OAK RIDGE
NATIONAL LABORATORY

MANAGED BY UT-BATTELLE
FOR THE DEPARTMENT OF ENERGY

Oak Ridge National Laboratory Legacy Materials Disposition Initiative Strategic Plan

Environment Safety, Health and Quality Directorate
Environmental Protection and Waste Services Division
Environmental Management Programs (Legacy)

July 2003

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ORNL-27 (2-03)

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OAK RIDGE NATIONAL LABORATORY
LEGACY MATERIALS DISPOSITION INITIATIVE
STRATEGIC PLAN

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ACRONYMS AND ABBREVIATIONS

CSD	Chemical Sciences Division
DOE	U.S. Department of Energy
ECR	Environmental Compliance Representative
EM	Office of Environmental Management (DOE)
EPO	Environmental Protection Officer
EP&WSD	Environmental Protection & Waste Services Division
ES&H	environment, safety, and health
FEVA	Facility Environmental Vulnerability Assessment
FMD	Facility Management Division
FRP	Facility Revitalization Project
ft^2	square foot
FY	fiscal year
GI	Generator Interface (supports waste disposition)
GIE	Generator Interface Equivalent (supports waste disposition)
HP	Health Physicist
LMDI	Legacy Material Disposition Initiative
LWS	Laboratory Waste Services
m^3	cubic meter
M&O	management and operating
ORNL	Oak Ridge National Laboratory
RCT	Radiological Control Technician
R&D	research and development
RH	remote-handled
SBMS	Standards Based Management System
SC	Office of Science (DOE)
S&M	surveillance and maintenance
UT-B	UT-Battelle, LLC
Y-12	Y-12 National Security Complex

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1. INTRODUCTION

This Legacy Material Disposition Initiative (LMDI) Strategic Plan for Oak Ridge National Laboratory (ORNL)

- provides the genesis of the LMDI;
- identifies the types and estimated amounts of legacy materials at ORNL;
- establishes the risk-based approach to prioritize legacy material management and disposition;
- defines the disposition process,
- provides the baseline cost estimate and schedule for legacy material disposition at ORNL;
- identifies "breakthrough" approaches to achieve cost effective disposition; and
- optimizes resources to solve ORNL's legacy challenges.

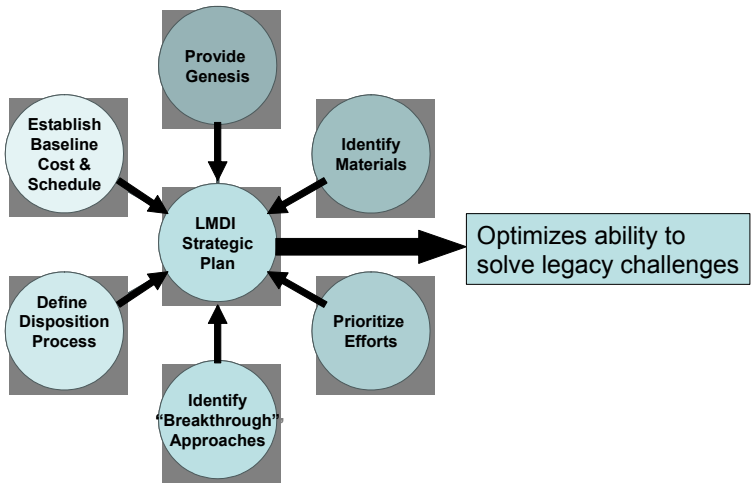

Figure 1. The LMDI Strategic Plan optimizes ORNL's ability to solve legacy challenges.

The LMDI Strategic Plan is a living document that will be reviewed and updated annually to reflect changing priorities, incorporate future activities, and document completed actions. Appendices to the LMDI Strategic Plan are included to document specific processes, procedures, or scope.

1.1 BACKGROUND INFORMATION

UT-Battelle, LLC (UT-B) conducted a Facility Environmental Vulnerability Assessment (FEVA) at ORNL in fiscal year 2002 (FY02), which indicated that legacy materials found in and around many ORNL facilities present environmental vulnerabilities and impede ORNL's revitalization. This buildup of legacy materials is the result of 60 years of operations and nuclear and scientific research and development (R&D) activities at ORNL. Legacy materials are found throughout the Laboratory and affect most ORNL Divisions. Responsibility for these materials is not obvious due to reorganizations at ORNL and the loss of historical knowledge. In many older facilities, ORNL Divisions inherited legacy materials when they were assigned responsibility for programs and/or space. Assumption of responsibility for these materials is often delayed or disputed because of the associated clean up and disposition costs.

The U.S. Department of Energy (DOE) Office of Environmental Management (EM) establishes annual budgets for waste disposition costs for waste streams at ORNL. Prior budgets did not explicitly include the volume of legacy materials identified in ORNL facilities managed by the DOE Office of Science (SC) and UT-B, their Management and Operating (M&O) contactor for ORNL, since these materials were not considered wastes. The allocation of available funding is not sufficient to support the disposition of excess legacy material streams (primarily low-level waste) from DOE SC managed facilities. Initial cost and schedule estimates developed in FY02 indicated that legacy material disposition would be a $102.5 million, multi-year effort, which would support the revitalization of ORNL.

1.1.1 Genesis for the Legacy Material Disposition Initiative (LMDI)

With legacy materials identified as an operations and environment, safety and health (ES&H) vulnerability during the FEVA, UT-B management took a proactive approach to disposition legacy materials. A key part of UT-B's Laboratory Agenda is obtaining and maintaining "excellence in laboratory operations and ES&H". Legacy material disposition supports this UT-B agenda and three related UT-B objectives, which are

(1) reduce ORNL's facility footprint in order to reduce operating, surveillance, and maintenance costs,

(2) reduce ES&H vulnerabilities at ORNL, and

(3) revitalize ORNL.

During FY02, UT-B management approved the LMDI and spent more than $1.2 million for the disposition of legacy materials from DOE SC/UT-B managed facilities at ORNL and the Y-12 National Security Complex (Y-12). UT-B management implemented a $10 million per year "legacy tax" in FY03 to help fund costs associated with areas being returned to the space pool, Non-Reactor Nuclear Facility Division initiatives, and legacy material disposition. Two million dollars of the "legacy tax" is targeted to provide baseline funding for the LMDI in FY03 and beyond. UT-B management expects that additional programmatic and discretionary funding will be provided in the future so that legacy materials can be safely dispositioned and efficient processes and requirements can be established to ensure that the buildup of legacy materials does not reoccur in ORNL facilities. It is important to note that the LMDI is not intended to allow the proper management of waste to be deferred. It is the responsibility of ORNL waste generators to properly identify and manage their wastes.

The LMDI provides support to ORNL Divisions with legacy material challenges and the ORNL Facility Revitalization Project (FRP), which is in the process of reducing ORNL's facility footprint by 1.8 million square feet (ft^2) by cleaning out, deactivating, decommissioning, and eventually demolishing old, unneeded facilities. The FRP will provide modern, newly constructed research facilities for ORNL Divisions and personnel, which will support future ORNL R&D missions. The movement of ORNL Divisions and personnel into these new facilities is expected to result in the identification of additional legacy materials that are no longer needed to support ORNL missions. The LMDI, FRP, and ORNL Divisions are integrating efforts to insure that legacy material disposition is performed safely, cost-effectively, and in a timely manner to support personnel moves and facility revitalization. These efforts will reduce the hazards to ORNL personnel associated with the presence of these materials in the work place.

2. DEFINING AND IDENTIFYING LEGACY MATERIALS

2.1 LEGACY MATERIALS DEFINITION

Materials generated during ongoing research and ORNL operations are not considered legacy materials. However, this begs the question of "What qualifies as legacy materials?" This question is answered in the box on the right.

Legacy materials include old furniture, equipment, computers and electronics, papers and excess publications, scrap metal, excess chemicals, hazardous items, and radiologically contaminated materials that have accumulated over the past 60 years of ORNL operations. Legacy materials are found in most ORNL facilities in places like attics, storage areas, labs, cabinets, etc. Figure 2 is a graphical representation of the types and volume of legacy materials found at ORNL during the FEVA. During FY02 facility clean outs an inventory process was piloted to help identify, mark, and compliantly manage legacy materials through the LMDI.

What qualifies as legacy material?

- Excess or unneeded materials not generated from current operations.
- Excess or unneeded materials generated by Programs that are no longer in existence.
- Materials that accumulated because a disposition path was not identified, available, or affordable.

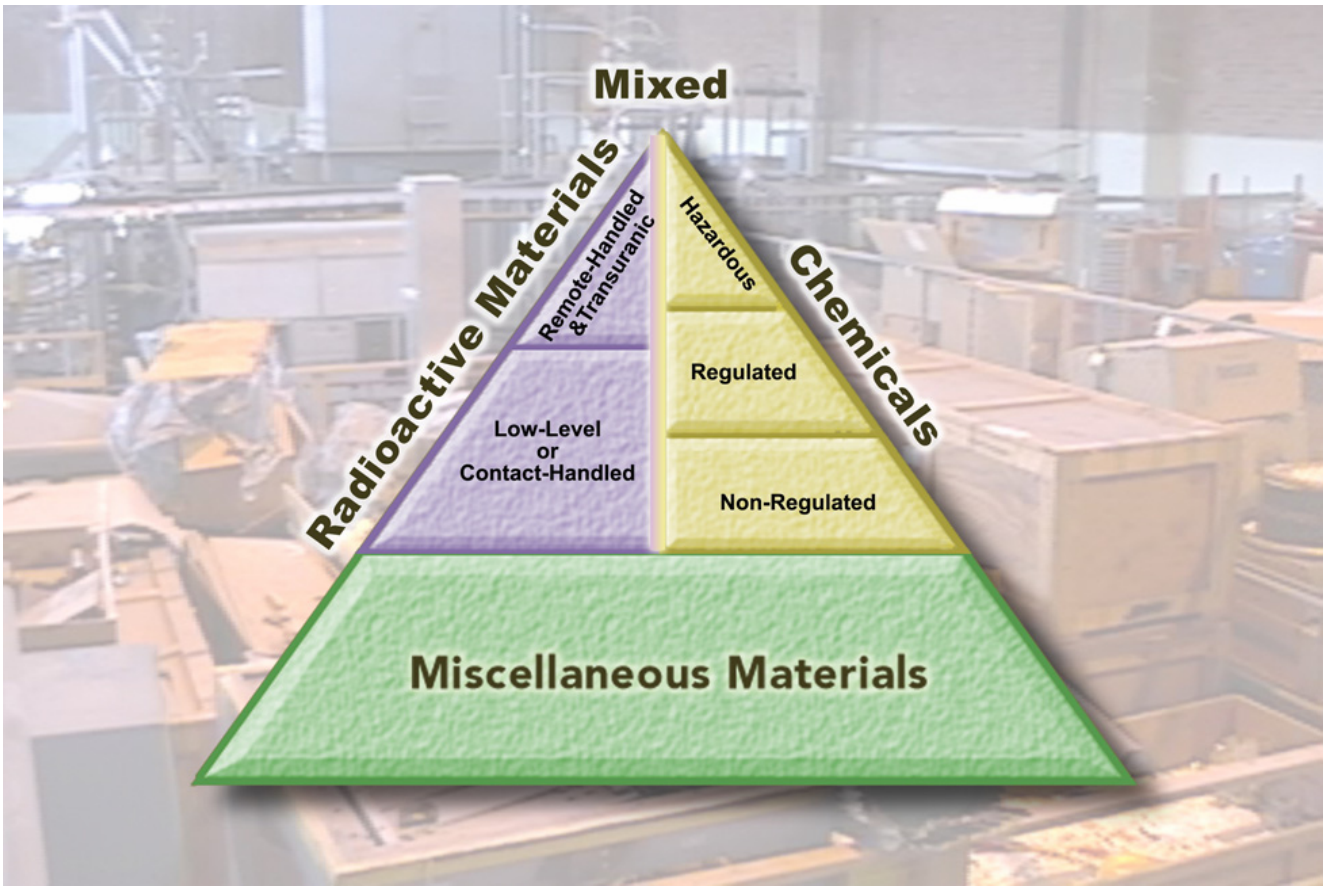

Figure 2. The legacy material pyramid represents the types and comparative volumes of legacy materials found at ORNL.

2.2 IDENTIFYING LEGACY MATERIAL CHALLENGES AT ORNL

The presence of legacy materials in and around ORNL facilities was initially identified during the FEVA. The LMDI team also conducted facility walk-throughs in FY02 to determine the types and amounts of legacy materials contained in ORNL facilities. It became apparent during the facility assessments that there are many types of legacy materials, and various needs (e.g., FRP, Division, radiological material disposition, ES&H) driving the clean up of these materials, which are summarized in the following sections.

As of April 1, 2003, a total of 315 specific legacy challenges were identified by ORNL Divisions, and the FRP, which will require approximately $50 Million to solve. The status of the legacy material challenges is updated regularly. Other legacy material challenges are added when they are identified by the LMDI, ORNL Divisions, or the FRP as facility upgrades and personnel moves are scheduled and become more imminent.

2.2.1 FRP Legacy Material Challenges

The LMDI is supporting the FRP by planning and implementing facility clean outs and legacy material disposition to support facility deactivation and decommissioning projects, which are part of ORNL's footprint reduction efforts. During ORNL facility footprint reduction efforts, ORNL R&D activities will be consolidated on ORNL's main campus. All ORNL facilities at the Y-12 site and several additional aging facilities located on ORNL's main campus will be cleaned out over the next five years. These facilities will either be

- deactivated and demolished as part of the revitalization process, or
- deactivated and placed in a "cheap-to-keep" mode until plans are finalized for their future, or
- transferred to another DOE organization, such as BWXT Y-12, LLC, the M&O contractor for the Y-12 site.

Figure 3 is a map showing the location of the facilities identified to be cleaned out over the next three years to support the FRP footprint reduction efforts. These facilities total over 980,000 ft^2 (an additional 820,000 ft^2 of space was vacated in FY02). Many of these facilities contain a wide variety of materials ranging from old furniture, papers, and office equipment, to large process machinery, which may have a limited user base.

The LMDI is also supporting the FRP and ORNL Divisions with the disposition of legacy material resulting from facility and personnel moves being conducted as new ORNL facilities are completed or aging facilities are vacated. Divisions are required to meet the ORNL space return criteria, which can be viewed at: http://sbms.ornl.gov/sbms/sbmsearch/subjarea/fsm/returncriteria.cfm, when retuning unneeded space to the space pool. One major legacy material challenge that needs to be addressed is legacy materials that are not yet identified, but may remain after facility/personnel moves are completed.

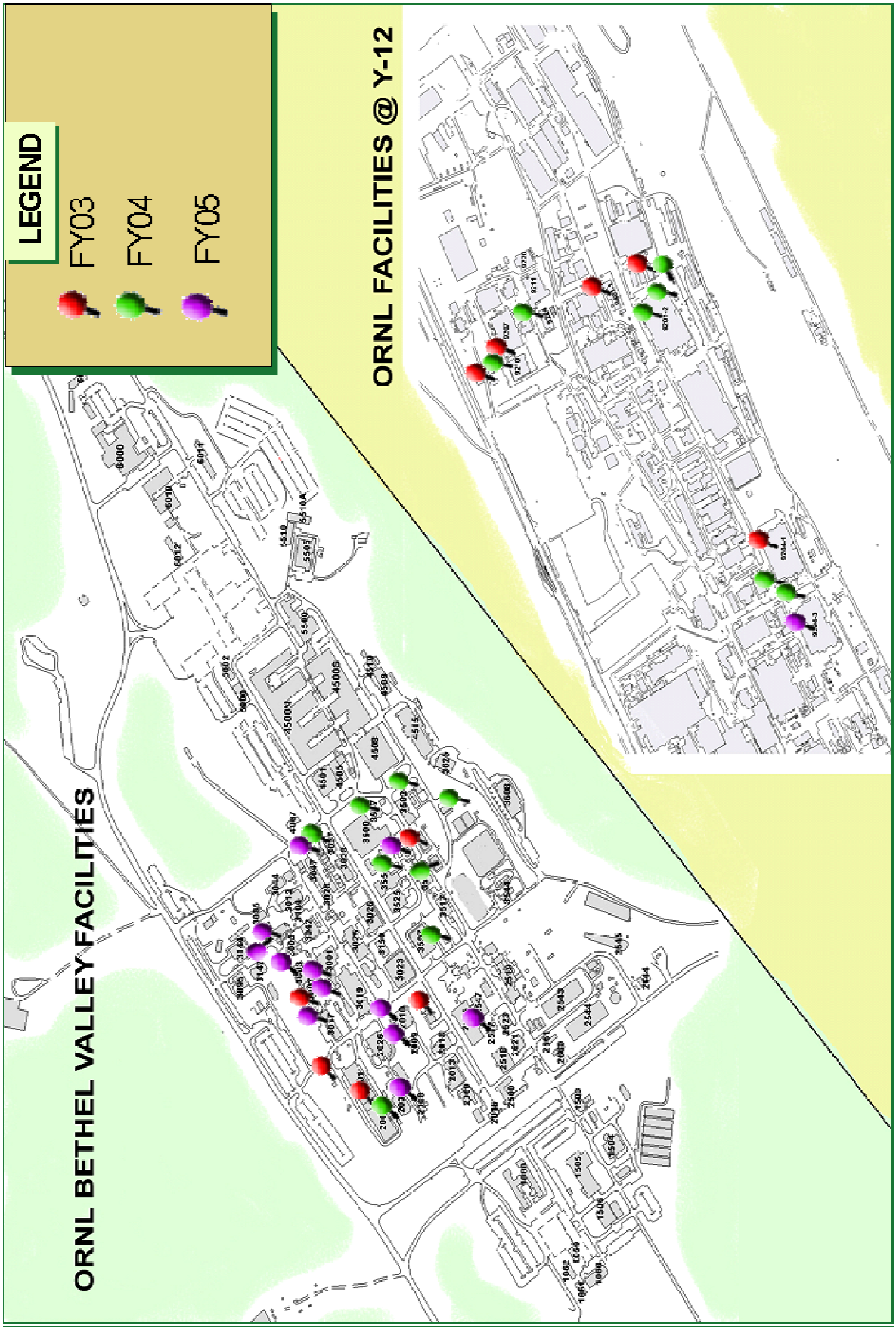

Figure 3. Locations of UT-B managed facilities identified to be cleaned out over the next three years to support the FRP facility footprint reduction efforts.

2.2.2 ORNL Division Legacy Material Challenges

In FY02, an LMDI survey was sent to all ORNL Divisions requesting information about the types of legacy materials in the Division's areas of responsibility. During FY03, there have been follow up activities to the initial LMDI survey. Division input was reviewed, and Divisions that did not respond were contacted to encourage response and input concerning legacy materials. Responses to the LMDI survey were integrated into an LMDI database that tracks legacy material information provided by the Divisions and the status of disposition efforts. Once entered into the database, data on each Division's identified legacy material challenges were sent to the Division's Director, Operations Manager, and the Division's assigned Environmental Protection and Waste Services Division (EP&WSD) Generator Interface (GI) or Generator Interface Equivalent (GIE), and Environmental Protection Officer (EPO) or Environmental Compliance Representative (ECR). It was requested that they review the information, make corrections or updates, provide any missing information, and discuss Divisions needs and priorities. The Divisions were also requested to assign an initial ranking (1, 2, 3, etc.) to the identified legacy challenges, which indicates the Division's priorities for dispositioning their materials.

As of March 2003, twenty-one out of thirty-four ORNL Divisions reported legacy material challenges. Two additional ORNL Divisions may have legacy materials as a result of moves taking place as part of the FRP. The top three priorities for the 21 Divisions reporting legacy materials have been identified. Initial cost estimates indicate that approximately $13 Million will be needed to solve these legacy material challenges.

2.2.3 Legacy Radiological Materials (Contact- and Remote-Handled Low-Level and Transuranic)

A remote-handled (RH) waste inventory for UT-B managed facilities was developed in FY02. Approximately 550 RH legacy items were identified by ORNL Divisions. Table 1 summarizes information provided by the ORNL Divisions reporting RH materials. It should be noted that Table 1 does not reflect recent ORNL Division input, specifically the Non-Reactor Nuclear Facilities Division, which was organized in early FY03, nor does it reflect the possible consolidation of hot cell operations at ORNL that is currently being evaluated.

Table 1. Examples of ORNL Divisions with RH materials, associated number of items, and estimated volumes.

Division	Number of Items	Estimated Volume (m^3)
Metals and Ceramics Division	345	0.8
Research Reactors Division	173	5.3
Nuclear Science and Technology Division	27	10.6
Life Sciences Division	2	2E-05
Total	**547**	**16.7**

Additional Division input will be sought and hot cell consolidation efforts will be taken into account as the LMDI progresses with strategic planning for legacy low-level and transuranic materials. Facilities with hot cells that are currently being evaluated include Buildings 2026, 3025E, 3047, 3525, 4501, 4505, 7920, and 7930). Buildings 4501, 4505, and 3047 also have additional legacy materials and environmental vulnerabilities, which are candidates for LMDI support. These legacy materials and environmental vulnerabilities were inherited by certain Divisions during ORNL's reorganizations in FY02 and FY03. There has been a reduction of historical knowledge for some materials and the facilities due to the reorganization and personnel attrition over the years.

2.2.4 Legacy Materials Identified With ES&H Vulnerabilities

During FY02 facility assessments it became apparent that there were large volumes of similar types of legacy materials in many older ORNL facilities, which present ES&H vulnerabilities. The LMDI is planning and implementing campaigns for specific types of legacy materials to reduce ES&H vulnerabilities in facilities across ORNL. These campaigns will provide an efficient method for dispositioning similar types of legacy material from all ORNL Divisions. Performing campaigns for similar types of materials provides an economy of scale, via reduced characterization, handling, packaging, and disposal costs. Campaigns for specific materials allow the LMDI to make a greater impact across the ORNL campus to minimize ES&H vulnerabilities.

Currently LMDI material campaigns are underway for the following legacy materials.

- Gas cylinders – 1,012 gas cylinders were removed from the ORNL site as of March 2003. Of these, 704 were successfully sampled, treated, and recycled (Figure 4). The remaining cylinders are radiologically contaminated that are currently being processed. Approximately 150 of the radiologically contaminated cylinders have been processed as of June 1, 2003
- Excess chemicals – over 10,000 excess chemical items have been identified by ORNL Divisions. Clean up activities are in process or scheduled for seven ORNL Divisions with significant excess/legacy chemical challenges. These chemicals are compliantly managed and dispositioned by LMDI subject matter experts.
- Excess pumps and motors – approximately 2,500 legacy pumps and motors have been identified and inventoried (Figure 5). It is estimated that this number could rise to more than 2,800 before the LMDI Pump and Motor Campaign is completed. The disposition process was successfully piloted on a test group of pumps and motors (over 600 pumps and motors), with plans to disposition these materials at Envirocare. Additional information about the LMDI Excess Pump & Motor Campaign can be found at http://eshtraining.ornl.gov/eshq/EPWS/EM_Program/Pump_Motor_Campaign.htm.

Figure 4. Gas cylinder sampling during the LMDI Gas Cylinder Campaign.

Figure 5. Legacy vacuum pumps are located in many facilities throughout ORNL.

Another identified environmental vulnerability is legacy radiologically contaminated materials that are stored outside, including:

- approximately 181 legacy B-25 boxes located around the ORNL campus containing a variety of materials,
- 28 B-25 boxes containing legacy materials from the FY02 clean out of Building 9201-3 at Y-12 and now located at the Biology Complex at Y-12,
- 5 large transformers located in a roped off area in the 7000 area, and
- 4 Sealand containers of legacy materials located behind Building 7009.

These containers/materials will require assessments, characterization, repackaging, and disposition.

Other materials that present ES&H vulnerabilities are candidates for LMDI material campaigns, such as old filters, combustibles, old computers/electronics, lead, and scrap metal from radiological material management areas. The LMDI is preparing plans for these types of material campaigns, which will be implemented as funding allows.

3. PRIORITIZATION APPROACH

LMDI activities in FY02 and the first half of FY03 were selected to

- achieve significant progress in dispositioning high priority legacy materials,
- support the FRP Performance Evaluation Plan,
- address Division needs and their priorities,
- address key ES&H issues, and
- identify breakthrough solutions and processes.

Figure 6 summarizes current LMDI priorities over the next several years. Efforts to establish disposition pathways for RH materials are expected to take several years due to their significant ES&H, cost, and programmatic issues. Efforts to support the Building 4500 North renovation are expected to be conducted in concert with new facility construction activities.

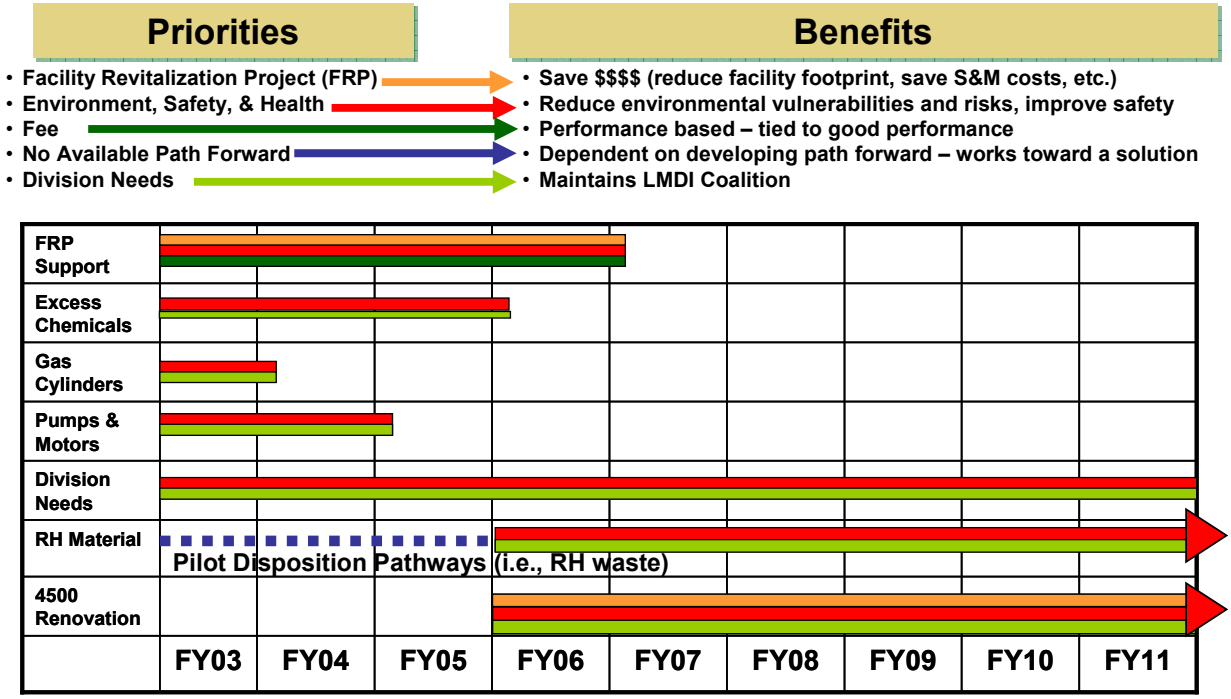

Figure 6. Summary of LMDI priorities and benefits.

The LMDI is responsible for addressing legacy materials challenges at ORNL. There are a wide variety of challenges (e.g., excess chemicals, contaminated materials, excess equipment and electronics, combustibles, etc.) and drivers (e.g., regulatory compliance, risk reduction, Division needs, FRP needs, general housekeeping needs, etc.) that need to be considered in ORNL's strategic plan for legacy material disposition. The LMDI Team recognized the need to prioritize ORNL's legacy material challenges to effectively manage risks, resources, and funding so that the legacy material disposition process can be strategically planned to provide the most benefit. The LMDI team decided to incorporate a risk management approach to the prioritization process. Assessing and ranking the risks associated with identified legacy material challenges provides input for developing work plans that focus on reducing legacy vulnerabilities and effectively managing risks associated with legacy materials at ORNL.

3.1 PRIORITIZING LEGACY MATERIAL CHALLENGES USING A MODIFIED RISK-BASED APPROACH

A modified risk-based prioritization process was implemented in FY03 to guide future LMDI activities. This process utilizes the ORNL Standards Based Management System, Quality Management System guidance document *ORNL-QA-G01: Risk Prioritization Guidance for ORNL* as a basis for the modified approach. This modified process utilizes the ORNL Risk Ranking Board to assess the risk impacts and likelihood of occurrence for identified legacy material challenges. This assessment and ranking process results in an overall risk score for each challenge. The resulting scores are used as a basis for prioritizing legacy challenges for the allocation of available resources and the call for additional resources to eliminate legacy challenges with unacceptable risks.

The ORNL Risk Ranking Board was convened in April 2003 to perform an initial review of the top 3 priorities of Divisions reporting legacy materials and FRP FY03 and FY04 projects as a pilot test of the process. The modified process considered the availability of disposition paths, coordination with Laboratory Agenda, ORNL's revitalization efforts, impact on performance measures, and Division initiatives and priorities, and included the assessment of six risk/impact categories, which are summarized in the following bullets.

- A combined public and site safety and health category includes potential adverse impacts to health and safety.
- The compliance category includes failures to comply with laws, regulations, compliance agreements, DOE orders, and Executive orders that could adversely affect the confidence of DOE and other agencies in the ability of ORNL to operate, while protecting the public, workers, and the environment.
- The modified mission impact category includes potential adverse impact to the ability to perform the research or production mission of ORNL, and takes into consideration ORNL's revitalization mission.
- The cost-effective risk management category includes performance-based requirements, potential losses to ORNL's capital investments or loss of fee, or an opportunity for cost savings or improved program development.
- The environmental protection category includes potential adverse impacts on natural resources, such as air, water, land, or wildlife.
- The Division priorities category was ranked based on Division input.

The modified risk-based priority assessment and scoring process takes into account the likelihood of an event happening. A numerical likelihood value was assigned to each column of the ranking form. The likelihood value was multiplied by the weighted value of the risk impacts to derive the relative risk in each scoring cell on the form. Table 2 summarizes the likelihood factors incorporated into the modified risk-based priority model.

Table 2. Likelihood factors incorporated into the modified risk-based priority model for legacy materials at ORNL.

Column	A	B	C	D
Likelihood	Very High	High	Medium	Low
Likelihood Factor	1.0	0.1	0.01	0.0001
Expectation of occurrence	≥1 in 1 year	<1 in 1 year, ≥1 in 10 years	<1 in 10 years, ≥1 in 100 years	<1 in 100 years, ≥1 in 10,000 years

3.1.1 Summary of Initial Risk Ranking Results

Table 3 lists the top ten legacy material challenges with the highest risk scores. These legacy material challenges typically received high scores in either the compliance risk category or mission impact category. The total risk score may represent risks in any one or more of these impact categories. For example, a compliance failure may impact health and safety, which adversely impacts the Laboratory's mission.

Table 4 provides a summary of the composite risks scores and estimated legacy material disposition costs for the top three priorities of the twenty-one ORNL Divisions reporting legacy materials. It should be noted that some Divisions reported less than three legacy challenges (identified by a * in the Table 4), which resulted in a lower composite risk score.

Table 5 summarizes the risk scores of ORNL FRP FY03 and FY04 facility clean out projects that will support facility deactivation and ultimately ORNL facility footprint reduction efforts. These projects typically received high scores in the modified mission impact category.

Table 3. Top ten legacy material challenges at ORNL prioritized by risk scores.

Risk Score	Division	Building	Material Description	Estimated Cost
418	Environmental Protection & Waste Services Division	Various	~181 B-25 boxes stored outside containing various types of legacy materials	$2,000,000
364	Fusion Energy Division	9201-2	Misc. metal, wire, wood (south side of creek)	$ 500,000
350	Fusion Energy Division	9201-2	Misc. metal, wire, wood (east and west track first floor)	$ 500,000
346	Fusion Energy Division	9201-2	Unused equipment, e.g., lathes, milling machines, drill presses (first and second floor)	$ 100,000
323	Environmental Sciences Division	1506	Disconnect and disposition pumps and motors associated with dysfunctional growth chambers & miscellaneous excess equipment in 1506.	$ 50,000
317	Facility Management Division East Complex/Nuclear Science and Technology Division/FRP	7600	Assist with legacy material disposition to prepare for deactivation.	>$ 75,000
315	Fabrication and Site Services Division/FRP	7600	Several containers of legacy materials	$ 45,000
295	Metal & Ceramics Division/FRP	9204-1	Facility clean out to support deactivation and decommission	$4,100,000
287	Life Sciences Division	9224 and 9210	9224: Legacy material disposition (includes radiological waste and hundreds of bottles of chemicals). 9210: legacy material disposition (includes hundreds of bottles of chemicals).	$1,107,000
285	Fusion Energy Division/FRP	9201-2	Balance of facility clean out to support deactivation and decommissioning	$4,044,000
			TOTAL	**$12,521,000**

Table 4. Summary of ORNL Division's legacy material composite risk scores (in descending order) and estimated disposition costs for the Divisions top three priorities.

Division	Composite Risk Score	Estimated Disposition Costs
Fusion Energy Division	1060	$ 1,100,000
Environmental Protection & Waste Services Division	790	$3,225,000
Non-Reactor Nuclear Facilities Division	683	$830,000
Life Sciences Division	651	$1,657,000
Facility Management Division/Central Complex	623	$ 275,000
Environmental Sciences Division	617	$ 118,000
Metals & Ceramics Division	600	$700,000
Physics Division	599	$584,000
Fabrication & Site Services Division	588	$295,000
Research Reactors Division	567	$325,000
Facility Management Division/West Complex	545	$300,000
Nuclear Sciences and Technology Division	545	$2,200,000
Engineering Science and Technology Division	446	$136,000
Chemical Sciences Division	438	$799,000
Facility Management Division/East Complex*	381	$85,000
Operational Safety Services Division	345	$42,000
Quality Services Division*	280	$100,000
Condensed Matter Sciences Division	195	$25,000
Computational Sciences & Engineering	80	$30,000
Human Resources Division	78	$8,200
Networking & Computer Technologies Division	75	$245,000
Creative Media*	11	$5,000
Information Services (Library)*	10	$500
	TOTAL	**$13,084,700**

Table 5. ORNL FRP FY03 and FY04 facility clean out projects sorted by risk score. Clean out activities are in process or completed for facilities annotated with a *.

Risk Ranking Score	Building	Project Description	Estimated Disposition Cost
317.1	7600*	Assist with legacy material disposition to prepare for deactivation	> $ 75,000
315	7600*	Legacy waste disposition	$ 45,000
295	9204-1*	Facility clean out to support deactivation and decommissioning	$ 4,100,000
285	9201-2	Facility clean out to support deactivation and decommissioning	$5,144,000
285	9210*	Facility clean out to support deactivation and decommissioning	$657,000
271	Biology Complex	28 B-25 boxes of legacy materials from the clean out of Building 9201-3 in FY02 located at the Biology Complex at Y-12	$175,000
264	2011*	Assist with legacy material disposition and forced move to prepare for deactivation	$150,000
261	2011*	Creep Machines - will have to be disconnected	$ 25,000
261	9401-1*	Facility clean out to support deactivation and decommissioning	$ 300,000
260	9224*	Facility clean out to support deactivation and decommissioning	$ 152,000
207.5	3503*	Facility clean out to support deactivation and decommissioning (some work performed in FY03, additional funding required to continue work)	$250,000
205.5	2024*	Assist with legacy material disposition to prepare for deactivation	$ 100,000
		TOTAL	**>$ 11,148,000**

3.2 UTILIZING RISK RANKING RESULTS FOR STRATEGIC PLANNING, PRIORITIZATION, AND EFFECTIVE RISK MANAGEMENT

Initial risk ranking results for the Division's top 3 legacy priorities and FRP FY03 and FY04 facility clean outs will be used in LMDI strategic planning for FY04 and beyond. Risk assessment and ranking for all remaining legacy challenges will be performed in the third quarter of each FY so that hazards and risks are addressed and priorities are established for the next FY. Prioritizing legacy material challenges based on risk scores provides a basis for funding requests and establishing work plans, which can be implemented when funding becomes available. By establishing good risk management practices early in the LMDI, available funds and resources can be allocated to those legacy challenges with the highest risks, and strategic planning can address the reduction and elimination of these risks over time. Figure 7 breaks down the ranked ORNL legacy challenges into groups with similar issues/risks.

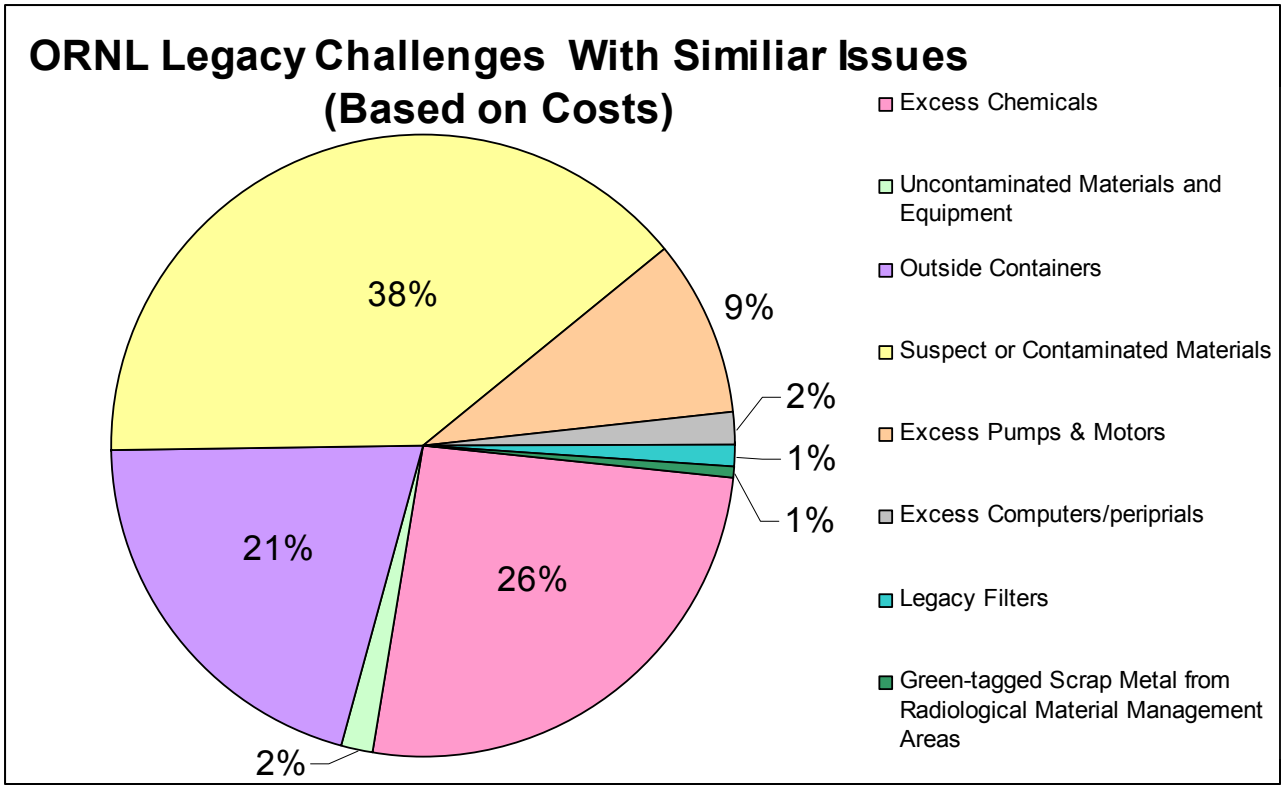

Figure 7. ORNL Legacy material challenges grouped by similar hazards or issues (percentages are based on the overall estimated costs).

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4. DISPOSITION PROCESS

The LMDI will establish processes and procedures to safely, compliantly, and efficiently expedite the disposition process and find cost-effective solutions to the legacy material challenges that face ORNL. The LMDI has had success in dispositioning legacy materials because the LMDI team is "projectizing" its efforts through project planning and management, and integrating needed resources to efficiently accomplish the disposition of legacy materials. The disposition process includes the establishment of disposition teams that include a team lead, subject matter experts, health physics (HP) representatives, craft and labor resources, and Division and facility management representatives. Hazard analysis is performed at the beginning of the disposition process, and a project "kickoff" meeting is held to ensure that everyone understands their roles and responsibilities so that the work can be performed safely and efficiently. A key goal of the disposition process is to avoid procedural or compliance issues with legacy material clean outs, and to ensure "legacy contaminated" items are identified and managed appropriately. Efforts will be made during this process to optimize the potential for reusing or recycling non-contaminated legacy materials.

Excess materials, including chemicals and radioactive materials, will be evaluated for intrinsic value before declaring it as waste. Chemical items will be evaluated for intrinsic value as stated in LMDI Excess Chemical Campaign Project Plan. Those items declared as having no intrinsic value will be managed in accordance with the ORNL Standards Based Mangement System (SMBS) Subject Area, Hazardous and Mixed Waste Management, found at: http://sbms.ornl.gov/sbms/sbmsearch/SubjArea/Hmwm/HmwmSA.cfm.

Radiologically contaminated excess materials, equipment, and items having no intrinsic value will be managed as solid radioactive waste in accordance with the SBMS Subject Area, Solid Radioactive Waste Management, found at: http://sbms.ornl.gov/sbms/SBMSearch/SubjArea/radwaste/rwsa.cfm, and the ORNL Radioactive Waste Management Basis Document, found at: http://sbms.ornl.gov/sbms/sbmsearch/progdesc/rwmb/pd.cfm. According to these internal requirements, radioactive wastes must not be staged for more than 120 days from the date that 2109 waste form sets are completed and approved. Requests for extension to this accumulation time limit must be granted by DOE through the Laboratory Waste Services (LWS) organization.

4.1 BREAKTHROUGH SOLUTIONS

The LMDI Team is exploring and implementing breakthrough solutions to ORNL's legacy material challenges. Some of the solutions are identified in the following bullets.

- The LMDI has developed and implemented an inventory process that is integral to identifying legacy materials and potential disposition paths. The inventory process is essential to developing accurate cost estimates and scheduling work for the compliant management and disposition of legacy materials. The LMDI established the inventory process for legacy materials to provide a consistent method of identifying the location of legacy materials, potential hazards, disposition paths and resources needed. All legacy materials are included in the inventory and a unique barcode number is attached to the materials. The LMDI *"Procedure on Inventory of Legacy Materials"* can be linked to via the LMDI webpage at: http://eshtraining.ornl.gov/eshq/EPWS/EM_Program/Material_disposition.htm.
- The LMDI established campaigns for specific types of legacy materials to improve the disposition process and better utilize resources and reduce characterization costs by achieving an economy of scale. .
- The LMDI is investigating and will utilize technologies with potential to improve the disposition process or improve safety or security. For example, the LMDI purchased a mobile radiological

monitor and is testing the equipment and establishing processes with the goal to reduce manual radiological survey costs.

- The LMDI is establishing broad waste profiles with Envirocare and is reviewing other treatment and disposal facilities for future use to open up viable, cost-effective, alternative disposition pathways for the variety of legacy materials encountered at ORNL.
- The LMDI is investigating special waste disposal approaches with the State of Tennessee to increase the amount of legacy materials dispositioned at the on-site sanitary and industrial landfills.

The LMDI Team has already piloted and implemented some of these solutions, and continues to look for ways to improve the legacy material disposition process by:

- incorporating lessons-learned,
- taking into consideration DOE and ORNL missions,
- accounting for Division and Program needs, as well as
- integrating risk management, safety management, environmental compliance, and security requirements to reduce ORNL vulnerabilities.

4.2 RESOURCES

The LMDI Project Managers integrate resources and support required to successfully complete planned legacy material disposition activities. Required support and resources include:

- Division support (e.g., Operations Managers and researchers) to help identify legacy materials and provide process knowledge to help reduce disposition costs;
- Industrial hygiene and safety support from the Operational Safety Services Division to help identify job hazards and make recommendations for safe and effective material inventory, facility clean outs, and legacy material disposition;
- Legacy material inventory support to assist with the identification of legacy materials and the development of the project management base for compliant and cost-effective material disposition;
- HP and Radiological Control Technician (RCT) support from the Operational Safety Services Division to perform radiological surveys of material and support characterization efforts;
- Computer technicians and security experts to ensure that laboratory information and sensitive materials are not inadvertently distributed via legacy material disposition;
- ORNL Property Sales support to assist with the sale and salvage of uncontaminated items that have the potential for reuse or recycle (e.g., scrap metal, furniture, electronics, etc.);
- Subject Matter Experts to manage and support specific LMDI campaigns (e.g., vacuum pumps, gas cylinders, and excess chemicals);
- The EP&WSD Chemical Management Center support to assess chemicals found during facility clean outs and determine if chemicals can be recycled/reused internally at ORNL;
- EP&WSD/LWS support, including the assignment of EPO's/ECRs, GIs, GIEs and waste handlers for specific LMDI projects, and waste characterization and packaging support to prepare identified waste for safe disposition;

- EP&WSD waste certification and environmental compliance support to ensure that ORNL legacy material disposition complies with environmental and transportation requirements, as well as the waste acceptance criteria of the identified disposal facility; and
- Support from the Facility Management Division (FMD) Project Leads and various labor and craft personnel to assist with the preparation, breakdown, movement, loading, and transport of legacy materials.

The LMDI Program and Project Managers will manage legacy material disposition efforts for UT-B facilities and assist with the integration of LMDI and FRP plans, including the coordination of resources. Weekly staff meetings have been implemented with key members of the LMDI team. ORNL leadership and Division management are briefed regularly on the LMDI progress and identified legacy material challenges, and their recommendations are sought on the prioritization of legacy material disposition at ORNL.

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5. LMDI BUDGET AND SCHEDULE SUMMARY

Based on experience and information gained since June 2002, the initial LMDI cost and schedule estimate has been reduced from the initial $102.5 Million estimate to approximately $80 Million. This estimate reflects funding limitations expected through FY05 due to ORNL revitalization needs. The revised total estimated costs and schedule are summarized in Figure 8. The disposition of legacy materials still requires a multiyear effort to achieve ES&H vulnerability reduction, solve Division legacy material challenges, support the revitalization of ORNL, and safely disposition legacy materials.

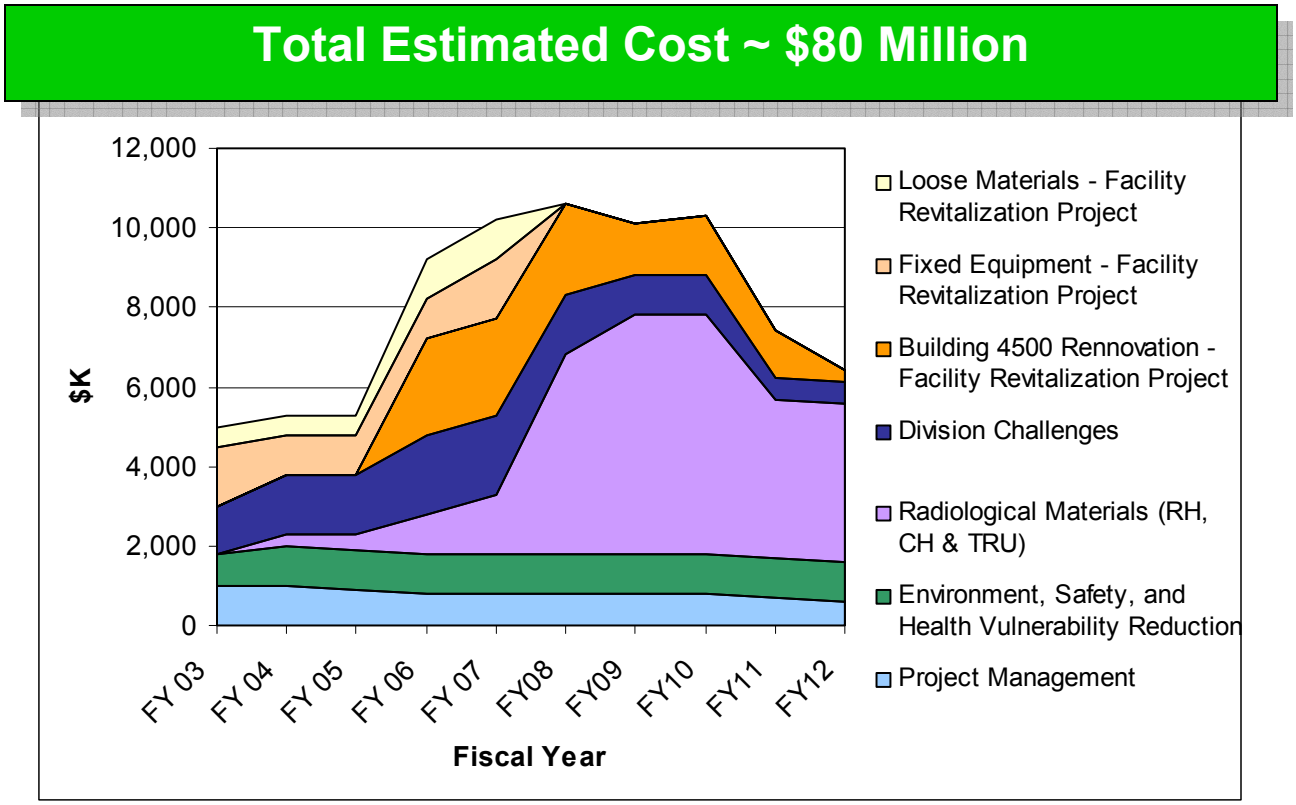

Figure 8. LMDI schedule and cost estimate summary

Table 6 summarizes the planned legacy material disposition activities for FY03 that are supported by available funding. The grand total of these efforts is $5,135,000, which on target with the estimated FY03 costs.

Table 6. Legacy material disposition activities and budget for FY03.

LMDI Funded Activities	**$K**
Y-12 Facility Clean Out Support: Initial 9204-1 Clean Out	547
ORNL Facility Clean Out Support: 1560, 2011, 3503, 4500S Attic, 7600, 2024	124
Legacy Gas Cylinder Disposition	174
Excess Chemical Campaign	166
Excess Pumps & Motors Campaign	502
4500N Attic – Wings 2 and 3 Chemical Sciences Division (CSD) Cage Clean Out (CSD priority and vulnerability reduction)	78
CSD legacy waste from B-25 boxes, attic clean out and lab clean outs	25
Legacy B-25 Box Moves – Strategic BJC Support	17
Legacy Contaminated Filters	11
Envirocare Profile Revision and Legacy Material Disposition	254
Legacy Challenge Assessment, Risk Management, LMDI Strategic Plan, and LMDI Information Management	118
Mobile Radiological Monitor	134
TOTAL	**2,150**
FRP Funded Activities	**$K**
9204-1 Fixed Equipment and Scrap Yard Clean Out	1,800
ORNL Facilities Clean Outs (2011, 2024, 2093, 3013, 7600)	400
Y-12 Facility Clean Out (9401-1, 9743-2, 9770-02, 9999-3)	140
Personnel/Facility Move Clean Outs (5510 and 5500 labs)	140
Y-12 Biology Complex Clean Out	100
TOTAL	**2,585**
Other Clean Outs	**$K**
Bethel Valley Hot Cell Initiative – Building 4501 clean out	400
TOTAL	**400**
GRAND TOTAL	**5,135**

Additional funds are needed to address LMDI and FRP high priority activities [i.e., top ten risk challenges based on risk score (Table 3)]. There are expected to be additional spending opportunities in FY03 if additional year-end funds become available. Each year a list of additional spending opportunities for legacy material disposition will be developed. Key factors for successfully managing any additional year-end funds for the efficient execution of legacy material disposition include:

- having enough lead time for adequate planning (e.g., inventory, job hazard analysis, work plans, etc.),
- having enough resources and materials available to do the work, and
- having enough time available to spend the allocated funds before the end of the FY.

6. CONCLUSION

Legacy material disposition reduces environmental vulnerabilities and improves workplace safety. The reduction/elimination of ORNL's legacy material challenges will require a multi-year effort and approximately $80 Million in funding. The LMDI has implemented a risk-based prioritization process to identify high risk legacy material challenges and establish a basis to allocate available funding.

UT-B management has taken a proactive approach toward legacy material disposition. During FY02, they approved more than $1.2 million for the disposition of legacy material from DOE SC managed facilities at ORNL. In FY03, UT-B management allocated approximately $2 Million in base funding for legacy material disposition. Over $5 Million will be spent in FY03 (includes base funding plus additional programmatic and overhead funds) for facility clean outs and legacy material disposition in UT-B managed facilities, which is on target with cost and schedule estimates for the LMDI.

This plan is considered a living document and will be updated annually to incorporate future plans and document completed actions.