	2,456	NA	NA

4.3 STORAGE

Regulations in 40 C.F.R. § 761 specify that PCB wastes must not be stored longer than one year. Inadequate treatment and disposal facilities for radiologically contaminated wastes necessitated storage of waste for longer than one year at the PGDP. Therefore, as discussed in Section 4.1, the TSCA FFCA was negotiated to allow storage periods of greater than one year for TSCA/RAD wastes. The TSCA FFCA also requires that all PCB waste storage areas meet several storage area requirements in accordance with 40 C.F.R. § 761.65, including requirements for labeling, marking, curbing, and containment. It is noted that the TSCA FFCA allows for variations in storage area design to address nuclear criticality issues.

4.3.1 Toxic Substances Control Act Storage Capacity

Information on storage capacity was provided by the LMES Waste Tracking Database and waste generation information was obtained from LMES (Davis, 1997). The PGDP primarily stores TSCA waste in standard 208.2-liter (55-gal) drums or 321.7-liter (85-gal) overpacks. Four standard 208.2-liter (55-gal) drums are placed on a 1.2 m x 1.2 m (4 ft x 4 ft) wooden pallet that requires 1.5 m^2 (16 ft^2) of floor space, or 0.19 m^2 (2 ft^2) per double-stacked drum. In the case of the overpack, a 1.5 m x 1.5 m (5 ft x 5 ft) pallet is used to store four 321.7-liter (85-gal) overpacks and requires 2.32 m^2 (25 ft^2) of floor space, or 0.29 m^2 (3.125 ft^2) per double-stacked overpack. The DOT 7A Type A boxes are 2.5 m^3 (87 ft^3) or 2.7 m^3 (96 ft^3), depending upon the container. The 4,542-liter (1,200-gal) poly tanks are also used. The boxes and the tanks occupy 1.8 m x 1.8 m (6 ft x 6 ft) footprint that requires 3.3 m^2 (36 ft^2) of floor space. Additional space is occupied by doors, structural supports, tanks, and aisle space for forklift access.

The PGDP currently stores TSCA waste in seven on-site storage facilities (Figure 4-1). Storage capacity of these facilities are discussed in Section 4.3.2. The locations of the PCB waste storage facilities are depicted in Figure 4-1. Figure 4-2 provides TSCA waste currently in storage. Table 4-4 provides a description of the storage facilities and the waste streams within each facility. Considerable TSCA storage has been added with the addition of the C-753-A TSCA Waste Storage Facility and the C-752-A Environmental Restoration Storage Facility.

4.3.2 Storage Options

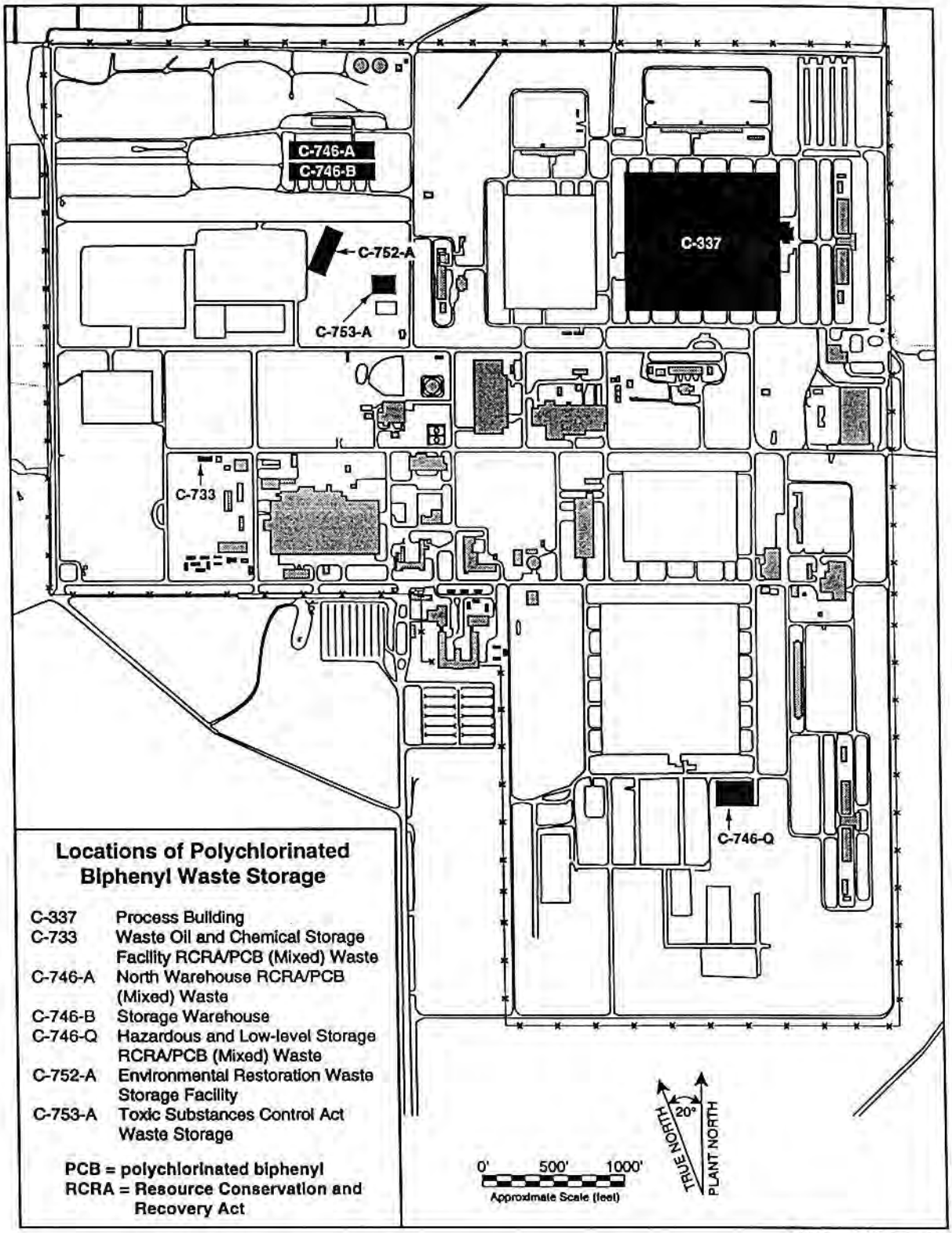
With the completion of the C-753-A Storage Facility during FY 1996, TSCA storage space at the PGDP has increased by 2,619.6 m^3 (92,500 ft^3) to a total volume of 7,201.5 m^3 (254,291 ft^3). Based upon waste projections, TSCA storage capacity will be adequate. However, there are TSCA waste items awaiting characterization that are stored at various generator locations throughout the PGDP that have not been placed in the storage facilities. These items, such as drums and overpacks, have an unworked RFD and could account for a large amount of storage space after characterization and pickup. Since the total volume of these items is unknown, projected needs for storage capacity are difficult to estimate.

4.4 TREATMENT OF TOXIC SUBSTANCES CONTROL ACT WASTES

Since limited treatment capability exists at the PGDP, the following sections provide information on off-site treatment options. Information is also included on the Vortec vitrification system, which will be constructed during FY 1998.

4.4.1 Toxic Substances Control Act Treatment Capability

The PGDP currently does not have on-site treatment capability for solid wastes contaminated with PCBs; however, liquid TSCA wastes are currently shipped to the ORR ETTP TSCA Incinerator for incineration. During the past year 204,535 kg (451,000 lbs) of PCB-contaminated liquids from the PGDP were incinerated at the ORR ETTP TSCA Incinerator. This incinerator cannot accept solid wastes; however, an action plan to incinerate soft solids was developed and approved. Soft solids include those waste streams that can be easily incinerated due to their Btu content. Soft solids include



Jacobs EM Team, 1997

Figure 4-1. Paducah Gaseous Diffusion Plant Facilities Currently Used for Polychlorinated Biphenyl Waste Storage

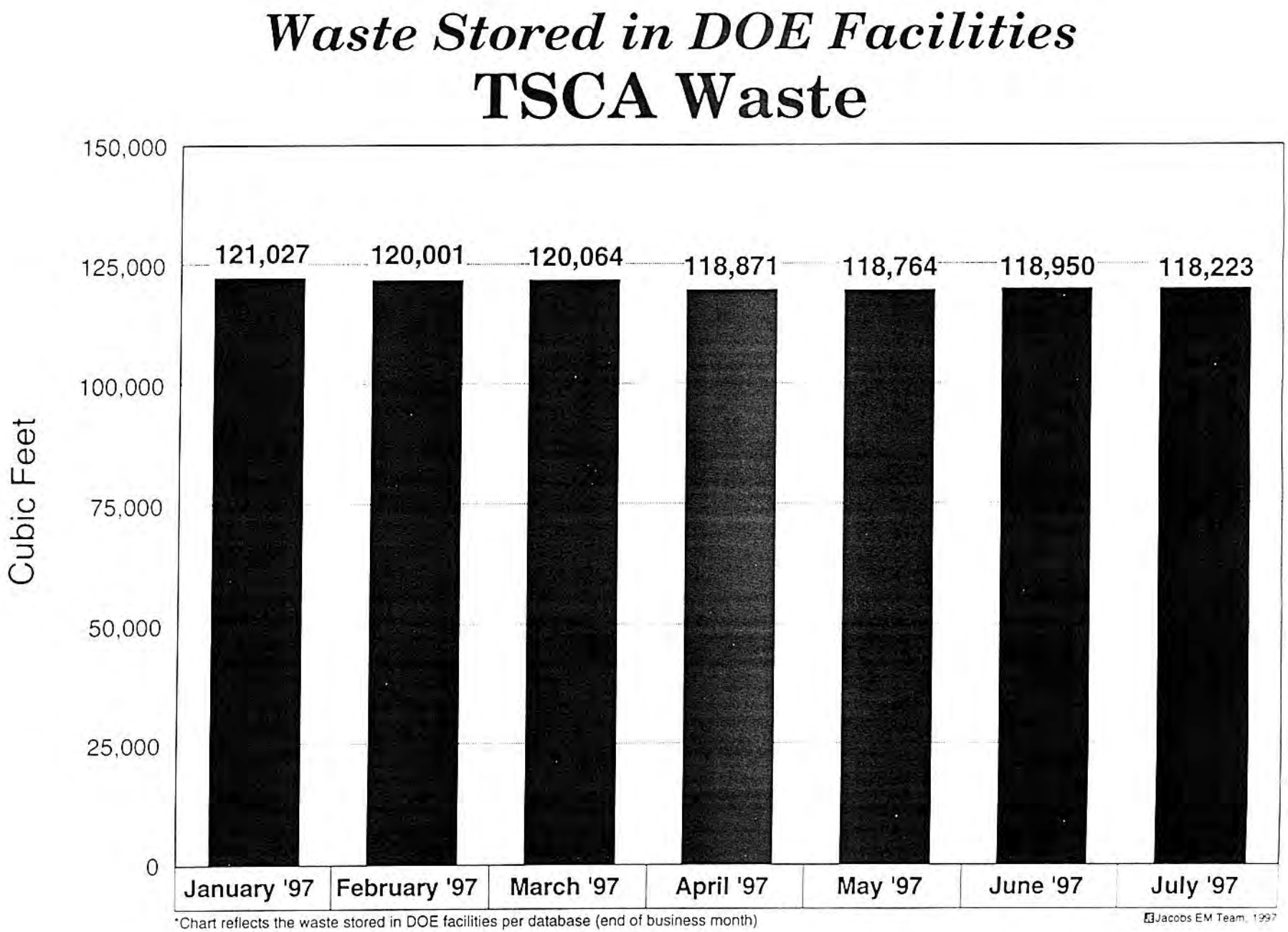


Figure 4-2. Toxic Substances Control Act Waste Storage Capacity

Table 4-4. Polychlorinated Biphenyl Waste Facility Summary for the Paducah Gaseous Diffusion Plant*

Facility	Description	TSCA Operational Storage Capacity (ft^3)
C-733	Waste Oil and Chemical Storage Facility	NA*
C-746-A	North Warehouse	NA*
C-337	Facility is used for PCB waste only. It is inspected biweekly.	49,136
C-752-A	New ER Phase I Waste Facility. At present, no waste is stored in this facility.	16,064
C-746-B	This facility is currently used for LLW and PCB storage. It is inspected biweekly.	71,923
C-746-Q	Hazardous, LLW, and PCB Storage	NA*
C-753-A	Facility is used for PCB storage. It is inspected biweekly.	92,500

* Information not available for these facilities at this time.

wastes such as plastic, PPE, paper, and cardboard. No soft solids have been shipped offsite from the PGDP. The ETTP TSCA Incinerator is scheduled to burn soft solids generated on the ORR first and then will process off-site wastes. Soft solids generated at the PGDP are scheduled for incineration some time during 1999 at the earliest.

In addition to the incinerator, the PGDP also has the ability to treat a limited quantity of waste water contaminated with PCBs at the C-752-A Environmental Restoration Storage Facility. This system is an activated carbon filtration system.

Currently, solid wastes cannot be shipped offsite to a commercial facility because of the May 1991 DOE-imposed "moratorium" prohibiting the shipping of wastes other than LLW (e.g., TSCA, RCRA) unless the off-site facility has an NRC license or has received state approval. The exception to this ban was the shipment of the entire PCB capacitor inventory, which to date has totaled 6,430 capacitors. With the exception of PCB capacitors, this requirement has prevented the PGDP from disposing of solid TSCA wastes offsite.

4.4.2 Vortec Vitrification System

The Vortec vitrification system, which is scheduled to be operable early 1999, is described in Section 2. Vortec has the potential to treat the absorbents, asbestos, concrete, gravel, rock and soil, sewer sludge, sediment, and soil waste streams identified in Table 4-1. These waste streams, which would make excellent candidates for vitrification, constitute 67.6% of the total TSCA waste by volume. The DOE will apply for a TSCA permit or meet equivalent requirements in accordance with the TSCA Mega Amendments (proposed to be codified in 1998), to allow vitrification of TSCA waste streams in the Vortec unit.

4.5 DISPOSAL OF TOXIC SUBSTANCES CONTROL ACT WASTE

Disposal requirements under TSCA are found in 40 C.F.R. § 761.60(a)(b)(c). There are several disposal methods that can be used for different types of PCB materials. Approved PCB disposal methods include PCB incinerators, PCB high-efficiency boilers,

PCB landfills, and alternative disposal methods. The alternative disposal method can be used only under the current regulations with the EPA's written approval. The EPA has published a proposed rule for the disposal of PCBs called the "Mega Amendments" [59 Fed. Reg. 62788 (Dec. 6, 1994)(to be codified at 40 C.F.R. § 761)]. The final rule may change current practices for PCB TSD and should be reviewed by the DOE once finalized.

Disposal of asbestos wastes is consistent with the disposal regulations identified in RCRA Subtitle D (i.e., disposal of asbestos in contained landfills). Asbestos is disposed of at the C-746-U Solid Waste Landfill after characterization determines it does not contain radiological contaminants. Since much of it does, it is stored until TSD options or alternatives are identified.

4.5.1 Disposal Capability

With the exception of the capacitors and liquid wastes, all solid PCB wastes at the PGDP are stored onsite since they have been contaminated with radionuclides or they require additional characterization. Assuming the Vortec unit is constructed, glass frit produced by the system will be disposed of in the C-746-U Solid Waste Landfill, provided it meets the waste acceptance criteria (WAC). Permitted levels for contained landfills in Kentucky are < 50 ppm detectable PCB.

4.5.2 Disposal Projected Needs

Because the bulk of the PGDP's TSCA/RAD waste inventory is solid waste, alternative methods of disposal and treatment must be investigated. As previously discussed, additional volumetric characterization and categorization data must be obtained before disposal at any commercial non-licensed NRC facility is considered.

4.6 ISSUES AND RECOMMENDATIONS

Recommended actions included in the 1996 IWMP related to TSCA wastes include the following: develop plans and procedures necessary to ship wastes offsite that are contaminated in volume (Section 3.6 provides detail on this issue); develop the ability to treat TSCA wastes using Vortec; purchase and use drum cleaning equipment; and negotiate a 25 ppm PCB cleanup level for contaminated soil for ER-related remedial activities. The related issues and recommended actions are updated in the following paragraphs.

As discussed in the previous section, the Vortec vitrification system is being constructed to vitrify mixed wastes. In order for DOE to vitrify TSCA wastes, a permit must be obtained. As a result of the proposed Mega Amendments, which are to be codified during the next year, the normal permitting procedures will likely change. Such changes may include deferring TSCA requirements to the RD&D permit.

The purchase of drum cleaning equipment was recommended last year by WM and Environmental Compliances staff. In general, several hundred empty drums that contained PCBs have accumulated. Although some empty PCB drums are being reused for newly generated waste, drum cleaning equipment would allow for other alternative uses, save space, and save money. At a minimum, a cost analysis of using this equipment should be conducted.

The PCB soil cleanup level was identified last year as an issue that had the potential to impact the WM program. This issue is basically unchanged from last year. In general,

KDEP is trying to establish a soil cleanup level of 1 ppm, without regulations to that effect, and DOE/LMES ER is trying to negotiate a level of 25 ppm. Since this issue is outside of WM, little can be done from its standpoint.

The last issue recognized as potentially affecting the WM was previously mentioned and includes the impact of the Mega Amendments if they are codified. Lockheed Martin Energy Systems, Inc., is aware of this issue and will incorporate the requirements into procedures when they are applicable.

4.7 PATH FORWARD

In general, significant effort has been conducted by ER and WM personnel in the past year to consolidate wastes and reduce the number of smaller areas that store wastes. These efforts will continue in the future as well as continuing efforts to ship wastes offsite.

The path forward for the TSCA program has been outlined in Table 2-4 in Section 2. The milestones presented are programmatic and affect all wastes types. Since the DOE is selecting a new M&I contractor, changes to the WM program will occur that cannot be anticipated at this time. Next year's IWMP will reflect these changes.

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5. SOLID WASTE

In general, solid waste includes trash, sanitary waste, and industrial wastes. For the purposes of this chapter, solid waste includes wastes that are not classified as RCRA, low-level, mixed, TSCA waste, or waste water. Scrap metal may also be considered a solid waste. However, considering the large volume, metal types, and shapes, scrap metal will be addressed in Section 8.

Historically, most solid wastes have been landfilled at the PGDP. The new landfill, designated as the C-746-U Solid Waste Landfill, began operation and started accepting waste on February 7, 1997. During the first seven months of operation, the landfill has accepted over 9,628 m^3 (12,592 yd^3) of solid waste and has saved the DOE over $5.8 million (Vander Boegh, 1997).

5.1 WASTE DESCRIPTION

Descriptions of the solid waste groups that will be addressed in this section are presented in the following subsections. Although the IWMP addresses DOE wastes, USEC has also disposed of wastes in the C-746-U Solid Waste Landfill and they are briefly mentioned here.

5.1.1 Residential Waste

Residential waste consists of paper, cardboard, and food refuse. Residential waste from the landfill office is the only residential waste that is regularly disposed of in the C-746-U Solid Waste Landfill. All residential waste from the Kevil facility goes to a commercial landfill and all residential waste generated at the PGDP site is collected by LMUS and disposed of at the LWD Sanitary Landfill, Inc., in Calvert City, Kentucky.

White paper from the DOE and LMES on-site facilities and Kevil office are collected for recycling along with aluminum cans and toner cartridges. All other office wastes are collected and disposed of in an off-site commercial landfill.

5.1.2 Industrial Waste

Industrial waste consists of concrete, shredded tires, scrap wood, and construction spoils. These wastes are placed in dumpsters, roll-off containers, or other acceptable temporary disposal receptacles at the generating area. The dumpsters are monitored for radiological contamination. Approximately 743.9 metric tons (820 tons) of legacy redwood was disposed of in the C-746-U Solid Waste Landfill during the first seven months of operation. In addition, approximately 381.0 metric tons (420 tons) of USEC cooling redwood and 1,108 metric tons (1,222 tons) of USEC roofing material were disposed of in the landfill.

5.1.3 Asbestos Waste

Asbestos waste that was not contaminated by uranium or PCBs and was nonhazardous had been containerized and placed in temporary storage awaiting completion of the C-746-U Solid Waste Landfill. When the C-746-U Solid Waste Landfill became operational, asbestos was placed in it. Asbestos waste is processed on a case-by-case basis upon completion of the waste certification packages. Approximately 149.7 metric tons (165 tons) of Munters fill, used in the PGDP cooling towers, were disposed of in the landfill.

5.1.4 Underground Storage Tank Soil

Soil contaminated with petroleum is exempt from RCRA hazardous waste requirements and can be disposed of in a contained landfill. The PGDP has approximately 18 15.3 m^3 (20 yd^3) roll-off bins filled with soil from underground storage tank (UST) projects. Disposition of the soil at the C-746-U Solid Waste Landfill was pending until the KDWM accepted the WAC for the UST soils. Approximately 231.3 metric tons (255 tons) of UST soils were disposed of in the C-746-U Solid Waste Landfill on February 18, 1997.

5.1.5 Environmental Restoration Wastes

Wastes typically generated by LMES ER include PPE, soil cuttings, investigation-derived waste (IDW), and trash. Much of this waste is generated in noncontaminated areas and is considered to be an excellent candidate for disposal at the C-746-U Solid Waste Landfill once the WAC are approved. The KDWM approved the disposal of approximately 8,000 drums of IDW soils, which are scheduled for disposal during FY 1998.

5.1.6 Enrichment Facilities Wastes

Enrichment facilities (EF) wastes generated by USEC or LMUS typically consist of industrial wastes (see Section 5.1.2) or construction/demolition debris such as cooling tower materials, redwood, soils and concrete, roofing materials, asphalt debris, wooden power poles, and other materials that meet the WAC. These wastes are typically delivered in roll-off containers and dump trucks; however, other methods can be accepted according to the WAC. For FY 1998, EF wastes expected include concrete rubble and possibly some cooling tower materials.

5.2 CURRENT DISPOSAL CAPACITY

The C-746-U Solid Waste Landfill is a modern disposal facility with a low-permeability synthetic liner consisting of material with a maximum permeability coefficient of 1×10^{-12} cm/sec and a leachate collection system to control fluid migration. The landfill is permitted with a 10.1-ha (25-acre) waste boundary and a final design volume of 1,146,900 m^3 (1.5 million yd^3) of air space. Construction of the initial phase was completed by the end of 1996 and began accepting waste when it was put into operation on February 7, 1997. The first five cells consisting of 2.0 ha (5 acres) of the C-746-U Solid Waste Landfill is expected to handle the PGDP's needs for 8 to 10 years if waste streams and forecasts remain as currently projected (Vander Boegh, 1996).

5.3 SOLID WASTE STORAGE PROJECTIONS AND PROJECTED NEEDS

Prior to the operation of the C-746-U Solid Waste Landfill when the PGDP was managing solid waste pursuant to the Interim Solid Waste Disposal Strategy, solid waste projections could not be accurately provided (Vander Boegh, 1996). However, since the opening of the C-746-U Solid Waste Landfill, a annual waste stream projection of 3,823 m^3 (5,000 yd^3) solid waste disposal based on past history has been provided. Over 9,627 m^3 (12,592 yd^3) of solid waste has been disposed of in the first seven months of operation. This increased amount is a result of disposing of the waste that was stored during construction of the C-746-U Solid Waste Landfill and implementation of the Interim Solid Waste Disposal Strategy and the landfill operating limits.

Based on the recommendation of the DOE, tipping fees for disposal of solid wastes at the C-746-U Solid Waste Landfill have been established. The tipping fees for EF waste were set at $125/ton. This fee is based upon landfill capacity (air space) and operational costs, with no consideration of equipment costs or environmental monitoring costs. A $300/ton tipping fee was established for USEC wastes, and this has facilitated the DOE in the cleanup of the DMSAs (Vander Boegh, 1997).

5.4 SOLID WASTE ISSUES AND RECOMMENDATIONS

Prior to issuing a solid waste landfill permit, the KDWM required that the DOE submit waste stream certification information, including a description of the waste that is to be disposed of in the C-746-U Solid Waste Landfill, sampling plans, and sample results. This requirement is a direct result of the Commonwealth of Kentucky's attempt to restrict the disposal of radioactive wastes by the DOE. The DOE proposed a limit of 30 pCi/g for total uranium for all solid wastes disposed of in the landfill. The Radiation Control Branch agreed with this value; however, the KDWM wanted to include it on the permit and the DOE did not want this language in the permit. The DOE maintained that the KDWM did not have the authority to regulate the disposal of radioactive materials and the KDWM disagreed. As a result, the KDWM would not issue the DOE a landfill permit unless all materials to be disposed of in the landfill were subject to review and approval by the KDWM. The DOE is currently appealing this restriction, although they are complying with all KDWM requirements.

It is recommended that equipment and environmental monitoring costs be included in the tipping fee disposal costs. This action will drive up the cost of disposal of materials sent to the landfill, will provide incentives for pollution prevention/waste minimization activities, and also will allow the waste generators to pay for a new landfill once the current landfill reaches capacity.

Although adequate disposal of solid waste at the C-746-U Solid Waste Landfill is anticipated for several years, accurate waste projections are recommended. These projections will be necessary for the DOE to plan for the future.

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6. WASTE WATER

Waste water is generated from a variety of activities at the PGDP and can be classified as sanitary waste water, LLW, mixed waste, or TSCA waste depending on the contaminants present and/or the processes by which it was generated. The majority of waste water can be categorized into five groups: (1) waste water generated from decontaminating equipment (decon water), (2) ground-water monitoring well purge water, (3) ground-water monitoring well development water, (4) sump water (which also includes rainwater), and (5) C-404 leachate. Additional information on the sources of waste water, storage location, quantities in storage, treatment capability, projected needs, and issues and recommendations is presented in the following subsections.

6.1 WASTE-WATER DESCRIPTION

Decon water is waste water that has been generated by a decontamination process. The majority of decon water is produced by the ER program at various permanent decontamination (decon) staging areas at the PGDP. These staging areas routinely decontaminate environmental drilling equipment, such as hollow-stem augers, drill rods, drill bits, and the drill rig both before and after drilling activities. Contaminants in the waste water may include detergents, alcohol, minute traces of acetone, PCBs, and radionuclides.

Purge water is generated prior to collecting water samples from ground-water monitoring wells. Sampling protocols typically require each ground-water monitoring well be purged the equivalent of three well volumes prior to collecting water samples. This technique is sometimes still conducted. However, during the past year, micropurging techniques have been employed as both a waste minimization and cost reduction measure. Since the PGDP routinely monitors approximately 170 environmental and residential wells, a large quantity of purge water can be generated. The primary contaminants identified from samples collected around the PGDP include TCE and ^{99}Tc.

Development water is generated from pumping a newly installed well to remove sediments and suspended solids and to enhance ground-water flow into the well. Since the water contains sediment and suspended solids, it is handled differently than purge water. Contaminants identified in this waste stream are the same as those identified for purge water (i.e., TCE and ^{99}Tc).

Sump water consists of waste water collected in sumps from various DOE-operated facilities, such as those located at decon staging areas and outdoor waste storage facilities (e.g., H3 Pad). This waste category also includes storm-water runoff that is collected in diked areas, which may or may not be collected in a centralized collection point through the use of a sump. Although most sump water is determined to be uncontaminated and discharged pursuant to the KPDES permit, some sump water may contain PCBs, VOCs, and radionuclides. Since the C-746-R RCRA storage area is to undergo RCRA closure, considerable rainwater will be discharged directly to a storm-water sewer or outfall once clean closure is completed.

The final waste category includes leachate collected from the C-404 Hazardous Low-Level Landfill. The collection point, which is an overflow weir converted into a sump, is located on the southwest corner of the landfill. The landfill leachate contains PCBs, radionuclides, and low levels of TCE and is classified as a TSCA mixed waste. The leachate is periodically withdrawn from the sump pursuant to the RCRA permit when the leachate reaches a specified level.

6.2 CURRENT INVENTORY

The quantities of waste water in storage for each of the waste-water categories is presented in Table 6-1. This information was collected from LMES Site Operations August 19, 1997 (Hayden, 1997). In comparison to the volume of water in storage last year at approximately the same time period, 189,250 liter (50,000 gal), there has been a 40% reduction in inventory.

Table 6-1. Waste Water Currently in Storage

Source Category	Quantity (gal)
Sump water	11,000
Purge water	0
Decon water	300
Development water	0
PCB water (legacy)	3,000
C-403 Neutralization Pit	15,000
C-404 Leachate	1,100
Total of all waste water in storage	**30,400**

6.3 TREATMENT CAPABILITY

During FY 1996, 75,283 kg (166,000 lbs) of waste water was treated through various processes. During a similar time frame (August 1996 through August 1997), the amount of waste water treated by weight has decreased approximately 50% to 39,523 kg (87,150 lbs). The following subsections describe the waste-water treatment processes that are currently available at the PGDP.

6.3.1 Lime Precipitation

Waste water containing high levels of uranium and heavy metals can be treated at the C-400-D Lime Precipitation Unit (No. 5 Dissolver), which is leased by the USEC. This unit uses a batch neutralization and precipitation operation to remove the RAD constituent and metals from waste water. A rotary vacuum filter is then used to further separate the water from the precipitate, leaving uranium in a solid form as a filter cake (Hayden, 1995). The supernate resulting from treatment is containerized in storage tanks, pending characterization. Depending on the results of the characterization, the effluent is either discharged according to the PGDP's KPDES permit, further treated in the C-400-D unit, or stored as LLW. The resulting solid residues, in the form of filter cake, are containerized and placed in storage pending characterization (DOE, 1995a). This facility cannot treat water that contains solvents because they may produce sludges that could clog the unit. Additionally, waste water containing detergents cannot be treated due to foaming problems (Hayden, 1995).

6.3.2 Ion Exchange

The DOE has two ion exchange units at the PGDP. The first unit is located in Building C-400 and is connected to the C-400-D unit. Ion exchange is a process whereby toxic ions are removed from the aqueous phase by exchange with relatively harmless ions held by the ion exchange material. Although ion exchange units can treat a broad range of ionic species from water, the unit in C-400-D is used primarily to remove ^{99}Tc.

The second ion exchange unit at the PGDP is part of the C-612 Northwest Plume treatment system. Since an air stripper is also used with the system, waste water containing TCE can be treated in addition to ^{99}Tc. Although the facility was built to treat ground water recovered from the Northwest Plume, the unit was constructed to allow for the treatment of ^{99}Tc in other contaminated waste water. During the previous year, approximately one 208.2-liter (55-gal) drum of purge water per month was treated at this facility. During FY 1997, treatment of purge water at C-612 was reported to be approximately 246.0-liter (65-gal) per month (Boulton, 1997).

6.3.3 Activated Carbon

The DOE has two activated carbon units, although only one is operational and it is located in the C-752-A Environmental Restoration Storage Facility. Activated carbon is a well-developed adsorption treatment technology that is widely used in the treatment of aqueous waste streams. The process of adsorption onto activated carbon involves the contact of a waste stream with the carbon, which selectively adsorbs hazardous constituents by a surface attraction phenomenon in which organic molecules are attracted to the internal pores of the carbon granules. The activated carbon units at the PGDP treat a wide range of contaminants; however, the targeted waste-water constituents include PCBs and VOCs.

6.3.4 Photocatalytic Reactor

Although not assembled or ready for use, LMES WM has purchased a photocatalytic reactor (by using pollution prevention funds) that will be used to process waste waters containing VOCs (primarily TCE). The photocatalytic reactor is located at the C-752-A Environmental Restoration Storage Facility. The system utilizes high-intensity mercury-vapor ultraviolet light (253 nm) to stimulate the production of hydroxyl radicals in water. The system will operate at room temperature under low pressure with an expected flow rate of 3 to 5 gpm.

6.4 OFF-SITE TREATMENT CAPABILITY

As discussed in Sections 3 and 4, thermal destruction of waste is possible at the ORR ETTP TSCA Incinerator. Some waste water that contains high levels of PCBs, VOCs, oils, or organic solvents (e.g., C-404 leachate) cannot be treated economically at the PGDP and are shipped to the DOE ORR ETTP TSCA Incinerator.

During the past year, the Tennessee Department for Environment and Conservation challenged the DOE's need to ship several waste-water waste streams to the DOE ORR ETTP Incinerator. As a result, waste water from the C-403 Neutralization Pit will not be shipped to the DOE ORR ETTP Incinerator but will be treated through a multiple-step treatment train at considerably higher cost.

6.5 PROJECTED NEEDS

In the past, waste water has been stored outside. As a result, spills have occurred during winter months from freezing valves. With the addition of the C-752-A Environmental Restoration Storage Facility (a modern, heated storage facility), the likelihood of damage to containers from freezing has been greatly reduced. In addition, the condition of containers used for waste-water storage appears to be excellent (Hayden, 1996). Based on the level of ER activity and the previously discussed improvements, no needs for FY 1998 are projected (Hayden, 1997).

6.6 PATH FORWARD AND RECOMMENDATIONS

Eliminating sources of waste water is an obvious path forward and is currently being conducted at the PGDP. The majority of waste water in storage is generated from collecting waste water (including rainwater) in sumps. Ideally, all waste stored at PGDP should be inside enclosed facilities. The RCRA closure of C-746-R, which generates considerable amounts of waste water, is an excellent step in discontinuing such practices.

The second largest producer of waste water at the PGDP is generated as a result of ER activities. As a support group, WM can do little to eliminate its generation (i.e., decontamination of equipment and monitoring of ground water wells, etc., must continue to support the ER program) until cleanup of the PGDP is complete. The path forward should encourage ER to reduce waste-water generation. Such activities should focus on waste minimization with a primary focus on source limitation and utilizing decontamination practices, procedures, or remedial technologies, which do not generate waste water.

7. RESOURCE CONSERVATION AND RECOVERY ACT WASTE

Currently, all RCRA wastes are categorized as RCRA/RAD wastes because of the DOE's "No Radioactivity Added" policy. When this policy is lifted, or an exemption is granted through a PSC or volumetric package, a section will be added to this plan presenting a summary of RCRA storage at the PGDP, as well as a path forward for disposition alternatives.

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8. SCRAP METAL

The PGDP has generated in excess of 54,430.8 metric tons (60,000 tons) of scrap metal consisting of contaminated, uncontaminated, and classified materials that are stored at various locations and scrapyards at the PGDP. Although scrap metal could be classified as LLW (as described in Section 2), due to the abundance of the material and the potential for recycling, it will be addressed in the following subsections.

8.1 STORAGE OF SCRAP METAL

The majority of scrap-metal wastes is stored in various "yards" in the northwestern corner of the plant (Figure 8-1). A detailed inventory of the yards was completed by Parsons Engineering Science and United States Steel November 30, 1994 (DOE, 1995d). This survey is considered the most accurate estimation of scrap metal stored in the PGDP scrapyards. A summary of the scrapyard inventory is presented in Table 8-1, and a detailed description of the items by yard is provided in Appendix A. Copper, stainless steel, iron, and aluminum scrap have been derived from a variety of sources including piping, old machinery, construction debris, and many other miscellaneous sources (Appendix A). However, nickel at the PGDP consists of ingots that were contaminated with radionuclides from plant operations. In addition, there are some aluminum ingots that are a result of past smelting operations.

8.2 SCRAP METAL GENERATION FORECAST

Since the USEC has leased the process facilities and D&D projects are not funded, waste forecasts for scrap metal cannot be made.

A Study of Metals Reclamation and Associated Site Remediation for the Paducah Gaseous Diffusion Plant, KY/EM-238, was issued as a draft for internal review only in FY 1997. The plan examines the decontamination of scrap metal for recycling and the disposal of scrap metal that has no value and then reviews the investigation and remediation of the SWMUs under the scrapyard. Funds from these activities could be derived from the revenue of recycling the scrap metal. A presentation of the study was made to the DOE in November 1997.

8.3 RECYCLE/TREATMENT/DISPOSAL OF SCRAP METAL

Inventory and radiological characterization need to be completed to sort scrap metal into clean and contaminated waste streams for recycling, storage, treatment, and/or disposal options. Once properly characterized, recycling, storage, treatment, and/or disposal options can be determined dependent upon the clean or contaminated designations.

Recycling involves direct, indirect, and restricted recycling. Direct recycling releases scrap metal directly to a recycling vendor. Uncontaminated and "cleanable" metal may be candidates for direct recycling. "Cleanable" materials are those metal objects with surface-only contamination that possess simple surface geometrics and might be eligible for surface decontamination and free release. This method is the most cost-effective treatment because minimal waste would be generated and the metal would be sold in exchange for other cleanup services. However, all metal would have to be rescreened to ensure that any metal shipped offsite is not contaminated.

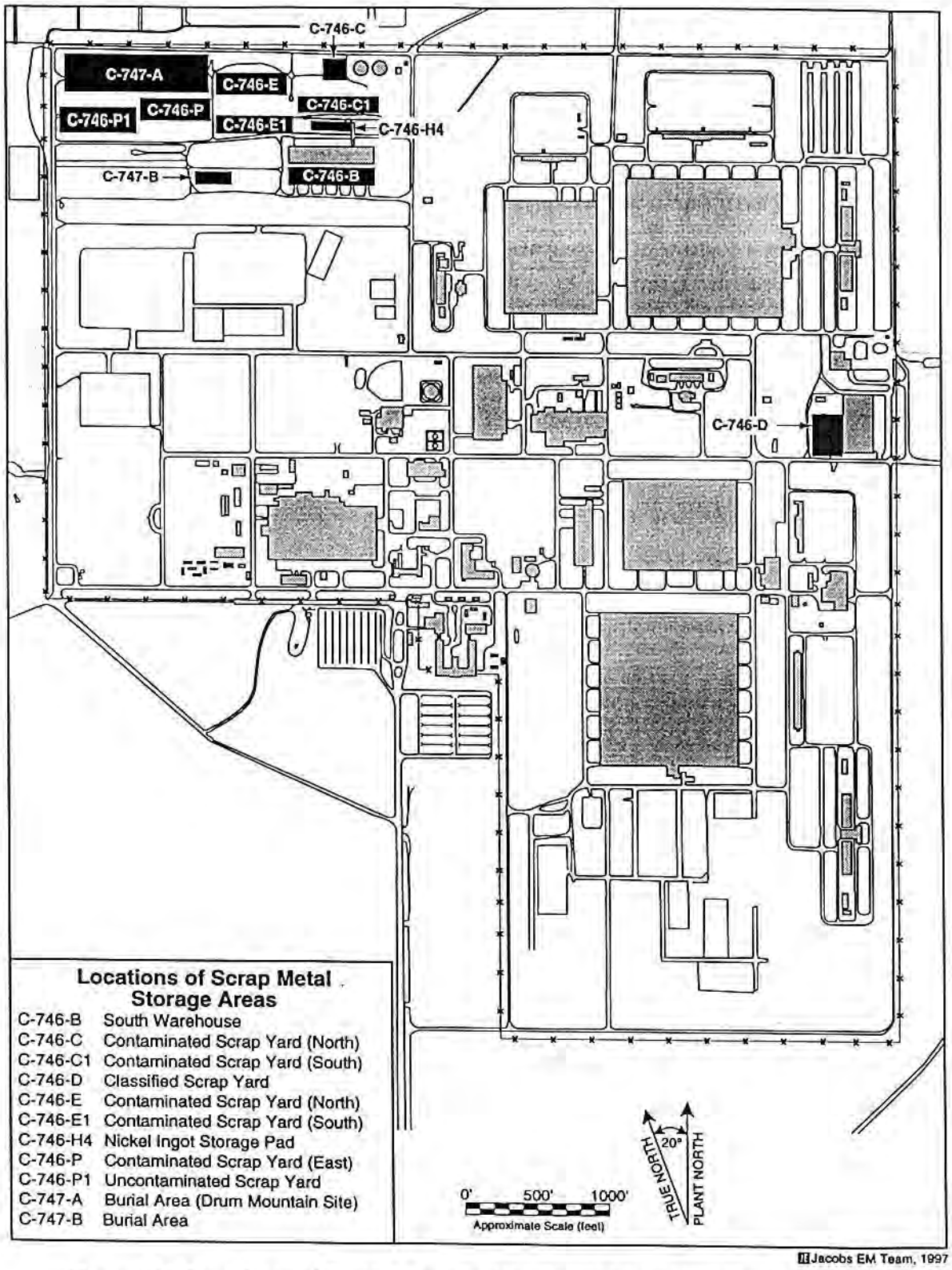

Figure 8-1. Locations of Scrap Metal at the Paducah Gaseous Diffusion Plant

Table 8-1. Summary of Scrap Metal at the Paducah Gaseous Diffusion Plant

Metal Type	Weight (tons)
Aluminum	4,581
Copper	43
Iron	46,108
Nickel	9,700
Stainless steel	41
Total	**60,473**

Indirect recycling involves releasing the scrap metal to a licensed vendor who treats the metal to NRC Regulatory Guide 1.86 standards and then releases it to the scrap market. The remaining scrap metal could be treated with this method, assuming that technology is available to treat the scrap metal to NRC Regulatory Guide 1.86 standards. Currently, the Duratek (formerly the Scientific Ecology Group, Inc.) and Manufacturing Sciences Corporation (MSC) are the only facilities identified for treatment of scrap metal. Both Duratek and MSC use a surface decontamination and smelting process to treat the metal before selling it to a recycling facility. The primary drawback of this alternative is that any scrap not successfully decontaminated by the vendor, or that becomes RAD-contaminated in the decontamination process, is generally shipped back to its site of origin unless specific arrangements are made for the vendor to send the waste to another DOE TSD facility. As a result of this arrangement, the liability for an unintentional contaminant release is transferred from the DOE to the vendor.

Restricted recycling involves recycling of scrap metal within the nuclear industry. This process uses melt or electrolytic refining technologies to mold the metal into either shielding blocks or containers for RAD waste or other hazardous materials. The advantage of restricted recycling is that the metal may not need to meet NRC Regulatory Guide 1.86 standards or DOE Order 5400.5 release criteria. Also, liability for unintentional release issues does not arise. Disadvantages include high costs associated with melt and electrolytic refining, the concentration of RAD contaminants in the slag from the process, and the disposal of this slag.

8.4 ISSUES AND RECOMMENDATIONS

In researching the issues concerning scrap metal, no regulatory drivers could be identified that would require the DOE to treat, recycle, or dispose of the scrap metal at the PGDP. (Although not a regulatory driver, an investigation of the scrapyards in WAG 24 will be conducted and may require that some metal be moved.) Consequently, a plan or strategy for conducting such activities is not well defined.

Several options for disposition of the scrap metal were identified and are detailed in the following list:

- Initiate the recommendations of the *A Study of Metals Reclamation and Associated Site Remediation for the Paducah Gaseous Diffusion Plant*, KY/EM-238;

- Wait for D&D of the PGDP and address process equipment and scrap metal simultaneously;

- Build a central facility to treat the scrap metal;
- Utilize innovative technologies and demonstration projects to treat scrap metal;
- Dispose of scrap metal in an on-site landfill; and
- Utilize a smelter and rolling mill to fabricate the scrap metal into LLW containers and equipment. This process is being completed successfully in Oak Ridge at the Duratek and MSC facilities.

In order to proceed with disposition, the following criteria and commitments must be developed and implemented by the DOE:

- Implement *A Study of Metals Reclamation and Associated Site Remediation for the Paducah Gaseous Diffusion Plant*, KY/EM-238 to manage or dispose of the scrap metal;
- Establish off-site release levels for the resale, recycling, or disposal of scrap metal;
- Approve funding for LMES Site Operations to manage or dispose of the scrap metal; and
- Develop plans and procedures to ensure that the characterization and decontamination of the scrap metal has achieved "clean" levels.

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APPENDIX A

SUMMARY OF WASTE STREAMS BY CATEGORY AT THE PADUCAH GASEOUS DIFFUSION PLANT

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Table A-1. Summary of Low-Level Waste Streams at the Paducah Gaseous Diffusion Plant

Waste Streams	Number and Types of LLW Containers	Weight (lb)	Volume (ft^3)
Absorbent media	293 55-gal drums, 2 85-gal overpacks, 1 30-gal drum, and 12 5-gal drums	48,411.00	2,202.77
Activated carbon	3 55-gal drums and 38 85-gal overpack	26,187.00	455.40
Aqueous cleaner	5 55-gal drums and 1 85-gal overpack	2,468.00	48.40
Asbestos (including asbestos vacuum)	2,293 55-gal drums, 3 85-gal overpacks, 10 30-gal drums , 2 5-gal drums, 2 7AType A metal boxes, 2 B-25 metal boxes, 3 540-ft^3 metal rolloff containers	517,747.00	18,939.94
Barium (barium shot)	8 85-gal overpacks	10,008.00	91.20
Batteries	Various container sizes including a 400-ft^3 container of recyclable batteries	20,244.00	796.81
Burnout waste	1 55-gal drum	1,074.00	7.40
Cerium hydrate	5 30-gal drums	750.00	20.00
Chromate water	8 55-gal drums	2,513.00	59.20
Classified waste	50 55-gal drums and 34 85-gal overpacks	67,077.00	757.60
Cleanup debris	2,591 55-gal drums, 17 5-gal drums, 1 15-gal drum, 3 30-gal drums, 10 85-gal overpacks, 1 40 ft^3 containers, 6 7A Type A metal boxes, and 10 145-ft^3 containers of soil	1,721,388.00	21,275.99
Collection	53 55-gal drums, 2 110-gal overpacks, 3 5-gal drums, 1 B-25 box, 1 653-ft^3 container, and 1 674-ft^3 container	5,880.00	1,853.81
Concrete/dust	114 55-gal drums, 3 85-gal overpacks, 1 30-ft^3 container, and 3 64-ft^3 containers of asphalt	63,614.00	1,097.20
Cylinder wash sludge/ rust	12 55-gal drums, 1 30-gal drum, and, 1 85-gal overpack	7,294.00	104.70
Dirt (including rock and dirt, excavated dirt and dirt/ concrete)	2,680 55-gal drums and 3 85-gal overpacks	1,624,465.00	19,799.20
Dye	1 55-gal drum	60.00	7.40
Empty drums*	5 55-gal drums and 2 5-gal drums	310.00	38.34
Ferrous sulfate	1 55-gal drum, 2 2-1/2-gal drums, 2 5-gal drums	13,310.00	1,650.26
Filters (including air, HEPA, spent, and NaF powder)	166 55-gal drums, 2 85-gal overpacks, 2 16-ft^3 containers filled with HEPA filters, and 2 B-25 metal boxes	16,318.00	1,450.40
Firebrick	71 55-gal drums	36,117.00	525.40

Note: This information was compiled for the LMES WM database as of June 10, 1997. Since considerable information was not available in the database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

Table A-1. Summary of Low-Level Waste Streams at the Paducah Gaseous Diffusion Plant (Continued)

Waste Streams	Number and Types of LLW Containers	Weight (lb)	Volume (ft^3)
Floor sweepings (including rags)	268 55-gal drums, 4 85-gal overpacks, 2 30-gal drums, and 1 22.2-ft^3 container filled with mops	90,451.00	2,759.50
Graphite crucible	1 55-gal drum	421.00	7.40
Grease	2 55-gal drums and 1 30-gal drum	183.00	18.80
Insulation	250 55-gal drums and 1 85-gal overpack	24,740.00	1,861.40
Laboratory waste	9 55-gal drums and 2 5-gal drums	766.00	67.94
Lithium carbonate	1 55-gal drum	0.00	7.40
Manometers	1 55-gal drum	310.00	7.30
Miscellaneous*	116 55-gal drums, 24 85-gal overpacks, 15 2.5-gal drums, 20 5-gal drums, 17 30-gal drums, and 3 15-gal drums, 1 18-ft^3 container, 1 30-ft^3 container, 1 36-ft^3 container, 1 42-ft^3 container, 1 45-ft^3 container, 1 64-ft^3 container	47,111.00	1,991.61
Nickel (including cake and dust)	3 55-gal drums	498.00	14.80
Oil sludge	1 55-gal drum	88.00	7.30
Oxalic acid	1 5-gal drum	17.00	0.67
Plastic/dirt*	299 55-gal drums and 296 85-gal overpacks	178,440.00	5,587.00
PPE/plastic*	449 55-gal drums and 444 85-gal overpacks	178,500.00	8,384.20
Radium source/lead	1 30-gal drum	274.00	4.00
Redwood	1 32-ft^3 container, 1 30,000-ft^3 pile	1,640,469.00	30,032.00
Rock	9 55-gal drums, and 1 85-gal overpack	6,957.00	74.40
Sand	153 55-gal drums and 6 85-gal overpacks	121,367.00	1,274.60
Scrap metal	696 55-gal drums, 32 85-gal overpacks, 14 5-gal drums, 3 15-gal drums, 97 30-gal drums, 1 7A Type A metal box, 5 B-25 metal boxes, and several miscellaneous items such as a tool chest, welding machine, metal cabinet, desks, etc.	338,388.50	35,957.77
Slag	1 5-gal drum and 25 85-gal overpacks	19,175.00	285.67
Sludge (including cylinder wash, alkali, spray bath, oil and solutions)	73 55-gal drums, 27 85-gal overpacks, and 4 30-gal drums	55,737.00	871.40

Note: This information was compiled for the LMES WM database as of June 10, 1997. Since considerable information was not available in the database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

Table A-1. Summary of Low-Level Waste Streams at the Paducah Gaseous Diffusion Plant (Continued)

Waste Streams	Number and Types of LLW Containers	Weight (lb)	Volume (ft^3)
Sodium fluoride	42 55-gal drums, 3 30-gal drums, and 8 5-gal drums	19,225.00	357.76
Soil* (including ER augur cuttings, autosampler and pH temperature)	5,019 55-gal drums, 10 85-gal overpacks, and 8 5-gal drums	3,279,117.00	37,870.36
Sweeper brush	1 55-gal drum	82.00	7.40
Thorium fluoride	1 5-gal drum	8.00	0.13
Trap media (Al, NaF, and miscellaneous trap mix)	395 55-gal drums, 4 85-gal overpacks, 65 30-gal drums, 10 5-gal drums, and 1 15-gal drum	145,516.00	3,105.17
Autosampler Trash	4,010 55-gal drums, 65 30-gal drums, 21 2.5-gal drums , 2 5-gal drums, 3 15-gal drums, 41 85-gal overpacks, 10 7A Type A metal boxes, 22 B-25 metal boxes, and 4 miscellaneous items such as wood tables, shelves, etc.	687,828.00	33,485.39
UF_6, hydrolyzed	3 85-gal overpacks	1,362.00	34.20
Uranium chips*	1 5-gal drum, 1 55-gal drum, and 19 85-gal overpacks	7,438.00	224.67
Uranium compounds	7 55-gal drums, 4 85-gal overpacks, 2 30-gal drums, and 4 5-gal drums	10,797.00	107.73
Uranium precipitate	642 55-gal drums and 6 2.5-gal drum, 3 30-gal, 37 85-gal drums	298,170.00	5,180.67
Vacuum dust	10 55-gal drums, 2 85-gal overpacks, 3 30-gal drums, and 2 5-gal drums	6,069.00	98.74
VDC	1 85-gal overpack drum	183.00	11.40
Water	197 55-gal drums, 2 5-gal drums, 3 30-gal drums; and 8 85-gal overpacks	74,799.00	1,390.27
Wood (including wood pallets)	30 55-gal drums, 5 7A Type A metal boxes, 6 B-25 metal boxes, 1 21-ft^3 stack wooden pallets, 2 32-ft^3 stack wood items, 64-ft^3 stack pallets, 440-ft^3 stack pallets, and 3,904-ft^3 stack pallets	102,764.00	5,778.30
Totals		**11,522,485.50**	**248,048.77**

NOTE: Bolded waste streams represent the largest LLW streams stored at the PGDP.

This information was compiled for the LMES WM Database as of June 10, 1997. Since considerable information was not available in the database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

*Includes ER wastes that have not been completely characterized.

Table A-2. Summary of Resource Conservation and Recovery Act Waste Streams at the Paducah Gaseous Diffusion Plant

Waste Streams	Number and Types of RCRA Items	Weight (lb)	Volume (ft^3)
Absorbent media	6 drums 1 overpack	1,555.00	41.67
Activated Carbon	97 drums	18,987.00	592.39
Aerosol Cans	149 drums	10,679.00	530.74
Aqueous (including wetting agent)	69 drums 6 overpacks	19,021.00	361.64
Asbestos	6 drums	2,154.00	44.40
Ash Receivers	466 drums 171 overpacks 172 lage containers	163,115.00	16,405.80
Balls (including cadmium, zinc, plastic, and metal)	8 drums 3 overpacks	1,716.00	64.47
Batteries	119 drums 9 overpacks 1 large container	55,607.80	394.02
Brass	62 drums 3 overpacks	16,563.00	280.41
Breached fluorine cells	12 items	115,420.00	2,508.00
Bulbs (including fluorescent and incandescent)	179 drums 24 large containers	26,955.20	1,748.26
Capacitor/capacitor parts (including potential devices)	51drums 7 large containers	48,416.00	972.27
Concrete	3 drums 1 overpack	1,534.00	33.60
Coolant	400 drums 5 overpacks	113,683.00	937.60
Debris (including spill debris and spill cleanup)	62 drums 3 overpacks	17,017.00	472.14
Degreaser	14 drums 1 overpack	3,024.00	104.87
Dirt	14 drums	10,758.00	96.80
Electrical equipment (including fuses, light ballasts and wire)	11 drums	3,523.00	72.00
Filters	24 drums	3,145.00	162.80
Flush solvent	1 drum	375.00	7.40
Gravel	5 drums 1 overpack	3,582.00	45.00
Grease	22 drums 1 overpack	2,628.00	135.07
Liquid	114 drums 2 overpacks	15,387.50	426.63
Miscellaneous	274 drums 4 overpacks 4 large containers	39,717.00	1,532.15

Note: This information was compiled for the LMES WM Database as of June 10, 1997. Since considerable information was not available inthe database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

Table A-2. Summary of Resource Conservation and Recovery Act Waste Streams at the Paducah Gaseous Diffusion Plant (Continued)

Waste Streams	Number and Types of RCRA Items	Weight (lb)	Volume (ft^3)
Mud	1 drum	234.00	7.40
Pentachlorophenol	231 drums	23,659.00	916.80
Pipe (including pipe fittings)	2 drums	36.00	0.67
Plastic	43 drums 3 large containers	9,479.50	584.70
PPE	128 drums	12,446.00	888.08
Oil (including clean, hydraulic, misc., transformer, U-contaminated, waste, etc.)	3,144 drums 195 overpacks 2 large containers	849,220.80	14,687.31
Rock	2 drums	325.00	7.40
Scrap metal (including lead, brass, and equipment)	6 drums 2 large containers	6,278.00	212.60
Sediment	5 drums	1,508.00	23.54
Sludge (including oil sludge and sewer sludge)	131 drums 64 overpacks	57,294.00	1,640.85
Soil	51 drums	31,252.00	343.08
Solvents	129 drums 2 overpacks	11,885.60	651.17
Trash	6 drums	642.00	37.00
Uranium precipitate	11 drums	2,906.00	74.67
Vacuum dust	17 drums 1 overpack	6,595.50	103.20
Water (including waste water and water/sludge)	379 drums 37 overpacks 44 large containers	1,017,321.34	17,217.53
Welding supplies	2 drums	323.00	10.07
Totals		**3,744,487.34**	**84,885.42**

NOTE: Bolded items account for the waste streams with the highest volumes.

This information was compiled for the LMES WM Database as of June 10, 1997. Since considerable information was not available inthe database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

Table A-3. Summary of Polychlorinated Biphenyls Waste Streams at the Paducah Gaseous Diffusion Plant

Waste Streams	Number and Types of PCB Items	Weight (lb)	Volume (ft^3)
Liquids (includes water, chromated water, and oil)	159 5-gal drums 853 drums 66 overpacks 88 large containers	1,396,573.00	57,846.90
Capacitors (includes capacitor parts)	308 drums 1 overpack 128 large containers	840,849.00	12,547.80
Absorbents	**1,952 drums** **75 overpacks**	**399,156.00**	**15,299.80**
Debris (including spill debris)	629 drums 86 overpacks 3 large containers	456,221.00	5,868.30
Insulation	14 drums 20 overpacks	3,383.00	331.60
Waste oil	628 drums 20 overpacks 110 large containers	848,007.00	20,033.70
Asbestos (including autoclave asbestos)	**685 drums** **1 overpack** **14 large containers**	**98,455.00**	**5,828.60**
Concrete	**324 drums** **1,376 overpacks**	**1,178,769.00**	**18,088.00**
Empty drums	26 drums 22 overpacks	4,841.00	4,432.00
Motors	27 drums 1 large container	14,812.00	272.70
Gravel	**31 drums** **481 overpacks** **1 large object**	**396,561.00**	**5,605.80**
Miscellaneous	124 drums 5 overpacks 20 large containers	187,713.00	4,330.50
Rock and soil	**1,949 drums** **1,2001 overpacks**	**2,251,929.00**	**27,683.80**

Note: This information was compiled for the LMES WM Database as of June 10, 1997. Since considerable information was not available in the database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

Table A-3. Summary of Polychlorinated Biphenyls Waste Streams at the Paducah Gaseous Diffusion Plant (Continued)

Waste Streams	Number and Types of PCB Items	Weight (lb)	Volume (ft^3)
Scrap metal	429 drums 76 overpacks 6 large containers	132,558.00	4,131.70
Sludge	212 drums 1,094 overpacks	789,166.00	14,584.20
Sediment	1,308 overpacks	902,282.00	14,911.20
Dirt (Including Fill Soil)	69 drums 48 various objects	173,880.00	525.40
Transformers	9 drained carcasses 4 large transformers 3 small transformers 31 drums 4 overpacks	489,790.00	13,719.70
Flush solvent	7 drums	2,588.00	385.00
Bushings	1 drum 9 crates	10,469	1,487.4
Electrical equipment (including light ballasts and wiring)	282 drums 1 overpack 1 large container	95,714.00	2,575.00
Switchgear	126 large containers	95.825.00	16,706.00
Tyvek Suits, PPE	54 drums	7,954.00	407.00
Trash	2,084 drums 76 overpacks	310,729.00	16,396.30
Miscellaneous	124 drums 5 overpacks 20 large containers	187,713.00	4,330.50
Totals		**6,751,431**	**140,999**

NOTE: Bolded items account for the waste streams with the highest volumes.

Note: This information was compiled for the LMES WM Database as of June 10, 1997. Since considerable information was not available inthe database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

Table A-4. Inventory of the Paducah Gaseous Diffusion Plant Scrapyards

Site	Metal	Description	Weight (tons)
C-747-A	Fe[a]	Crushed UF_4 drums	7,507.00
		Tanks	40.50
Total Fe C-747-A			**7,547.50**
C-747-B	Fe[a]	Grating	1.00
		Mobile units	1.50
		Scrap	2.00
		Mobile crane	4.00
		Pipe	5.00
		Trucks	6.00
		Mobile units	11.00
		RR flat car	50.00
		Fork lifts	81.00
		Tanks	4.00
		Tanks	4.00
		RR Rail	81.00
Total Fe C-747-B			**250.50**
C-746-C1	Al[a]	Aluminum ingots	1,053.00
		Bomb casings	7.50
		Cast aluminum ingots	11.00
		Compressor shells	187.50
		Aluminum fins	204.00
		Aluminum lids	260.00
Total Al C-746-C1			**1,723.00**
	Cu[a]	Fairbanks - Morse pump motors	9.60
		Tubing - air handlers	12.00
Total Cu C-746-C1			**21.60**
	Fe[a]	Tub	.50
		Marvel saw	1.50
		Mixture	2.00
		Pipe	8.50
		Fairbanks - Morse pump motors	38.40
		Sheet - Air handlers	48.00
		Grating and equipment	1.50
		Tanks	2.00
		Nickel - plated pipe	651.00
		Mixed pile	879.90
Total Fe C-746-C1			**1,633.30**
	SS[a]	Plating acid tank	.50
		Tub	.50
		Tanks and equipment	14.00
		Pipe	1.50
Total SS C-746-C1			**16.50**

Note: This information was compiled for the LMES WM Database as of June 10, 1997. Since considerable information was not available inthe database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

Table A-4. Inventory of the Paducah Gaseous Diffusion Plant Scrapyards (Continued)

Site	Metal	Description	Weight (tons)
C-746-E	Al*	Aluminum shavings in 55-gal drum	3.80
			0.25
Total Al C-746-E			**4.05**
	Fe*	Iron shavings in 55-gal drum	38.50
		End pieces	17.50
		Converter shells	21.50
		Nickel-plated scrap - small pile	60.30
		Nickel-plated scrap - large pile	11,900.00
		Small rings	3.00
		Large rings	4.30
		Nickel plate	5.00
		Mixture	7.50
		Mixture	39.00
		Miscellaneous iron pipe	71.00
		Large diameter - 1-inch thick rings	93.60
Total Fe C-746-E			**12,261.20**
	SS*	Pipe	4.00
Total SS C-746-E			**4.00**
C-746-H4	Al*	Aluminum ingots	121.00
		Aluminum ingots	1,153.00
	Al*	Miscellaneous aluminum	4.20
		Aluminum ingots	48.70
Total Al C-746-H4			**1,326.90**
	Ni*	Pure nickel ingots	9,700.00
Total Ni C-746-H4			**9,700.00**
C-746-C	Al*	Pile just south of drums	1.50
		Aluminum portion of large pile	46.00
Total Al C-746-C			**47.50**
	Cu*	Pile 1 just south of drums	2.00
Total Cu C-746-C			**2.00**
	Fe*	55-gal drums	60.60
		55-gal drums	60.60
	Fe*	Pile just south of drums	16.50
		Pile south of above pile	27.25
		Large Pile - 20% nickel plated	4,521.00
Total Fe C-746-C			**4,685.95**
	SS*	Pipe	2.00
Total SS C-746-C			**2.00**
C-746-E1	Al*	Aluminum covers and heat exchangers	21.50
		Aluminum covers	34.50
		Aluminum blades	41.60
		Aluminum covers	42.00

Note: This information was compiled for the LMES WM Database as of June 10, 1997. Since considerable information was not available inthe database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

Table A-4. Inventory of the Paducah Gaseous Diffusion Plant Scrapyards (Continued)

Site	Metal	Description	Weight (tons)
		Mixture	108.00
		Aluminum lids and compressors	115.00
		Aluminum converter shells and blades	208.00
		Mixture of fins and shells	741.00
Total Al C-746-E1			**1,311.60**
	Fe*	10-ft diameter pipe	31.00
		10-ft diameter pipe	10.00
		RR rail	19.50
		Nickel-plated pipe shells	106.76
		Large pile	2,499.00
Total Fe C-746-E1			**2,666.26**
C-746-P East	Al*	Big pile	153.60
		Pipe	0.50
		Pipe	0.50
Total Al C-746-P East			**154.60**
	Cu*	Pile	2.00
		Transformers	2.0
		Wire	1.00
Total Cu C-746-P East			**5.00**
	Fe*	Cabinets and lockers	2.00
		Miscellaneous	3.50
		RR rail	5.50
		Light structural pipe	6.00
		Transformers	8.00
		Steel in insulators - no ceramic	29.00
		1 package mobile boiler	37.00
		Big pile	1,382.40
		Mixture and drums	6.00
		Mixture	10.00
		Galvanized pipe and sheet	12.00
Total Fe C-746-P East			**1,501.40**
	SS*	Pressure vessels	12.00
Total SS C-746-P East			**12.00**
South of C-746-B Yard	Al*	Aluminum compressor sections	1.25
		Aluminum	4.50
Total Al C-746-B Yard			**5.75**
	Fe*	Car	4.00
		Transfer cars	5.00
		Pump	6.00
		Douys, miscellaneous Fe	7.50
		Mixed Fe	61.30
Total Fe C-746-B Yard			**83.80**

Note: This information was compiled for the LMES WM Database as of June 10, 1997. Since considerable information was not available inthe database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

Table A-4. Inventory of the Paducah Gaseous Diffusion Plant Scrapyards (Continued)

Site	Metal	Description	Weight (tons)
C-746-P1	Al[b]	Miscellaneous	0.50
		Aluminum conduit	0.25
		Aluminum blades	3.00
		Pile 2	3.50
Total Al C-746-B Yard			**7.25**
	Cu[b]	Copper pipe sprinklers	1.50
		Miscellaneous	2.00
		Motors	0.90
		Copper heat exchanger tubing	10.00
Total Cu C-746-Yard			**14.40**
	Fe[b]	Refrigerators	0.50
		Pipe	1.00
		Drums	3.50
		Rail	5.50
		RR rail	9.00
		Carrier	14.00
		Pile 1	383.00
		Pipe	2.00
		Motors	3.60
		Tanks	7.00
		Structural	10.00
		Pipe	12.80
		19-inch diameter pipe	15.50
		RR rail	327.00
		Miscellaneous	1.00
		Cooling tower standoff pipe	11.00
		Pile 2 mixed sheeting	31.50
		RR rail	38.35
		Pipe	41.50
Total Fe C-746-B Yard			**917.75**
	SS[b]	Mesh	2.00
		Pipe	4.50
Total SS C-746-B Yard			6.50
C-746-D	Fe[a]	(Classified)	14,560.00
Total Fe C-746-D			**14,560.00**
TOTAL Fe			**46,107.66**
TOTAL Ni			**9,700.00**
TOTAL Al			**4,580.65**
TOTAL Cu			**43.00**
TOTAL SS			**41.00**

[a]contaminated
[b]uncontaminated

Note: This information was compiled for the LMES WM Database as of June 10, 1997. Since considerable information was not available in the database (e.g., weights and volumes for some wastes), numbers should be considered estimates.

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APPENDIX B

POLYCHLORINATED BIPHENYL-RELATED TERMS DEFINED BY TOXIC SUBSTANCES CONTROL ACT REGULATIONS

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Polychlorinated Biphenyl-Related Terms Defined by Toxic Substances Control Act Regulations*

Term	Definition	Examples
PCB	Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees, or any combination of substances that contain such substance.	PCB dielectric fluids, PCB heat transfer fluids, PCB hydraulic fluids
PCB article	Any manufactured article, other than a PCB container, that contains PCBs and whose surface(s) has been in direct contact with PCBs.	Capacitors, transformers, electric motors, pumps, pipes, etc.
PCB container	A device used to contain PCBs or PCB articles and whose surface(s) has been in direct contact with PCBs.	Packages, cans, bottles, bags, barrels, drums, tanks
PCB equipment	Any manufactured item, other than a PCB container, that contains a PCB article.	
PCB item	Any PCB article, PCB container, or PCB equipment that deliberately or unintentionally contains, or has as a part of it, any PCBs.	
PCB transformer	Any transformer that contains PCBs in concentrations of ≥ 500 ppm.	
PCB-contaminated electrical equipment	Any electrical equipment that contains > 50 ppm but < 500 ppm PCBs.	Transformers, capacitors, circuit breakers, reclosures, voltage regulators, switches, cable electromagnets
PCB wastes	PCBs and PCB items that are subject to the disposal requirements of TSCA.	
Small capacitor	A capacitor with < 3 lb of dielectric fluid.	
Large capacitor	A capacitor with ≥ 3 lb of dielectric fluid.	

*TSCA regulations are contained in 40 C.F.R. 761.3

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