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OAK RIDGE NATIONAL LABORATORY

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Reengineering of Waste Management at the Oak Ridge National Laboratory

Volume II

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T. E. Myrick

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LOCKHEED MARTIN ENERGY RESEARCH CORPORATION
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Reengineering of Waste Management at the Oak Ridge National Laboratory

Volume II

T. E. Myrick

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APPENDIX D

POLLUTION PREVENTION AND MATERIALS RECYCLING REENGINEERING PROCESS TEAM

Team Report

8 May 1997

INTRODUCTION

In accordance with the provisions of the charter of the Pollution Prevention and Materials Recycling Reengineering Process Team, the following report is issued and reflects the opinion of the majority of the team. Eighteen primary recommendations/areas for improvement were identified. Those items are listed together in the "Primary Recommendations" section. The Team was also tasked with identifying primary waste steams, waste management costs currently incurred by the generator, benchmarking information needs and potential barriers to reengineering implementation. The findings associated with each of these tasks are identified in corresponding sections.

PRIMARY RECOMMENDATIONS

The primary recommendations of the Pollution Prevention and Materials Recycling Reengineering Team follow. Several of the recommendations warranted further explanation. In those cases, corresponding attachments are referenced.

1) Revamp the Solid Low-Level Waste Program *(Attachment A)* to include the following key points:

   a) SLLW pickup by WMRAD on a *per item* basis.
   b) Internally institute a category of SLLW called "reducible waste."
   c) Institute a "store for decay" policy for SLLW containing short-lived isotopes.
   d) Develop (or purchase) a facility for automated checking of small items for radioactive contamination.

2) Reduce the amount of sanitary waste generated by the ORNL Cafeteria. *(Attachment B)*

3) Develop a simple and logical protocol for the disposition of waste electrical wiring. *(Attachment C)*

4) Establish a central facility for collection recyclable materials. *(Attachment D)*

5) Create an active, aggressive program to reduce the current excess chemical inventory and keep the future inventory as small as possible. The ideal program should include one or all of the following:

   a) A" purge team" that will reduce the current inventory of excess chemicals and equipment at the Lab. *(Attachment E)*
   b) A virtual Between Use Storage (Bus Stop) for utilizing excess chemicals. *(Attachment F)*
   c) A Centralized Chemical Stockroom to better utilize all chemicals, to permanently reduce the Lab's chemical inventory, and to make chemical acquisition and disposal easier and cheaper for researchers. *(Attachment G)*
   d)A link between the AVID and HMIS systems that would alert generators ordering chemicals to the availability of identical chemicals.

6) Evaluate the performance measures and best organizational structure and placement for the Pollution Prevention Department and . *(Attachment H)*

7) Emphasize and expedite research on improved methods of ion exchange column

regeneration at the Process Waste Treatment Plant to decouple the process waste system from the LLLW system and therefore eliminate the largest LLLW flow into the system.

8) Implement a policy to reuse drums on-site or sell them to others for reuse. Since the beginning of 1996 over 687 steel drums and 36 plastic drums have been discarded as waste. (This issue is currently being worked by the Property Management Section of the Administrative Services Division.)

9) Emphasize need for change in policies concerning gas cylinders. Used gas cylinders are currently being delivered and used in non-radioactive areas and then are found to be radioactively contaminated when checked by local radiation protection personnel before return of the cylinders to the vendor. These cylinders are obviously contaminated upon receipt by the user, who then becomes responsible for their decontamination or disposal. This is a significant expense to the cylinder user that is unfairly imposed upon them.

10) ORNL needs an onsite filtration system to purify used oil for onsite reuse, or at least a recycle contract to eliminate the need for disposal of used oil. The stream should be collected and managed centrally to reduce analysis and other management costs. (This issue is currently being worked by the Property Management Section of the Administrative Services Division.)

11) Encourage the distillation of used solvents on a laboratory scale for reuse. This must first be negotiated with state regulators.

12) Materials procurement at the Lab needs to be controlled with an eye toward the future disposal of those materials, rather than allowing anyone at the Lab to obtain any material in any quantity they want with no regard to future disposal problems or costs.

13) The Lab needs a strong advocate to negotiate for it, **representing its needs**, when dealing with regulators and regulatory issues which involve waste disposal, salvage, or recycling.

14) There needs to be conformity and continuity in recycling programs. These programs are currently confusing with a variety of differing contracts, regulations, and contact points. All recycling contracts should be implemented via the P2 Department to ensure that P2 personnel are aware of the program and how it is run. The P2 Department could therefore act as a central point of contact to disseminate information on all recycling programs. Recycling programs must be both easier and cheaper than waste disposal for the programs to be effective. Collection bins for recyclables need to be plentiful and convenient and emptied often.

15) Generators need to be made aware that they are going to be charged for WM services in the future so that they can begin implementing cost-saving procedures now - especially recycling.

PRIMARY RECOMMENDATIONS (CONT.)

Clear and concise recycling and salvage materials guidelines need to be established and published.

16) HP green tag procedures need to be clear and totally understood by every HP at the Lab. Lab-wide procedures for green-tagging should be followed and used so that it is possible for clean materials to be tagged as such. It should be recognized that HP technicians provide a *service*, much as analytical chemists do, in the waste disposal process. The widely recognized feeling among waste generators, waste certifiers, and radiation protection personnel is that their signature on a waste form means that they are opening themselves up to later liability. The perception is that the Company will use this signature as a means of "going after" the signatories in the event that problems surface at a later date. Company policy should be to support those who sign documents in good faith using approved procedures and best available knowledge and technology.

17) Laboratory policy should prevent personnel from retiring or leaving the Lab without first arranging for the disposition of their chemical inventory (and legacy waste).

18) The current pollution prevention charge back tax program should be eliminated because:

a) It costs a great deal of money (approximately 33% of the revenue generated) to collect the tax to cover accounting costs, etc., and,

b) Charge numbers for collecting the tax are frequently invalid due to the lag time between project conclusion and waste disposal.

A potential replacement would be a program that taxes incoming items (chemicals, equipment, etc.) as they are purchased and makes the tax proportional to disposal costs. Advantages are that the charge number will be good, the tax per item will be lower since more items will be taxed, and personnel can be encouraged to buy materials which can be recycled more. Revenues can be used to fund P^2 projects and to reward individuals/projects that go "above and beyond" in P^2 areas.

IDENTIFICATION OF PRIMARY WASTE STREAMS

David Wasserman of WMRAD conducted a detailed evaluation of the wastes generated by ORNL in CY 1996. He prioritized these wastes based on quantity, process and disposal point. Attachment I contains the detailed prioritization. The following were classed as "priority wastes."

SLLW	Personal protective equipment Rad. Contaminated equipment
RCRA	Excess chemicals Lead slag from melting pots Fluorescent and incandescent light bulbs Chrome plating tank waste Hydraulic oil Solvents
TRU & SLLW	Radiochemical processing trash
TSCA	Fluorescent ballasts and fixtures

The streams have not yet been analyzed to see if there are potential areas for improved management.

GENERATOR COSTS

The subteam determined waste management costs currently charged to the generator. Spirited discussion of the endless variables associated with these costs led to the following generalized costs:

- In a best case scenario (generator knows what the waste is and where it came from, can characterize it with process knowledge, and WMRAD picks it up in a timely manner), the cost to a generator for "turning over" the waste to WMRAD can be as low as $100. Approximately 90% of the hazardous and mixed wastes generated at ORNL fall into this category. With 3,200 items generated in CY 1996, it is estimated that ORNL generators spent **$288,000** in waste management related costs.

- In a worst case (legacy waste, no knowledge of hazardous or radioactive constituents, have to characterize using sampling and analysis, long delay before waste is picked up leading to high storage and management costs), just the sampling costs can easily reach $5000 and total costs can approach $10,000. Unfortunately, in many divisions, this scenario is the norm rather than the exception. The additional 10% of hazardous and mixed wastes fall into this category. Assuming an extremely conservative estimate of $1,500 per item, ORNL generators incur approximately **$480,000** in charges per year for these types of items.

- Harold Hall of WMRAD conducted interviews of several generators and waste certifiers to establish generator costs for SLLW. He established and average of $4,000 in generator costs per B-25 containing approximately 30 items. Considering 9,350 items submitted to WM in CY 1996, the estimated cost to generators is **$1,247,000**.

QUESTIONS FOR BENCHMARKING

The Team identified the following questions/areas of interest to be explored during benchmarking opportunities:

- How do other facilities handle their "suspect waste?" Suspect waste is a very large issue at ORNL and whether it is handled as radioactive or "clean" waste has a huge impact on the amount of SLLW disposed.
- How is "process knowledge" handled at other facilities? Is a two-page form like we have really necessary? Does it add any value?
- Methods/techniques of chemical inventory control.
- Cultural change...how to make it happen.
- Cost gains...what has worked and what hasn't.
- Determination of what waste is hazardous and what isn't...who makes the decision? This has to be clearly defined before P2 can be effective.
- Recycle contracts...who does what? One person? A team?
- What materials do other sites recycle and how do they do it? Particularly used oil (motor oil, vacuum pump oil, diffusion pump oil) and solvents.
- Who does the actual separation of sanitary waste for recycle...the generator, the janitor, a waste handling group?
- How are P2 projects funded?
- Do other sites have a decontamination facility? Is it worthwhile? Who funds it? Is it a centralized facility?
- Salvage and readiness issues...are these dedicated jobs or a divisional cost?
- Is there an easier (cheaper) way to establish the presence or absence of PCBs? Common sense needs to apply - especially in the case electrical wire, which ORNL considers as PCB waste.
- Is there any way to keep employees from bringing in prohibited items on their own? Example - WD-40.
- How to manage short-lived isotopes. ORNL considers them the same as any other rad waste, which is very expensive and inefficient.

BARRIERS TO IMPLEMENTATION

This team recognizes the following as barriers to implementation of its recommendations:

- Lack of a willingness to make decisions at all levels of Laboratory management

  - The Laboratory needs to provide clear and concise high-level guidance with regard to waste policies and needs to support workers who follow these policies in the event problems with the waste are later found.
  - Coordination between the various departments involved in waste disposal must occur, with the departments coming under a common manager who provides strong leadership and is capable of resolving conflicts.
  -The Laboratory needs strong, knowledgeable negotiators to deal with federal and state regulators.
  -Laboratory management must never lose sight of the reason for the Lab's existence - research - and must constantly strive to make it easier to conduct research. This attitude must permeate the service organizations, such as waste management. They should strive to become active, constructive members of the research process and should be rewarded for doing such.

- The Office of Environmental Compliance and Documentation needs to make itself known to researchers at ORNL as an ally to them in solving environmental issues and concerns and should never be perceived by researchers as a threat or an adversary.

  > "If the standard for safety is 10 ppm and I say my standard is 5 ppm even though it may cost millions of dollars extra to meet that unnecessary standard, we've set a hurdle that represents an unwarranted expenditure of federal funds. We need to think more like taxpayers in that respect. They are the ones who bear the brunt of malicious or idiotic compliance." *Dr. Alvin W. Trivelpiece*

- The lack of acknowledgment of the presence or existence of suspect radioactive waste (what this Team is calling "reducible" waste) which can be separated into "clean" and "hot" streams. This is currently leading to the inefficient use of valuable waste disposal/storage facilities.

- Union issues which promote inefficiency and high costs. These issues especially affect sanitary waste disposal.

- DOT regulations - the Lab does not need to comply with them on local roads that are not used by the public.

- Personnel making policies or decisions regarding waste disposal should be accountable for those decisions. The source of all policies should be known. No anonymous decisions should be allowed to be promulgated.

- DOE restrictions are often a serious impediment to efficient and logical waste disposal policies with no apparent benefit to the public or the environment. For example:
  - DOE Order 5820.2A, which requires that a "performance assessment" be prepared for all SLLW disposal sites. This assessment includes a hypothetical "intruder scenario" which severely limits the waste which can be sent to the IWMF.
  - DOE Order 435.1 (currently in draft form) will effectively shut down SWSA 6 for waste disposal, leaving only NTS as a disposal option which cannot be used due to apparently unsolvable political ramifications.
  - DOE distinction between "defense" and "non-defense" waste may eliminate WIPP as a disposal site for TRU waste.

ATTACHMENT A

Solid Low-Level Waste Management

Current Status

The current SLLW disposal system requires generators to dispose of all waste which has any possibility of being even slightly radioactive as SLLW, including waste containing very short-lived isotopes. All of this waste must currently be segregated as to its waste type, bagged, characterized as to its radioisotope content (even if no radioactivity can be detected), and placed in B-25 boxes by the generators. WMRAD then picks up the B-25 boxes. Short-lived isotopic waste must be characterized, handled, and packaged as SLLW even though the radioactivity is essentially gone from decay of the radioisotopes by the time the waste is actually disposed.

Proposed

The Proposed program has several key points, those being:

1) Generators will no longer be required to pack their own B-25 boxes. Generators will continue to segregate their waste and but will package it for pickup by WMRAD on a *per item* (package) basis. WMRAD will be responsible for placing the waste items in the B-25 boxes.

Advantages:

- Reduction of the number of active B-25 boxes at ORNL from the current number of 400 to 40 or less.
- Greatly reduced amount of space taken up at generator facilities by accumulating waste for B-25 boxes and by the boxes themselves.
- Improved packaging of boxes since WMRAD can package similar types of waste and ensure that all B-25 boxes are full before going to storage or treatment facilities.

For this to be effective, WMRAD must pick up waste items in a timely fashion to avoid generators having to devote valuable laboratory space to waste staging activities.

B-25 boxes for construction projects or large volume generators would remain available.

2) The category of "reducible waste" should be instated. Reducible waste is potentially radioactive waste (or waste from contamination areas) with undetectable amounts of radioactivity. This waste will not have to be characterized by generators for pickup by WMRAD; generators will be required only to list the isotopes capable of being present.

Advantages:

- Huge cost reduction to generators currently trying to obtain isotopic characterization on non-existent amounts of radioactivity
- Probable **70-80%** reduction in the volume of SLLW by checking reducible waste at an automated waste checking facility which will ensure that only waste that is actually

radioactively contaminated is disposed as such. The waste determined to be "clean" at the checking facility can then be recycled or disposed as sanitary waste.

It should be noted that the category of "reducible waste" will exist only at the Laboratory. All waste initially categorized as reducible will be determined to be either "clean" or "contaminated" before final disposition.

3) Implement a facility to check reducible waste to divert as much of it as possible to the "clean" waste stream. This facility should also be capable of decontaminating large items and removing contaminated portions of otherwise clean waste items.

4) A "store for decay" policy for SLLW containing isotopes with short half-lives should be instituted. This policy states that SLLW containing only short-lived isotopes (half-life < 65 days) can be stored for decay for a period not less than 10 half-lives and then disposed as non-radioactive. This is the legal store-for-decay policy which is practiced by hospitals and other research institutions.

Advantage:

- This policy would eliminate approximately 12 B-25 boxes per year of SLLW and greatly reduce the amount of paperwork and time spent on waste disposal by generators of waste containing short-lived isotopes.
- The four-person Nuclear Medicine group estimates that a store-for decay policy would eliminate three B-25 boxes of SLLW annually just from that group. This would save the group about **$31,000** annually (5% of its annual budget).

5) Researchers who receive funds for a project which includes funding for waste disposal must set those funds aside for that purpose, preferable under an account with a different charge number than the rest of the project.

Cost Savings

- Assuming that management of incinerable and compactible SLLW in the previously mentioned manner would result in a 20% overall reduction in SLLW generated at ORNL, generators alone would realize a savings of **$275,000** per year. Using the average DOE Management cost of $1,600/m^3*, the Team estimates that **$340,000** could be saved in treatment costs (from the elimination of 213 m^3 of SLLW).

- It is more difficult to determine an estimated savings for partially contaminated noncompactible materials. The volume reduction would be approximately 200 m^3. Using the same DOE average, the Team estimates **$320,000** in savings, for treatment alone.

- Because ORNL is doing very little in the area of volume reduction for SLLW, it is difficult to determine the cost for such a program. A detailed analysis would be required to establish those costs. Only then could a true savings be projected.

* Source: Avoidable Waste Management Costs, INEL-94/0250, January 1995

ATTACHMENT B

Reduction of Sanitary Waste from the ORNL Cafeteria

Current Status

ORNL has two fresh food service areas, the Canteen in 4500S, and the Cafeteria in 2010. These two areas produce sanitary waste from food preparation activities, service, and consumption, including:

- organic waste from food preparation
- bi-metal cans, cardboard boxes, and 1 gallon plastic jugs from bulk food
- glass bottles from individual fruit juices
- small plastic bottles from individual milk containers
- large quantities of Styrofoam and clear plastic from containers and cups.

Cardboard and aluminum cans are currently being recycled at the main cafeteria. Aluminum cans are recycled in 4500S. A more detailed breakdown of the plastic, paper, and Styrofoam wastes are attached to this document in Table 1.

Neither the main cafeteria nor the Canteen offers discounts for using personal cups.

Recommended Reduction Plan

1) Since the majority of ORNL's cafeteria waste is from disposable paper and Styrofoam products, the best way to reduce this waste stream is to eliminate, where possible, the use of disposable products. This can be done by:

- giving employees a discount on drinks purchased in their own reusable cups,
- replacing cardboard trays at the Canteen with permanent plastic trays,
- replacing disposable cups at the cafeteria with washable cups, and
- beginning composting of organic waste from both the cafeteria and the Canteen.

2) Other waste streams can be greatly reduced by implementing common recycling practices such as glass and scrap metal recycling. A detailed list of waste reduction options is included in Table 1.

3) Policy changes that encourage the use of reusable dishes should be implemented. An example would be to offer discounts on all carry-out food that is purchased in personal reusable containers. Another example would be to place a surcharge on all Styrofoam products.

Advantages of Implementation

- From preliminary investigations, the phase-out of disposable dishes will be cost effective for the laboratory. The return-on-investment period is estimated to be between six months to one year. Estimates have been made to establish costs savings (see Tables); however, a more in-depth cost analysis needs to be done before a precise return-on-investment period can be established

- The most important advantage of this plan is the reduction of sanitary waste generated. An estimate of the percentage of waste that will be reduced with implementation of this plan is a minimum of 50% (See Tables for details).

Barriers to Implementation

- The major barrier to the implementation of this plan will be the attitude of ORNL employees. Making this, or any recycling effort, work requires effort from every employee, not just food service employees. If an employee chooses to get food to go, the responsibility of caring for a personal reusable dish will fall on the individual. A dish service, much like a towel service at gyms, could be investigated to eliminate this problem.

- Staff at both facilities view themselves are very busy. An added work load may cause resistance, especially in areas where the work needs to be performed during cafeteria hours. This may include cashiers who may be asked to give discounts, servers who will have to serve into varying types of containers, etc. This type of barrier will be individual and job specific.

- Resistance may also come from management at the Canteen. The Canteen does not have dish washing facilities, therefore all reusable dishes or trays will have to be ferried back and forth between the Canteen and the main cafeteria. While this will add labor time to both facilities' budgets, the Canteen already receives supplies and food on a daily basis from the main cafeteria. The dishes can be added to the already existing transportation route.

ATTACHMENT C

Electrical Wiring Disposition

Current Status

In the past, Plant and Equipment (P&E) Division personnel have collected and disposed of all waste electrical wiring at ORNL. Now that all electrical wiring is being treated as suspect PCB waste, both P&E and MK Ferguson have been forced to leave old electrical wiring from building maintenance projects for personnel in the building to dispose. Unfortunately, they cannot dispose of it either, since 1) no guidance is available on how to differentiate between PCB and non-PCB wire, 2) no disposal alternative for waste electrical wire currently exists, and 3) no one in Laboratory management seems to be working the issue or determining what the policy on wire disposal will be. This situation has existed now for over two years. Therefore, waste electrical wiring continues to accumulate around the Laboratory.

Proposed

The ORNL Office of Environmental Compliance and Documentation has to take on this issue and resolve it as quickly as possible. Years of inaction have turned this into a frustrating issue for many Laboratory employees.

Recommendation

A simple and logical test for determining if electrical wire is PCB contaminated would be that if the wire is oily or sticky, it is PCB, and if it is not, it is not PCB. Oily/sticky waste electrical wire would then be managed as PCB waste and non-oily wire would be recycled. As a worst case, management must at least make a decision that all electrical wire is PCB so that it can be disposed as such.

Cost Savings

The only cost incurred for the management of wire at ORNL at this time is associated with "stashing it where ever you can find a place"; therefore, it is not reasonable to try to associate a cost with this activity. It is logical to assume that if the problem is not solved soon, ORNL could see a duplicate "scrap metal yard" for wire.

ATTACHMENT D

Recycle of Glass, Wood and Wood Pallets, and NiCad Batteries

Purpose

The purpose of this recommendation is to eliminate the disposition of glass and wood products as industrial waste and the management and disposal of Nicad batteries as hazardous waste.

Current Status

At present, wood products, including pallets, are either burned by ORNL staff on-site or are disposed of at the Y-12 sanitary landfill. Wood products are generated at the rate of approximately 2000 cubic yards annually, which includes approximately 2000 wood pallets.

Glass is presently collected in 6 cubic yard dumpster containers for disposal at the Y-12 landfill. Approximately 60 cubic yards of glass are disposed of annually.

At present, approximately 55 gallons of Nicad batteries are collected and disposed of by P&E and I&C Divisions at ORNL annually. These batteries are managed and disposed of as hazardous waste.

Proposed

It is recommended that a central collection point be established to receive wood products, glass, plastics, and other potential recyclables. Recycle or sales contracts or off-site users should be identified for each stream.

Cost Savings

Estimated savings for managing these streams as stated above would be less than $10,000 per year, but it would cost ORNL much less than that to implement the proposed program.

ATTACHMENT E

The Purge Team

Purpose

The purpose of the Purge Team will be to avoid future costs associated with the handling, packaging, and final disposition of excess chemicals and equipment in anticipation of limited and decreasing funding opportunities for R&D programs at ORNL.

Background

ORNL has been in existence for over 50 years. It is, and always has been, a R&D institution. Although the role and mission of ORNL has changed numerous times, its core strength has always relied heavily on scientist and engineers engaged in basic and applied R&D. As a result ORNL houses several hundred laboratories, each having its own unique identity and history. Each laboratory has been supported by numerous programs, which have come and gone, and as a result been used by various and numerous researchers, guest scientists, co-op students, etc. Due to the continuous transition of programs and personnel in and out of these laboratories it is anticipated and assumed that each laboratory probably contains variable quantities of excess chemicals and laboratory equipment. In many cases, it has been easier to find a place to stash the items rather than dispose of them; therefore, ORNL attics and storage rooms have become "graveyards" for defunct equipment.

Method of Accomplishment

All Division Directors will be briefed on the purpose and the objective of the Purge Team program. Participation will be voluntary. Divisions will submit a list of laboratories that choose to participate in the program. Each laboratory that chooses to participate in the program will provide a brief description of current activities, and provide a brief list of known excess chemicals and equipment. The purpose of this description and list will be to determine if "clusters" of laboratories exist with similar activities and/or excess items. This "cluster" analysis will be performed to assess if the Purge Team activities can be expedited, made more efficient, and to determine if economies of scale can be achieved. Once this assessment is made, a schedule listing all participating laboratories will be made based on geographical location and/or the "cluster" assessment. Laboratories will be notified one week advanced of the Purge Team's arrival and will be given other pertinent instructions at that time.

Resource Requirements

The Purge Team will be comprised of at least two full time equivalents and not more than three. If time constraints exist multiple teams can be used. A staging area will be required for disposition of excess items. One suitable transport vehicle will be required per team. Plant and Equipment labor will be required to manage excess equipment. One half time equivalent will be required for data base maintenance and preparation of mock billing invoices (see below).

Disposition of Excess Chemicals and Equipment

Disposition of excess items will be accomplished primary by using the three different approaches described below:

> Internal Disposition:
> Means of internal disposition will be sought first. Many organizations within ORNL may have a need and/or be able to use the excess items collected. For example; the Liquid and Gaseous Waste Operations Department would be able to use excess nitric acid, sulfuric acid, acetic acid, oxalic acid, and sodium hydroxide, to mention a few.
>
> External Disposition:
> After exhausting internal disposition means, external disposition means would be sought. For example, excess chemicals would be transferred to qualifying organizations such as high school chemistry laboratories.
>
> Off-site Disposition:
> Off-site disposition of excess chemicals would only be used for chemicals remaining after using the two approaches described above. Excess equipment will be moved to a central Plant and Equipment location so that it can be readied for disposal or sale.

Mock Billing (Handling/Packaging/Disposition)

Within a week, after purging excess items from participating laboratories, a mock bill will be delivered to the appropriate Division Director itemizing handling, packaging, and disposition charges for performing this service. The purpose of this mock bill will be to illustrate to Division Directors and their research staff the magnitude of costs that will be incurred by them to dispose of similar waste in the future.

The duration of this activity is anticipated to last anywhere from two months to two years depending on the degree of participation and the success of implementation.

Cost Savings

A detailed cost analysis would need to be performed before this option could be implemented. It is, however, a logical solution to a growing problem and one can assume that a centralized team of people with the right contacts and facilities could conduct this activity much cheeper and more effectively than hundreds of individuals.

ATTACHMENT F

Virtual "Bus Stop"

Current Status

Researchers occasionally only need a small amount of a chemical to perform an experiment. Currently, they request a HMIS search from their division representatives or informally contact coworkers to find a supply. Several researchers have requested direct access to HMIS to gain this information. Divisions are generally leery about giving everyone access to HMIS and are seeking ways to give staff read only capabilities.

Proposed Action

Items can be identified on HMIS as excess for reuse. A link should be made between HMIS and AVID in the read only mode. A researcher or someone in purchasing would automatically be referred to excess items on the HMIS inventory so that they would be a ware of the item's availability before purchasing a new container.

Advantages

- Saves researchers money by informing them of a potentially free source of chemicals.
- Reduces chemical inventories by as much as 75%.
- Requires only computer support. No safety concerns.

Disadvantages/Barriers

- HMIS inventory is not always current. There are too many people charged with the task of keeping these inventories current. The range of accuracy is very large.
- Researchers are leery about identifying chemicals as excess. They have been told that identifying a chemical as such starts a regulatory clock, requiring disposal within a specified time.
- HMIS is often very difficult to search. Identical items may be entered under several different names or RECIDs. Chemicals are not entered in accordance with standard laboratory nomenclature.

Cost Savings

See savings for Central Chemical Stockroom

ATTACHMENT G

Centralized Chemical Stockroom

Purpose

To establish a new system that offers a better way to track chemicals and a novel way to keep leftover chemicals out of the waste cycle by offering the surplus to alternate users.

Background

Currently, users purchase chemicals by outside purchase requisition or through AVID. The result is a large quantity of excess chemicals with no place to go but disposal. Lawrence Livermore National Laboratory (LLNL) was facing the same problems ORNL is now when they started a Chemical Exchange Warehouse (CHEW). The CHEW identifies and stores surplus chemicals that are made available for use upon request. After set times in storage, the chemicals are offered to offsite organizations or disposed off through an adjacent waste storage area.

Proposed Action

Create a central chemical acquisition facility. This facility would handle all chemical acquisition and dispersal. The acquisition facility would operate as a pharmacy style dispensary with a counter for walk in customers, as well as a delivery service. All requests would come to the facility and be filled first from chemicals in stock. If the desired chemical was not available, the order would then be filled from outside sources. Upon receipt of new chemicals from outside sources, all containers would be barcoded, assigned to a user, labeled appropriately (if needed) and delivered to the user. Surplus would be sent back to the facility.

The first phase of this project would include working with each division to purge its inventory of all excess chemicals. Additional services would be gradually phased in.

Advantages

- Reduced divisional inventories, thus reduced compliance issues and reporting requirements.
- Reduction of legacy waste and unknowns.
- Reduced waste costs.

- Improved tracking.

Barriers

- A suitable facility will have to be made available that can house the inventory as well as a 90-day RCRA area.
- Not just anyone could manage this area. Highly qualified operators will be necessary to complete the tasks and to gain the respect and support of the research staff.
- The DOE, OECD, and TDEC will have to buy into this plan from the very start in order to keep the excess chemicals for the length of time necessary. The value of "exotic" and/or expensive chemicals must be recognized and incorporated into operating procedures.

Cost Savings

Since it started in November of 1993, CHEW has saved LLNL $750,000. A similar program at Los Alamos National Laboratory has saved that Lab $180,000 in purchasing costs alone in its first year. LANL estimates that with increased use their stockroom could save the Lab as much as $360,000 per year.

ATTACHMENT H

Pollution Prevention Program Organizational Recommendations

Purpose

To maximize the effectiveness of the Pollution Prevention Program goals of reducing waste generation, avoiding costs/saving money, creating plant-wide cultural awareness and promoting the purchase of recycled and environmentally friendly products.

Current Status

The Program is currently a Lockheed Marin Energy Systems EMEF organization. The ORNL Program is a portion of the reservation-wide program funded by EM-70 and is matrixed to ORNL's WMRAD. It is currently supported by two Lockheed Martin staff and several subcontractor staff.

Proposed

Because the future organizational structure of WM at ORNL is unknown, the Pollution Prevention Process Team will not recommend a specific organizational location for the Pollution Prevention Program. The Process Team does recommend that the funding and staff be transferred to ORNL and that a matrixed relationship be maintained to the remainder of the reservation's Pollution Prevention Program to continue the economies of scale from managing certain reservation programs (HiVal and the computerized project tracking system).

The Process Team offers the following suggestions for the location of the Pollution Prevention Program:

- The Program should be in a position to interact daily with generators. The members should be active participants of the NEPA review process and in negotiations for subcontracts where waste is a concern.
- It should be close to the organizations that require its services in reporting.
- The Program should be in the best position to manage recycling programs. It should be charged with coordinating the recycle contract process from the identification of opportunities to completion.
- It should be in a position that will ensure visibility and priority for the Program's goals.
- The position should be chosen to maximize the potential for multiple funding avenues.

- The position should allow ORNL management to emphasize that the program is a Lab program and a team effort rather than the responsibility of a hand full of people.

This Team also suggests that the following be implemented into the Pollution Prevention Program:

- P2 performance measures for ORNL should not be based on the reduction of waste by quantity. Instead, viable areas for improvement should be identified and performance tracked against ORNL's ability to implement solutions.

- The P2 program members should be active participants in identifying and assigning disposal endpoints. We should be choosing disposal endpoints because it's the right thing to do, not just the easiest.

- The P2 program should make an effort to dispel the idea that all Waste Management does is "take out the trash." Everyone associated with waste management at ORNL should begin to think of themselves as "resource managers" and quit drawing the line from generation straight to disposal. "One man's trash is another man's treasure."

ATTACHMENT I

POLLUTION PREVENTION AND MATERIALS RECYCLING REENGINEERING TEAM CHARTER

The Pollution Prevention and Materials Recycling Reengineering Team is a subcommittee of the Waste Management Program Reengineering Team. It is tasked with evaluating the current related ORNL programs and providing the Core Team with recommendations that will afford ORNL cost-effective, compliant and generator-friendly programs that are consistent with maintaining a viable Laboratory research mission. The Subteam approach will include the following:

- Identification of primary waste streams that have the greatest potential for improved management. This evaluation should include identification of areas where technology improvements are appropriate and feasible.

- Identification of waste management costs currently incurred by the generator.

- Evaluation of existing organizational structures and recommendations for improved performance. Recommendations should be made that would allow the program to affect a cultural change and make pollution prevention and materials recycling crucial parts of waste management at ORNL.

- Evaluation of the magnitude of the current chemical inventory and recommendations for reducing said volume where appropriate.

- Recommendations for the development of an effective program that reduces the generation of radioactive wastes and minimizes the volumes that need to be treated and/or stored after generation.

- Evaluation of the current pollution prevention generator chargeback tax program.

- Identification of benchmarking information needs. Utilization of benchmarking data obtained by Core Team in developing recommendations.

- Identification of barriers to reengineering implementation.

Weekly updates on the teams progress will be made to the Core Team. The subteam recommendations will be provided to the Core Team by April 7, 1997.

The makeup of the Pollution Prevention and Materials Recycling Subteam will include, but is not limited to (1) a team leader who is from an operating division, (2) a member of the Core Team, (3) the WMRAD Section Manager for Pollution Prevention, (3) WMRAD technical advisors, (4) the ORNL Property Utilization Manager, (5) waste generators and (6) and Plant and Equipment Division representative. Other generators, technical advisors, ES&H representatives and industrial representatives may be consulted as needed.

POLLUTION PREVENTION AND MATERIALS RECYCLING SUBTEAM MEMBERSHIP

Team Leader	John Parrott, CTD
Core Team Champion	Kim Thomas, CASD
Facilitator	Available party
WMRAD Section Manager	Susan Michaud
WMRAD Technical	Jeff Baldwin
WMRAD Technical	Harold Hall
Waste Generator	Marie Williams, M&C
Waste Generator	Randy Burnett, ETD@Y-12
P&E Representative	Jim Hackworth, P&E
Property Utilization Manger	Anna Martin
Industrial Representative	Melissa Green

APPENDIX E

Report on Reengineering Waste Certification/ Verification

May 21, 1997

Prepared for:

Oak Ridge National Laboratory
Waste Management Reengineering Team

by:

The Reengineering Team on
Waste Certification/Verification

OAK RIDGE NATIONAL LABORATORY
MANAGED BY LOCKHEED MARTIN ENERGY RESEARCH CORPORATION
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Date: May 21, 1997

To: Mr. T. E. Myrick, 1000, MS-6296, 1-4597
Chair, ORNL WM Reengineering Team

cc: Karl Haff, Ron Auble, Dale Caquelin, Don Gregory, Joe Knauer, John Norman, Bob Orrin

From: J. A. Chapman, 7824, MS-6388, 4-5729

Subject: Submittal of Reengineering Report on Waste Certification/Verification

On behalf of my colleagues on the waste certification and verification reengineering team[1], it is my pleasure to submit the enclosure,"Report on Reengineering Waste Certification/ Verification." We have addressed, to the best of our ability, the comments of the reviewers: Nancy Dailey, Marv Poutsma, Mac Roddye, and you. Major improvements to the report are: modifications of the illustrative waste certification models to reflect implementation of the existing GIG team, and placement of eight recommendations in the executive summary. If you have any questions, please do no hesitate to call Karl Haff or me.

enclosure: "Report on Reengineering Waste Certification/ Verification," May 21, 1997.

[1] Karl Haff, Ron Auble, Dale Caquelin, Don Gregory, Joe Knauer, John Norman, Bob Orrin

EXECUTIVE SUMMARY

The reengineering team on waste certification/verification evaluated and prioritized waste certification issues in order to recommend measures that will ultimately improve the process. Waste certification (WC) is a process that integrates a number of subtasks. As a result, the collective thinking of the process should be re-evaluated once each of the "reengineered" subcomponents is put into place and operating efficiently. Re-evaluation is a recurrent process that should continually focus on minimizing duplication, streamlining data collection and management, and building synergism between subcomponents. As part of this new system, our vision is one encapsulated in the following major recommendations:

1. **Develop a WC Model**
   Reorient Waste Management at ORNL to embody a system in which ORNL becomes the one single generator with the research organizations being the customer of the Waste Management service organization. This should enable the laboratory to consolidate what are today considered as individual waste streams into broader "ORNL waste streams" that are then <u>certified by the laboratory</u> prior to disposition. Section 2 describes the process and the subtasks we believe should be performed by WM. Figures 2 and 3 illustrate the concept of model building (current and proposed).

2. **Adopt our Proposed WC Model**
   We fully support and endorse the waste certification improvements developed and implemented by the ORNL Waste Certification Team (Daily et. al.). The concept of a Generator Interface Group (GIG) is an excellent idea and will certainly streamline waste management operations for the researcher divisions. The existing model, however, still places the most important[1] and difficult certification step in the hands of the researcher: characterization. Without a consistent, verified, and validated approach to characterization, the laboratory incurs an unknown business risk of or vulnerability to <u>undetected miscertifications.</u> A recommendation of the characterization team, to perform a systems analysis of the existing WM program, will ferret out inadequacies or inconsistencies in approach and thus streamline tasks and responsibilities. We concur with the waste characterization subteam that a systems approach to waste management should be adopted. This approach should identify specific waste streams <u>at the source</u> that will be destined for specific disposal sites. Waste characterization, packaging, and/or treatment issues should specifically address the off-site waste acceptance criteria. Critical issues should be separated from non-critical issues, for example, what isotopes are important or what items are forbidden.

3. **Validate the WC Process**

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[1] DOE G-435.1-5 part C

The waste certification process should be validated through assessments and audits in order to insure that the process is being followed and implemented as delineated by laboratory policy, action plans, and procedures. Validation assures that the certification program is in order and that it is being implemented. However, the fact that the certification plan/process has been validated does not necessarily provide any degree of confidence about the certification of any individual container. As pressure continues to push more waste to off-site repositories, certification of individual containers will become much more important than it has in the past.

4. **Verify that Containers of Waste are Correctly Characterized, Packaged, and Manifested**
   To achieve confidence regarding the certification of an individual container requires verification. Verification is potentially more rigorous than validation and for this reason should be subjected to the Necessary and Sufficient process. This will require a "systems analysis" to determine answers to the following questions: what is an acceptable undetected miscertification rate? what is the business risk in miscertification? what resources are available? what constitutes a heroic effort, i.e. putting in place more personnel/equipment resources than we have funding for? what verification frequency should be utilized (10%, 20%...)? is the waste processed or treated (e.g. incineration, acid dissolution)? how good and appropriate are existing waste certification steps? and what tools do we use for verification (real-time radiography, independent laboratory sampling and analysis, nondestructive assay)? The means for determining and performing verification should be developed through a Data Quality Objectives (DQO) process.

5. **Deploy Technology**
   Several improvements to the waste certification process can be realized by the deployment of technology. For example, an advanced database system should track and trend information facility by facility, include smart processing for consistent decision analysis (including feedback/branching based on input data), and validate user input entries. Currently, WM relies on personnel to "eyeball" facility data for legitimacy and consistency. Decision analysis is on a case by case basis. Another example is the deployment of technology for measuring radionuclide quantity or consideration of treatment technologies for specific waste streams. Significant improvements could be realized for making the TRU concentration determination (100 nCi/g) or for assuring that "no-rad was added"" to outgoing hazardous waste. We would hope that other subteams have identified these re-engineering activities and have reported them elsewhere.

6. **Evaluate the Use of Process Knowledge**
   Process knowledge plays a very large role in waste certification, especially characterization. Good process knowledge is paramount, particularly in the case of making the no rad added decision. Since process knowledge plays such a key role in certification, it needs to be evaluated under a set of boundary conditions for when it is really sufficient and when it is not.

Upper management should be acutely aware of potential business risks associated with PK and should evaluate liability on a laboratory basis, not at a waste certifier level.

7. **Respond Decisively to the Needs of the No Rad Added Program**
   The quantity of hazardous material currently under the control of waste generators is large. Waste generated from the use of this material, particularly when it originates from within an RMMA (Radioactive Material Management Area), has the potential to be contaminated with radioactive material. The existing ORNL infrastructure, support, and guidance for delineating No Rad Added under these conditions is NOT responsive to the generator's needs. A program needs to be established to respond to this significant need.

8. **Act Soon**
   Waste certification re-engineering is urgent: changing international transportation regulations will impact certification; a much larger fraction of waste will likely be shipped off-site in the near future (more impetus to perform to higher receiving facility standards/plus business risk of miscertifying containers that will then be in another state and facility); and finally, the rebidding of one of the contracts in the Oak Ridge Waste Management consortium requires that ORNL pay attention to decisions being made in preparation for that contract, including waste funding priorities and paths, and ownership of waste located at ORNL and elsewhere. As a result of ensuing change, we recommend that the laboratory appoint personnel to keep abreast of the reengineering subtasks, to assure that the integration of these subtasks is efficient and timely. An individual with a process/systems engineering background would be optimum.

In putting together these recommendations, the team reviewed an extensive set of reference material (see references) and met with experts in transportation, sampling for no-rad-added, and the transuranic waste program. The team charter and the reengineering process were embodied by use of facilitators and a joint meeting was held with members of the waste characterization reengineering team. Our charter (Appendix I) was ambitious. Nevertheless, its composition in conjunction with our recommendations should guide future development in the reengineering process.

The team approached issues and problems objectively, yet concrete solutions emerged slowly. Waste *certification* is a process that is worth doing well but just good enough, nothing better, nothing worse. To engineer the process means that each step is pieced together in a logical manner that maintains generator responsibility but reduces significantly his or her number of tasks. A process that builds confidence because it is defensible will reduce costs. This process will be achieved and assured when all of the reengineering elements are mapped out. The waste certification plan simply conveys that all the pieces are working together properly: waste characterization, administration, and waste minimization, for example.

This report begins by describing the waste certification philosophy which embodies the concept of managing waste right the first time. Secondly, the report then distinguishes between the waste certification process and the Waste Management System, and thirdly the team has prioritized the issues facing certification, followed by illustrative models of how we envision the system now and how it "might" be in the future. Ideas for how improvement may be measured and barriers to success are presented in the final sections of the report. We did not perform a detailed cost analysis because we felt that cost reduction realized within the waste certification process would result from a linear combination from each of the ensuing subtasks. We only made some broad remarks about cost savings and then deferred to some previous work performed by the Waste Certification Team WCT (Dailey et. al.), shown in Appendix IV. Other appendices present the team charter and the members of the team. Appendix III includes candid remarks from each of the individual team members----must reading for those who believe consensus-building is too politically correct.

This reengineering process is an opportunity. As of today, ORNL has never validated or verified the waste characterization process. It is for this reason, for example, that such large uncertainties have been placed on the IWMF source term. Improvements in waste certification will reduce future source-term uncertainties, thus possibly extending the useful life of the facility. Additionally, when the momentum of existing waste management policy shifts toward moving waste offsite, the laboratory will be better positioned to meet the more demanding rigor that may be brought about by the NRC, DOT, repository site requirements, and new DOE Orders.

CONTENTS

1. WASTE CERTIFICATION PHILOSOPHY

Waste certification is about managing waste right the first time, from identifying and quantifying the constituents, to determining the proper classification and packaging. A lot of small steps are required; analytical measurement data is acquired and interpreted; an auditable paper trail is mandatory.

The waste certification process is a large, imposing responsibility that requires a collective effort of Oak Ridge National Laboratory employees. Personnel must be highly skilled in order to move waste through the system, rather than simply brokering waste or cutting deals to move it from "one back alley to another." Whether it be the misapplication of personnel or equipment resources, little or no management attention, or simply a cavalier attitude toward waste---the "after all it's **just** waste" syndrome---a poorly thought out waste certification process can result in a waste management operation that is overly complex, prescriptive, and costly. Estimates of how costly are difficult to come by, but a widely held view is that researchers spend upwards of 20-25% of their time trying to get rid of the waste they created in the progress of their vital work. We have world-class researchers "wasting" their time on waste.[2]

Thus, the waste certification process must be simplified. Performing tasks consistently, collectively, and with clear direction will build confidence that the waste is being managed properly. To achieve this level of accomplishment will require bold new decision making by upper management and a renewed commitment to put the right people in the right positions with the right resources. This can and must be done.

What does waste certification mean? First it is a process. It results from the formulation of a proper set of instructions to achieve a reasonable confidence that waste has been classified and packaged according to operating procedure, regulations, and the waste acceptance criteria. Second, it is a program. When a sound process is in place, the program is very simple. The program is the final step in the process----a quality assurance and control measure----that says yes, the process is working as it should. The program certifies that the process works properly. An efficient process will reduce time, aggravation, and money.

To this end, 'ORNL' certifies the waste because the waste generator is ORNL. The researcher is not the generator, but rather the authenticator that all knowledge about that waste has been conveyed through the proper channels, period. This paradigm shift will be further discussed in Section 4 Waste Certification Models.

To achieve a waste certification process that operates more efficiently will require culture change, cooperative problem solving, resource leveraging, an expert-based approach, a highly-skilled workforce with synergistic environment, a best in class data logging system, the best affordable technology and methods, and smart waste-stream tracking and computerized validation. The process

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[2] Survey Conducted by J. Norman, Chemical Technology Division, 1996

must build teamwork, confidence, and trust among all participants. ORNL must embrace a logical Data Quality Objectives (DQO) Process. This will enable the laboratory to set boundary conditions on what it is and isn't doing, under the supposition that performance beyond these boundaries is not worth paying for.

2. THE PROCESS AND THE PLAN

The Waste Management Plan or System must describe in a concise way how the process works and demonstrate that it a) works well enough to be compliant with the DQOs and receiving facility Waste Acceptance Criteria, b) allows for the safe management of material, c) and is within a budget that the researcher can reasonably afford.

The team, in discussing current operations of the waste management organization, sees the system as listed below:

Waste Management System

a. segregation/avoidance/pollution prevention/declare waste
b. characterization
c. documentation
d. packaging/interim storage
e. verification
    1) remeasure
    2) confirm
    3) use better methods
f. audit/assess
g. certification/final sign-off
h. shipment/storage/disposal
I. ship off-site

Certification consists of doing all the above steps correctly.[3]

The current program places the responsibility for items a. through g. on the researcher/generator, with items h. and I. being Waste Management responsibilities. This team proposes a shift in responsibility in which Waste Management would **take responsibility** (as opposed to just being involved) for items b. through I. In other words, the team proposes that Waste Management personnel would become the 'experts' in waste management activities and allow the researchers to get on with their very important role of research, which is after all the purpose of ORNL's existence. The team recognizes that even waste management 'experts' cannot control all processes, etc. so there must be a cooperative effort between the researcher and the waste management team and in some instances that the researcher will have to provide the information required by the waste management system. Charge backs, which seem to

[3] See excerpt from DOE Directive. DOE G 435.1. Low Level Waste Operations

be inevitable, would be adjusted depending on the amount of assistance provided by Waste Management in developing the entire certification package. Research organizations must have a feed-back mechanism to ensure that waste management activities become cost-effective and to determine if the information provided by them is adequate and accurate.

An overall waste management plan or system must be devised for ORNL that includes the Waste Characterization Process as the main element of the certification process (see excerpt below), has ORNL management and DOE approvals for the plan/system, and certifies that the waste characterization process works, i.e., verifies X% of the waste items (X depends on program history and WAC) by remeasuring some fraction of items; confirming information on some fraction of items; and uses 'better' techniques to confirm characterization of some fraction of items, as funding allows; audits and assesses against the plan; and certifies the process by signature on manifests/forms.

> Excerpt from DOE Directive, DOE G 435.1-5 Low Level Waste Operations, Requirement for Waste Certification Program
>
> C. Waste Characterization
>
> The most important component of the waste certification program for a LLW treatment, storage, and disposal facility is the characterization that waste must meet to be acceptable for receipt. Besides the minimum technical information required by M435.1, IV.3.C.(3)(b), each receiving site or facility, or generator organization, may establish additional characterization requirements for LLW to be acceptable.
>
> The WAC documentation should specify the requirements for characterization necessary to ensure waste is acceptable at the receiving facility, and it should specify the waste characterization documentation the generator needs to prepare and submit... This information should be appropriately incorporated in the generators certification plan The generators certification plan should specify any additional characterization necessary to meet specific needs of the generator organization.

The process must be systematic in that it establishes a DQO baseline to spell out risk, error, cost, technology limitation; uses proper methods that are consistent and traceable; uses a graded approach to develop performance methods that are only 'necessary and sufficient'; maintains a well-trained, consistent staff; ensures a robust paper trail exists between a container and the point of generation; and does what you say you're doing.

3. PRIORITIZATION OF ISSUES

We identified sixteen important waste certification issues. The issues were ranked by seriousness, urgency, and growth. A score was computed. Figure 1 below is a summary of the 16 issues, ranked by score. The original "thought process" order number is shown to the right---interestingly enough, the most important issues were though of last!

Original "thought of" order	Issue/Problem	Seriousness	Urgency	Growth	Score
12	Changing regulatory environment	H	H	H	9
14	Self-imposed over-regulation	H	H	H	9
16	DOE's role in certification	H	H	H	9
3	What is adequate verification? What is a must? What is a want?	H	H	M	8
4	What is the Waste Acceptance Criteria (WAC)?	H	H	M	8
	What are the Data Quality Objectives?				
11	Responsibilities.	H	H	M	8
	Who does what?			l	
	What is the process?			l	
	Waste flow/data flow mapping			h	
1	Cost to the generator (cost savings)	H	M	M	7
6	What are the available disposal facilities? (Envirocare, LLW, MW)	H	H	L	7
8	Traceability assurance	H	H	L	7
9	Acceptable risk level/consequences	H	H	L	7
10	Acceptable methods/technologies	H	M	L	6
13	Waste minimization (incentive or disincentive)	L	L	H	5
15	DOT Requirements	H	L	L	5
2	Generator is "now" a customer	L	M	L	4
5	Conflicting missions---more waste is better (EMEF/ER)	L	L	L	3
7	Funding Sources	L	L	L	3

H: High (3)
M: Medium (2)
L: Low (1)

Figure 1. Prioritization of Issues Facing Waste Certification

A brief summary of the major issues is presented below. It is from this summary that the recommendations were formulated, keeping in mind those issues that were beyond our immediate control and those that we are fortunate enough to control.

1. Changing regulatory environment. Federal, state, and local regulations are undergoing many changes. The team's concern is how to develop and maintain a waste management program when the rules keep changing. This is an issue for which the team has no immediate response and/or conclusion on how to deal with it, but it is a recognizable problem which must be dealt with.

2. Self-imposed over-regulation. This issue is a worrisome one in that we tend to be our own 'worst enemy' by 'going the regulators one better' and imposing requirements above and beyond those required by regulations. Our present programs should be directed toward meeting those necessary requirements to ship the waste off site and nothing more. ORNL should also look at the requirements of ridding ourselves of 80% of our waste and not 100% (the assumption being that we can quickly do something about 80% and be that far ahead), i.e., do not have the same stringent requirements for all waste streams when it is not necessary.

3. DOE's role in certification. Several of the complications in managing wastes on the Oak Ridge Reservation stem from micro-management by DOE. This micro-management has led to numerous requirements not specified in Waste Acceptance Criteria (most based on fears of the state of Tennessee) for off-site repositories. The ORNL response must be 'put it in writing and send money' for these over-indulgent requirements - especially those regarding reporting and documentation.

4. What is adequate verification? What is a must? What is a want? It is clear here that musts and wants must be separated. A stringent line-by-line comparison must be made for all waste certification requirements and only those which are 'musts' included in the ORNL plan.

5. What are the Waste Acceptance Criteria? What are the Data Quality Objectives? The Waste Acceptance Criteria (WAC) are fairly well defined for the various off-site repositories. The ORNL problem seems to be to determine which waste streams will go to which repository which will set the WAC and Data Quality Objectives (DQO) for that waste stream. DQOs are not well defined in any but the Waste Isolation Pilot Plant WAC and need to be established and approval obtained for other repositories. Which WAC should ORNL use to write the certification requirements?

6. Responsibilities. Who does what? What is the process? Waste flow/data flow mapping. the program needs to clearly define the responsibilities of the researcher, generator, waste management organization, and ORNL management in the entire waste management process.

7. Cost to the generator. This is a major concern for the research divisions. Waste management is already a significant part of their budgets and every effort needs to be made to keep costs down. See later discussions on cost savings.

8. What are the available disposal facilities? Acceptable facilities need to be identified for each waste type and contracts put in place so ORNL can start moving waste off-site.

9. Traceability assurance. The required 'paper trail' from generation to disposal needs to be defined. Ultimately, an individual container is certified as having met a certain quality level. A major component of this process is to assure that the sum or the parts has been logged properly and that the information has been recorded and conveyed accurately.

10. Acceptable risk level/consequences. A 'zero risk' program is not considered to be possible due to the cost. An acceptable level of risk needs to be defined and the consequences of an unintentional noncompliance need to be determined.

11. Acceptable methods/technologies. The impact of this issue is significantly lessened if a team of 'experts' is given the responsibility to characterize waste for the researchers; however, even in this case these methods/technologies must be defined in order to have a cost-effective program.

12. Waste minimization (incentive or disincentive). At the present time, a lot of waste is disposed of as SLLW even when no radioactivity is believed to be present since there are no 'de minimus' values for declaring no-rad-added. This issue must be addressed.

13. DOT Requirements. This is an area where we have clearly 'shot ourselves in the foot' by imposing DOT or equivalent for on-site shipments. The on-site transportation manual needs to be overhauled in its entirety.

14. Generator is not a customer. This issue must be addressed if charge-backs/taxes on waste generation are imposed. The paying individual must have some say and budget control of his operation. A more detailed discussion of this issue is presented later in this report.

15. Conflicting missions-more waste is better. The concept of waste as an 'asset' is discussed later in this report. This issue has been discussed as a problem in Red Team reports which have evaluated DOE waste management operations throughout the entire DOE complex. ORNL does not seem to be an exception.

16. Funding sources. This issue is a major concern to the research organization. It involves control of budgets and many other vital interests to the researchers. A more detailed discussion of this issue is presented in this report.

4. WASTE CERTIFICATION MODELS

The existing waste certification model stagnates waste. EMEF writes the contracts. EMEF controls the money. 1500 ORNL waste generators each must endure the multitude of steps to penetrate the black zone. The process is unnecessarily iterative because each facility generates several waste streams, which are then handled by the ORNL system as individual waste streams, that eventually make their way to a TSD facility. The incorporation of the GI/GIE (Generator Interface/Generator Interface Equivalent) has greatly improved the handling of waste streams thought the maze of compliance-related policy and procedure. We think this good idea can be expanded, as shown in figure 3.

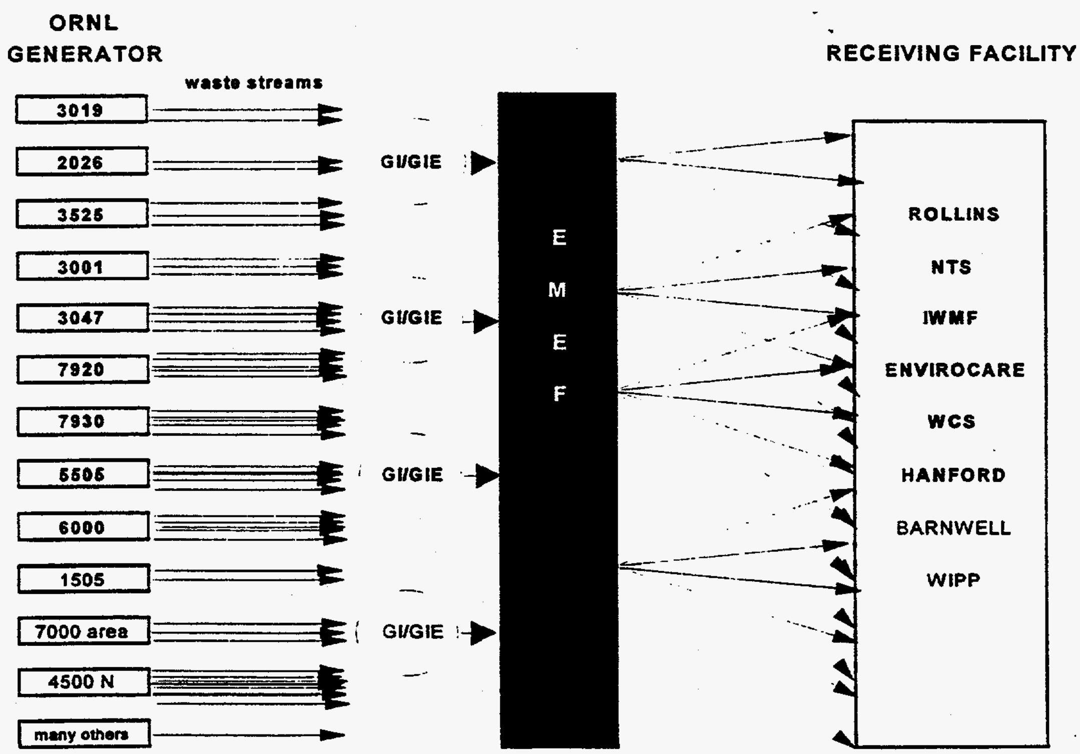

Figure 2. Existing Waste Certification Model

A new model is proposed whereby ORNL is the generator. ORNL writes the contracts. ORNL generates not 1500 waste streams but 4-5-6 waste streams. A broad based approach, with centralized efforts to isolate tasks which are repetitive and put them in the hands of experts, rather than the 1500 generators. A major fraction of the effort, waste characterization, can be consolidated to be performed by experts that work with <u>waste-type specific</u> GIs.

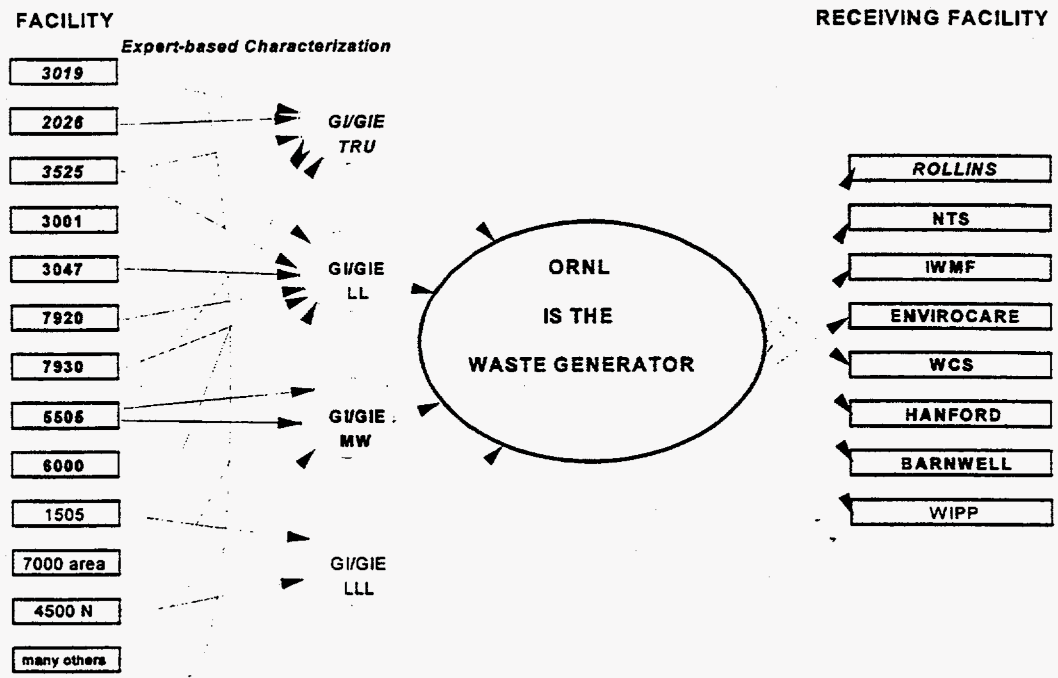

Figure 3. Proposed Waste Certification Model

With the GIs completely familiar with each of their respective waste acceptance criteria and DQOs, they can work with the characterization experts to streamline, and combine small waste streams into larger, "ORNL" waste streams for offsite shipment.

Some major assumptions are made to assure success of this approach:

1. A competent, empowered waste certification team will be put in place.

2. ORNL Management will (must) place a high priority on progress in establishing working, cost-effective programs for waste stream characterization, use of process knowledge, sampling and analysis, and certification. An ORNL waste plan must be written which includes these elements, and it must be approved by ORNL and DOE management.

3. Data collection will be reasonable and regulation driven, not 'nice to know'. Forms will be changed to make them more user friendly and efficient for data handling.

4. Final disposal points need to be identified so that WACs can be incorporated into the plan.

5. The issue of no-rad-added must be addressed forthrightly and squarely. Standards (not just sampling plans) must be established which are acceptable to both the recipient sites and to ORNL.

5. MEASURING IMPROVEMENT

During the past 2 year period, 4053 containers---216,178 items [2054 drums,. 1174 B25 boxes, 97 @180 ft^3] were generated. This was about 50,000 ft^3 of SLLW a year. The data presented in Appendix IV is based on much more conservative data than these actual numbers and still indicates significant cost savings to the laboratory and to researchers.

Additionally, the team estimates that of the 1500 individual researchers now classified as generators, that about 500 of them now spend approximately 20% of their time on waste matters (the other 1000 spend significantly less on waste matters.) Using a conservative estimate of $150,000 per person year, this amounts to 100 person years or approximately $15,000,000. The team believes that this time could be reduced to less than 10% of the researchers' time by the addition of 10 FTEs at a cost of $1,500,000, and a total cost "savings" of $6,000,000 per year. These "savings" do not represent an actual dollar savings to DOE or to the ORNL but rather makes an additional 10% of the time of the researcher available to do the work he/she is being paid to do.

6. BARRIERS TO SUCCESS

There are many barriers to the success of this concept of waste management. Notably:

1. A significant reorientation in priorities, responsibilities, goals, and concepts of waste management must occur. Normal human resistance to changes this drastic will be very difficult to overcome.

2. Waste is considered an asset by the waste management organization in the majority of DOE facilities and ORNL is no exception. Specifically, waste management organizations view the management of waste as job protection. This has been reported in the Red Team reports commissioned by DOE Headquarters in essentially every instance.

3. Cultural changes, both in the ORNL waste management organization and in DOE, must take place in which the researcher is regarded as the customer on one end, ORNL is regarded as the generator, and DOE is viewed as a customer on the other end.

4. DOE must set realistic goals as to the fate of waste materials and waste management organizations must set appropriate goals to achieve those ends. To date this has not happened.

5. Any charge-back system for waste management will be self-defeating and regressive.

    a. They are difficult and expensive to administer.
    b. Front-end loaded "taxes" are unfair to those researchers who make genuine attempts to control wastes and generation rates.
    c. Back-end assessments will result in researchers accumulating waste materials rather than having them disposed of properly in attempts to cut costs and spend research dollars where

they accomplish the most - for those goals considered most important to the researcher, i.e. a new piece of lab equipment is much more important than disposing of waste.

d. It is difficult for management, DOE and ORNL, to really follow or assess the efficiency of the system.

e. The researcher has no control over his expenditures. The cavalier attitude of 'we didn't raise enough money, so raise the tax' will blow some programs and projects out of the water.

f. The concept of 'Taxation without Representation' is abhorrent to American (all being patriotic Americans read 'ORNL') society. We fought a revolution over this issue - and won!

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Appendix I: The Waste Certification/Verification Team Charter

ORNL Waste Management Re-engineering Certification/Verification Process Team Chartered Tasks

Mission:

The mission of the ORNL Waste Management Program Re-engineering Process Team on Certification/Verification is to develop the approaches, organizational philosophy, and implementation for providing ORNL staff with cost-effective, generator-friendly, safe and compliant waste certification/verification for newly-generated wastes and recyclable materials.

Basic Requirements:

1. Focus on waste generator needs and maintaining research mission
2. Incorporate Necessary and Sufficient Process into certification/verification

Source and Sink:

1. Identify waste streams (generators), present and near future
2. Identify disposal end points and release limits

Certification Process:

1. Identify primary available methods of certification
   - 1. a. Include influences like off-site shipments, regulations, and No-Rad-Added requirements
   - 1. b. Look at technology improvements
2. Survey other sites
3. Evaluate interaction of process knowledge, knowledge, and data with respect to rigor (Level of Quality)

In the End:

1. Estimate of cost savings

Appendix II: The Team

Waste Management Reengineering Process Team on Certification/Verification

Position	Name	ORNL Division
Team Leader	Jeff Chapman	Waste Management
Core Team Champion	Karl Haff	Chemical Technology
Facilitator	Kathy Johnson	
WM Representative	Bob Orrin	ORNL Quality
Technical Representative	Don Gregory	Office of Radiation Protection
Waste Generator 1	John Norman	Chemical Technology
Waste Generator 2	Dale Caquelin	Chemical and Analytical Sciences
Waste Generator 3	Ron Auble	Physics
Waste Generator 4	Joe Knauer/Kevin Felker	Chemical Technology

Appendix III: Up Front and Personal, Candid Remarks from the Team

One of the downsides of establishing a team of "thinkers" in an attempt to build consensus is that ideas, or strong convictions of each <u>individual</u> are averaged out, or "watered down." For this reason we decided that each team member should have his say, unedited and uncut, about the three biggest issues facing the successful implementation of an affordable waste certification program. Here they are:

Don Gregory, Certified Health Physicist, Office of Radiation Protection

1. The certification ideas developed by the Certification Team are endorsed. The one-page outline (p. 6) we generated sums up our view of certification. It describes certification of the overall process.

2. It is a problem that we do not have identified places to send several types of waste. Waste types we have identified: large volume generators of a regular waste stream, small generators of process-known waste, and those individuals with hundreds of unknown bottles on their hands. Each has unique problems, but all three categories need help getting rid of waste as efficiently as possible. We aren't sure what the (DQO?) requirements will be for a particular type of waste (i.e., what the WAC will say), but (the good news) the planned certification program seems to be adequate for all WACs we have looked at.

3. We have identified a number of issues that probably belong to the another team. Two examples that come to mind:
   a. DOT on-site is one example where we appear to over-regulate, and
   b. Data quality objectives, I believe, are more Characterization than Certification. Do it right the first time, because the waste package does not get certified, the program does.

4. THE BIG BONUS - Nothing is going anywhere until LAB management forces (and empowers) some one or some organization to get off his/her (their?) rears, make decisions about how to do stuff, document those decisions, stand up to DOE because we have decided how we will operate (within the requirements of the law and the orders), and then do what we said we would do. Until that happens, we can meet all we want, but no waste will go anywhere. This extends beyond certification, and beyond waste as well.

Dale Caquelin, Facility Management, Radioactive Materials Analytical Laboratory , Chemical and Analytical Sciences

The main issues that I feel most adversely affect the cost effective management of waste are:

1. I think the 'powers that be' have too microscopic a definition of a generator. This approach hinders our ability to act more centrally in our waste management approach and leads to more actions and

responsibilities being pushed down to the level of the researcher, who is ill-equipped to handle it. This approach also hinders the characterization, certification and verification process because we end up with 10,000 slightly different waste streams instead of a few dozen waste streams with a broadened range of characteristics. Net result is increased cost and waste logjams.

2. Certification and verification are directly a function of the WAC for the receiving site. As of this moment, for most waste types, we do not yet know its destination and therefore get into a mode where we try to qualify our waste for any potential repository. This pushes undue requirements down to local generator level where it is least cost effective.

3. As of this time, waste management does not treat the generators like customers. They continuously push more requirements down to generator level, implement new programs and procedures, mandate training and documentation which appears to do little more than make their life easier. If I had somewhere else to go with my waste, I wouldn't give them the time of day. Why can't the solid waste program be more like the liquid waste program?. You provide some basic information, certify that you have complied with the WAC, then wave good-bye!

Ron Auble, Physicist, Physics

You asked for 3 main concerns from each team member. I'm finding that hard to do since there are so many unknowns in this whole process. However, I do have one that I feel should be on the list. We need to finalize the process for determining what is rad and what is not rad. DOE M 435.1 will require such a program if it ever goes into effect.

DOE M 435.1, Ch.1, 2.A.(6) "Waste generating organizations shall have a formal program for determining and documenting what material meets the definition of, and must be managed as, radioactive waste, and what material is suitable for free release".

Another concern is clearly defining which programs and documents flow from which other documents. Don Gregory's notes would include Certification as part of the Characterization Plan but my own feeling is that the Certification Program and Plan should be the governing documents and Characterization should be part of the Certification process.

Should we get ORO involved since they apparently are going to be the approval authority for any programs/plans we generate?

Sorry I can't presently give 3 nice clear suggestions but at this point nothing really seems clear to me.

Bob Orrin, Waste Certification Officer, ORNL Quality

1. The Waste Certification Team's (Nancy Dailey's) development process is the correct approach for ORNL.

2. As off-site waste shipments become a factor for ORNL, a strong certification process needs to be in place to ensure minimum risk and characterization of waste for off-site disposal. The process needs to address the DQO for the receiving site.

3. Identify release limits for various waste types...Free release limits for rad, levels that constitute no-rad-added in hazardous waste, etc.

Karl Haff, Department Head, Chemical Technology

1. Self-imposed over-regulation. -- I have a real problem with the fact that we regulate ourselves above and beyond requirements of off-site storage/disposal sites. This needs to be looked at very hard by someone and a line-by-line comparison made with all the requirements of the off-site groups and our requirements. Then we can let DOE or LMES argue the merits of a more stringent requirement or tell them that we don't plan to comply with a more stringent requirement unless directed to in writing.

2. What is adequate verification? What is a must? What is a want? -- We need to define this technically (DQOs), who has the responsibility, and incorporate it into the certification plan. The three phase approach espoused by the team is a good one. This should be a Waste Management funded program.

3. Responsibilities. Who does what? What is the process? Waste flow/data flow mapping? -- I am in favor of a centralized system/group of experts that does the characterization, certification, and verification. The team recommendations express this very well. We have to take this monkey off the researcher's back and put it with the experts. This can be a group reporting directly to the Waste Management Division Director to assure independence.

4. Bonus 1(or for whatever it's worth!) I completely support the positions taken by and the recommendations of the characterization team.

5. Bonus 2. I am very much opposed to any form of charge-back or taxation system for waste management. Who does WM report to, to whom are they accountable on these systems? These systems are notoriously ineffective, inefficient, and unfair in general. In our accounting system it is too easy to raise the tax when not enough money is raised to support the operation as deemed necessary by the powers-that-be with no accountability to those providing the money.

Joe Knauer, Radiochemist, Radiochemical Engineering Development Center, Chemical Technology

After reading the comments from the other sub-team members, I don't think there's anything much I can add. I agree with everyone's 'top three' issues and would reemphasize the following.

1. The responsibilities for certifying/verifying waste, moving it from the generators facility, etc. (once it has been characterized and properly packaged) must become transparent to the generator/researcher. I think the pilot program described to us in our earlier meetings is a step in the right direction. Hopefully it will prove successful.

2. Although the waste streams generated at ORNL are varied and diverse in quantity, type, hazard, etc., efforts to characterize, certify, store, and ship to final disposal sites must be coordinated through a centralized organization of some description. This organization must do more than oversee and make rules. It must assist and participate in the various activities and operations necessary to transfer the waste from the generator to the storage and/or disposal site.

3. Rather than focusing on developing procedures, programs, operations, etc. that handle "all" possible waste streams generated at ORNL before we get rid of "any" waste stream, shouldn't someone evaluate what has been done with characterizing, certifying, etc. various waste streams against the WACs for potential disposal sites to determine if "some" of waste streams could go off-site? Other labs seem to be able to ship at least part of their waste. Why can't ORNL?

John Norman, Microbiologist, Chemical Technology

My top 3 issues are as follows:

1. Cost to generators- I cannot diminish the importance of this issue by placing any other before it. I have never been happy referring to this group as "generators" These generators are the scientist and engineers that give purpose to the national lab philosophy. As I have said, we are extremely close to killing the host. Simply walk through the corridors of 4500N or many other buildings. You will notice that the once active labs are silent and dark. Many of the labs are being converted to offices. When you do see activity, it is with a single technician who is working on waste and compliance issues at least 20% of their time. Is 20% significant in the scientific community? What 20% of the historical cures for diseases and technological advances are we willing to give back? This is what we are doing to our future. If this issue is not considered as a high priority in the resolution of the waste problem, the host will die and we will all be left sitting in an empty room, finally 100% compliant enjoying staggering waste minimization statistics. We win.

2. Responsibilities / acceptable risk level / what is adequate / certify vs. certainty- Imagine the following scenario. A truck backed up to the gate. Security personnel surrounding the perimeter. The finest minds in radiochemistry and regulatory compliance hovering around the finest detection equipment known to man. A package is received from a generator via a chain of custody with a multitude of paperwork attesting to the history of the package. The package is examined, tested and retested, the

data analyzed, more paperwork generated. The package is placed in the truck and escorted by armed guard to its final resting place. This scenario approaches 100% certainty.

In reality, we are requiring individuals with no waste management background, whose stated mission does not mention waste and whose yearly progress assessment (DPPR) does not consider waste, to spend 20% of their time dealing with waste. This scenario is uncertifiable.

We have embraced the practice of certification of the program rather than the package. This must be coupled with an expert based approach to the characterization of the waste. A centralized effort with acceptable equipments and subject matter experts would surely be more cost effective than the present piecemeal approach.

3. Generator as customer/conflicting missions/waste flow/funding/the real disease---I am convinced that we are currently dealing with the symptoms of a complex disease. We need to deal with the disease. The fact is that waste does not move. All efforts must be measured against the movement of the waste to its final resting place. Currently the gates are locked. Why?

   In private industry, waste is viewed as a liability and systems are designed to ensure its movement. On this reservation, waste is an asset. Budgets are determined by the management of this huge bulk. (Would this problem be solved by attaching a significant portion of the waste management budget to requirements of waste movement rather than static management?) Coupled with this reality is the fact that DOE has multiple missions. EM = waste, ER =R&D. When you throw in the fact that the branches of DOE fund and manage us under non-unifying missions, the results are predictable. These problems do not point to personalities but to system constraints.

   Please forgive me for being overly editorial. Above all, two truths still remain: 1) We have a window of opportunity to solve these problems, and 2) "The significant problems we face cannot be solved at the same level of thinking we were at when we created them" Albert Einstein

Jeff Chapman, Nuclear Engineer, Waste Assay Facility, Waste Management and Remedial Action

1. Waste certification is a process that begins the moment a potential waste stream is identified. A system where teamwork is fostered between well-trained, qualified waste management personnel and facility representatives who can assure that the waste is managed safely and at the lowest possible cost will reduce costs. The process of waste certification needs to be simplified and consolidated so that the laboratory plays on its strengths. A consistent approach in the formulation of the steps that are the building blocks of a waste certification program will harvest confidence.

2. A realignment within the WM division will result in big payoffs. WM <u>must</u> establish <u>well-respected core competencies</u> to facilitate prudent waste management decision making <u>with</u> the generator. The core competencies must result in action, rather than the penning of thick guidelines, help documents, or more procedures. Respect is earned through action. WM must also make the

paradigm shift that is coming within the context of the draft DOE Order and prepare for greater responsibility once more waste is shipped offsite, for example NTS.

3. The DQO process must be embraced---not to make a research project out of a single waste stream, but to provide the framework (the rules) of what we plan to do and how well we plan to do it at a cost and with a risk we can afford. Once DQOs are in place, the proper resources (personnel, technology, know-how) can and must be deployed to meet them. Waste management is complex, but not rocket science. Let's move forward like we mean it.

Appendix IV: Progress of the Waste Certification Team

The Waste Certification Team (WCT) formed in 1996 and headed by Nancy Dailey has identified and is now implementing a number of positive changes to the waste certification process. The pilot program was launched April 14, 1997. It will remain in effect for one year. Adjustments to the program will be made as improvements can be identified, provided resources are available. We commend their efforts. A few of our thoughts regarding the road ahead are provided below:

1. The WCT's approach was:

   1.a. Rewrite Waste Acceptance Criteria to regulatory requirements. Do not self-impose additional requirements that do not meet Necessary and Sufficient, work smart standards.

   1.b. Install a Generator Interface Team to assist generators with completing forms and identifying improvements to waste characterization, segregation and packaging. Improvements result in waste being accepted by WM sooner and at a lower cost.

   1.c. Allow the generators to choose the array of assistance desired.

   1.d. Write waste characterization guidance documents to inform the generator of approved methods for characterizing waste.

2. The WCT appears to have responded effectively to the results of a generator survey indicating that the greatest amount of aggravation is from completing forms, followed by obtaining information necessary to complete the forms. It at least partially addresses the issue of providing an 'expert based' waste certification system for ORNL, though not totally. <u>This team believes that a full-time, WM funded, waste certification team should be formed with the responsibility of characterizing, certifying, and verifying all ORNL wastes.</u>

3. The questions still remain: What is certification? What is verification? What is validation? What are the Data Quality Objectives for the management of waste? What are acceptable misclassification/miscertification rates?

4. The manner in which generators obtain quantitative data for classifying waste can be improved, streamlined, and made more consistent. This can be achieved by advanced technology. More consistency will lead to an easier waste certification and verification process.

5. Validation can be significantly improved by the implementation of a computer system that validates user entries, checks for inconsistencies over time, and trends generator activity.

6. Establishing measures for cost savings is a difficult task, but the WCT made a go of it. We believe their bench marking figures are worth attaching here and are as good as any for establishing a

baseline for achievable cost savings,, although they are very conservative based on actual figures for numbers of packages, numbers of B25 boxes, and numbers of drums (see Section 5 of this report.)

Waste Certification Program Cost Comparison Assumptions
(Prepared by the WCT, Dailey et. al.)

General

- Burdened labor rate is $55/hour. Labor year is 1760 hours.
- All information provided is on an annual basis.
- EPP-100 is not implemented
- Only differences between current and new programs are highlighted. Requirements that are the same in both programs are not presented.
- Twelve interface personnel will be required. 90% of their time will be spent with generators, financed by generators. 10 % of their time will be spent with WM, financed by WM.

Documentation/Form Completion

- Form completion includes obtaining information (from HP, etc) to complete form and the time required to fill in the form
- Documentation to be completed: existing 2109 form set, WID, attachments, and process knowledge information
- Current and anticipated annual waste volumes (assume waste volume does not change)

Waste Type	# Containers	# Items/Container	Total Items
SLLW	400 B-25 boxes	20 items/box	8000
	50 drums	5 items/drum	250
TRU	40 drums	50 items/drum	2000
	6 casks	50 items/cask	300
Hazardous	900 drums	1 item/drum	900
	100 drums	20 items/ drum	2000
Mixed	90 drums	1 item/drum	90
	10 drums	20 items/drum	200
LLLW	30 streams	N/A	30
TOTAL	**1626 containers**		**13770**

- Current program requires completion of forms for each item (13,770 forms). New program will require one form per container (1626 forms).
- Time required to complete form: Current - 1.5 hr/form, New Program - 0.5 hr/form. Current program required generator to complete form. New program will require interface person to complete form with assistance from generator.
- Current WM review time per form: Total - 30 min/form (Field Tech: 10 min/form; Data Entry: 15 min/form; Document Clerk: 5 min/form)
- New WM review time per form: 15 min/form total

Certification Assumptions

- Audits under current program:
  - 200 WCPs, 3 audits per WCP = 600 audits/surveillances
  - Gen Time: 5 hr × 600 audits = 3000 hrs
  - WM Time: 5 hr × 600 audits = 3000 hrs
- Verification of forms under current program
  - 10% of all forms verified
  - 13,770 forms × .1 = 1377 verified
  - 15 min/form × 1377 = 344 hrs (WM)
- Maintain WCPs under current program
  - 200 WCPs × 8 hr/WCP = 1600 hrs (gen)
  - 200 WCPs × 1 hr/WCP = 20 hrs (WM)
- Audits under new program - one annual program certification audit (2 wk period; 3 audit teams)
  - WM: 6 people × (2 wk audit + 1 wk prep + 2 wk close-out) = 1200 hrs
  - Gen: 240 hr prep + 240 hr contact + 480 hr response = 960 hrs
- Maintain 5 procedures under new program
  - 40 hr/procedure × 5 procedures = 200 WM hrs
- Verification of forms under new program - not required

Training Assumptions

- Assume approximately 1500 total generators
- Generator Training:

		Current Program		New Program *	
Type of training	**# generators**	**hrs/class**	**Total hrs**	**hrs/class**	**Total hrs**
SLLW	990	5	4950	1	990
TRU	420	2	840	0.5	210
Haz/Mixed	1493	5	7465	2	2986
LLLW	75	2	150	2	150
Certifier	436	4	1744	0	0
WCP	1500	2	3000	0	0
TOTAL			18149		4336

*This would be the minimum hours required of generators, assuming they all chose full service.

- Assume 80% full service, generator hours = 3470 + 3030 = 7500 hours.
- Assume 12 interface personnel to support 1500 generators at ORNL. Interface personnel would require full SLLW, TRU, Haz/Mixed and LLLW training = 14 hrs/person × 12 = 168 hrs
- Assume training costs are $12/contact hour.

Rejection Assumptions

- Current Program - rejected forms
  5% of forms are rejected = 700 rejections per year
  WM: 1 hr/rejected form = 700 hr
  Gen: 1 hr/rejected form = 700 hr
- Current Program - rejected packages
  18% of packages at WEAF are rejected
  500 packages go to WEAF × 18% = 90 packages
  WM: 2 hr/rejected package = 180 hr
  Gen: 8 hr/rejected package = 720 hr
  Exposure: 5 mrem/rejected package = 450 mrem exposure

- New Program - rejected forms
  1% of forms are rejected = 20 rejections per year

WM: 1 hr/rejected form = 20 hrs
Gen: 1 hr/rejected form = 20 hrs

- New Program - rejected packages
  1% of packages at WEAF will be rejected
  500 packages go to WEAF × 1% = 5 packages
  WM: 2 hr/rejected package = 10 hr
  Gen: 8 hr/rejected package = 40 hr
  Exposure: 5 mrem/rejected package = 25 mrem exposure

Waste Certification Program
Annual Expenditure Comparison

	Current Program		New Program	
	Gen hrs	**WM hrs**	**Gen hrs**	**WM hrs**
Documentation				
Completion of forms	20,655	6885	813	407
Certification				
Audits	3000	3000	960	1200
Verification of forms	0	344	0	0
Maintenance of procedures	1600	200	0	200
Waste Management Training	18,149	0	7500	168
Rejections				
Forms	700	700	20	20
Packages	720	180	40	10
TOTAL	**44,824**	**11,309**	**9333**	**2005**

	Existing Program	**New Program**
Documentation (one time	200 WCPs required to be	5 Procedures required to be
Annual training costs	$217,788	$92,016
Annual exposure during	450 mrem	25 mrem

Annual Labor Dollar Savings:

Generator: 44,824 hr - 9333 hr = 35,491 hr (loss)
90% interface personnel added: 0.9 × 12 × 1760 hr = 19,008 hr (gain)

Generator Savings: 35,491 - 19,008 = 16,483 hr = $906,565

WM: 11,309 hr - 2005 hr = 9304 hr (loss)
10% interface personnel added: 0.1 × 12 × 1760 hr = 2112 hr (gain)

WM Savings: 9304 - 2112 = 7192 hr = $395,560

Total Annual Savings

Generator Labor	$906,565
WM Labor	395,560
Training Costs	125,772
Total Savings	$1,427,897

APPENDIX F

ORNL WASTE MANAGEMENT REENGINEERING

REPORT FROM THE

WASTE CHARACTERIZATION PROCESS TEAM

May 16, 1997

INTRODUCTION

The Waste Characterization Process team evaluated the process of characterizing heterogeneous radioactive solid wastes (LLW, TRU, and mixed) with the emphasis on the radionuclide content. The team identified one major, long-term recommendation for a "systems analysis" of the total ORNL waste picture to determine the optimal management of all waste streams, be that segregation, combination, alteration, on-site treatment, off-site treatment, storage, and/or disposal. This study is needed to create a strategic vision for efficient and cost-effective management of ORNL waste.

The team also identified four other recommendations which can be implemented near-term and which should rapidly result in efficiency gains and/or cost savings. These include: Making waste characterization "expert"-based, segregating and free releasing certain wastes to the Y-12 landfill, challenging the apparent conservatism in existing on-site/reservation WAC, and using standard radiological controls to govern on-site radioactive waste movements.

In addition, the team identified one issue on "culture change" to be handed off to and evaluated by the Teaming/Forecasting Process team.

The team charter and roster are provided in an Appendix, along with selected notes from team meetings.

RECOMMENDATIONS

RECOMMENDATION #1: (Long-Term)

Perform systems analysis to guide management of ORNL wastes.

NARRATIVE:

ORNL generates a wide diversity of radioactive and mixed wastes. This diversity extends to the amounts and types of radionuclides encountered and to the waste materials themselves (matrices). Currently, this range of materials encountered includes remote-handled transuranic (TRU) wastes such as polypropylene filters from the REDC with external dose rates exceeding 10,000 R/h and personal protective equipment and other items that are uncontaminated but which are treated as such.

The waste generating organizations are subjected to a maze of complex, sometimes conflicting, confusing, or conservative, requirements for managing their wastes. These requirments can confound even the experts at times. In addition, the available technology for some wastes (e.g., TRU) is not yet up to the challenge of cost-effective management. In other cases, administrative barriers limit the use of existing technology to promote more cost-effective management. Nowhere is this situation more problematic than in the area of waste characterization and waste stream definition.

The Laboratory needs to perform a systems analysis on its waste generating and management activities to determine the optimum approach for each waste stream, covering the range from generation to ultimate disposal, and for the waste management enterprise in its entirety. The analysis should focus initially on the generating steps and the disposal end points. A catalogue of waste streams and their major characteristics is needed to determine the potential for aggregation (i.e., similar materials together), for volume reduction and the need for other treatment, and for matching with a particular end point. Data Quality Objectives (DQOs) covering characterization and waste form need to be developed *and agreed upon* for each disposal end point in order to guide those analyzing or conducting the intermediate steps in the process (characterization, treatment and volume reduction, certification, and packaging).

One major outcome of the systems analysis should be a graded approach that places greatest emphasis on wastes that affect disposal facility performance and allows current limited resources to be redeployed for maximum effect in characterization and/or treatment, as required to meet DQOs.

The following are examples of characterization-related questions that should be answered as part of the systems analysis.

1. In which cases are measurements not required at all for waste characterization? For example, can wastes known to contain quantities that are trivial in relation to criteria limiting disposal

facility performance be exempted?

2. Is storage for radioactive decay an effective tool in reducing requirements for characterization and downstream management?

3. When is aggregation, followed by volume reduction and/or decontamination, and characterization of the treated residuals more cost-effective than the current approach (detailed characterization before acceptance by a waste management organization)?

4. Are there cases where enhanced on-site treatment is required in order to meet waste acceptance criteria (WAC) for disposal? Does it make sense for the waste generating organization to perform anything other than very limited characterization under such conditions: That is, when the waste residuals will have to be extensively characterized prior to certification and packaging for disposal?

5. Which wastes need the most extensive effort in characterization? Is some form of enhanced on-site processing or treatment needed to characterize the wastes adequately, i.e., to provide the level of homogenization needed to permit adequate sampling and analysis? In which cases can the increased use of Non-Destructive Assay overcome the need for homogenization?

6. In which cases is new technology needed to permit cost-effective characterization? Does the technology exist currently or is development needed to provide such capabilities?

7. If off-site treatment is desirable or required, what is the appropriate balance between characterization needed for shipping the wastes to a treatment site (e.g., to meet DOT requirements) and that required to certify waste residuals for disposal (after treatment; e.g., see Final Report of the On-Site Waste Treatment and Storage Process Team)?

COST SAVINGS:

Planning the transition from EM-funded to generator-funded WM over the next several years will require a significant investment in systems analysis (perhaps on the order of $1 million) if the DOE's goal of significantly lowered *life-cycle* WM costs is to be achieved. The systems analysis would provide data and information needed to support strategic planning. Data and guidance needed for waste characterization would also be an inherent product.

Lowered costs for characterization of some waste streams should be one of many beneficial outcomes of the systems analysis. The complexity of ORNL waste generating processes makes it difficult to define a baseline for overall cost comparisons or to estimate potential cost savings unique to waste characterization. However, we think that life-cycle cost reductions ≥10% for the overall ORNL WM enterprise (covering generation through disposal) are likely to result from this investment. This should produce cost savings >$5 million/year.

It is possible that cost savings from application of a graded approach to waste characterization could be offset by cost increases associated with needed improvements in characterization of complex, high-activity wastes (e.g., performance-assessment-limiting LLW, TRU wastes) (see Recommendation #4). However, if a graded approach is not employed to reduce costs for most ORNL waste streams, characterization costs could increase more significantly in future.

BARRIERS TO IMPLEMENTATION:

Planning is currently fragmented by the division of labor between ORNL and the EMEF organization. For example, under the current structure, ORNL cannot chart its own course independent of the EMEF organization, even for newly generated wastes, for certain critical waste streams: LLW, TRU, and mixed wastes. The principal management responsibility for these streams resides at the EMEF level rather than at ORNL. This may make it difficult even to obtain the resources needed to perform the systems analysis, let alone apply more cost effective approaches in future, e.g., to move from a conservative, liability averse, command-and-control approach to a problem-solving mode or to apply a graded approach to characterization.

This situation will become even more problematic when a new contractor takes over these responsibilities from Lockheed Martin Energy Systems because their primary customer will still be DOE-EM, and not ORNL or the Y-12 Plant. The potential for requirements to be "dictated" to ORNLwould appear to be even greater under the proposed M&I-contractor regime.

RECOMMENDATION #2: (Near-term)

Move characterization of ORNL radioactive waste to an expert-based system.

NARRATIVE:

ORNL generates a wide variety of radioactive wastes (see first recommendation). Characterizing such waste presents many challenges. For example, obtaining cost-effective, representative samples from heterogeneous, non-uniformly distributed waste is very difficult. Wastes may vary widely in physical characteristics (materials, density, etc.) and types of radionuclides present, and wastes from the same location may vary significantly with time. If bulk analysis techniques are employed, a knowledge of the potential interferences posed by the waste type as well as the application of proper data analysis techniques must be considered. A basic decision as to when sampling and analysis or other approaches are needed at all can be a difficult decision - one requiring careful and knowledgeable decision-making.

In the past, the burden of providing waste characterization data has fallen upon the waste generator. This strategy promotes "home-grown" solutions with each generator performing waste characterization in a unique and often piecemeal or inconsistent fashion. As a result, numerous, unproductive iterations can be required before necessary approvals can be obtained. A systematic, expert-based approach to waste characterization appears to be more reasonable from both a technical and cost perspective. Establishing a small, highly-trained team of experts with the requisite knowledge to perform waste characterization would not require ORNL researchers who generate waste to become experts. This approach would require the minimum amount of time devoted by the researcher to the characterization of the radioactive waste generated during his or her research.

This expert team would consist of technical staff with appropriate training and experience in waste characterization (e.g., radioassay, sampling, radiochemistry, etc.). An expert-based system would also make it possible to apply a graded approach to the waste characterization process and to ensure data quality objectives (DQOs) are achieved. For example, the expert team would be able to determine the level of characterization required for a given application (i.e., a graded approach). It would, for example, apply nondestructive assay or sampling and analysis or a combination of both for wastes that require that level of characterization. For other cases, a simpler approach such as a dose-rate conversion may be adequate to ensure DQOs are achieved. The overall result should be a more cost-effective and more technically defensible and auditable program.

The components of an expert-based waste characterization system would consist of the following:

- Waste Characterization Strategy
  - -- Defines waste characterization program
  - -- Provides for graded approach
    - -- Applicability of waste characterization techniques

- Radionuclide-specific
    - Waste stream-specific
    - Characterize to applicable WAC
  - Develops waste stream profiling
  - Provides approaches for characterization of unique wastes
  - Establishes data quality objectives (DQOs) for measurement protocols
  - Ensures instruments used to conduct waste characterization are traceable to a national measurement standards program (e.g., NIST)
  - Establishes requisite training and certification for "waste characterizers"
  - Ensures data reporting meets QA/QC requirements
  - Utilizes segregation as an effective waste characterization tool

- Central waste characterization facility (e.g., Waste Examination and Assay Facility, WEAF)
  - Sophisticated characterization equipment for "hard-to-characterize" waste and waste not amenable to field characterization
    - APNea System
    - Tomographic Segmented Gamma Scanner
    - Real-time Radiography
    - Development project at the WEAF to provide radiofrequency quadrupole (RFQ) assay system for TRU wastes (also see recommendation # 4).
  - Systematic characterization already in place
  - Expert staff already available

- Satellite characterization facilities (if follow-up study demonstrates cost-effectiveness)
  - Establish for larger waste generators (e.g., P&E)
  - Tailor equipment/technique to particular waste streams (e.g., REDC)

- Field-portable characterization equipment (provided by ORNL and/or private vendors)
  - Waste curie monitors
  - Transportable TRU waste assay systems (APNea, RFQ)
  - Portable gamma-ray spectrometry
  - Neutron counting to determine alpha activity through (α,n) reactions

- Data reporting support
  - QA/QC checks
  - Software verification & validation

COST SAVINGS:

Cost savings for an expert-based approach are included in the Final Report from the Waste Certification Process Team; characterization is a part of the overall certification process. The Waste Certification Team identified a subset of 500 major waste generators who were estimated to devote

20% of their time to "waste matters" (most of which time was thought to be spent on waste certification, including characterization). Reduction of this level of effort from 20% to 10% using a similar expert-based concept was estimated to result in cost savings of $6 million/year (see Waste Certification Process Team Final Report).

Our team was not able to develop a firm consensus on the level of savings for an expert-based waste characterization process. Our team members agreed that the 20% estimate of a major generator's time spent on waste-related activities appeared to be reasonable. However, their estimate of the fraction of a major generator's time specifically devoted to waste certification ranged from 50 to 100% of the time spent on "waste matters." The uncertainty was associated with variations in the perceived level of effort in waste handling (packaging, interim storage, etc.) exclusive of certification per se. The estimated fraction of the certification effort devoted to waste characterization ranged from 25% to 50%. (A limited survey of representative LLW generators by the WMRAD indicated that about 30$\pm$20% and 70$\pm$20% of their costs for waste management were associated with characterization and certification, respectively.)

We estimated that two FTEs @ $130,000/person-year (beyond the 10 identified by the Waste Certification Process Team) would be needed to augment the proposed Generator Interface Group (GIG) in order to provide technical guidance on waste characterization.

We used the same basis for calculating cost savings as the Waste Certification Team but applied our percentage estimates and additional staff costs as given above. Our estimate of annual cost savings resulting from application of an expert-based approach ranges from $0.5 to $3 million, with a median value of about $1 million. (Given the magnitude of the uncertainties, use of more than one significant figure is not warranted.)

Our median value for savings is about half of the estimate of total waste generator costs ($2 million/year for hazardous, mixed, and low-level wastes) provided by the Pollution Prevention Process Team. If we estimate characterization costs from the latter by applying the 30% figure derived from the WMRAD survey, we obtain an estimate of $0.6 million (not including costs for TRU wastes). Thus, *our median value for savings* is $\geq$ *total current characterization costs* derived from these data. On the other hand, our *median* value appears to be about *one-fourth to one-half* of the estimated cost savings for characterization derived using the Waste Certification Process Team's results. Finally, our median value appears to be somewhat consistent with the $1 million/year cost - and associated cost savings - for generators to complete and validate certification forms estimated by the Records/Reporting Process Team.

Reducing the uncertainties and resolving the differences in the various estimates will require an accounting exercise (perhaps augmented by time-and-motion studies) beyond the scope of the Teams' expertise and knowledge base. It may be necessary for the WM Reengineering Core Team to define a follow-up activity to analyze and, if possible, to resolve the differences in the generator-cost estimates from the various teams.

We reiterate that the "savings" (actually efficiency-improvement cost equivalents) estimated by our

Team are already included - and perhaps then some - in those provided by the Waste Certification Team, and should not be cited separately to avoid "double-counting." The projected cost savings do not include those associated with reduced training requirements, etc., which likewise have been covered in the reengineered Waste Certification Process (see that Team's Final Report).

BARRIERS TO IMPLEMENTATION:

1. Near-term investment in development/deployment of waste assay/monitoring equipment and personnel on the order of $1-2 million is needed. Much of this investment would be needed to support enhanced TRU waste characterization (but see Barrier #2 below; also see Recommendation #4 later in the report). Additional investments in new equipment may also be required, depending on the results of the proposed follow-up assessment for satellite characterization facilities.

   A significant portion of the equipment needed to perform waste characterization measurements already exists either at the WEAF or in other ORNL divisions. The WEAF is operated by the Applied Radiation Measurements Group in the WMRAD. It contains a diverse array of equipment (and an expert staff) representing a capital investment of about $3.5 million that is not being fully utilized currently.

   Enhanced use of the WEAF capabilities to perform waste characterization appears to be desirable. This would relieve waste generators of a task which is outside their R&D or production missions. The most efficient approach would be to have some of the WEAF staff serve in a dual capacity, both as resources to the GIG, as described above, and as performers of waste characterization. Use of the WEAF in this capacity would require an annual operating budget of about $1.3 million /year (excluding costs for GIG support and RTR).

2. The ORNL RFQ-based NDA system for remote-handled TRU wastes cuurently under development provides the best available technology for achieving the required level of measurement sensitivity ($\leq$100 nCi/g) for wastes with low neutron fluences (i.e., virtually all DOE-complex wastes outside ORNL). However, that fraction of ORNLTRU wastes with an inherently high neutron fluence may limit the sensitivity of this NDA technique to between 200 nCi/g and 500 nCi/g. This issue must be addressed and resolved in ongoing development work (also see Barriers following Recommendation #4).

3. A need exists for a culture change at ORNL to recognize that technical challenges in waste characterization are comparable to those faced in R&D activities and require that the best people and technologies be involved in providing solutions.

4. The waste-generating organizations and WM staff must develop an effective teaming arrangement to provide accurate, technically defensible, and auditable waste characterization data (also see Final Report of the Teaming/Forecasting Process Team).

RECOMMENDATION #3: (Near-term)

Deploy ORNL equivalent of accepted nuclear industry practices to segregate uncontaminated waste from LLW at the source and to dispose of uncontaminated materials in the Y-12 landfill.

NARRATIVE:

One of the major areas identified as having potential for far reaching gains is the free release of suspect contaminated waste. Several unofficial studies have been performed, supplemented by operational knowledge, relating to the characterization of material that has no detectable contamination. From a technical perspective, it is difficult to assign an appropriate radionuclide distribution and to calculate associated activity. From an operational perspective, it is estimated that approximately 80% of this type of material is NOT contaminated and could/should be free released provided "standard industry accepted practices" are utilized. Free release of such materials, if administered via a common-sense approach, has the potential for significant savings associated with subsequent characterization, documentation, handling, storage, treatment, and disposal costs attributable to this waste category.

An overall approach containing several options for implementing a free release program is described below (see On-Site Waste Treatment and Storage Team's Final Report for description of an alternative approach). The proposed approach and options need to be evaluated in more detail to determine the effectiveness and amount of effort that would be required to administer this program:

1) Two possible approaches for initial segregation could be employed dependent upon facility specific controlling factors. The program would establish the appropriate procedural steps for source segregation:

a) Initial frisk of materials (e.g. PPE, lab trash, etc.) designated as waste from controlled areas. This program would involve worker participation to place waste items from the area that had no detectable activity above background upon frisking into a receptacle designated as being "potentially releasable waste."

b) Segregate solely based on worker familiarity with possible material contamination potential. Place materials in "potentially releasable waste" bag based upon knowledge of where materials were used or came in contact with area contamination. Once full, bags could be transported to centralized facility for free-release determinations.

2) Once the "potentially releasable waste" receptacles are full; receptacle bags would be surveyed in a low background area, and if contact dose rates on bag are below a designated threshold then transport to a central release station where the items in the bags would be surveyed.

a) This survey could include sensitive "waste curie" monitors or could be as rudimentary as hand frisking each item. Criteria would be established for threshold values associated with "waste curie" monitor measurements and hand-held frisking.. All items/waste found to be below a specified detection threshold would designated as "potentially free releasable."

b) All waste for release should be in a nonidentifiable form (e.g. all radiation symbols or identification markings defaced, obliterated, or removed). This step is essential to ensure that waste could not be discerned as being potentially contaminated due to its specific markings or physical attributes.

c) All waste should be surveyed for "final release"; release criteria must be established (e.g., specified microR/hr above background). If criteria are not met, remove offending item or designate entire bag as radwaste.

3) Defensible program must be established which tracks waste for release through the process. Should include recording of free release process, technicians involved, instruments, calibration, and instrument checks.

COST SAVINGS:

$400,000 annually, assuming 80% free release for only incinerable and compactible waste categories. Cost savings for incinerable and compactible wastes take into account off-site vendor's processing costs, reduction in number of waste containers required, and reduction in number of off-site waste shipments. It was assumed that an equivalent amount of time and effort would be required for free release determinations versus waste characterization and supporting documentation. Cost savings only consider reduction in waste volume for tangible costs. No credit was given for reduced storage space and extension of storage facility life.

Extending the approach to other waste categories would require further evaluation but should result in additional cost savings (see Final Report of On-Site Waste Treatment and Storage Team).

BARRIERS TO IMPLEMENTATION:

1. Operations at some facilities within ORNL are not set up to perform frisking at the source. Frisking stations are not set up at the point at which PPE is removed when exiting the radiological area.

2. Evaluation mechanism would have to be established to determine which facilities/areas could be considered for implementation. In some instances, hard-to-detect radionuclides (e.g. alpha or beta emitting radionuclides with weak or no gamma rays) being present in a facility would preclude consideration if NDA techniques are employed for final release determination.

3. All workers would have to be trained in the implementation of the segregation program. Workers would be directly involved with the initial determination of whether waste could possibly be segregated for possible free release. However, it is possible that this training could be provided routinely (and cost effectively) during normal RWP briefings.

4. Program would have to develop the appropriate technologies and systematic approach required to establish free release criteria for waste having surface contamination. The establishment of a justifiably, defensible program utilizing "acceptable industry practices" would be required. This program would have to be operationally implementable, not be cost prohibitive, and not require exorbitant analytical techniques or heroic efforts in determining free release acceptability.

RECOMMENDATION #4:

Reevaluate on-site waste acceptance criteria to eliminate unnecessary conservatism.

NARRATIVE:

There is a tendency for increasing conservatism in interpretation and flowdown of requirements from an original source to the ultimate compliance point. Although a guidance document for waste characterization at ORNL has been developed, the actual requirements for "compliance" with characterization requirements are contained within the WAC. Examples related to waste characterization appear to include the following:

- The WAC for the Nevada Test Site (NTS) and Hanford LLW disposal sites require that nuclides constituting >1% of the total activity in the waste be quantified while the ORNL WAC indicates that those comprising >0.5% of the activity (i.e., major radionuclides) are to be reported. The ORNL value was developed as guidance for waste generators based on interpretation of the DOT regulations, which require that radionuclides comprising $\geq$95% of the hazard be identified. However, the DOT regulations do not specify how accurately wastes must be characterized and appear to provide some flexibility for cases where detailed information is limited.

- The WAC for the Waste Isolation Pilot Plant (WIPP) require that the fissile gram equivalents of Pu be reported for each container such that specified limits are not exceeded. Bulk measurements [i.e., Non-Destructive Assay (NDA] are an accepted means of demonstrating compliance. In contrast, the ORNL WAC require that "*All quantities* [of 18 listed fissionable isotopes ranging from U-233 to Cf-251] *must be reported* so that the U-235 fissionable equivalent mass *can be calculated*" (emphasis added). The ORNL requirements were developed in response to stringent fissile materials requirements for waste storage facilities.

  Although the ORNL emphasis is on determination of fissile mass equivalents of U-235, rather than Pu-239, it is not the isotope but rather the approach to characterizing the hazard that is the primary issue (see below). For TRU wastes, fissile equivalents of both U-235 and Pu-239 are technically required to meet all WAC requirements. The need for this redundancy may also deserve some reexamination.

Another tendency is to impose more conservative requirements to provide additional controls or to reduce the chances for error. (This may also apply to the last example cited above.) Examples:

- The NTS and Hanford WAC require that nuclides exceeding 1% of their performance-assessment-based disposal criteria be reported but ORNL requires reporting when values exceed 0.1% of the corresponding criteria for the Interim Waste Management Facility (IWMF). Use of the lower value for ORNL was designed to limit inventories of short-lived radionuclides (e.g., Co-60) that have very high disposal limits (i.e., it is a derived value designed to provide conservatism). Because there are other controls on such isotopes (e.g., radiological protection requirements, such as external dose rate, etc.), it may be advisable to reexamine the need for the conservative approach adopted for ORNL.

- ORNL requires that both TRU waste and high-activity alpha-contaminated LLW (i.e., containing U-233, Cm-244, Cf-252, or other alpha emitters, not meeting the definition of TRU waste, and not disposable in the IWMF) be packaged in expensive stainless steel drums ($650/drum). Other LLW can be packaged in a variety of containers. Packaging of high-activity alpha-contaminated LLW in stainless steel drums is not required for shipment to an off-site LLW disposal facility.

  The ORNL requirement appears to be a carryover from earlier management practices at ORNL, and reflects concerns about deterioration of black iron drums, in particular. A large fraction of the TRU wastes packaged in such drums have had to be overpacked because of corrosion during long-term storage. A conservative approach was adopted because it was feared that the absence of disposal outlets would force long-term storage of alpha-contaminated LLW. It may be advisable to reevaluate this requirement in light of new options for off-site disposal (NTS or Hanford). Use of less-expensive steel drums may be a viable approach for shorter periods of interim storage.

  The WIPP-WAC require that TRU wastes be packaged in stainless steel drums for disposal. However, the blanket ORNL requirement for packaging of all TRU wastes in stainless steel drums may also warrant reexamination. The majority of ORNL's TRU wastes cannot currently be certified to the WIPP WAC. Thus these wastes will have to be characterized, in some cases treated, and repackaged prior to shipment to WIPP for disposal. It is expected that the original stainless steel drums will not be reusable, and thus will become wastes. An on-site treatment facility for solid TRU wastes is under development and is expected to become available around the year 2005. Thus it may not be necessary to package TRU wastes in expensive stainless steel drums (i.e., in final disposal containers) for short-term interim storage.

- The WIPP WAC (incorporated by reference in the ORNL and EMEF WAC) require that the concentration in each container [canister for remote-handled (RH-) wastes] of transuranic nuclides with half-lives >20 years be >100 nCi/g of waste matrix. The concentration >100 nCi/g is to be accompanied by a propagated measurement error. Direct measurement of this concentration is often precluded by the complexity and heterogeneity of major ORNL waste streams, which limit the use of NDA and make sampling and destructive assay both very difficult and very costly. The WIPP WAC were developed with weapons-grade-Pu wastes in mind and do not reflect a full appreciation for the problems associated with more complex streams generated by ORNL and other DOE sites.

  Conceivably, however, this hurdle could be overcome by combining bulk measurements of total alpha activity via NDA (see following paragraph) with waste-stream-level isotopic profiles generated through a best-faith effort in sampling and destructive assay. Other alternatives appear to be much more costly based on the conclusions of a 1997 white paper.

Additional reporting requirements for WIPP include total alpha activity (for RH-TRU wastes), Pu-239-equivalent (PE) curies, and the thermal power, all of which are to be compared with specified limits. All three of these requirements plus the fissile gram equivalents of Pu-239 could potentially be satisfied by bulk measurements: Radiofrequency-Quadrupole-driven neutron assays for the first two plus the fissile mass measurements and calorimetry for the last mentioned - if development can be completed and capital outlays are then made available to deploy the needed capabilities at ORNL. The PE curies are calculated as the sum of the activities of individual nuclides divided by weighting factors (1.0 for Pu-239, 1.9 for Cm-244, 3.9 for Cf-252, etc.). This WIPP requirement could be satisfied with bulk measurements alone (by assuming all activity present is Pu-239, which has the lowest weighting factor) or by combining bulk measurements of total alpha activity with average isotopic profiles developed for the waste stream via sampling and destructive assay techniques (as described in the preceding paragraph).

The corresponding ORNL requirements are that all nuclides comprising >0.5% of the total waste activity be reported along with detectable quantities of all transuranic isotopes either with half-lives >20 years *or with daughters that have half-lives >20 years*. (Wastes from Building 7920 at the REDC contain >20 alpha-emitting radionuclides with half-lives >20 years or with daughters that have half-lives >20 years, plus a number of fission products that can exceed 0.5% of total waste activity.)

Other examples can be cited, but these serve to illustrate the current situation.

In today's world of declining resources, ORNL must retain the maximum flexibility possible in meeting waste characterization requirements. We must ensure that internal requirements are consistent with established practice at other DOE or industrial sites and that we do not add unnecessary requirements "just to be safe" or to permit independent calculations of quantities that can be determined by other means. This situation becomes particularly acute when questionable requirements imposed in off-site WAC (i.e., for WIPP) are repeated or exacerbated by addition of requirements at ORNL. If we are to be successful in challenging or modifying requirements in off-site WAC, we must start by reexamining our on-site requirements, both for ORNL and for the EMEF organization.

Another concern is that major ORNL waste streams (e.g., from the REDC) are being managed exclusively via exceptions to the WAC. That is, because the requirements are not technically achievable or are cost-prohibitive for major waste streams, the WAC have to be satisfied either through variances from the requirements or through tacit acceptance of wastes by the waste management organizations while knowing that the criteria are not being met. This situation needs to be resolved and will require that WM staff and the R&D organizations work together to develop technically acceptable and compliant solutions (also see Final Report of the Teaming/Forecasting Process Team).

ORNL waste characterization and acceptance requirements should be reassessed to eliminate unnecessary conservatism and to develop alternative approaches for satisfying waste characterization needs. This will need to be revisited when the findings of the systems analysis of ORNL waste generation and management in Recommendation #1 is completed (i.e., so that the proposal for a graded approach to waste characterization can be applied most effectively).

COST SAVINGS:

1. Life-cyle cost savings of $50 million (median value from 1997 white paper) if contrasted with alternatives wherein ORNL has to implement an independent treatment capability utilizing decontamination/homogenization to facilitate characterization of newly generated solid TRU wastes. Extension to heterogeneous LLW and mixed waste streams could significantly increase that figure.

2. Cost savings of about $600 for each case in which the use of a stainless steel drum can be avoided for interim storage of alpha-contaminated LLW or TRU wastes. The annual savings are estimated to be $30,000 to $60,000 for the REDC alone. Over the longer term, the savings could be sustantially higher, given that disposal of long-lived transuranic radionuclides in the IWMF reportedly will be severely restricted as part of the proposed remedy for performance assessment limitations at that facility.

BARRIERS TO IMPLEMENTATION:

1. Current resource limitations could prevent completion of development work and ultimate deployment of NDA systems. Although the RFQ-based system under development at ORNL is the most sensitive NDA system available, it may not have the sensitivity needed to assay all ORNL RH-TRU wastes (i.e., those with the highest neutron fluxes; also see Barriers to Implementation under Recommendation # 2). Initial deployment and testing are needed to fully assess the capabilities of this assay system and to evaluate the need for further development.

   An "out-of-the-box" alternative for deployment of a mobile RFQ-based assay system for TRU wastes has been developed. This alternative is estimated to cost about $0.5-0.6 million, or 75% less than a system housed in a dedicated facility. The costs probably could be defrayed even more through use of DOE development funds if ORNL management supports the technical approach and provides co-funding. Annual operating costs for such a facility are estimated to be $0.3-0.4 million/year.

If viable NDA systems are not ultimately developed for TRU waste characterization/ certification, alternative approaches, including the potential for obtaining variances from both DOT requirements and the WIPP-WAC, will have to be explored. Given the uncertainties described above, it is recommended that such alternatives be evaluated as a high-priority followup activity.

2. Need for culture change to move from a conservative, liability averse, command-and-control approach to a problem-solving mode, i.e., let's find a way to work together to get the job done safely and properly but without imposing overly burdensome and unnecessary requirements.

3. Need for culture change on the part of ORNL middle and upper management to recognize that the current technical challenges in WM (e.g., in characterization of heterogeneous, highly radioactive wastes) are comparable to those in R&D and require that the best people and technologies be involved in their solution. There is also a need for management to recognize that waste generating organizations have not been meeting their responsibilities (e.g., in characterization) in WM consistently and that a commitment to change, including teaming with WM staff to solve problems, is required on their part also.

4. Current EM philosophy that all characterization costs must be borne by the waste generating organization.

5. The life of the ORNL IWMF is to be extended by restricting the disposal of long-lived radionuclides and by requiring *increased* analytical data on wastes containing such nuclides. This could offset potential cost savings from application of less restrictive characterization requirements unless the graded approach covered in Recommendation #1 is implemented.

RECOMMENDATION #5: (Near-term)

Use standard radiological protection procedures - not DOT requirements - to move materials on-site. Revise the On-Site Transportation Plan for ORNL.

NARRATIVE:

The current On-Site Transportation Plan for ORNL has been interpreted as requiring that all on-site waste movements have to comply with DOT requirements for off-site shipments. However, the DOT requirements are not applicable or necessary for on-site shipments of hazardous materials such as wastes.

The ORNL Transportation Plan should be modified to allow standard radiological protection requirements to govern on-site waste movement, where appropriate, thus eliminating a myriad of paperwork and records that have been created to meet this perceived need. This recommendation is similar to one made by the Hazardous/Mixed Waste Stream Process Team in that we have been overly stringent in the application of off-site DOT requirements to movement of wastes on-site. Implementation of this recommendation will also eliminate costly site-access controls (e.g., additional guarded checkpoints) that were added as a result of the previous interpretation of applicability of DOT requirements to on-site shipments.

COST SAVINGS:

Some cost savings (est. $50,000/year) are anticipated through elimination of paperwork and approvals for exceptions for radioactive waste shipments. However, these savings are thought to be relatively small when compared to potential savings which can be obtained by applying this recommendation to other waste streams (see Final Report from the Hazardous/Mixed Waste Stream Team).

By far the largest savings (about $200,000/year) will accrue to the Laboratory from eliminating the additional guarded checkpoints and site access controls that were put in place when the more restrictive interpretation of DOT requirements was made.

BARRIERS TO IMPLEMENTATION:

Possible misinterpretation by staff, management, oversight groups, or the DOE that we are relaxing our compliance with requirements. In fact, what we need to do is correctly identify the applicable requirements, and then comply with them faithfully.

HAND OFF TO TEAMING/FORECASTING PROCESS TEAM

Promote Cooperation-Teamwork-Culture Change-Paradigm Shift-Educate Management

NARRATIVE:

Much of the present waste management process is based upon an "us vs. them" culture (i.e. "waste management organization vs. the generators") that appears to have developed as a means of insulating certain organizational elements (i.e. departments, divisions, business units, and companies) from having to accept total liability for the wastes as they move through the process. An elaborate system of forms, certifications, checks and rechecks, training, and procedures has been developed with the apparent purpose of pushing as much responsibility (and cost), thus liability, back onto the generator, with the WM organization's ever-present threat to refuse to "accept" waste as the ultimate hammer to force the generators to comply. Certainly this "attitude," "culture," or "paradigm" of the WM organization being "in charge" is a product of direct programmatic funding for waste managment out of DOE. Thus the DOE WM organization is viewed as being the customer of the process, rather than the waste generators who are wanting to get rid of the waste.

This "attitude" must be adjusted to recognize that the generator is the customer of the process and that the WM organization is the supplier of a service to that customer. (This will be especially true if and when the generator chargeback system is put in place.) In addition, waste generators must recognize that the WM organization can provide the best service when they receive the best possible process knowledge/characterization information in a cooperative spirit.

The process must be re-designed around cooperation, customer convenience and the acceptance of reasonable risk. The cost and inconvenience of "risk aversion" must be eliminated when it is not clearly warranted unless specifically prescribed by upper management to be in the company's best interest despite the cost impact.

The WM organization must understand that their core mission is to manage the generator/customer's waste in a compliant, timely, and cost-effective manner with minimal disruption to the generator/customer. Generators must understand that their input input to the process is critical to its ultimate success. Both WM and generators must recognize that if we can not accomplish this mission through cooperation, there are competitors out there who believe they can and will gladly do anything to get the opportunity to try. The WM organization must adopt an attitude of customer service and cost efficiency. Development of the Generator Interface Group is a positive indication that this transformation has begun.

The Waste Characterization Process Team recommends that the Teaming/Forecasting Process team devote considerable effort to developing specific recommendations to accelerate this transformation.

APPENDIX

Team Charter

Team Roster

Meeting Notes

WASTE CHARACTERIZATION REENGINEERING TEAM CHARTER

The Waste Characterization Reengineering Team is charged with providing ORNL with a common-sense, technically sound, compliant (including ALARA), generator-friendly, and cost-effective approach to characterization of radioactive and mixed wastes. Although the primary focus will be on resolving the substantive issues associated with heterogeneous radioactive solid wastes (LLW, TRU, and mixed; with emphasis on characterization of the radionuclide content), some issues involving liquid wastes also may need to be addressed (for example, related to accountability for generation once the transition from EM-funded to generator-funded waste management has been effected?). The Team will be asked to do the following:

- Perform diagnostic evaluation of ORNL's current performance and issues to be addressed using materials presented to the WM Reengineering Core Team and other information as needed, e.g.:

  -- How far away are we from striking the appropriate balance between rigor (to avoid costly errors and perpetuation of legacy problems) and practicality (to avoid unnecessary requirements and added costs)?
  -- Limitations of current approaches and technologies when applied to heterogeneous solid radioactive wastes (resulting in mismatch, for example, between expectations laid out in waste acceptance criteria and actual capabilities)?
  -- Need for expanded generator support by technical experts to conserve resources and reduce potential for errors?
  -- Potential for loss of access to treatment and disposal capabilities resulting from inadequate waste characterization?
  -- Characterization issues associated with interpretation and application of "No Rad Added"policy?

- Provide early input to WM Reengineering Core Team on benchmarking information needs; use benchmarking data obtained by Core Team in developing recommendations.

- Assess needs, availability, and costs of analytical capabilities (including nondestructive assay) for ORNL waste characterization.

- Identify areas where technology improvements or development are needed.

- Identify barriers to reengineering.

- Estimate performance improvements and cost savings which will result from the recommended approach.

Team recommendations will be provided to the Core Team by March 31, 1997.

WASTE CHARACTERIZATION REENGINEERING TEAM

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Generator 2	Lloyd J. Turner	M&C (Hot Cells)	4-2559
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ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

<u>Situation Analysis</u> -Problems
Issues
Boundaries

- Systematic Waste Characterization
- WM service to generators for char.?
- Mgt. Perception that Waste Char. is simple - but should be considered "expertise"
- Mismatch between what's expected to meet WACs and what is tech. Achievable
- Affordability of waste char.
- Level of effort & paperwork required of generators
- Graded approach to characterization - are our WACs too inflexible/stringent/conservative
- We are not consistently meeting current WACs

Situation Analysis -Problems
Issues
Boundaries

- Penalty factors for IWMF because of charact. of long-lived isotopes - revisit?
- Graded approach based on actual hazards and/or half-lives
    - Communication w/gen on char. requirements
    - Generator incentives to minimize waste

Boundaries

Start — Generation of WM Plan (will this cover all NG waste?)

End — Appropriate sufficient data/info for cert/verif. Process - meets WACs

Customers of Characterization

- Generator (to be) - cost/ALARA
- Waste Mgt. ("as is")
- Disposal sites
- DOE EM and R&D
- Stakeholders/Regulators/Public
- Future generations

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

Why Is It So Difficult To Map The Characterization Process?

- Customized process
- Complex process
- Not a lot of prescriptive regulations/defined process - like HW
- No overall process definition - goals/objectives/methods - like HW
- Paperwork chase
- Not well understood by generators
- No A-Z process defined
- Highly "expertise" dependent process - hard to prescribe for non-expert generators

SUPPLIER	INPUT
Generator	Waste Process Knowledge Additional Measurements Characterization Strategy
LMER WM	Review & Approval PK Technical Assistance Review & Approve Characterization Data Procedures/Guidance Documents On-Site WACs - IWMPA, 10 CFR 61 Variances
Off-Site TSDF	WACs

SUPPLIER	INPUT
EMEF WM	Funding Requirements/Forms/Systems WAC - TSCA, K-25 QA Plan for TRU Program
LMTPM	DOT Requirements SARP for Casks TDEC Requirements
OORFS	NCSA, OSR, SARs
NMC&A	Accountability Requirements
HP	Source Control Requirements (10 CFR 61, IWMPA HP - Source Control)
QA	QA Plans

OUTPUT

- Data/Information for Verification/Certification - 2109 hardcopy & electronic
- Shipping Paper Data
- HP Source Control
- NMC&A
- Variances

OBJECTIVES OF CHARACTERIZATION TEAM
RE-ENGINEERING (1,5,10)

OBJECTIVE	GEN	DOE	MGT	REG
Minimize Cost	10	10	10	1
Overcome "Vested" Interests by Increasing Team/Coop/Communication	1	10	10	1
Lower the Amount of R&D Resouces Applied To WM	10	10	10	1
Meet WAC w/Defensible Data (Provide Appropriate Balance Between Rigor & Practicality	1	10	10	10
Deploy or Select Effective Technology	10	10	10	1
Use Graded Approach	10	10	10	1
Develop an Effective Waste Characterization Strategy	10	10	10	5
Waste Volume Segregation Reduction Through Approved Characterization	10	10	10	10

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

ISSUES	OPPORTUNTIES
• Recycle process	-- GES - "Expert" system that only asks for info needed according to complexity of waste (electronic signatures)
• On-site treatment process	-- Tie RECID with EPA codes for pure chemicals (D001, D002, D003)
• Generators not turning in 90-Day paperwork in a timely manner	
• Regulator objection to permit mods (lessor)	
• On-site equivalent DOT requirements -- reduction in DOT training/labelling -- consolidate multiple pick ups on one truck/don't need on-site manifesting -- no longer need to request on-site exemptions	

Top Level		1.0 Waste Information		2.0 Info to On-Site WM
Next Level	Strategy	Stream/Process Knoxledge		
			Measurements On Packages	Calculating Curie Content
		Unique Waste		Isotopic Dist.
	Determine Isotopic Distribution			Activity Level/ Curie Content Info to WM

Next Level

1.1
Strategy
- How was it generated
- Where did it come from
- How much historical info
- Inventory/mass balance
- Is it continuing stream or uniqe waste

1.2A
Stream/Process Knowledge
- Sampling & analysis
- Waste stream profiling
- Direct does rate & activity measurements
- NDA
- More detail on strategy questions
- Isotopic distribution
- Document stream/process knowledge/calculation method
- Maintenance of PK
- Frame the PK - develop approach

1.2B
Unique Waste
- Sample & analysis
- NDA
- Direct dose rate & activity measurement
- Waste profiling
  -- physical & chemical characterization
- Isotopic distribution
- +/- package measurement

1.3
Measurements on Packages
- Determine measurements based on PK or strategy
- Types of measurements
  -- bulk activity -- NDA -- sampling & analysis -- LSC
  -- direct dose -- NOMAD -- smears -- direct frisk
  -- alpha sepc -- Gamma spec -- TIMS
- Activity level of package

1.4
Calculations of Curie Content
- Convert measurement data to activities/concentrations of specific

isotopes, as necessary

1.5
Isotopic Dist. Activity Level/Curie Content to WM Ops.

RAD WASTE

Notes from Board

- 80% volume reduction possible thrugh segregation
- Excess requirements
- Non-rad added
- Better WM organization
- Generator control board
- Segregation
- Packaging - ALARA
- Characterize in the package
- Process/volume reduction
- Recovery of useable material
- Move from procedure/document based system to expect based system

APPENDIX G

ORNL WASTE MANAGEMENT REENGINEERING

REPORT FROM THE

HAZARDOUS/MIXED WASTE STREAM PROCESS TEAM

May 8, 1997

INTRODUCTION

The Hazardous/Mixed Waste Stream Process team evaluated the process of managing newly generated hazardous and mixed wastes from the point of generation through disposal. The team identified one major, long-term recommendation for a complete reengineering of the "cradle-to-grave" waste management process for all waste streams, supported by state-of-the-art, off-the-shelf information management technologies integrated with the process.

The team also identified five other recommendations which can be implemented near-term and which should rapidly result in efficiency gains and/or cost savings. These include: (1) stream-lining the off-site shipment approval process, (2) accelerating the LMES-to-LMER transition of facilities, (3) updating the HP database on radiological areas, (4) improving accountability for timely submittal of information on waste in 90-day areas, and (5) using standard OSHA controls to govern on-site waste movements. The team also identified three future actions relating to these recommendations.

Total cost savings resulting from successful implementation of the recommendations is estimated at $3,290,00 annually.

In addition, the team identified two issues to be handed off to other WM Reengineering Process teams. The first issue is on modifying the current certification process, to be handed off to and evaluated by the Certification/Verification and the Records and Reporting Process teams. The second issue is on re-opening central chemical stores or an equivalent, to be handed off to the Pollutuion Prevention/Waste Minimization Process team. All of the above are described in more detail in the following pages. Backup materials, including team charter, team roster, and meeting notes are provided in the appendix.

RECOMMENDATIONS

RECOMMENDATION #1: (Long-term)

Completely reengineer the "cradle-to-grave" waste management process to incorporate the principles of trust, teamwork, customer service, experience and expertise, "necessary and sufficient," and life-cycle cost efficiency. Support and facilitate this process using best available ("off-the-shelf") information management technologies linked together in such a way that waste can be tracked and managed from the point of generation to final disposal using the minimum information necessary, eliminating redundant reviews and approvals, and without the need to generate paper copies.

NARRATIVE:

Much of the present waste management process is based upon an "us vs. them" culture (i.e. "waste management organization vs. the generators") that appears to have developed as a means of insulating certain organizational elements (i.e. departments, divisions, business units, and companies) from having to accept total liability for the wastes as they move through the process. An elaborate system of forms, certifications, checks and rechecks, training, and procedures has been developed with the apparent purpose of pushing as much responsibility (and cost), thus liability, back onto the generator, with the WM organization's ever-present threat to refuse to "accept" waste as the ultimate hammer to force the generators to comply. Certainly this "culture" or "paradigm" of the WM organization being "in charge" is a product of direct programmatic funding for waste managment out of DOE. Thus the DOE WM organization is viewed as being the customer of the process, rather than the waste generators who are wanting to get rid of the waste.

Among the problems identified as being caused by the current situation are: (1) excessive documentation -- in the form of protocols, procedures, guidance documents, and paperwork/forms -- required to move waste through the process, (2) excessive training required of generators so they can make waste management decisions, (3) overly bureaucratic input, review and approval requirements imposed by the many separate organizations/functions involved, (4) very fragmented information systems support such that redundant data systems are used, generally requiring redundant data entry, and leaving many available technologies tremendously underutilized.

This paradigm must be shifted to recognize the generator as customer of the NG waste management process and that the WM organization is the supplier of a service to that customer. (This will be especially true once the generator chargeback system is put in place.) The process must be re-designed around generator convenience and the acceptance of reasonable risk by all parties involved. The cost and inconvenience of "risk aversion" must be eliminated when it is not clearly warranted unless specifically prescribed by upper management to be in the company's best interest despite the cost impact.

The entire waste management process should be reengineered to reflect the principles of trust, teamwork, generator service, experience and expertise, "necessary and sufficient," and life-cycle cost efficiency. The Hazardous/Mixed Waste Stream Process team developed an "ideal process" flow that reflects these principles and the assumption that available information management technologies can be fully utilized to support it (Figure 1). This reengineered "ideal process" needs to be expanded in breadth to encompass all waste streams and expanded in depth to a level that fully defines the needed capabilities of the supporting information management system.

Once the "ideal process" is fully defined, we believe that available, "off-the-shelf" commercial information management technologies can be linked together to provide a true "cradle-to-grave" tracking and management system that will eliminate the need for redundant reviews and approvals, eliminate the need for paper copies, and will provide capabilities to meet all regulatory and internal reporting requirements. Some of the desired attributes we envision for this system are listed in Table 1.

COST SAVINGS:

While quantitative cost savings would be difficult to estimate at this time, it is anticipated that the "ideal" process and support system would lead to significant cost savings in the areas of:

Procedures, Directions, and Guidance Manuals - A simplified process and shifting the burden of decision making off the generator and onto the WM experts will dramatically reduce the need to create instructions for telling waste generators how to make waste management decisions. It is estimated that approximately 4 FTEs of WM procedure writing and training staff could be eliminated as a result, amounting to approximately $400,000 a year in cost savings.

Training - A simplified process and shifting the burden of decision making off the generator and onto the WM experts will dramatically reduce the level of training imposed on waste generators. It is estimated that approximately 4 hours of training per generator could be eliminated. At a rate of $60 per hour and with 1,493 hazardous/mixed waste generators, that amounts to a savings of about $360,000 per year.

Redundant Reviews and Approvals - A simplified process and shifting the burden of decision making off the generator and onto the WM experts will eliminate redundant reviews and approvals because the waste management experts will be making the determinations on waste classification, handling, treatment, and disposal rather than reviewing and approving generator determinations. It is estimated that this could save larger generators approximately 40 hours per year in effort which, at a rate of $60 an hour and with approximately 149 larger hazardous/mixed waste generators would amount to an annual savings of about $360,000. Within WM it is guessed that the time saved would compensate for the extra time to make determinations in the first place.

Redundant Data Entry - A fully integrated support system will eliminate the present need to enter and reenter data to cross over from one electronic system to another. It is estimated that approximately 2 FTEs of WM data entry staff could be eliminated as a result, amounting to approximately $200,000 a year in cost savings.

Electronic Data and Process Management - Incorporating state-of-the-art, off-the-shelf, information management technologies into the fully integrated support system will allow for "real time" inventory management, compliance tracking, shipment planning, and regulatory reporting, all of which would provide substantial cost savings. If the effort associated with the

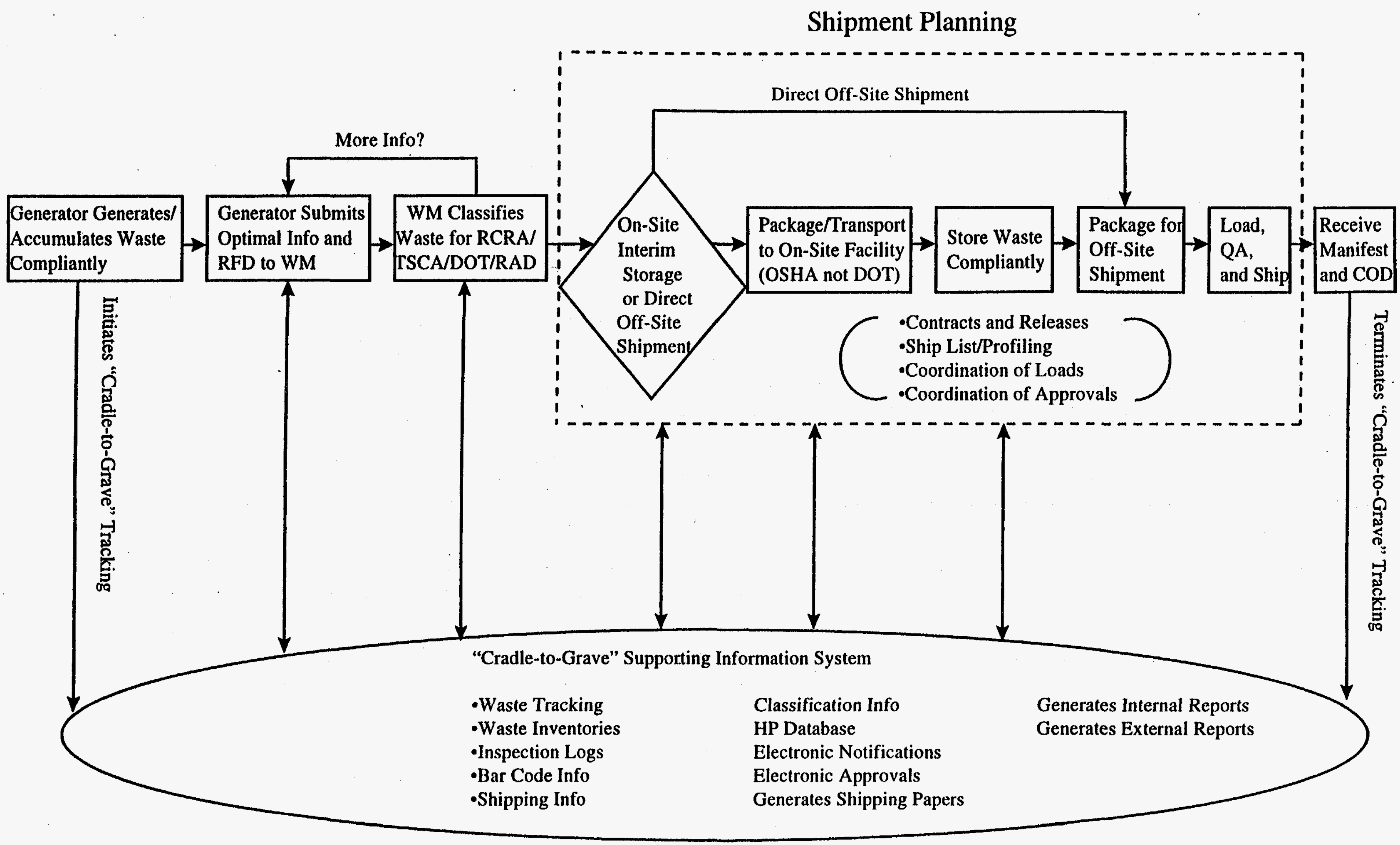


Figure 1. Simplified "Ideal" Process for Hazardous/Mixed Waste Stream

TABLE 1

ENVISIONED ATTRIBUTES OF A "CRADLE-TO-GRAVE" WASTE INFORMATION MANAGEMENT SUPPORT SYSTEM

User Friendly	Menu-Driven
"Expert" Based	"N&S" Based

Generator enters data into system at the beginning

Serves as notice that waste has entered accumulation area

Serves as inventory log

Barcode readers actually work with the system

Barcode readers facilitate waste movement

Barcode readers update tracking system directly

"Expert System" - Simple input required for simple waste, complex for complex

"Paperless" checking and certifications - minimum approvals in real time

Provides for electronic signatures

Easily generates inventory reports and corporate reports

Directly generates the off-site manifests

Waste Minimization/Pollution Prevention benefits

Allows for waste trending and forecasting

Provides electronic interface with off-site TSD

Easily generates annual regulatory reports

RCRA and PCB annual reports alone could be cut just 30%, this would amount to an annual savings of approximately $40,000.

Total potential annual cost savings for just the hazardous/mixed waste stream portion of this recommendation, based on the above, is about $1,350,000. Additional cost savings would be realized by expanding this "cradle-to-grave" reengineering to other waste streams.

BARRIERS TO IMPLEMENTATION:

Denial that current process and supporting systems are not optimal. (Specific recommendations to address this barrier are expected to be developed by the Communications and Reporting/Records subteams.)

Will require upfront investment of personnel to define process and personnel/capital to aquire and deploy supporting system. It is estimated that detailed "ideal" process definition for all waste streams would require approximately 2 FTEs worth of effort at a cost of about $200 K. Cost for deploying the system cannot be reasonably estimated prior to process definition.

Shifting of risk/liability from generator onto waste management, from customer onto service, from one company to another, from one DOE program to another.

RECOMMENDATION #2: (Near-term)

The approval for shipping waste to off-site facilities is to be streamlined to minimize duplicative reviews and delays in executing shipments. The Director of waste management shall be authorized to approve waste or waste stream shipments to off-site facilities verifying appropriate certifications are completed and requirements at the receiving facility are met.

NARRATIVE:

Waste to be shipped off-site for commercial processing is to be processed in accordance with written procedures (approved by DOE if for non-radioactive waste). The Director of the Waste Management Organization is to be accountable for assuring that shipments are certified in accordance with approved processes/procedures and with the receiving facilities waste acceptance criteria, permits and licenses where applicable. The overall actions for shipping waste off-site shall include a notification to the receiving facility of radioactive release criteria used if appropriate for non-radioactive waste. Understanding of such notification shall be demonstrated upon signature of the vendor's representative on the appropriate procurement or waste acceptance or waste transfer documentation. The Director may choose to approve each shipment of waste or all wastes of a given origin or container type or all shipments of a given waste stream to a given facility.

(NOTE: The below discussion applies only until March 1998. After that date, the above process is appropriate.)

Waste to be shipped off-site for storage or processing at another Oak Ridge site shall be shipped in accordance with site shipping procedures which shall include provisions for characterization according to the centralized RFD and/or waste data entry forms used to track waste. Once entered into the system, the waste tracking data base shall be used and updated as necessary to reflect the waste character or supplemental waste characterization and as the means for transferring waste from site to site. The required packaging, marking, or labeling to meet the receiving site requirements shall be affixed by the generating site. Shipping schedules shall be arranged with the receiving site.

COST SAVINGS:

Savings are in terms of multiple reviews requiring resources for both the review team and the site management team attempting to ship the waste. A typical review can consume as much as 20 man-hours of review team effort and 30 man-hours of site personnel time preparing and participating in the review. Some actions by the site team would be required as part of the planning preparation for the actual shipment. Considering there could be a shipment per month of hazardous waste and a shipment per quarter of mixed waste, this could be a savings of 800 man-hours ($60,000) per year in addition to any other costs attributed to delays of the actual shipment and waste movement. One such cost of this system "constipation" results from full storage facilities which prevents waste pickup from generator areas, thus requiring generators to devote extra time and resources to waste management tasks.

BARRIERS TO IMPLEMENTATION:

Objections to this modification could come from Central LMES Environmental Compliance in the form of no independent verification that LMES liability is minimized, as long as LMER is shipping under LMES waste disposal contracts. (The current level of reviews exceeds the number and method employed at other LM sites relative to shipping waste to off-site facilities. There is still a planned involvement for quality assurance to perform independent verification that the shipment process is intact throughout the planned shipment activities.) Some objection could stem from use of single versus multiple subcontracts and the source of funding. (The change in the EM subcontract will impact the current subcontracting arrangement anyway. Funding for LMER activities is expected to revert to direct funding at LMER after FY98.)

RECOMMENDATION #3: (Near-term)

Accelerate the LMES-to-LMER transition of waste management facilities and funding necessary for ORNL to independently manage newly generated waste, including:

Transfer legacy mixed waste to ETTP (formerly K-25 Site) as expeditiously as possible, ideally prior to the awarding of the EM M&I contract in March 1998. To accomplish this, the process for which waste is shipped to ETTP must be streamlined.

Transfer legacy hazardous waste (waste that presently does not have a "no-rad-added" approval) to off-site treatment or ETTP as expeditiously as possible.

Develop an MOU and schedule for the transition of NG facilities to LMER.

Close all Legacy Waste facilities emptied by transfer to ETTP or off-site treatment.

NARRATIVE:

One of the most common issues raised during Hazardous and Mixed Waste Reengineering discussions was the fact that hazardous and mixed waste storage facilities are near or at full capacity with legacy waste (i.e., waste for which no clear treatment capacity exists and therefore requires prolonged storage). This situation severely hinders the ability of waste management to accept newly generated waste from the generators in a timely and efficient manner. This problem is further compounded by the fact that all storage facilities at ORNL are co-operated with DOE by LMES only, not LMER, even though these facilities are LMER's sole capacity for the storage of NG waste.

The recommendations presented above should effectively eliminate these problems by first reducing the inventory of legacy mixed waste through expedited shipment to ETTP for interim management until such time treatment and disposal capacities can be established. It should be noted that at times it appears that some elements of the process for shipping waste to K-25 (for example, generation of new 2109 forms and changing barcode lables) are redundant and/or arbitrary. It is suggested that LMER and LMES work together to streamline the process to the extent possible. Likewise, legacy hazardous waste will be reduced by shipment to off-site commercial treatment. In fact, even a partial removal of the legacy inventory from ORNL will allow segregation of LMER NG waste from LMES (DOE EM Program) waste into LMER and LMES designated storage facilities (the current near full capacities do not allow such flexibility in storage arrangements).

Of course, in order to allocate sufficient ORNL storage capacity to LMER from the existing LMES storage units, a formal MOU must be negotiated (or existing MOUs must be revised). The MOU must clearly define roles and responsibilities as well as budgetary arrangements to properly align facility oversight (permit maintenance, facility management, etc.) with the program mission utilizing the facility (LMER with DOE-ER and LMES with DOE -EM).

One other consideration reflected in the recommendations was that the new M&I contract is scheduled to go into effect in March 1998. This suggests that only 12 months remain where two LM companies will be able to work together to solve this problem. Therefore, every effort should be made to build cooperation between LMER and LMES in areas that will help implement these recommendations within this window of opportunity.

COST SAVINGS:

If the recommendations offered above can be realized, tangible costs savings should be realized by LMER. The cost savings will be a result of more efficient and focused storage of LMER NG waste as legacy waste is either shipped off-site for treatment, shipped to ETTP for interim storage, or segregated to legacy designated units at ORNL. In the current storage facility configuration, over capacity storage results in much time spent "shoehorning" NG waste in with existing legacy inventories resulting in a large degree of staff work and facility planning to deal with the overcrowding. It is difficult to cleanly separate legacy storage costs from NG in the current budget structure and it is therefore difficult to calculate with any degree of confidence the reduction in NG waste management effort that may result with a reconfigured storage arrangement. However, if it is granted that there is roughly a 50/50 split in NG vs. legacy storage costs and a modest 25% reduction is assumed in the cost to manage NG waste, then a **$390,000** annual savings could be achievable.

This figure is based on overall storage cost for Haz. and MW of $395,000 and $2,728,000, respectively. Therefore cost savings might be (0.25)*(0.50)*($395,000 + $2,728,000) =

$390,000 in savings over the FY 1997 budget.

One other cost savings consideration involves savings resulting from facility closure. While it is likely that this savings will be reaped by the EM program rather than LMER per se, it bears mentioning here. The two facilities most likely to be closed first are facility 7823 located in SWSA 5 and bulk oil storage tank 7830A located near the MVSTs. These facilities now cost on the order of **$1.3 million** to operate per year.

BARRIERS TO IMPLEMENTATION:

Inability to transfer waste to ETTP due to lack of characterization for shipment and funds for characterization and shipment. An estimate of the cost to ship all hazardous/mixed legacy waste to ETTP is $325,000. Costs for any additional characterization or repackaging that might be required to allow shipping to ETTP have not yet been estimated.

Failure of LMES and LMER to work together for a "win-win" outcome before the transition to the new M&I contract.

RECOMMENDATION #4:

Update and maintain the health physics database on current posting of RMMAs to serve as a historical record and status of the RMMAs at ORNL. Allocate adequate resources to maintain the database.

NARRATIVE:

The Office of Radiological Protection has a database on the World Wide Web listing the posting of RMMAs at Oak Ridge National Laboratory. There are several organizations and projects that find the database useful including Pollution Prevention, Waste Management, Office of Radiological Protection, and RADNESHAP. Currently the database is out-of-date due to loss of funding and personnel.

In a telephone conversation, Jerry Hunt stated that due to funding cuts ORP has lost 30 people over the last two years. Four of these people spent part of their time maintaining the database. Time and money have not been allocated to update the database, which requires continuous effort. Currently the database is 9 to 12 months out-of-date.

The database ideally should be a real time status of the posting of the RMMAs of ORNL as well as a historical record of former postings. Presently, Waste Management has to confirm that the items they pick up are out of a RMMA or not by physically going to the area and checking its status before pickup. The No Rad Added program makes this check essential in planning for the pickup. A well-maintained database would serve to eliminate trips to the area to verify its status as a rad area or not.

This database has several users of which Waste Management is one. Generators in every organization will benefit from the more efficient operation of Waste Management when cost of waste disposal is charged to the generating organizations. LMER managers need to consider the wide spread impact a current RMMA database will have on the operating cost of ORNL when selecting a source for funding the maintenance of the database.

COST SAVINGS:

Waste Management would no longer have to make field trips to confirm the radiological posting status of the area before waste pick up. On 500 items recently approved for offsite shipment, availability of the HP database would have saved approximately 40 labor hours of WMRAD and generator time to conduct field verifications of postings. At a conservative average rate of $60 an hour, this amounts to about $2,500. Assuming only 12 off-site shipments of this size per year, it still translates into an annual savings of $30,000 on waste shipments alone.

BARRIERS TO IMPLEMENTATION:

Lack of funding to update and maintain the database appears to be a substantial barrier. The estimated $$$ it would take to accomplish this would seem to be within the reach of reengineering the Office of Radiation Protection.

RECOMMENDATION #5: (Near-term)

Operators of 90 Day Areas should turn in completed 2109s within 10 calender days of placing the waste in that area. This time frame will allow for the flexibility to ship off-site directly from large quantity 90 day areas. It will also eliminate duplication of work for waste items not fully classified due to the waste forms not being completed and received in a time frame to allow required steps for pickup.

If there are extenuating circumstances which prevent submittal of the forms within 10 days, a plan of action should be worked out before hand with agreement of the generator and WM. The generator will be accountable for any additional costs and regulatory noncompliances caused by submittal of 2109s later than 10 days.

NARRATIVE:

The submittal of complete 2109s is a vital part to the movement of waste out of the generators staging areas. In the past this vital step has not been completed by some generators until very late into the 90 day period. Waiting this late requires the HWOG to classify, package, transport and store temporarily on the best information available. When the completed 2109s are received, they are classed and the waste is moved to the proper interim storage facility. This situation requires additional tracking of temporary items and also result in duplication of work. These items become priority because of the danger of a noncompliance for exceeding the 90 day time limit.

Shipments made directly from 90 day areas will require coordination of preparing waste for shipment to off-site treatment and disposal facilities. This will require most of the 90 day time period to complete. After the completed 2109 is received, the waste must be tracked (cradle to grave), classified (RCRA and DOT), profiled with the disposal company, packaged, DOT marked and labeled, manifest prepared, checks and approvals completed, and coordination of pickup with the waste disposal company before the 90 day limit. Most of these disposal companies charge a flat rate for every truck brought on site, therefore shipments must be coordinated to get full loads and hold cost down.

COST SAVINGS:

Savings from eliminating duplication of work for waste going to on-site interim storage would be approximately $10,000 per year.

Savings from having the time frame to ship directly to an off-site disposal company would vary greatly depending on the amount of waste generated. Waste would need to be generated in a compatible quantity large enough to make it cost effective to bring a truck on site or combine a load coming from a interim storage facility. This savings is estimated at $20,000 per year, for a total annual cost savings of $30,000.

BARRIERS TO IMPLEMENTATION

Generators may feel as though they are being unduely imposed upon, but the process cannot work efficiently without their cooperation. Decision is still up to generator on when to submit forms, but they can no longer hide behind the arbitrary sheild of WM being responsible.

Generator Interface Group may not be available to help the smaller divisions immediately because it is a limited, pilot program.

RECOMMENDATION #6: (Near-term)

> The On-site Transportation Plan should be rewritten to clearly specify "necessary and sufficient"-type requirements applicable to movement of wastes on-site. The current version has lead WM to conclude that "off-site DOT equivalency" is required on-site, so they have created protocols, approvals, and recordkeeping systems to assure their compliance.

NARRATIVE:

The Occupational Safety and Health Administration (OSHA) regulations governing transportation of hazardous materials was adopted as part of Oak Ridge National Laboratory's (ORNL) Necessary and Sufficient Set of Standards (N&S). It was determined that U.S. Department of Transportation (DOT) standards would not be the contractual standard for on-site movement of hazardous materials at ORNL. Although this determination was made and agreed upon by ORNL and DOE in July 1996, it has not yet been implemented at ORNL.

It is recommended that ORNL's Transportation Department (R. Walker's organization) rewrite ORNL's On-site Transportation Plan to comply with OSHA standards for on-site transportation of hazardous materials. DOT regulations should be considered and incorporated where appropriate. Support for the effort would be provided by ORNL's Office of Safety and Health Protection (OSHP) and Waste Management and Remedial Action Division (WMRAD). Other organizations may be asked to assist, as needed.

It is recommended that an aggressive schedule be followed to rewrite the On-site Transportation Plan because an immediate cost-savings could be realized. A short review period by appropriate ORNL organizations should take place with immediate implementation.

COST SAVINGS:

The savings for changing On-Site DOT (marking, labeling, on-site manifest) to an OSHA based program is in the range of $20,000 annually in packaging and labelling costs. In addition, it is estimated that 1 FTE from LMER Transportation could be eliminated through elimination of the unnecessary reviews and approvals, with an annual cost saving of about $100,000. The total cost savings will vary depending on what OSHA requirements replace the DOT requirements, but are conservatively estimated here $120,000.

BARRIERS TO IMPLEMENTATION:

Misperception that LMER would not be complying with laws and regulations because we would no longer be going beyond compliance, as we have been.

Misperception of increase of risk to workers because materials are no longer packaged for off-site shipment just to move across the site.

FUTURE ACTIONS

FUTURE ACTION #1:

Eliminate excess requirements in RCRA permits.

NARRATIVE:

Requires a focussed "necessary and sufficient"-type review by small group of subject matter experts, followed by permit modifications. Listed as a future action because of present uncertainty regarding permit "ownership" and current regulatory climate not being conducive to permit modifications. Although specifically an item in the original charter, the team chose not to address it in detail at this time because of the above.

FUTURE ACTION #2:

Evaluate potential cost savings in analytical work - off-site analysis/sampling services.

NARRATIVE:

The cost of obtaining sampling and analytical services internally are generally regarded as not being competitive with external sources for small quantity work such as that used for waste characterization when process knowledge is reasonably good. The possibility of having direct ORNL contracts with outside labs (versus having to go through the Sample Management Organization) was raised. This was listed as a future action because of uncertainty as to how the formation of the "NEWCO" might affect the availability and cost of sampling and analytical services.

FUTURE ACTION #3:

Conduct make-or-buy analyses to determine the viability of outsourcing discrete elements or the totality of the hazardous/mixed waste management process.

NARRATIVE:

Listed as a future action because the discrete elements of the "ideal" process have not yet been fully defined, nor is cost information presently available on these elements to use for comparison purposes. Certainly commercial treatment and disposal will be outsourced, as can off-site shipping. On-site packaging for off-site shipments from storage areas is also a candidate for outsourcing. However, vendor packaging and pick-up direct from small quantity generator areas would not appear to be viable due to costs for low volumes and risk to laboratory areas.

HAND OFFS

HAND OFF #1:

Modify current certification process to achieve immediate benefits with minimal investment -HAND OFF TO CERTIFICATION/VERIFICATION AND RECORDS AND REPORTING PROCESS TEAMS

NARRATIVE:

The Hazardous/Mixed Waste Stream Process team believes that immediate benefits could be derived by reducing the level of information currently required on the 2109 form to the minimum that WMRAD needs to begin the waste management process. We believe this can be accomplished with minimal investment through a focussed "necessary and sufficient"-type review of the 2109 by 3 or 4 subject matter experts and a few waste generators. Once the required minimum input is determined, local (LMER) intructions would need to be issued to waste generators and the GES may need to be locally modified to accept the new minimum for information.

We recommend that the Certification/Verification and Records and Reporting Process teams work in conjuction with the Hazardous/Mixed Waste Stream Process team to commission this review and implement the results.

HAND OFF #2:

Reopen Central Chemical Stores or a similar function - HAND OFF TO POLLUTION PREVENTION PROCESS TEAM

NARRATIVE:

The Hazardous/Mixed Waste Stream Process team believes that ORNL would benefit by reopening Central Chemical Stores or an equivalent function. Benefits envisioned include pollution prevention through reuse of useable chemicals, waste minimization through availability of small quantities of chemicals that would otherwise have to be purchased in bulk, and increased convenience and compliance through the operation of a single 90 day area for ORNL-wide accumulation of waste (out-of-date or otherwise unuseable) laboratory chemicals.

APPENDIX

Team Charter

Team Roster

Meeting Notes

Hazardous/Mixed Waste Reengineering Team

The Hazardous/Mixed Waste Reengineering Team is charged with providing ORNL with a well-managed, compliant, generator-friendly, and cost-effective approach to hazardous/mixed waste management for newly generated wastes. The team will be asked to consider the following:

- Assessment of day-to-day operations
  - Map the operations process
  - Evaluate areas for technology improvements
  - Identify activities performed by operations personnel, i.e., ORNL site spill response
  - Once established, ORNL's Necessary and Sufficient standards will be evaluated for incorporation

- Identify process for off-site shipments of hazardous waste
  - Evaluate off-site shipment from generator areas

- Determine generator waste management cost from generation to delivery to waste management organization

- Assessment of current hazardous waste permits
  - Identify unnecessary requirements
  - Evaluate innovative approaches to relax permit requirements

- Identification and evaluation of areas where make-buy analyses are appropriate for outsourcing determinations

- Benchmark the best-in-class hazardous waste operation at a comparable R&D, government, and/or industrial setting, and use those data in developing recommendations

- Identification of barriers to reengineering

- Estimation of performance improvements and/or cost savings which will result from the recommended changes

The Subteam recommended changes will be provided to the core team by April 7, 1997, for the priority processes evaluated.

2/27

		Phone	E-mail
Team Leader	Jon Forstrom	6-5640	KAF
Core Team Champion	Jerry Bohannon	1-3709	OHA
Facilitator	Tim/Kathy		
WMRAD Rep	Dave Drake	1-3694	DKX
Technical	Jeff Gilpin	1-2844	KGI
Waste Gen. 1	Jamie Bain	6-8665	JMI
Waste Gen. 2	Gordon Miller	4-6235	ZGZ
Waste Gen. 3	Roger Spence	4-6782	SUU
P&E Rep	Larry Reeves	4-4214	VV5
Industry Rep	JIM BAILEY ~~Lance Monga~~, LMES	6-4489 ~~4-7258~~	~~RUN~~
Transportation Rep.	Greg Livengood/ Jeff Shelton	4-9458/ 6-6401	L6D/ EF6
ES&H	Crystal Schrof	4-9228	C7Z

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

S.A. – What are the issues? Bounds? Problems?

Haz./Mixed Ops.

- Start with when request for pick up comes in (includes verifying cert.)
- What am I trying to do with waste?
- Communication is an issue
- Storage facilities full
- No off-site shipments (May '91); therefore, the only alternative was K-25
- Nov.'96 - no rad added partial procedure (DOE approved) (still nothing on analysis)
- End point is shipping off-site or on-site treatment
- Start point starts when the generator says, "I need to get rid of some waste..."
- Include 90-day storage and satellite areas.

Customer(s)

(1)	–	generator	–	LMES Env. Compliance
	–	EPA	–	Corporate LM Board
	–	DOE	–	TSDF
	–	State	–	DOT
	–	General Public		

Process

Generator	(1)	Is it in 90 day?
Request	(2)	Is it in satellite?

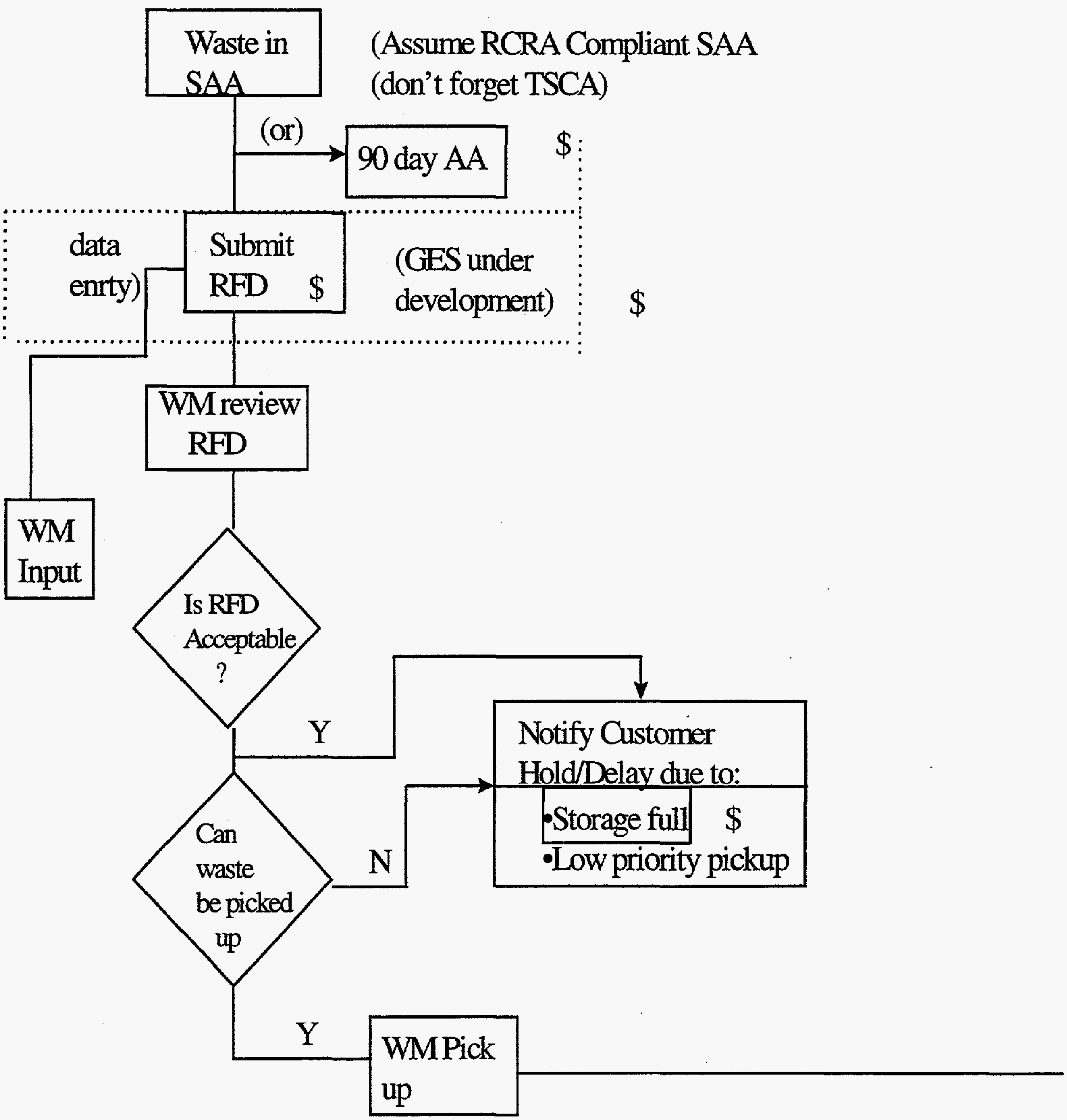
Analysis Team 1 90-Day		Analysis Team 2 Satellite Area	
1.	Gordon	1.	Jamie Bain
2.	D. Drake	2.	Jeff
3.	Crystal	3.	Jerry
4.	Greg	4.	Jeff
5.	Larry	5.	Jim
6.	Jon		

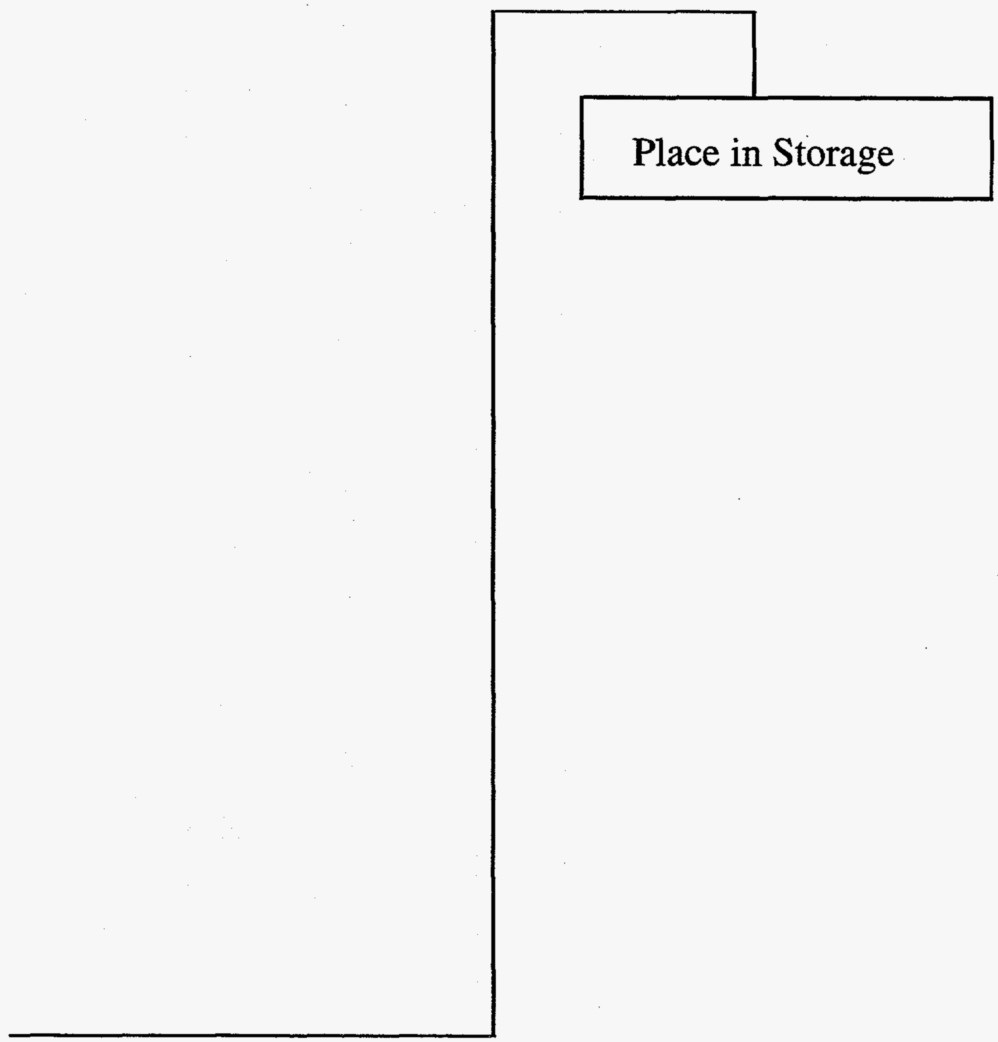
11:15 - 11:30 Next Steps

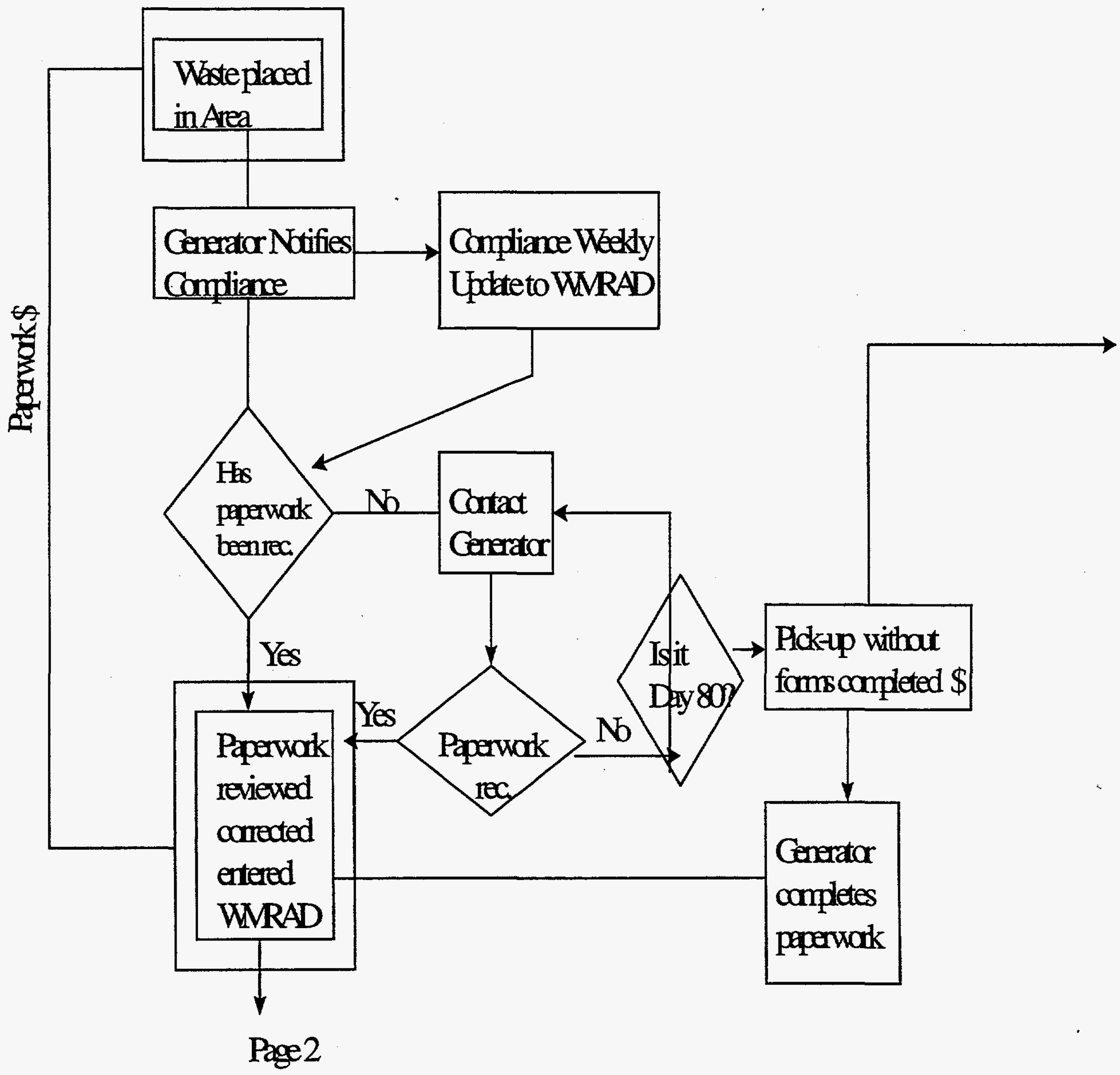
1. Complete S, I, O

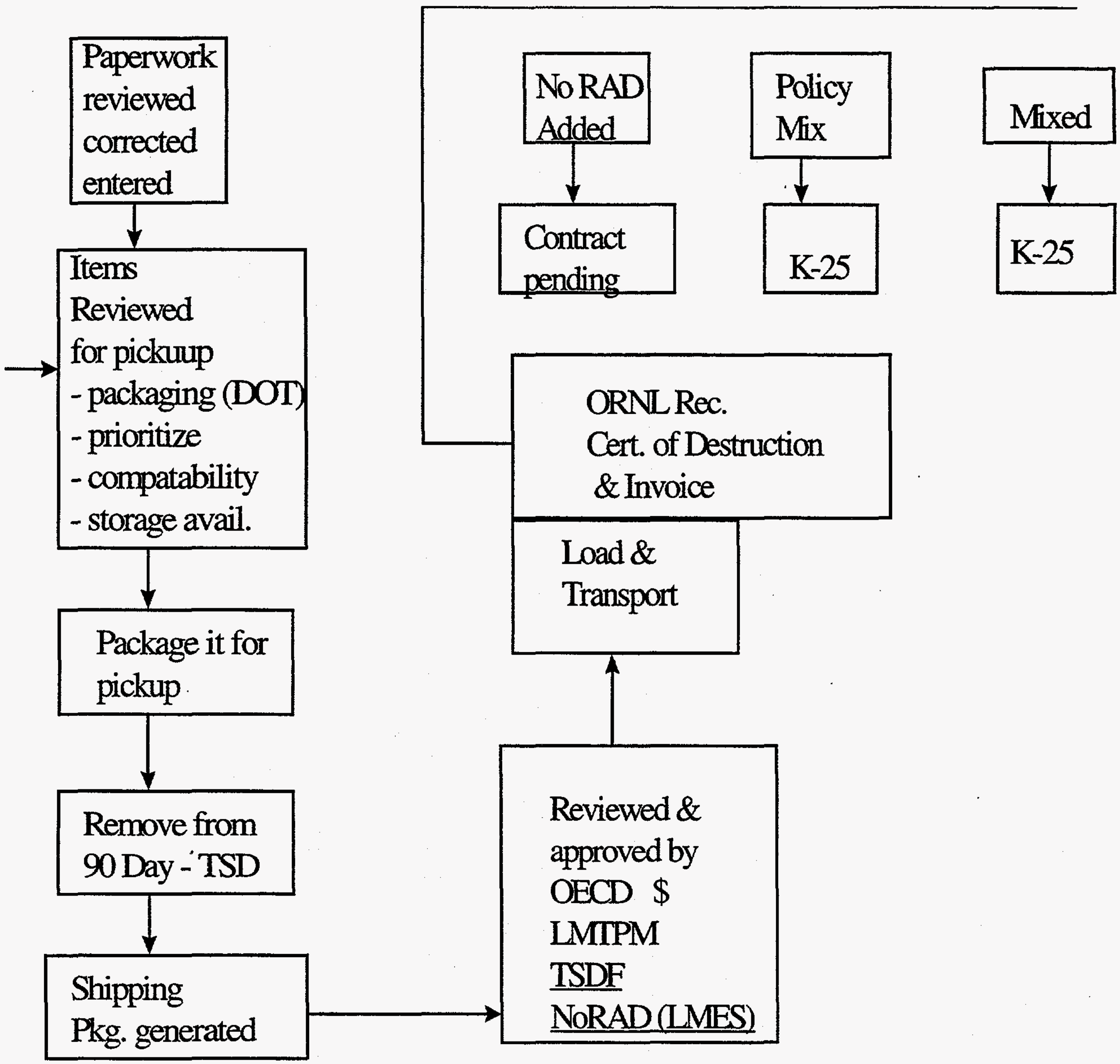
and 2. Map to be

3. Calculate savings (time & $)
4. PPA


Waste in SAA
(Assume RCRA Compliant SAA
(don't forget TSCA)
(or)
90 day AA
$
data enrty)
Submit RFD $
(GES under development)
$
WM review RFD
WM Input
Is RFD Acceptable ?
Y
Notify Customer
Hold/Delay due to:
•Storage full $
•Low priority pickup
Can waste be picked up
N
Y
WM Pick up


Place in Storage


Waste placed in Area
Generator Notifies Compliance
Compliance Weekly Update to WMRAD
Paperwork $
Has paperwork been rec.
No
Contact Generator
Yes
Yes
Paperwork rec.
No
Is it Day 80?
Pick-up without forms completed $
Paperwork reviewed corrected entered WMRAD
Generator completes paperwork
Page 2


Paperwork reviewed corrected entered
Items Reviewed for pickuup - packaging (DOT) - prioritize - compatability - storage avail.
Package it for pickup
Remove from 90 Day - TSD
Shipping Pkg. generated
Reviewed & approved by OECD $ LMTPM TSDF NoRAD (LMES)
Load & Transport
ORNL Rec. Cert. of Destruction & Invoice
No RAD Added
Contract pending
Policy Mix
K-25
Mixed
K-25

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

SUPPLIERS	INPUTS
Generator	Certification (Waste) (90-Day/SAA) HP Survey Results Forecasting General Information/Feedback Characterization Data Completed Forms GES/Electronic Input

EMEF Data Management	Data Systems
	    Software
	    Hardware
	    Procedures
	Data Processing Support
	Report Generation

OECD	90-Day Status Report
	Regulatory Compliance Support Services
	    Technical Support
	    Regulatory Review
	    Generator Interface
	    Permits/Preparation & Negotiation
	    Regulatory Reports
	    Oversight of GEN/TSD
	    QA/QC Checks
	    Regulatory Interface
	OCED Certification/Approval
	Sampling Services
	Vendor Approval

SUPPLIERS	INPUT
ASO/SMPO	Generator Characterization Data TSD Characterization Data Spill Data Data Re-evaluation
Off-Site TSDF	WAC (Not limiting for Hazardous) Containers for Lab. Packs QA/Regulatory Review (Transportation, Treatment/Disposal) Certificate of Disposal
WMRAD	Initiate Process
EMEF WM	Off-site Disposal Contracts Requirements Reservation WACs Certification Requirements Specifies Forms Readiness Review for Shipment Business Management Technical Input Compliance Oversight LDR/PCB FFCA Site Treatment Plan WM Planning Shipment Quotas Vendor Approval

SUPPLIERS	INPUT
HP	*ORP Database HP Surveys of Operations

* = Critical input requiring improvement - major effect on no-rad added

P&E	On-site Transport (Hoisting & Rigging) Maintenance of WM Equipment & Facilities
QA&I	Inspection/Calibration
Engineering & Facility Safety	SAR/OSR
Site Safety	Safety Oversight
LMTPM	DOT Regulatory Review Packaging & Transport Specs QA Check of Marking, Labeling, and Manifests Transport Contracts Specs for Containers Provide Certification for Shipment
LMES Transportation Safety	Approval of On-Site Transport Driver Certification Vehicle Certification General Information of Transport Regulations/Requirements
WM Document Management Center	Document Management System
WMRAD Training Department	Need for training Develop training Give training Keep training records Coordinate outside training

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

OUTPUTS

- Packaged Waste
- Shipping Papers
- Manifests
- LDR Forms
- Non-Compliance Reports
- RCRA/TSCA Annual Report Data
- Corporate Annual Report
- Mixed Waste Inventory Report
- Management Ad Hoc Reports
- "Cradle to Grave" Records
- Maintain Compliant Operation - No NOVs
- "Warm Fuzzy" for Management/Customers - safety nets beyond compliance
- Feedback to Regulators
- Mixed Waste - additional info for TSDF

OPPORTUNITIES

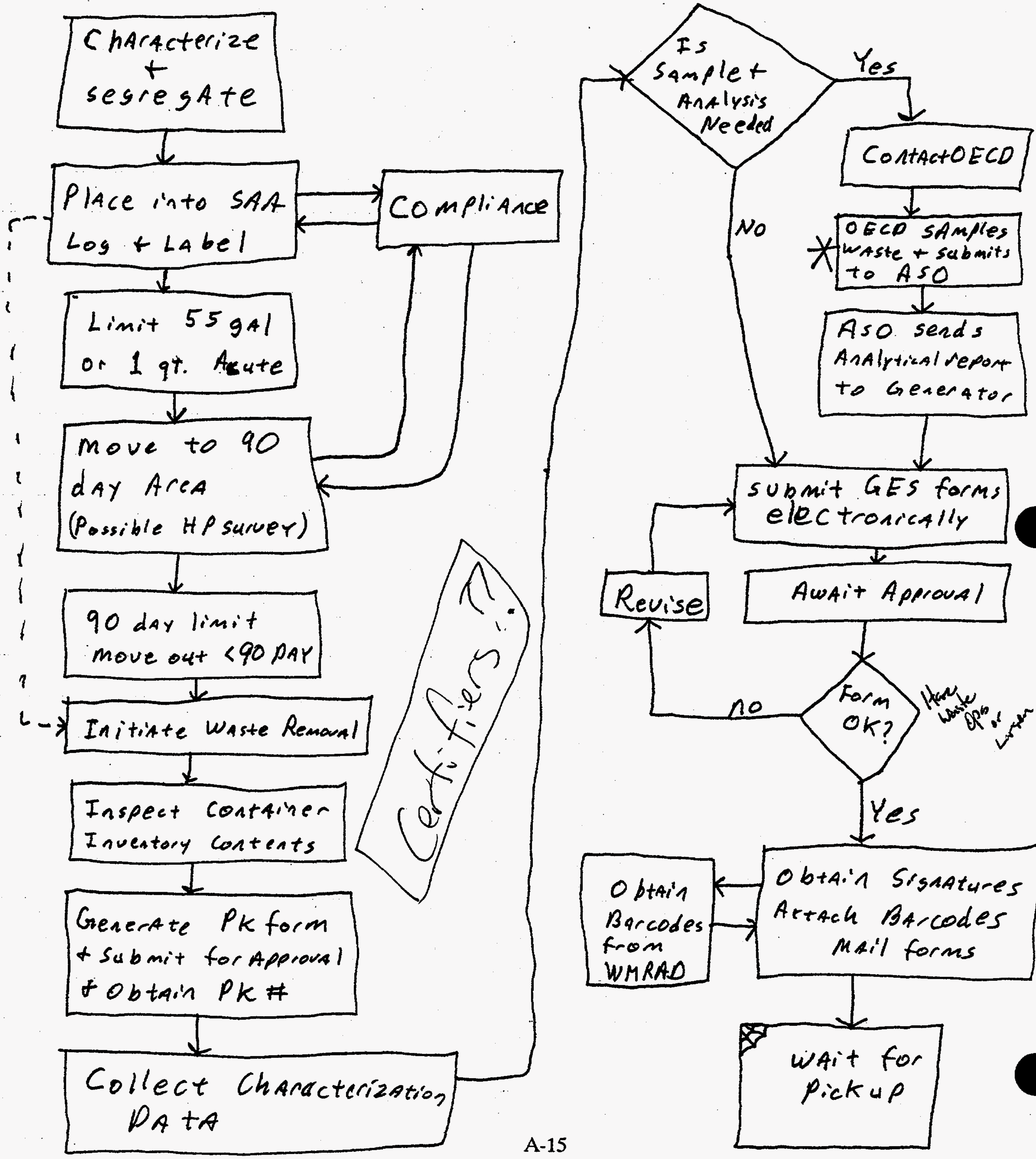
- PK & 2109 - expertise in WM, not researchers. Paperwork over & over - New 2109 for transport to sign
- Too many people in generator training because they are all assigning codes - let's have "professional" generators/code assigners
- ASO services extraordinarily expensive relative to off-site - not per sample, but burden on top
- HP surveys in non-RMMAs.

Possible fix in process:

Generator Interface Group -- GIE

Haz/Mix Team

Generator Flow 3/12



* Procedure says follow Protocol, Protocol not approved

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

OPPORTUNITIES

- Certifying no rad added - generators won't certify because WM has to pick up anyway - but then WM has to treat as policy mixed, do sampling and analysis, etc. - cost more
- What is going on beyond regulatory requirements - N&S and risk management - cost vs. risk reduction, NOT risk reduction at any cost
- Does LMER follow 5-site protocols or do what is right for Lab - Jan. '98 new EMEF contractor - who is in charge/responsible for WM decisions?
- New forms - 2109
- Change <u>management</u> culture - <u>trust</u> the generators and all organizations involved have done the right thing, rather than require training/checks/redundancies, etc.
- PPE - new DOE direction - <u>Implementation</u>
- Fix communications back to generators
- System to allow researchers to order only what they need - Pollution Prevention/Waste Minimization - Central Chemical Stores
- Training - too much/too many - still doesn't accomplish what it was supposed to
- Improve forecasting
- Improve efficiency of computerized systems - using electronic and multiple hard copies
- Permitting - N&S - overly restrictive requirements - self-imposed
- Sampling & Analysis - Worst case assumed most times in deciding on analysis - PK not used - so sample and analyze for everything, then results straight to WM who decides how to deal with based on data, no PK

- S&A strategy - using PK and <u>biased</u> strategy is ok, doesn't have to be "statistically representative"

- Is ASO using correct TCLP protocol for validation? Using safety factors to apply to data because don't know. Lab needs to be doing right thing.

- Vendor approval - N&S - why do we want to protect LM Corp more than they want? Use their lists when cost effective - unit costs.

NOTE: CONSIDER OUTSIDE VENDORS FOR ANALYTICAL SERVICES

- Computers to X-check environmental permits and waste inventories

- NEPA oversight ? of waste shipments

- Off-site hazardous/mixed waste disposal contracts - ORNL/ORR/Sector Options

- ORPS database deficient - needs to be improved/updated to provide maximum efficiency for no-rad added, light bulb recycling, surplus materials, materials movement, PPE of WMRAD facilities

- Excessive oversight/standards - SRIDS, Rus, self-assessments, SARs/OSRs, Conduct of Ops

- Approvals for on-site moves - transport safety and LMTPM both doing same reviews

- ASO turnaround time - can't get results fast enough, causes waste from 90-day handled twice. Data questionable, ASO not customer oriented.

- Use MSDs and PK more, especially if that is all vendor needs - not analysis

- Multiple certifications

- Streamline off-site shipment approval process

- Risk management on data - rad and non-rad - how much is really necessary to send to vendor?

OBJECTIVES OF HAZARDOUS/MIXED RE-ENGINEERING (1,5,10)

OBJECTIVE	GEN	DOE	MGT	REG
Cost Competive with Commercial Realm (Unit Cost)	10	10	10	5
Lower Cost to R&D Spent on Waste Disposal	10	10	10	5
Lower R&D Resources Devoted to WM - "Full Service"	10	10	5	1
Streamline Process - resp/auth/liab/account line up	10	1	10	1
Optimally Compliant Process (Necessary & Sufficient)	10	10	10	10
Off-Site Shipments are Routine	5	1	10	1
Mixed Waste End Point	5	10	10	10
Waste Minimization	10	10	10	10
Better Communication/ Teaming/Fewer Org. Barriers	10	1	5	1
Lower Service Resources (Lower OH) Devoted WM Process (HP, H&S, LMTPM, P&E, etc.)	5	1	10	1
Make Best Use of Info Technologies	5	1	10	1
Optimize Facility Use	1	10	10	1

3/14/97

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

HAZARDOUS/MIXED TEAM

Randy Walker

- DOT issues with Rollins during outsourcing - Lab pack shipments at &-12 - Rollins was not classifying properly for DOT, lots of problems
- Started watching Rollins closely, but they still did it wrong - had paid Rollins to pack, then paying to oversee, then paying to repack when there were problems
- DOT compliance is responsibility if Officer, not vendor - LM, not shared with DOE
- Now - WM does initial classification, then LMTPM checks (on rad side, Jeff does initial and Greg checks all LMTPM)

Butch

- Materials handled extremely complex, snake venom to explosives, very difficult to get correct DOT

Randy

- Have not had a RCRA manifest issue under this check and balance
- LMTPM - 27 DOT compliance people for 5 plants
    - Richland - 100
    - Sandia - 70
- If had to break out ORNL from Central, probably need about 13 - pre-centralization number for lab - K-25 highest volume, but ORNL highest complexity
- Initial classification is critical - but has to be based on correct information from generator!!
- If subcontractor taking things out, tend not to care what stuff is, just put in drum and take. No knowledge of processes, so no "expertise" in identifying potential problems, could wind up with incompatible, unknowns, rad wastes, etc.
- DOT is critical to process from the start
- Generators are not trained on DOT, WM classifiers are fully trained
  (Other level for Lab, unique shipments)

- If subcontractor came in to package and ship, LMTPM has to do at least same if not more oversight, also have to somehow ensure generators know more about DOT - either "idiot proof" forms or train generators - more burden on them.
- In past, Rollins should have been asking for more info from generators, but weren't, causing misclassifications from DOT and RCRA

<u>Butch</u>

- Shipped for about 6 years before moratorium
- Use to contract per shipment
- Then contracted for various classes
- Used Rollins/Insco/Chem Waste - decided by cost who to ship to
- Shipped about 200 K per year - once or twice a month
- X-10 used to pack own Lab packs
- Then the contractors decided to send own teams out because of problem at a Kiln
- When they came in to pack, WM put someone with them full time
- Drum size shipments - 60 to 80, took samples
- Also bulk shipments, lead, soil
- Bulk shipped out of tanks too, directly without going to permitted unit
- Were on charge back system to generator, so cost was a real driver
- Forms - old 13698 - some DOT information
- Upgraded forms for on-site shipping to have more info on DOT
- The RFD was one page
- Centralized 2109s asking for more info than necessary - much more than required to meet 40 and 49 CFR.
- It's a "one-fit-all" form - needs to be reviewed to remove excessive info required - does it still need to be "one-fit-all"?
- Would let on-site TSDs get about ½ full before shipping
- Would "top off" shipments with the non-regulated wastes
- Were on 100% charge back, charge for pick up then charge for disposal
- Have to pay for total package of waste for disposal, container, packing, and waste
- Staffing - increased after moratorium - new regulations but also new requirements/bureaucracy of new waste management "program"
- New forms, readiness reviews for off-site shipments, data bases, reporting requirements, procedures, conduct of operations, OSRs, PPE, etc.

  (Mod/High hazard facilities now - is this necessary?)
- Butch says in April 1991, had a system in place that he was comfortable with to prevent DOT and RCRA violations
- Paul Rowher signed manifests - Env. Compliance generators didn't have certifications except "brown tags", unknowns, certifying not in rad. areas
- Bulk shipments were from generator areas, didn't Lab pack at generator areas except Biology and Fusion Energy

Bailey

- Pre-moratorium - 5 plants shipped 2.1 million pounds per year to 16 different vendors - now down to about 2 vendors available

Brad McClelland

- Waste Certification team a year ago - wanted 4 improvements
  - waste certification
  - waste acceptance criteria
  - waste generator interface, support
  - characterization
- 7 people in group
- Will go out and assist divisions
- 6 or 7 divisions signed up for pilot program
- Paid for by WM this year - official start time April 14th
- Will do MOUs with generators
- Will do wide variety of services
  - multiple teams working on charging processes - certification team, generator interface
- Eliminating waste certification, but adding self-assessment program on the divisions
- GIG crosses all waste streams
- Will be tracking costs as if charging generators
- Waste profile forms will replace PK forms

Copy of presentation and memo

3/18 + 3/19

"IDEAL" DATA PROCESS

- **Generator Generates/Acc. Waste Compliantly 1.1.0**
  - Regulatory Training 1.1.1.0
  - Characterization/PK 1.1.2.0
  - SAA 1.1.3.0
    - Regulatory
    - Labelling
    - Segregation
    - Logs
  - 90-Day 1.1.4.0
    - Additional Training
    - Regulatory
    - Labelling
    - Segregation
    - Logs
    - Inspections
    - Required Documents
    - Annual Re-Training

- **Generator Provides Optimal Info. to Waste Mgmt. 1.2.0**
  - Generator Fills Out Electronic "Form" 1.2.1.0
  - Send Form to WM 1.2.2.0

(Initiates "Cradle to Grave Tracking")

Classify Waste for RCRA/TSCA/DOT/Rad 2.1.0

- **Review Forms for: 2.1.1.0**
  - Dot Determinations
  - Assign Shipping Names
  - Assign Waste Codes
  - Establish Packaging and Labelling Requirements
  - No Rad Added
- **Request Additional Info from Generator 2.1.2.0**

Enter Classification Data Into System 2.2.0

- **Cradle to Grave Electronic System**

•Generator enters data into system at beginning
•Serves as notice waste entered 90-day area
•Serves as inventory log
•Barcode readers actually work with system
•"Expert System" - Simple paperwork for simple waste
•"Paperless" checking and certification-real time
•Inventory reprots/corporate reports
•Off-site manifests
•P^2 benefits
•Waste forecasting/trending
•Interface to off-site TSD
•Annual Report

Package Waste at Generator Area 2.3.0

- **Get Packaging Instructions from System 2.3.1.0**
- **Verification of Materials as Packaging 2.3.2.0**
- **Packaged for Direct Off-Site or for On-Site Shipment 2.3.3.0**

<u>Packaging Includes</u>
•Marking
•Labelling
•Correct Containers
•Separation/Segregation for compatability

Transport to On-Site Storage 2.4.0

- **WM Requests P&E to P/U Packaged Waste 2.4.1.0**
- **P&E Picks Up Waste Under WM Direction 2.4.2.0**
- **P&E Transports to On-site Storage Under WM Escort 2.4.3.0**
- **P&E Unloads Truck at Staging Area Under WM Direction 2.4.4.0**

•Eliminating on-site DOT would reduce DOT training requirements for P&E laborers
•WM "oversees" as RCRA and trained person, so everyone on crew doesn't have to be

Store Waste On-Site 2.5.0

- ***WM Segregates Containers Into Storage Facilities (Unpack Lab Packs) 2.5.1.0***
- ***Update Electronic Tracking Status for Location (Bar code reader) 2.5.2.0***
- **Permit Compliance 2.5.3.0**

•$ - Needs N&S review of permits
•Inspections
•Corrective Actions
•Record Keeping
•Maintenance
•Tours & Audits $$

- Direct Off-Site Shipment From Generator Area 3.1.0
  - Shipment Planning 3.1.1.0
  - Packaged for Direct Off-Site or for On-Site Shipment 3.1.2.0
  - QA of Shipment 3.1.3.0
  - Load Truck and Finalize/Sign Manifest 3.1.4.0
  - Update Electronic Tracking Status with Barcoding 3.1.5.0
  - Final Load Check After Scale Out 3.1.6.0

- Truck Gone!

- Eliminate off-site shipment approvals (rad) for haz
- Release criteria in RFP
- Contract(s) in place
- Per load release - procurement
- Ship list/profiling to vendor
- Coordiante loads
  - storage/DOT/time
  - segregation/cost/vendor availability/other site
  - truck route inside plant to generator areas

- Off-Site Shipment from On-Site Storage 3.2.0
  - Shipment Planning 3.2.1.0
  - Package (if necessary), Mark, and Label for Off-Site Shipment 3.2.2.0
  - QA of Shipment 3.2.3.0
  - Loak Truck and Finalize/Sign Manifest 3.2.4.0
  - Update Electronic Tracking Status with Barcoding 3.2.5.0
  - Final Loak Check After Scale OUt 3.2.6.0

- Truck Gone!

- Eliminate off-site shipment approvals (rad) for haz
- Release criteria in RFP
- Contract(s) in place
- Per load release - procurement
- Ship list/profiling to vendor
- Coordinate loads
  - storage/DOT/time
  - segregation/cost/vendor availability/other sites

- Receipt of Info from Off-Site TSD 3.3.0
  - Receive Manifest & Update System 3.3.1.0
  - Receive COD & Update System 3.3.2.0
  - Receive Invoice Instruct Acct. Payable to Pay Invoice 3.3.3.0
  - Final Update to System 3.3.4.0

<u>System Flags</u>

- No receipt of manifest - phone call to facility
- Non-receipt - contact regulator
- Receipt of COD

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

FOCUS AREAS

- Cradle to grave streamlined process supported by an electronic waste management/operating/tracking/info system

  — "expert/menu-driven" system
  — necessary and sufficient
  — minimum approvals

- DOT on-site - rewrite on-site implementation plan
- Accountability for 90-Day issues - not putting in paperwork in time - WM has to do double work
- Off-site approval process - LMER contract - NEPA approval
- HP database
- Transfer appropriate WM facilities to LMER for newly generated waste

HAND OFFS

- Modify current certification process to achieve interim savings - minimum info on forms & steps - change instructions
- Records and Reporting
- Certification/Verification
- Central Chem Stores to Pollution Prevention

FUTURE ACTIONS

- Eliminate excess requirements in permits
- Get funding from DOE directly to pay for NG waste disposal
- Evaluate training against N&S requirements
- Evaluate cost savings in analytical work - off-site analysis, etc./sampling services

APPENDIX H

ORNL WASTE MANAGEMENT REENGINEERING

REPORT FROM THE

TEAMING/FORECASTING PROCESS TEAM

June 26, 1997

INTRODUCTION

The Teaming/Forecasting Process Team evaluated the processes, problems and issues associated with communications between the ORNL Waste Management Organization* (WMO) and its current external (DOE EM-30) and future internal (waste generator) customers. Although the reengineering task is aimed at the process of managing "newly generated" (NG) wastes at ORNL, it is difficult to separate that from the management of "legacy" wastes because funding for both is and will continue for some time to be provided directly from the DOE EM-30, rather than through the waste generators. As a result, the Team did consider issues beyond the strict scope of NG waste, which are reflected in Recommendation #1.

Within the scope of NG waste, special emphasis was applied to evaluating the potential for improvements in "teaming" between the ORNL waste generators and WMO. Successful teaming is regarded as critical to achieving optimum efficiencies in the process of managing NG wastes. An important aspect of teaming, waste and cost forecasting, was also a focus area. Data sources for this evaluation included other Process Team reports, generator input, EPO input, and anonymous WMRAD staff input.

The Process Team identified five general areas for recommended improvements:

1) Lockheed Martin internal approach to communications and interactions with our external customer (DOE).

2) Culture change within ORNL, including: a) within ORNL senior management, to recognize waste management as a support service which is critical to the Laboratory's success; b) within ORNL WMO to become "generator-as-the-customer" service oriented; and c) within the ORNL waste generators to become responsible customers of WMO.

3) Teaming between WMO and ORNL waste generators.

4) Waste generation and cost forecasting.

5) Communication of waste management requirements to and accountability of subcontractors.

The Team did not calculate any quantifiable cost savings resulting from successful implementation of the recommended improvements, recognizing instead that these tend to serve as the "enabling actions" that will allow the more specific recommendations of the other Process teams to be successfully implemented. Therefore, calculating cost savings here would be "double counting" the savings already accounted for in the other reports.

Backup materials, including the team charter, team roster, and meeting notes are provided in the appendix.

* ORNL WMO includes WMRAD and its service partners such as P&E, HP, OECD, etc.

RECOMMENDATIONS

RECOMMENDATION #1:

Lockheed Martin should change our corporate approach to communications with our DOE customers to be proactive not reactive, to reflect our perspective that DOE is a single customer even though there are multiple factions within that customer, and to reflect our ability to please multiple and diverse customers (DOE and non-DOE) by developing "win-win" solutions that help achieve overall program cost efficiencies to benefit all customers. Table 1 lists specific suggested actions to successfully implement this overall recommendation.

NARRATIVE:

Much of the present waste management process is based upon an "us vs. them" culture that appears to have developed as a result of direct programmatic funding for waste management out of DOE EM-30. Thus the DOE WM organization has been viewed by Lockheed Martin as the sole customer of the process, not the waste generators and their DOE Energy Research, Defense Programs, or WFO sponsors. This resulted in the construction of barriers and a sense of divisiveness between Lockheed Martin entities because of the difference in objectives between their "different" customers. Figure 1 illustrates this situation, which is considered to be the biggest obstacle or barrier to successful reengineering of the ORNL WMO.

The fallacy of this barrier is that Figure 1 is too myopic. Figure 2 illustrates that, with a broader perspective, there is really only one DOE customer with one set of objectives for the waste management process. That single customer is the pool of American taxpayers, represented by Congress and the Secretary of Energy. At a level below this there are indeed separate DOE entities (factions) with differing objectives. However, those objectives should not be mutually exclusive. Rather, they should be mutually compatible since they emanate from the single set of objectives of the Secretary of Energy. Therefore, there is no logical or philosophical reason why a single service provider - Lockheed Martin - cannot meet the objectives/expectations of a single DOE customer even if there are multiple factions in that customer that need to be managed by multiple entities within Lockheed Martin. Note that once the EM M&I contractor is in place, that company also becomes a Lockheed Martin customer representing DOE interests.

In addition, there is no reason that Lockheed Martin cannot satisfy potential non-DOE customers (i.e. Work for Others customers) as well. It is incumbent on the different Lockheed Martin entities to work as a team to identify solutions that benefit all customers, then "sell" those solutions back to each separate customer based on that customer's objectives. Table 1 contains a list of suggested actions to be undertaken by Lockheed Martin senior management in order to successfully implement this overall recommendation, which will fully enable the successful reengineering of the ORNL WMO.

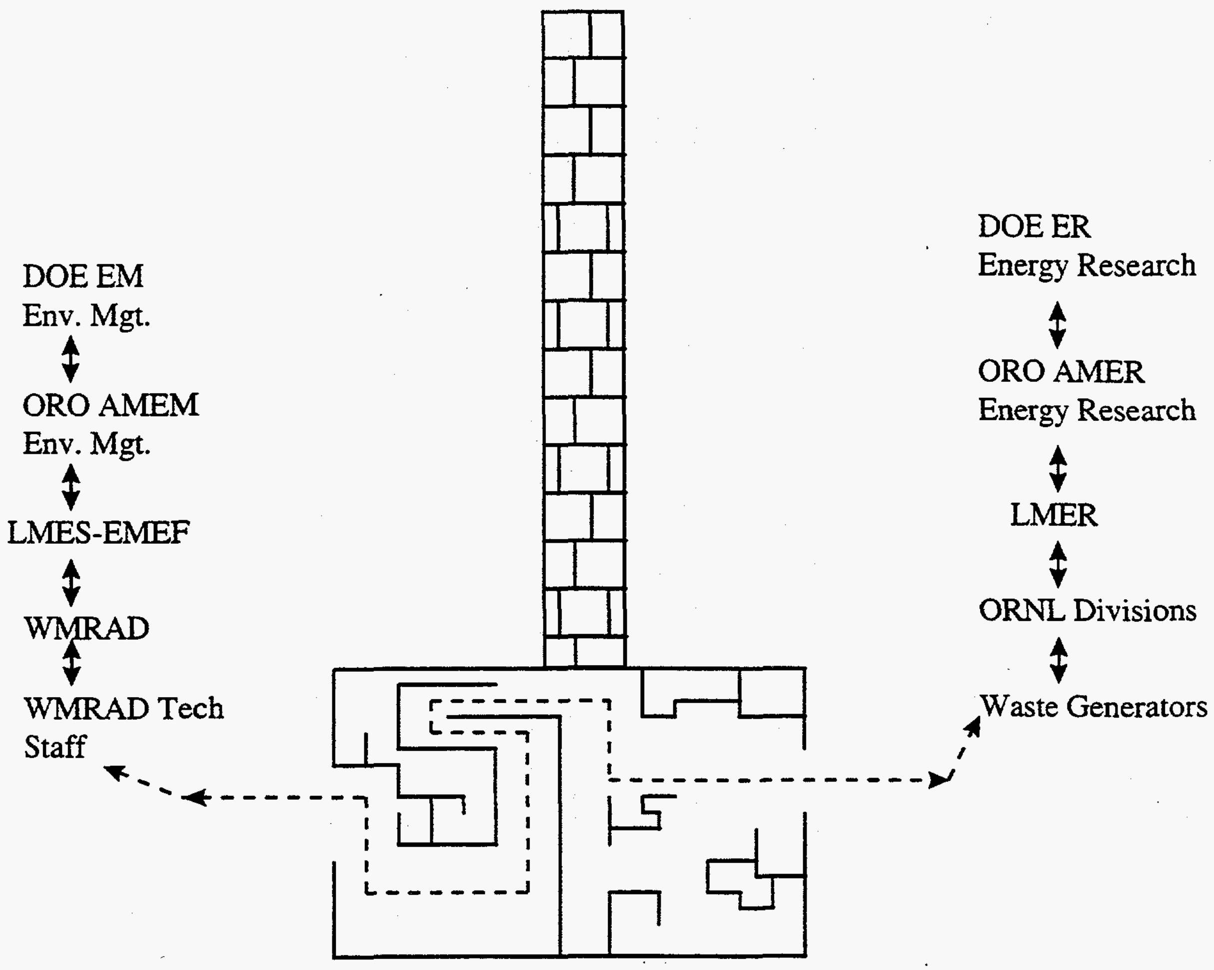


Fig. 1. Current Situation

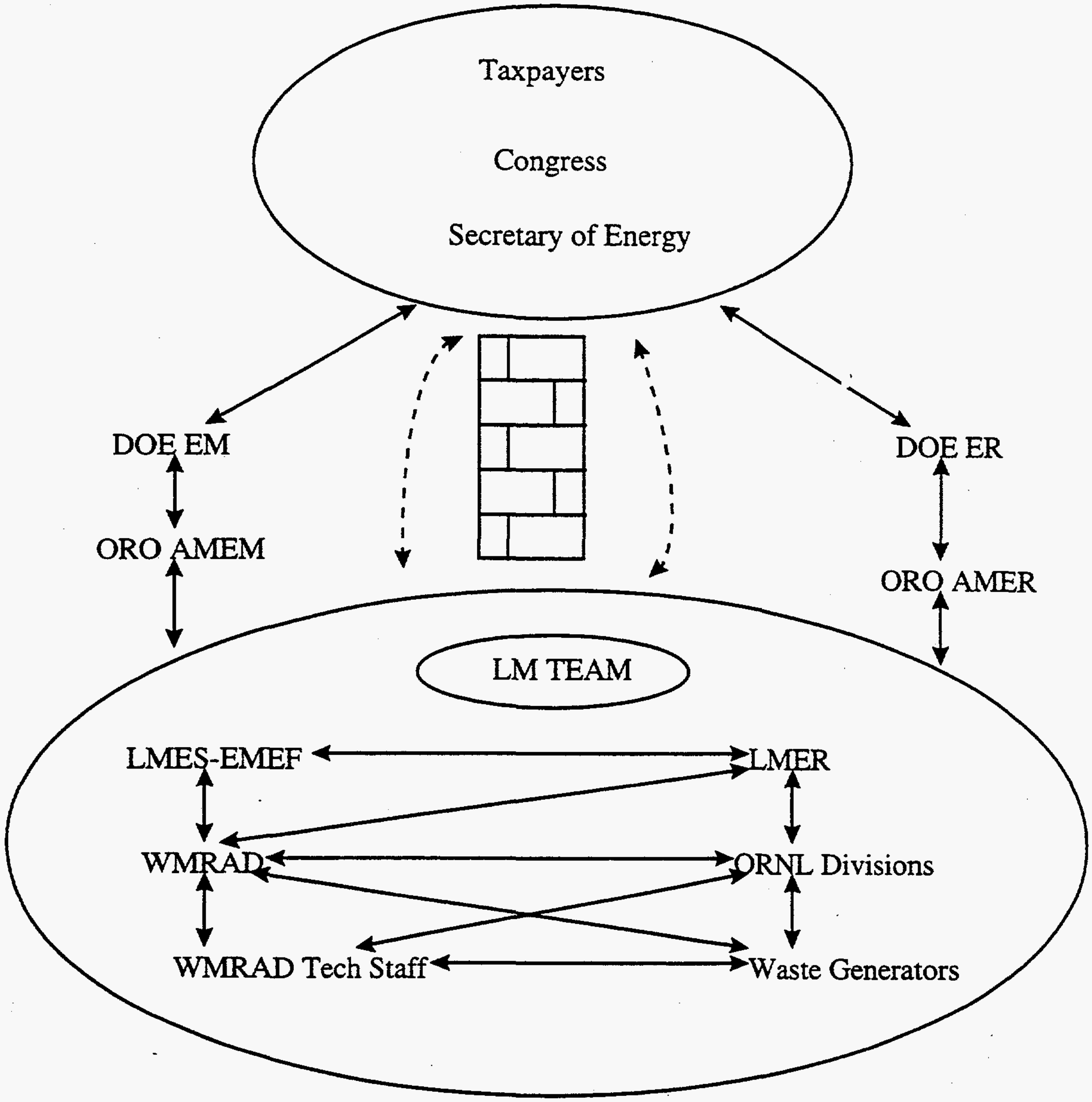


Fig. 2. LM Internal Team, External Relations

COST SAVINGS:

The cost savings to be achieved are reflected in the calculated savings of many of the specific recommendations in other process team reports which can only succeed through successful implementation of this recommendation. Therefore, to avoid double-counting, no additional cost savings were claimed.

BARRIERS TO IMPLEMENTATION:

Changing the status quo/shifting the paradigm - can be done, requires strong leadership in the form of an excellent communicator and salesperson, perseverance, a compromise builder, a person who can see things from multiple perspectives and strives to satisfy all customers. This leader must also be able to instill the same values through all levels of the organization to ensure they are working in harmony to achieve "win-win-win" solutions, and that no territoriality creeps in. An autocratic or dictatorial style is not the type of strong leadership needed for this role.

TABLE 1. SPECIFIC SUGGESTED IMPLEMENTING ACTIONS FOR RECOMMENDATION #1 (TO BE UNDERTAKEN BY LOCKHEED MARTIN SENIOR MANAGEMENT)

Recognize that DOE is a single customer with multiple factions.

Eliminate the artificial barriers constructed within Lockheed Martin to cater to separate factions of the customer. (May require organizational changes.)

Encourage teaming within all of Lockheed Martin, as the single service provider, to achieve the overall goals and objectives of our single DOE customer.

Recognize and accept that it is OUR (Lockheed Martin's) role to identify the solutions that meet the objectives of the single customer, then to "sell" those "win-win" solutions to the multi-factions. Sub-parts to this include:

> - NEVER ask a faction of the customer how to approach something - the answer will invariably consider only that faction's objectives, thus putting us at odds with the other factions (making us reactive).
>
> - NEVER tell the customer (especially not a single faction of the customer) that we have identified a problem they must solve before we can proceed. We were hired to develop solutions, not identify problems for the customer to solve. We should only request that the customer choose between multiple "win-win" solutions we have identified or buy into the single best solution we have identified, and even these requests for customer decisions should be rare. (Frankly, we should identify solutions and implement them. When the issue is of such magnitude that the customer needs to or should be involved, then we should be "selling" our best overall solution, not catering to individual factions at the detriment of others.)
>
> - WE (Lockheed Martin) should identify the solutions that meet the overall objectives of the customer, then proactively "sell" that approach to each DOE faction based on individual and overall benefits.

Communicate this philosophy throughout Lockheed Martin and live by it as the foundation of the "customer service" approach to doing business.

RECOMMENDATION #2:

Institute a culture change within ORNL--beginning with ORNL senior management--that recognizes waste management as an important service critical to mission success with potentially "show-stopping" ramifications. Further this culture change by instilling a "generator-service" attitude and approach to doing business within the WMO. Complete this culture change by encouraging ORNL waste generators to be responsible, accountable, and cooperative customers of the WMO. Table 2 lists specific suggested actions to successfully implement this overall recommendation.

NARRATIVE:

Much of the present waste management process is based upon an "us vs. them" culture (i.e. "WMO vs. the generators") that appears to have developed as a result of direct programmatic funding for waste management out of DOE EM-30. Thus the DOE WM organization is considered the customer of the process, not the waste generators who are wanting to get rid of the waste. This "paradigm" must be shifted to recognize the generator as the customer of the NG waste process and that WMO is the supplier of a service to that customer. (This paradigm will be consummated once the generator chargeback system is put in place.) The process for managing NG waste at ORNL must be reengineered around generator convenience and the principles of trust, teamwork, generator service, experience and expertise, "necessary and sufficient," and life-cycle cost efficiency.

For the ORNL WM reengineering to be fully successful, this culture change must be adopted at three different levels of the organization - ORNL senior management, the ORNL WMO, and the ORNL waste generating organizations. Specific suggestions of implementing actions for each of these levels are provided in Table 2.

At the first level, ORNL senior management must recognize that waste management is a support service which is critical to the mission success of the Laboratory. ORNL management also must recognize that there are parts of the waste management process which are highly technical and may require management investment and support to overcome technical and political obstacles. Finally, ORNL senior management should publicly embrace the return of the reengineered WMO to LMER and the ORNL team, which will begin a "cascading effect" of this culture change throughout ORNL.

At the second level, ORNL WMO must undergo a complete "re-direction" to focus on the waste generator as customer (not just DOE WM - and in the near future, must add the M&I contractor as customer), and to have a generator-as-customer service, teaming attitude. Obviously this will require WMO management not only to whole-heartedly adopt and endorse this attitude, but to demonstrate commitment to it through daily actions. "Cascading" of the culture change through the ORNL WMO can and will be successful only if WMO management leads the way.

At the third level, ORNL waste generators must recognize that along with the benefits of being the customer of the process comes the responsibility and accountability of budgeting and paying for waste management services, the responsibility of implementing P2 and waste minimization in their processes, and the responsibility to be cooperative customers of (team with) the WMO in order to optimize the NG waste management process.

COST SAVINGS:

The cost savings to be achieved are reflected in the calculated savings of many of the specific recommendations in other process team reports which can only succeed through successful implementation of this recommendation. Therefore, to avoid double-counting, no additional cost savings were claimed.

The costs to implement this recommendation would be minimal and composed of administrative effort along with the cost of training. Total costs are estimated to be less than $15,000.

BARRIERS TO IMPLEMENTATION:

DOE reaction - should be managed under Rec. #1.

Changing the status quo/shifting the paradigm - can be done, requires strong leadership in the form of an excellent communicator and salesperson, perseverance, a compromise builder, a person who can see things from multiple perspectives and strives to satisfy all customers. This leader must also be able to instill the same values through all levels of the organization to ensure they are working in harmony to achieve "win-win-win" solutions, and that no territoriality creeps in. An autocratic or dictatorial style is not the type of strong leadership needed for this role.

TABLE 2. SPECIFIC SUGGESTED IMPLEMENTING ACTIONS FOR RECOMMENDATION #2

TO BE UNDERTAKEN BY ORNL SENIOR MANAGEMENT

Issue official announcements heralding the return to ORNL of a reengineered WMO support service.

Consider technological advancements needed for ORNL to manage its own waste in the future when funding discretionary research (set asides?).

Consider investment of Energy Research capital and ORNL overhead funds into waste management projects that benefit and support the research mission of the lab.

Consider the plans and needs of the ORNL WMO in strategic planning for the Laboratory.

TO BE UNDERTAKEN BY ORNL WMO

Top-down attitude change/commitment to generator service/communication of that commitment to staff/reinforce commitment through actions - "Walk the Talk".

> Communication to staff can include memos, all hands meetings, department staff meetings, one-on-ones, MBWA.

Revise Vision/Mission statements for ORNL WMO to reflect generator service/teaming attitude.

Provide "Service with Soul" reorientation of WMO (see footnote for broader application).

Promote internal teaming, WMO working together (organizational changes may help)

Promote teaming between ORNL WMO and waste generators across the Laboratory - see Rec. #3 (organizational changes may help)

Provide additional service/marketing training for WMO managers.

Ensure success of Waste Coordination Team pilot - don't redirect priorities, assign right skill mix and cross-train, be able to expand service if requested by paying customers.

Make sure WMO performance metrics include measures of customer service.

Tie customer service/satisfaction performance directly into personal incentives like PPR, promotions, raises, awards, etc.

Celebrate generator service successes!!

TO BE UNDERTAKEN BY ORNL WASTE GENERATORS

Recognize and accept responsibility/accountability for budgeting and paying for waste disposal in the future.

Team with WMO to ensure optimum efficiency in the waste management process (see Rec. #3).

Provide WMO with waste forecasting information for planning purposes (see Rec. #4).

Review historical generation rates to evaluate potential future costs.

Review processes for waste minimization/P2 potential, which will lead directly to future generator cost reduction.

Footnote - "Service With Soul" Reorientation - The Process team wanted to take the opportunity to express its consensus opinion that the need for establishing a "customer service attitude" exists throughout the ORNL support service organizations. Other organizations frequently cited as excellent candidates for a "Service with Soul" reorientation include OECD, HP, H&S, P&E, and ORNL Transportation.

RECOMMENDATION #3:

Improve teaming between the ORNL waste generators and WMO to achieve optimum efficiencies in the NG waste management process. Table 3 lists specific suggested actions to successfully implement this overall recommendation.

NARRATIVE:

This recommendation is very closely related to #2. It has become obvious through the WM reengineering exercise that WMO and generators must work together to achieve the optimum NG waste management process. Neither party can operate isolated from the other yet expect for their part of the process to mesh perfectly with the other. That would be like constructing a tunnel from 2 sides of a mountain and never checking to be sure you were going to meet in the middle - you might wind up with 2 separate tunnels all the way through when you only needed/wanted one! Imagine the negative cost, schedule, and competence implications!

For this teaming to be most effective, it must take place continually and cover the entire spectrum of the NG waste management process from planning of waste generation through disposal. Limiting "teaming" to periodic communication and selective issue resolution would be like checking on the progress of approaching tunnels every once in a while. You might wind up with a single tunnel at the end, but it may have multiple curves and angles due to the magnitude of the periodic course corrections. Continuous teaming over the spectrum of the waste management process is like checking on the progress of the advancing tunnels daily - course corrections are so small as to be undetectable once they connect - they appear to be a single, straight tunnel through the mountain.

Table 3 contains specific suggestions on how this teaming can be accomplished. The most significant of these is the establishment of a Customer Advisory Panel. This panel would become a key mechanism to ensure that waste generator issues, concerns, ideas, and suggestions are incorporated into WMO's implementation of the NG waste process. It is envisioned to be composed of approximately 12 members representing the 5 ORNL directorates, Environmental Restoration, and Project Engineering. This group would meet regularly with WMO (including WMO management, operations, and generator interfaces) to represent the interests of the approximately 1,500 registered waste generators at ORNL.

COST SAVINGS:

The cost savings to be achieved are reflected in the calculated savings of many of the specific recommendations in other process team reports which can only succeed through successful implementation of this recommendation. Therefore, to avoid double-counting, no additional cost savings were claimed.

BARRIERS TO IMPLEMENTATION:

Changing the status quo/shifting the paradigm - can be done, requires strong leadership in the form of an excellent communicator and salesperson, perseverance, a compromise builder, a person who can see things from multiple perspectives and strives to satisfy all customers. This leader must also be able to instill the same values through all levels of the organization to ensure they are working in harmony to achieve "win-win-win" solutions, and that no territoriality creeps in. An autocratic or dictatorial style is not the type of strong leadership needed for this role.

TABLE 3. SPECIFIC SUGGESTED IMPLEMENTING ACTIONS FOR RECOMMENDATION #3 (TO BE UNDERTAKEN BY ORNL WASTE GENERATORS AND ORNL WMO)

Establish a Customer Advisory Panel that is chartered to provide a teaming link between WMO and generators, and to represent the 1,500 ORNL generators in resolving issues and identifying solutions to new situations.

WMO and Customer Advisory Panel provide "PR" sessions on the new "WM TEAM" approach to waste management at ORNL. Sessions could be held at staff meetings, EPO meetings, facility manager meetings, and open forums.

Establish a phone and e-mail "hot line" to improve generator access to WMO.

Establish direct e-mail communications to generator subsets (e.g. SAA, 90-day, PCB, SLLW, etc.) for rapid dissemination of information and requests for feedback.

Upgrade the WMO homepage for customer access and service - make it an application tool for the generators with a menu of services to select/request, not just an information resource.

RECOMMENDATION #4:

Establish a "user-friendly" electronic waste and cost forecasting system that will help WMO manage the program based on waste projections and will assist generators in their budgeting process by providing cost projections. Table 4 lists specific suggested actions to successfully implement this overall recommendation.

NARRATIVE:

An important component of the teaming between generators and WMO is 2-way forecasting. In order to effectively manage the waste management program according to projected waste volumes, WMO needs the best possible forecasts of future generation rates from the waste generators. On the other hand, waste generators will need the best possible forecast of future waste management costs to build into their budgeting processes. Both entities are in need of an effective waste generation and cost forecasting system, which presently does not exist. Table 4 lists specific suggestions of what such a system should do.

Some of the benefits of having this forecasting ability include:

+ Allows WMO to plan based on projected waste volumes, rather than projected budgets.

+ Helps ensure adequate WM and generator budgets are requested to avoid impacts to planned R&D tasks

+ Allows WMO to resource load/level - possess sufficient but not excessive staff/ capabilities/facilities.

+ Provides early identification of potentially problematic waste streams - allows WMO to ensure they have capabilities/capacities BEFORE the waste is generated.

+ Two-way forecasting provides generators with feedback on the effectiveness of their P2 activities, which should enhance their efforts.

COST SAVINGS:

Based on the above benefits, there would certainly appear to be cost savings associated with having an effective waste generation and cost forecasting system. However, with no present system to baseline, quantifying potential savings really is not feasible.

BARRIERS TO IMPLEMENTATION

Generators may feel as though they are being unduly imposed upon, but if they don't participate in the process they can't get the cost projection information they need for their own budgeting.

There would be an initial investment cost to establish a user-friendly electronic system with attributes such as those listed in Table 4. The magnitude of this investment is difficult to estimate due to the very preliminary definition of the system. However, based on the limited definition provided in this recommendation, it is estimated that the required investment could be in excess of $50,000.

TABLE 4. SUGGESTED ATTRIBUTES OF A WASTE GENERATION AND COST FORECASTING PROCESS/SYSTEM (TO BE DEVELOPED BY ORNL WMO)

Web-based and very user-friendly so generators can get in and make changes easily, which will help ensure changes are made as necessary.

Links to WTS so the historical information on actual generation is available for generators to review/use in forecasting.

Provides generators with unit prices for management of wastes by type/stream, for use in generator budgeting.

Annual survey of small, consistent generators, more often for large, variable generators.

Includes project management/project engineering section(s) so waste management plans can be entered.

Includes sections for major Laboratory initiatives such as new processes, process shut-downs or re-starts, major refurbishments, etc.

Provides P2 interaction as well.

RECOMMENDATION #5:

Improve communication of waste management requirements to and the accountability of subcontractors. Table 5 lists specific suggested actions to successfully implement this overall recommendation.

NARRATIVE:

The team identified the projected increase in subcontractor activities at ORNL as a potentially significant vulnerability with regard to waste management. A number of examples of subcontractors leaving job sites without fulfilling their contract requirements on waste management were described, as were examples where the contracts themselves did not appear to include the correct requirements. Each of these examples cited the additional cost and burden placed on the ORNL "generator organization" (project sponsor) as considerable. There is a serious potential for these costs and burdens to increase along with increasing subcontractor activity.

The team recognized that the ORNL link to subcontractors is through project managers/project engineers through the mechanism of a contract. Therefore, the suggestions for improving this situation, which are listed in Table 5, revolve around getting project managers/project engineers involved in the WM process and the contracts to reflect appropriate requirements and incentives.

COST SAVINGS:

Successful implementation of this recommendation would result in paying for disposal of waste from subcontracted projects only once, either through the subcontract or by the generating organization when (purposely) not included in the subcontract. It would eliminate the current situation where disposal appears to be paid for in the subcontract, but the subcontractor walks off and leaves it for the generating organization to take care of and pay for. Assuming this presently occurs about 10 times per year at a cost to the generation organization of $5,000 to $10,000 per episode, annual cost savings would amount to $50,000 to $100,000.

BARRIERS TO IMPLEMENTATION:

Procurement process may need to be changed.

May be legal limitations on some forms of "leverage".

TABLE 5. SPECIFIC SUGGESTED IMPLEMENTING ACTIONS FOR RECOMMENDATION #5 (TO BE UNDERTAKEN BY ORNL ENGINEERING AND ORNL WMO)

Project engineers/project managers are ORNL's "front-line" of communications with subcontractors, therefore they need to be represented on the "Generator Oversight" committee and have direct electronic communications from WMO, as well as participating in all aspects of the teaming described in Recommendation #3.

Contracts need to have "performance retainers" to ensure subcontractors handle wastes in accordance with contract requirements.

Contracts need to include up-to-date waste requirements and include funding for waste disposal.

Project engineers/project managers must ensure waste are being appropriately handled BEFORE approving invoices for payment.

Waste issues need to be considered with every BCP or contract change, and WMO involved if waste changes are necessary.

APPENDIX

Team Charter

Team Roster

Meeting Notes

CHARTER
GENERATOR/WASTE MANAGEMENT TEAMING/FORECASTING TEAM

The Generator/Waste Management Teaming/Forecasting Process Team is charged with addressing (a) communication channels and staff interactions between the Waste Management (WM) organization and other ORNL organizations and (b) mechanisms for forecasting future waste management needs. The specific goal is to identify improvements in these interfacing areas that will assist the overall goal of providing ORNL staff with cost-effective, generator-friendly, safe, and compliant waste treatment, storage, and disposal (TSD) services for newly generated wastes and recyclable materials.

For the following elements, the current status will be analyzed, barriers to improvement will be identified, and recommendations for change will be made to the Core Team:

- Communication and staff interactions between WM and the dispersed and varied ORNL waste generators, with the goal of achieving improved responsiveness and a true partnership involving all parties.

- Communication and staff interactions between WM and the relevant ORNL compliance and operational support organizations, with the same goal.

- Communication and planning strategies, as well as organizational structures and definitions of staff assignments, that will assist implementation of recommendations made by other Process Teams and approved by the Core Team.

- Mechanisms to translate "upper management commitment" into real culture change among the staff, in particular, the acceptance of a generator-as-customer attitude in WM and of a waste minimization/pollution prevention focus among the generators.

- Appropriate planning/forecasting mechanisms to anticipate future waste management needs and challenges, both within WM and at the ORNL Strategic Planning level. Issues include qualitative and quantitative changes in waste streams and TSD processes driven by, for example, (a) changes in ORNL operations, new ORNL initiatives, and Environmental Restoration operations at the ORNL site, (b) new/improved TSD technology, (c) changes in disposal endpoints and regulatory drivers, and (d) selective future outsourcing.

- Forecasting issues for R&D and support organizations driven by, for example, (a) waste disposal charge-back costs and (b) balancing the often opposing drivers of waste minimization/pollution prevention and upgrading ORNL infrastructure.

The Process Team will begin work on April 2, 1997, will provide the Core Team progress updates as requested, and will submit its analyses and recommendations to the Core Team by April 30, 1997.

DRAFT -- DRAFT -- DRAFT

GENERATOR/WASTE MANAGEMENT TEAMING/FORECASTING PROCESS TEAM

Ron Baldwin, M&C, Waste Generator

Bud Brickeen / Suzanne Herron, Env Restor, Waste Generator

Darrell Daugherty, ETS, Industry Repr

Debbie Dillener, OECD, ES&H Repr

Jon Forstrom, Leader

Jim Hackworth, P&E, Waste Generator

Katrina Hendrix, RRD, Waste Generator

Bob Mason, WMRAD Mgr

Gordon Miller, LSD, Waste Generator

Marv Poutsma, CASD, Core Team Champion

GENERATOR/WASTE MANAGEMENT TEAMING/FORECASTING TEAM

POSSIBLE ISSUES PRELIMINARY TO FORMULATING A CHARTER

Teaming: the WM/Generator interface

Goal: Identify the most effective communication mechanisms between WM and dispersed generators that will enhance a true partnership; ideally (a) WM staff and individual generators each should understand conceptually the drivers that influence the other's actions, (b) each should have evidence to accept that the other is working for the overall value of the R&D enterprise, and (c) generators should be allowed continued input into, and thereby a sense of ownership of, changing WACs and other WM requirements

Evaluate current status and key barriers to effective communication: many of the concerns expressed by generators in previous surveys will hopefully be addressed by implementing probable recommendations from other Teams (e.g., Certification, Characterization, Records/Reports, and Disposal End-points) and the new GI concept

Identify communication and planning mechanisms to maximize the probability of success of the recommendations in the item above and to improve Lessons Learned among generators; address the future role of the existing divisional EPOs vis-a-vis the WM GIs

Explore the characteristics of an environment that will promote timely responsiveness, both by WM contacts when assistance/service is requested by generators, and by generators when missing information is requested by WM; balance the need for individual requests for information with that available from existing data input

Consider effective mechanisms to translate "upper management commitment" in the WM/pollution prevention arena into real culture change among the staff

Teaming: the WM/Compliance/Operations interface

Goal: Identify improved mechanisms that provide consistent, reliable interchange of advice and data and eliminate "second guessing" at the WM/OECD, WM/Transportation, etc interfaces

Evaluate current status and key barriers to communication at these interfaces

Forecasting: the WM/Generating Organizations interface

Goal: Evaluate the need for a more formal WM Strategic Plan or Forecast and, if so, what elements should be included and how it might be assembled in the future. CAVEAT: This Team should NOT be tempted to prepare a draft of such a Plan or Forecast

Evaluate current status: what planning/forecasting mechanisms, formal or informal, are already in place in WM?; is WM part of ORNL Strategic Planning or Facilities/Site Planning?

Identify forecasting issues for WM operations, their relative importance, and possible planning system implementations:

> Short-term: need for better mechanisms for "short-term" forecasting, i.e., giving WM a "heads-up" about pending jobs?
>
> Mid- to long-term: anticipating volume/capacity changes for the various waste streams from (a) ongoing ORNL operations (how to solicit general trends and anticipate significant changes from current generators without creating meaningless "quantitation"); (b) possible new ORNL initiatives, or abandoned operations (step-function changes such as NSNS, Pu-238, mouse moves to X-10); and (c) EnvRestor operations at ORNL site (relation to the Ten-Year Plan)
>
> Changes driven by new/improved TSD technology; complex because several waste streams are inter-related; processing one stream generates waste for other streams; changing one disposal end-point can affect others
>
> Changes driven by changes in disposal endpoints and WACs or by selective future outsourcing

Identify forecasting issues for R&D and support organizations

> Waste disposal charge-back: factoring these costs and limitations into new project/product projections; QUERY: Is any part of establishing the basis for charge-back included in the charter of this Team (I hope not)?
>
> Balancing the often opposing drivers of (a) waste reduction, pollution prevention, and disposal cost and (b) upgrading existing laboratory space and infrastructure (which typically generates "newly generated" waste, albeit it from historic operations)

mlp 3/18/97
WM.297

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

Concerns: Opportunities and Threats

- Two primary customers have different objectives
  - -- Asst. Mgr. - WM
  - -- Asst. Mgr. - Lab
- Lack of shared resource for data recovery
  - ~ 2109s - can't assess - lack of understanding of what is available
- Subcontracting - subs remaining current on WM requirements and management
- Way to plan and recover data for forecasting
  - ~ WM plans, P&E data, Subcontractor
  - ~ Short term, long term
- Consistency in communicating requirements
  - ~ to get waste picked up
  - ~ segregate
- Communicating/Interfacing - established interfaces between generators and WM
  - ~ broaden
- Teaming between related functions
  - ~ P&E, HP, legal, OECD, support functions, ASO, DOT
  - ~ Feedback and response needed
- Funding for Pollution Prevention
- Facility for Pollution Prevention
- WM can only work Pollution Prevention that are not over 3 sites ~ sites issues addressed differently
- No defined requirement list re: Excess material or property (LMER & LMES when transported)
- Lack of communication of understanding requirements ~ who to call? How many to train?
- Additional feedback on corrections to 2109s
- How does WM want to see data for forecasting?
- Company - Company Communications
- Individual roles/responsibilities
  - ~ when does it become someone else's?
- No explanations given to "No" answers to questions
- WM is a "Service Organization" and should communicate as such
- Users do not know how to use information provided ex: WEB page access

Concerns (cont'd):

- WM interface personnel must have good interpersonal skills, content knowledge
- Training? Right kind, right time
  - ~ compliance
  - ~ WEB training

  ex: new waste certification curie content calcal.
  - ~ develop own system to be approved by WM
  - ~ are the right people doing this job?
  - ~ excessive training being used to communicate changes in policies
- Response to occurrences
- Management of 90-day areas (funding)
- Transition from one change to another
  - ~ how to communicate changes in timely manner
- Decisions made in generator organizations without input - lack of knowledge of DOE and above
- Characterization communication - meaningful
- Getting to generators impacts of new laws - ability to comment
  - Order 435
- Compliance beyond ability
- Resolve issue around sampling analysis or no rad-added waste
- Method to recycle rad waste
- New storage facility
- Where to store and manage reusable waste
- Segregation between rad/non-rad waste
- Suspect land fill
- Make recycle contracts in place for use - communicate they are available
- Waste certification program
- Generators need to communicate needs, problems
- Phased-approach to disposition
- New M&I contractor interface
- Action Plan for legacy (generator stored waste)

  ~ how generators are going to handle daily generated waste
- Communicate **NOW** with current M&I and move as much waste as possible
- Communicate the higher cost to come with new M&I
- Communicate the need for more internal awards for "good" work
- Sharing of characterization data

RECOMMENDATIONS FOR REENGINEERING

1. Mediation of customer demands. (Actions to bring conflicting objectives closer together)

   A. Action Items: MOU for ORO/WMTD and the ORNL DOE Site Office on the transition of facilities from LMES to LMER will spell out the responsibilities of each organization. MOU on the funding distribution for the newly generated waste and legacy waste for FY 1998 and FY 1999.

   B. Providing a EM Program Manager at ORNL has provided an avenue to get some of the objectionable criteria on the table and discussed with DOE WM.

   C. Separate the budget for newly generated waste from the legacy waste as a trial program for FY 1998 where the budget is provided to ORNL from DOE-OR.

2. Action to ensure the pilot "Waste Coordination Concept" will transform a culture change of the way we do business.

   A. Action Items: The Pilot has been established and should be given every opportunity to succeed. It should be expanded as soon as the data is available to assess its success.

   B. WMRAD should backfill the position it used from Solid Waste Operations to ensure the pilot program personnel do not work both programs.

3. Action to establish a team approach to involving generators in decision making.

   A. Establish a team approach to reviewing the new environmental law and DOE Order impacts on the Waste Management procedures and waste TSD.

4. A System in place to ensure generators and subcontractors understand and accept implementation of new requirements.

5. An effective system for forecasting generator quantities that will help WM understand future demands and facilitate budget planning for generators.

   A. Establish a meeting with each of the divisions that generate waste for WMRAD and set the long range waste planning for that division. The Laboratory does require a policy on how waste will be forecasted and approved for new programs.

   B. Evaluate how the P2 Program will fit into the waste forecasting activity. It is my recommendation that the WMRAD P2 Manager for ORNL be the focal point for the waste estimates from the generators.

Communications/Teaming Team meeting

4/11/97

From Hazardous/Mixed Waste Team

1. Reengineer to incorporate **trust, teamwork, and customer service**.
2. Presently, an "**us vs. them**" culture.
3. "Attitude, culture, or paradigm" of the WM organization being "in charge".
4. This "attitude" must be **adjusted** to **recognize** that the generator is the customer of the process.
5. The process must be **re-designed** around customer convenience.
6. " ... **shifting** the burden of decision making off the generator onto the WM experts ..."
7. FOR IMPLEMENTATION: **Denial** that current process and supporting systems are not optimal.
8. **Shifting** (1) of risk/liability from generator onto WM, (2) from customer onto service, (3) from one company to another, and (4) from one DOE program to another.
9. User friendly - IMS
10. FOR IMPLEMENTATION: If DOT plan is rewritten -- (1) **Misconception** that LMER would not be complying with laws ... and (2) **misconception** of increase risk to workers.
11. Key **interface** with Transportation.
12. "... a plan of action should be worked out before hand with **agreement** of the generator and WM." 10 day notification of 90 area storage
13. FOR IMPLEMENTATION: 10 day notification -- Generators may feel as though they are being unduly **imposed upon**.

From P2 & Recycling Team

1. Key **interface** with Materials Procurement.
2. Materials Procurement "needs to be **controlled**."
3. Key **interface** with Regulators.
4. "**All** recycling contracts should be implemented via the P2 Department." A **change of interface**; implies this is not happening today.
5. "Generators need to **BE AWARE** that they are going to be charged ... NOW"
6. "HP green tag procedures need to be clear and totally **UNDERSTOOD** by every HP at the Lab." (internal to Rad Protection?)

7. "… Generators ordering chemicals are made **AWARE** of …"

8. "Lab policy should **PREVENT** personnel from retiring or leaving …"

9. "The availability of BUS Stop needs to be **PUBLICIZED** and its use **ENCOURAGED**."

10. "**REINSTATE** a new version of the old Chemical Stores … where Researchers obtain **ONLY** …"

11. "**TAX** incoming materials … "

12. The Laboratory needs to provide clear and concise high-level **GUIDANCE** …

13. **COORDINATION** between various (WM) Departments … must occur

14. Key **interface** … OECD should be seen as an **ASSET** to researchers … implication of non-service orientation.

15. The widely **recognized FEELING** among … Company should **SUPPORT** … a change

16. Key **interface** with Bargaining Unit

17. … source of all policies should be **KNOWN** …

From the Characterization Team

1. The WM Organization must **UNDERSTAND** that their core mission is to manage the generator/customer's waste …

2. Generators must **UNDERSTAND** that their input to the process is critical to its ultimate success.

3. "… accelerate this **TRANSFORMATION**."

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

NEXT STEPS

Recommends to Improve the Following:

1. Mediation of customer(s) demands (actions to bring conflicting objectives closer together).

2. Actions to ensure the pilot "waste coordination concept" will transform a culture change of way we do business (new service mentality).

3. Actions to establish a team approach to involving generators in decision making.

4. A system in place to ensure generators and subcontractors understand and accept implementation of new requirements.

5. An effective system for forecasting generator waste quantities that will (1) help WM understand future demands and (2) facilitate budget planning for generators.

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

1. Mediation of customer demands ER vs. EM

   - MOU for ORO/WMTP and ORNL DOE Site Office on transition of facilities from LMES to LMER
   - MOU and separate budget for newly generated vs. legacy, give NG budget to LMER
   - Find way to make multiple external customers happy - win/win
     (Maybe biggest barrier - not a recommendation)

2. Actions to ensure the pilot "waste coord. concept" will transform a culture change (new service mentality)

   - Establish performance measures - cost, customer satisfaction, waste backlog decrease, error reduction, pollution prevention
   - WM Division Mgmt. Support
   - Backfill previous positions so individuals don't "revert" to old job
   - Staffing - expertise and interpersonal skills/compatibility
   - Cross-training of staffing "generalists" vs. "specialist"
   - "Displaced" EPOs to deal with? WCOs?
   - Menu of services
   - Better awareness of program - communicate success/failure with generators
   - Forecasting needs for program expansion - level of effort wanted

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

3. Actions to establish a team approach to involving generators in decision making.

- Make sure all generators are represented in decision making process
- Customer service person in WM?
- Direct electronic communication with waste generators?
- Customer input/satisfaction in the performance appraisal (Service Org.)
- Targeted ad-hoc information when issues need to be addressed - Not regularly scheduled meetings
- Use piloting more on changes before full implementation
- Hotline or hot e-mail for generators to request help
- Generator oversight committee (10 members?)
- Culture change - customer service
- Needs to apply to OECD, HP, H&S, P&E, all service groups

4. Generators informed and accept requirement changes

- Establish a team approach to reviewing the new environmental law and DOE order impacts on WM procedures and waste TSD
- Early involvement
- Reverse forecasting:
  - -- what is coming down the pike that might affect generators
- Subcontractors leaving "presents"
  - -- different mechanism - contractual
  - -- procurement needs to have requirements in contract boilerplate
- Bonding or pay schedules on work until complete
- Generator org. Needs to know requirement changes to be included in subcontracts and BCPs
- Changes in requirements (e.g. WACs) can have big influence on forecasting of waste volumes

5. Forecasting

- Generator forecast waste volumes - WM
  WM forecast cost - Generator
- Initial forecasting system - practice
- WM Plans for projects
- Need to get initial forecasts of costs out to the divisions so they understand impacts in future

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

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2. Institute culture change in WM - customer service

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   - Cross-training of staffing "generalists" vs. "specialist"
   - "Displaced" EPOs to deal with? WCOs?
   - Menu of services
   - Better awareness of program - communicate success/failure with generators

- Forecasting needs for program expansion - level of effort wanted
- Strengthens interface between WM and generators
- "Service with Soul" re-orientation of WM
- WCT - endorse, support, implement faster
- Generators - team members, paying so need to reduce/minimize
- Union culture change (see P&E reengineering)

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

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- Changes in requirements (e.g. WACs) can have big influence on forecasting of waste volumes

5. Forecasting - need a formal, annual forecasting process, include:
   - Long-term - guesses/WM plans
   - Short-term - budget based and WM plans
   - Info in to WM volumes, types, and timing of waste generation
   - Info out from WM - historical generation rates, cost factors
   - Focus on big waste generators and unique waste generators
   - "Significant" changes in forecast need to be entered ASAP
   - Generator forecast waste volumes - WM
     WM forecast cost - Generator
   - Initial forecasting system - practice
   - WM Plans for projects
   - Need to get initial forecasts of costs out to the divisions so they understand impacts in future

6. Accountability

   - (#16)
   - (#43)

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

1. Mediation of customer demands ER vs. EM

WHATS

- MOU for ORO/WMTP and ORNL DOE Site Office on transition of facilities from LMES to LMER
- MOU and separate budget for newly generated vs. legacy, give NG budget to LMER
- Find way to make multiple external customers happy - win/win
  (Maybe biggest barrier - not a recommendation)

HOWS

<u>2 Different Customers: Environmental Restoration and Environmental Management</u>

- ? Multiple customer focus slants
- Waste Management (WM) customer service philosophy - keep both happy
- Sales approach to WM
  (Attitude - what is good for the generator is what is good for WM)

2. Institute culture change in WM - customer service

WHATS

- Actions to ensure the pilot "waste coordination concept" will transform a culture change (new service mentality)
- Establish performance measures - cost, customer satisfaction, waste backlog decrease, error reduction, pollution prevention
- WM Division Mgmt. Support
- Backfill previous positions so individuals don't "revert" to old job
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- WCT - endorse, support, implement faster
- Generators - team members, paying so need to reduce/minimize
- Union culture change (see P&E reengineering)

HOWS

<u>WM Internal Staff Culture Change</u>

- "Service with Soul" reorientation of WM (OECD, HP, P&E, etc)
- Service/Marketing training for managers
- Internal teaming - working together
- Teaming across the Lab - WM is an important support service to accomplish lab mission of research
- Revised Mission/Vision statement for WM reflect customer service/teaming attitude
- Make sure performance metrics measure customer service
- Top down attitude change/commitment to customer service/communication of that commitment to staff*/reinforce through actions - "Walk the Talk"
- Tie customer satisfaction performance directly into incentives like PPR, promoting, raises, awards, etc.
  *communication to staff - memo, all hands, department staff meetings, one-on-ones, "glad hands"

<u>Successful WCT (Not CIE's)</u>

- Demonstrable customer service attitude infused through team
- <u>Management support</u> - don't redirect priorities
- Specific performance metric to evaluate success of WCT - make visible the results
- Ensure WCT has correct waste management skills and cross training for team members
- Ability to expand program as requested by paying divisions

<u>Generator Culture Change</u>

- Inform generators they will have to pay for waste disposal in the future - accountability
- Inform generators of historical generation rates and potential future costs
- Inform generators of how to get that help from WM

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

3. Improve WM - Generator Teaming

WHATS

- Make sure all generators are represented in decision making process
- Customer service person in WM?
- Direct electronic communication with waste generators?
- Customer input/satisfaction in the performance appraisal (Service Organization)
- Targeted ad-hoc information when issues need to be addressed - Not regularly scheduled meetings
- Use piloting more on changes before full implementation
- Hotline or hot e-mail for generators to request help
- Generator oversight committee (10 members?)
- Culture change - customer service
- Needs to apply to OECD, HP, H&S, P&E, all service groups
- Changes in requirements (e.g. WACs) can have big influence on forecasting of waste volumes
- Establish a team approach to reviewing the new environmental law and DOE order impacts on WM procedures and waste TSD
- Early involvement
- Reverse forecasting:
  - -- what is coming down the pike that might affect generators
- Hot line - phone & E-mail, on anything
- "Generator oversight" committee>charter>pulling together/teaming/2 way communication
- Direct electronic communications to affected parties
- WM homepage for customer access - application tool, not just information
- PR- Info sessions on new "WM Team" approach for lab population - EPOs, staff meetings, facility mgr. Meetings, open forums

4. Subcontractors informed and accept requirement changes

WHATS

- Subcontractors leaving "presents"
  - -- different mechanism - contractual
  - -- procurement needs to have requirements in contract boilerplate
- Bonding or pay schedules on work until complete

- Generator org. Needs to know requirement changes to be included in subcontracts and BCPs

HOWS

Communication of Requirements to Subcontractors

- Contracts need to have "performance retainer" to ensure subs handle wastes appropriately before they get paid - large enough to be incentive
- Contracts need to include:
  * Funding for waste disposal
  * Project Eng/Project Managers need to be on "oversight" committee
  * Electronic communications with project engineer/managers
- Project Managers must ensure wastes are handled BEFORE approving invoices for payment
- Waste issues need to be considered with every BCP or contract change
- WM reviews original WM plans, but doesn't get changes

5. Forecasting

WHATS

Forecasting - need a formal, annual forecasting process, include:

- Long-term - guesses/WM plans
- Short-term - budget based and WM plans
- Info in to WM volumes, types, and timing of waste generation
- Info out from WM - historical generation rates, cost factors
- Focus on big waste generators and unique waste generators
- "Significant" changes in forecast need to be entered ASAP
- Generator forecast waste volumes - WM
  WM forecast cost - Generator
- Initial forecasting system - practice
- WM Plans for projects
- Need to get initial forecasts of costs out to the divisions so they understand impacts in future

HOWS

- Annual survey of consistent generators
- More often for variable generators

- Need same kind of waste forecasting system for WM - not one now
- Could be web based so generator organizations could get in and make changes as necessary
- Historical information available for generators review/use in forecasting
- Can include project eng/mgt. Section as well (WM Plans)
- System needs to interlink with WTS (or WITS) to import actuals
- Needs to be useful for P2 interaction as well

APPENDIX I

ORNL WASTE MANAGEMENT REENGINEERING

REPORT FROM THE

RECORDS/REPORTING PROCESS TEAM

June 20, 1997

INTRODUCTION

The Records/Reporting Process Team evaluated the process of collecting and tracking the data and information necessary to compliantly and efficiently manage newly generated wastes from the point of waste generation through final disposal. The team identified one major, long-term recommendation for a complete reengineering of the information management process, to be supported by state-of-the-art, off-the-shelf technologies.

The team also identified eight other recommendations which can be implemented near-term and which should rapidly result in efficiency gains and/or cost savings. In addition, all eight of these recommendations move the Records/Reporting Process incrementally closer to the ideal vision described in Recommendation #1. These additional recommendations include: (2) modify GES to accept optimal information from the generator, (3) utilize GES to track accumulation time limits in 90-day and PCB areas, (4) do not switch to new LMES waste tracking system; continue use of existing ORNL system, (5) complete ORNL's barcoding system for electronic completion of TSD and WCR forms, (6) provide a new end-user reporting tool with more powerful features and functionality, (7) create a set of GES templates for commonly generated wastes, (8) implement electronic inspection recordkeeping/validation system for RCRA and TSCA storage or treatment units, and (9) include the PK form as an electronic form within GES.

Total cost savings resulting from successful implementation of the recommendations is estimated at about $1,500,000 annually. Total upfront investment required to implement the recommendations and achieve these savings is estimated at $340,000, resulting in an overall payback period of approximately 0.2 years. All of the above are described in more detail in the following pages. Backup materials, including team charter, team roster, and meeting notes are provided in the appendix.

The WM Reengineering Core Team specifically asked that the Records and Reporting Process Team review the relationship between the WOCC and the LERC to determine if there were any opportunities for cost savings associated with the overlapping nature of these systems. Through discussions with personnel knowledgeable of both systems and how they interact, the Team determined that the overlapping nature of the systems is of tremendous benefit to WM both during routine and non-routine operations. In addition, there is little if any actual duplication of effort associated with the two systems and therefore minimal, if any, cost savings to be gained. The Team believes that the benefits of vulnerability reduction that comes with running both systems far outweighs any small cost savings that might be achieved by shutting one of them down.

RECOMMENDATIONS

RECOMMENDATION #1: (Long-term)

> Restructure the existing waste information support system to provide a more seamless process to capture and distribute waste information. The ideal process will support the electronic capture of waste information as early as possible in the life cycle of the data. Once captured the data will be routed electronically from organization to organization and system to system with little to no paper involved in the flow. The process will utilize existing commercially available off the shelf software (COTS) wherever possible and will build on many of the technological infrastructure components put in place over the last 5 years including networks, servers, World Wide Web support and software technologies. The process will support and consolidate all waste information requirements, eliminating the proliferation of redundant subsystems with their associated duplication of effort in data entry and analysis. Automation of the process will minimize manual intervention.

NARRATIVE:

Existing processes and sequencing of waste information support systems evolved over a period of nine years, during which dramatic changes occurred in technological infrastructure, organizational alignment, regulatory and operational support requirements. The result has been a proliferation of various subsystems created as piecemeal solutions in response to immediate demands. This has resulted in considerable duplication of effort in data entry, analysis and reporting. Some of the core components of the supporting information systems are based on 1980's technology and have become cumbersome to use as well as support in light of today's technology.

Within the last year, the final pieces of the technical infrastructure utilizing state of the art hardware, software and networking technology were put into place. However, these components have not yet been linked in a seamless fashion which would eliminate the need for the numerous special purpose subsystems.

In many cases, users have developed redundant systems instead of asking the technical staff how to best go about implementing a feature via modifications to the core support systems, so the technical staff doesn't learn until after the fact that a redundant system exists. Significantly less investment and a more seamless system could have been realized by modifying the core support systems to support the feature. Historically, WM has also suffered from a problem in providing rapid response time in systems support due to limited resources and multiple demands, such as extended centralization efforts which provide little benefit.

One problem in particular with the current core systems has been the lack of user involvement in the design process. ("Users" including WMO, OECD, generators, etc.) The result was that system support personnel completed designs without this critical user involvement due to DOE milestones, central waste demands and the shutdown of legacy systems by the ORNL Office of Computing. As a result, a common perception that 'the tail is wagging the dog' created considerable non-productive tension between the user base and the systems support personnel. For an ideal process to succeed, a commitment by high level management to ensure user involvement up front in the design process needs to be made and carried out.

Many of the near-term steps to creating the ideal process are included in the other recommendations of this report. They will not be discussed in depth in this recommendation, only mentioned where appropriate.

BASIC OPERATIONS:

1) The Generator Entry System (GES) will be used as the primary means of data capture of the optimal information data set. GES will be modified to electronically transfer all generator-provided data (i.e., PK forms, barcode requests, etc.) to WM. GES will be modified to interface with barcode readers thus enabling the generators to perform electronic inventories of their storage areas in the same manner WM will. Additional features to support generators will include logic to support 90-day area timers.

2) Other modifications will be made to GES to allow automated consolidation of all 90-day and PCB inventories into a single GES repository. This GES repository will be made available to OECD to support preparation of the RCRA and PCB annual reports. All GES data transfers at ORNL will be via the intra-plant network. Providing the generators with a single application interface for all generator-to-WM interactions will reduce training requirements and avoid confusion.

3) While the issue of requiring paper copies of forms in order to accumulate record copies with hand-written signatures has been raised before, it needs to be raised again. As long as policy dictates handwritten signatures, no ideal process can electronically replace the paper trail. GES was specifically designed to support electronic submittal of waste forms from the generator to WM. It currently will allow the generator's name to be supplied in the signature block but it is not a true electronic signature. The assumption was that policy required paper signatures. If full accountability using all electronic transfer of waste information continues to be required, electronic signature technology should be added to GES and the paper trail terminated.

4) GES is used by WM to complete the form set(s) provided by the generator. GES will be modified to support all WM calculations (i.e., LSA, PA, etc.) thereby eliminating the subsystems currently being used and eliminating the cost of redundant data entry.

5) The GES form set is imported into the Waste Tracking System (WTS).

6) A Waste Pickup Order (WPO) is issued and downloaded to a barcode reader. The requirement that DOT classification must be performed prior to transfer of waste from the main plant to WM TSD facilities is dropped. DOT classification is only required if

the waste is being shipped directly offsite or in preparation for an offsite shipment from a WM TSD facility or to support WM reporting requirements.

7) Operators are deployed to the field with barcode readers containing WPO related information (waste item/container ID, location, description, generator, etc.). The waste is picked up and moved to the facility's staging area. The WPO is completed with the destination facility, date, operator, etc. using the barcode reader.

8) The WPO is uploaded for processing to the main system via docking stations distributed throughout the plant. The completed WPO information is processed, updating the WTS inventory.

9) The facility operators perform TSD operations including weighing and storage of the waste item/container using a barcode reader and upload the completed TSD information into WTS.

10) Waste inventory information is automatically distributed via the network to all affected parties on a scheduled basis for secondary processing as needed. The data is transferred in a format compatible with the software tool(s) preferred by the user. The user is notified by e-mail that their local database has been updated.

At this point the primary or basic operations pertaining to a generator waste pickup request, WM characterization, pickup, delivery and storage within a TSD facility have been completed. The following sections describe secondary activities related to reporting and shipments.

OFFSITE SHIPMENTS:

1) A waste review is performed in which the waste information of the selected items/containers is verified and updated as necessary. DOT classification is performed on-line during the waste review.

2) A proposed off-site shipping list (OSL) is printed and used to prepare the shipment. The proposed OSL is completed with the actual shipment data (final codes, final weights, etc.) and destination-specific information and input into the main system.

3) A uniform hazardous waste manifest is issued for the shipment.

4) On completion of the shipment, the manifest data is completed online.

5) Certificate of disposal (COD) data is input upon receipt.

GENERAL REPORT SUPPORT:

1) A trained user base accesses the system using a client/server tool to construct reports.

2) Reports categorized for routine wide distribution are submitted on a scheduled basis for automatic web distribution.

3) For selected reports, end users are notified automatically of when the report is available and/or the relevant data has been updated.

RCRA ANNUAL REPORT SUPPORT:

1) New RCRA waste is automatically assigned to a waste stream by the system when the waste data is input into the system.

2) Authorized users access the system and select either unassigned waste items for initial assignment or previously assigned items for review. (Allows for regulator notification of new waste streams within the required 30-day timeframe.)

3) Waste stream assignment recommendations are automatically made by the system using a pre-defined algorithm.

4) The user chooses to accept the recommendation or override it.

5) The waste stream assignment is updated in WTS.

6) All distributed 90-day inventory GES installations are merged into the master GES repository database.

7) Generator treatment data is input into the master GES repository.

8) TSD operating records (waste treatment, repackaging, etc.) are updated immediately at the time of the activity via the barcode reader system.

9) RCRA waste stream assignment information and TSD records from the main system are merged with the master GES repository.

10) RCRA annual report is output in both electronic and hardcopy format on demand.

11) The report is submitted to the state electronically.

PCB ANNUAL REPORT SUPPORT:

1) System classifies the PCB item as either a PCB waste article or as PCB waste via pre-defined algorithm.

2) Authorized users access the system and accept or reject the assigned PCB waste type

for newly generated PCB waste classification.

3) The WTS is updated on-line.

4) GES and TSD records are merged.

5) The PCB annual report is output in electronic or in hardcopy format on demand.

SUMMARY:

While the steps of the process described above vastly over-simplify the details involved, the most significant aspect of the overall, ideal process is its emphasis on electronic capture and transfer of waste information whenever possible. Paper transfer and record keeping is included only where it is mandated by regulatory requirements.

Numerous procedural and technical issues will have to be resolved to achieve the ideal process. However, the remaining recommendations of this report are incremental steps toward supporting such a process and are based on identified needs, user input and optimal utilization of available technology. The focus of future improvements in ORNL WMRAD's waste information systems should be procedural not technical. Considerable expenditures have been made in the last six years to ensure that ORNL WMRAD, as well as the generators, have the technical infrastructure in place to respond to a dynamic requirements environment. Maximum near term benefits can now be achieved in the areas of generator support and reporting support.

The core system requirements, however, will need to be addressed. Regardless of organizational trends and contract issues, ORNL WMRAD information systems should maintain a loosely coupled environment, allowing the main system to provide and accept 'feeder' subsystems where applicable. In addition, ORNL's success with end-user empowerment in the reporting environment needs to be continued. Design and functionality of the subsystems need to be planned to ensure that an integrated design is accomplished, thereby reducing redundant efforts. In order to ensure the success of the reengineered system, the on-going dialog between generators, WM and OECD should be continued as the routine way of conducting business.

COST SAVINGS AND BARRIERS

Cost savings and barriers for this long-term goal are addressed in the detailed recommendations of this report.

RECOMMENDATION #2: (Near-term)

Identify the optimal information that waste generators must provide on the Generator Entry System (GES) form set for Waste Management to accept and complete the form set for the generator.

NARRATIVE:

GES is an electronic platform designed to reflect the current form set used for data collection for wastes. GES requires completion of fields specified by ORNL's Waste Management to allow validation. A limited number of these fields can be completed with NA; the majority requires an actual valid value or entry. Although the form set needs to be reevaluated by appropriate Waste Management personnel to determine the continuing applicability of the requirements and/or to identify needed modifications or enhancements, the fields previously specified by Waste Management as mandatory currently still retain the status of mandatory, but the completion of all such mandatory fields by the waste generator is not practicable in most instances. Generators should be tasked with providing information that is readily accessible on all wastes generated, and should be expected to initiate the data form set with limited optimal information, but should not be required to complete the entire data form set prior to submittal to Waste Management.

To require only minimal, but optimal, information and data entry on GES by the waste generator will tremendously lessen the impact that completion of the entire form set has on their primary mission of research and development. Personnel resources can be more appropriately allocated to achieve this primary mission. Waste Management has subject matter experts who are trained to characterize wastes and make waste classification determinations based on optimal information and have a thorough familiarity with applicable regulations and requirements. Waste Management personnel currently perform in-depth reviews of all data submitted, and may modify the generator's form set to reflect the results of such reviews. A comparison of the time and resources necessary to compile the data and information necessary to complete the form set itself have been evaluated elsewhere. The evaluation that the Team was tasked with was the comparison of the time and resources necessary solely for the entry of the data into GES and the associated validation.

It is estimated that after compilation of all the necessary data to complete the GES form set, generators spend approximately 1 hour per form set inputting the data into GES and validating it. Upon receipt of these form sets, Waste Management currently spends approximately 10 minutes per form set inputting changes or reviewing results. If generators are required to only input the optimal information (as yet to be finalized by Waste Management), their input time would be reduced to 15 minutes. It is estimated that Waste Management's input time would be nominally increased to 15 minutes.

GES is currently configured to accept form sets with only the document identification number specified, and can accordingly already accommodate this proposed recommendation. GES will not have to be programmatically modified, but the GES HELP file will have to be modified since the HELP file reflects the current requirement for generators to complete all mandatory fields.

The Reengineering Team developed a draft set of optimal fields and provided these to Waste Management for review and consideration. Refinement and finalization of this list will coincide with concurrence to proceed with this recommendation.

COST SAVINGS:

Once a set of optimal data is defined by Waste Management, and if, minimally, generators supply this optimal information, tangible cost savings should be realized. Based upon an average of 13,000 form sets per year, the generator's savings is estimated to be $780,000 (0.75 hr/form set * 13,000 form sets * $80/hr). The cost increase to Waste Management would be about $54,000 (0.083 hr/form set * 13,000 form sets * $49.44/hr). The net annual savings would be the difference between these two values, or $726,000.

An initial investment of approximately $2,000 is expected to be expended in revising approximately four Waste Management procedures and in modifying and upgrading the GES HELP file to accurately reflect this recommendation.

Based on this limited initial investment and the dramatic annual net savings, the payback period for this investment is 0.003 years, or 1.1 days.

BARRIERS TO IMPLEMENTATION:

Waste Management must first accept the concept of waste generators providing only limited information on a form set and electronically forwarding it to Waste Management for either them or another selected organization to complete the form set. The minimal information provided must include at least those fields that Waste Management defines as optimal.

As mentioned above, an initial investment of about $2,000 will also be necessary.

RECOMMENDATION #3 (Near-term):

Utilize the existing Generator Entry System (GES) to provide inventory data and track accumulation time limits remaining for 90-day accumulation areas (90-DAA) and PCB storage areas.

NARRATIVE:

OECD and HWOG maintain a database that is used to identify the types and amounts of hazardous wastes, waste item descriptions (WIDs), and the accumulation start date for ORNL 90-DAAs. This data is updated weekly and is generated from waste inventory logs (usually paper inventories) sent in by the 90-DAA operators. Logsheets are sent to OECD each Friday and OECD enters the information in a Fox-Pro database that is networked to HWOG field operations. OECD uses their official list (database) of registered 90-DAAs and assigned operators to ensure the weekly list is reasonably complete. If inventories are not submitted, OECD will call or otherwise verify what wastes have been added or if the area has been closed. HWOG field operations uses the information in the 90-DAA inventory database to prioritize the pick up of the waste. OECD and HWOG use this data to verify whether 2109 form sets have been submitted by the operator. Once the forms are submitted, HWOG initiates waste form review and after the form is approved, schedules waste pick ups.

HWOG has historically not been able to use the 2109 forms or the existing waste tracking system to identify or track wastes in 90-DAAs. The two main reasons are: delayed submittal of 2109 forms (paper) and data entry of 2109 forms by operators, and incorrect use of the accumulation start date field on the forms by generators. For example, some generators unknowingly fill in accumulation start date on the 2109 form even though the waste is in a satellite area. As a result, HWOG cannot use this field on the 2109 form to accurately identify wastes subject to the 90-day time limit. Additionally, 2109 forms (both paper copy and electronic version) for 90-DAA wastes are typically not submitted to HWOG until day 45 or later. The complexity of the form set and complexity of the GES combined with the fact that generators have routine work assignments unrelated to waste management functions have contributed to this delayed submittal.

When the submittal of the 2109 forms are delayed, HWOG has to review and approve the forms and schedule the pick up in a short period of time. HWOG has to expend additional efforts (sometimes requiring overtime) to ensure the waste is picked up within the 90-day time limit. Analytical data may not be available and so waste is temporarily accepted based on what process knowledge is provided by the generator/area operator. As the analytical data becomes available, the waste is moved to appropriate storage units. Sometimes the waste is moved multiple times as more analytical data is received, thereby complicating WM's acceptance/storage of the waste.

A formal system for identifying inventories of wastes in PCB generator-accumulation areas has not been established. Most areas are set up to meet the one-year storage area requirements; occasionally temporary accumulation areas for 30-day storage are set up. PCB generators work individually with HWOG to get wastes picked up within the one-year or 30-day allowed time frame. The same complications arise with PCB pick ups that arise with 90-DAA pickups, but on a less frequent basis.

Year-end inventory data for 90-DAA and PCB accumulation areas are required for annual reporting (RCRA and PCB). Operators submit year-end data (paper copies of inventory logsheets or on OECD forms) for wastes held in their accumulation areas to OECD in January of each year. OECD uses the data to compile the annual report for wastes generated during that year but not in WM units.

The recent deployment of GES provides the basis for the proposed inventory system. Data from all waste generators are being captured electronically and can be accessed by the HWOG personnel even before the waste has been approved by HWOG for pickup. By incorporating look-up-tables of OECD's registered 90-DAAs and PCB accumulation areas, generators and WM will be able to verify that the waste is actually being stored in registered areas. Moreover, the GES could be modified to not allow the accumulation start date fields to be electronically entered unless the waste's accumulation area is in the look-up tables. This computer check enhances the accuracy of the GES data for those fields and can largely eliminate the problem of generators inserting inappropriate data. By incorporating an accumulation start date-tracking function, HWOG can accurately prioritize wastes for pick up. However, the problem of timeliness of submittal of the 2109 form must be overcome. The recent assignment of Generator Interface and/or Generator Interface Equivalents to assist generators with waste management functions including form submittals may help overcome the delayed submittal problem. The convenience of maintaining real-time area inventories via computer (rather than weekly and annual paper submittals to OECD) should be attractive to many area operators/generators. Forcing computer inventories may be unattractive to a few operators/generators, however. When combined with Recommendations 2 (optimal GES) and 7 (creation of GES templates) which both serve to reduce the complexity of GES and forms, generators may be more willing to enter their waste information earlier thereby facilitating the prioritizing and scheduling of waste pick ups.

Portions of and/or functions of the OECD databases (area locations, accumulation start date-tracking) of registered areas will need to be added to GES. Additionally, OECD will need to have primary access to control that data and ensure the list is updated when area information changes.

At present the OECD/HWOG inventory system is limited to RCRA 90-DAA for HWOG, however, it can easily be expanded to provide real-time inventories for 90-DAA for RSWOG, PCB areas, and eventually solid low-level waste areas.

Once the accumulation start date function is set up, this function can be modified to accurately track and notify HWOG of other mandatory compliance dates (1 year storage limits for hazardous wastes and 6 month/9 month storage limits for PCB wastes) and initiate off-site shipments.

COST SAVINGS:

Generators would not be required to submit weekly inventory information to OECD (savings estimated at $21,000 based on 20 90-DAAs) and OECD would not have to do the data entry for the generator. Moreover, OECD would not have to call or otherwise verify waste status in registered areas. Similarly, the GES inventory information could be used for year-end reporting by OECD, thereby eliminating the need for generators to submit year-end inventory data (savings estimated at $4000). Total OECD savings is estimated to be $16,000. The total savings for generators and OECD is $41,000.

Implementation of this system could avoid potential fines/penalties/violations issued by regulators for violating waste accumulation time limits. RCRA fines and penalties could be $3000 per exceedance. Moreover, the recent implementation of no-rad added will put added incentive on tracking wastes in PCB accumulation areas. WM will need advance warning of the generation of these wastes to ensure they are disposed of within 1-year. Failure to meet the 1-year PCB disposal requirement could trigger fines/penalties/violations of $5000 per occurrence. Annually, the new inventory system could eliminate as many as three potential violations (2 RCRA and 1 PCB) per year at an estimated cost of $11,000 in fines.

The total annual cost savings for this recommendation are estimated at $52,000.

The cost to implement and test the electronic inventory system for 90-DAA and PCB areas is estimated at $4,000.

BARRIERS TO IMPLEMENTATION:

Overcoming problems related to form submittal are critical to the success of providing real-time inventory information. Operators must willingly use the GES early in the process; operators unwilling to use GES for this process will need to pay WM for this service.

The initial investment of funds for programming and testing for modifying the existing GES is estimated at $4,000.

The current LM approach to control GES could delay full implementation of the proposed electronic inventory system.

RECOMMENDATION #4 (Near-term)

Do not shift to new LMES waste tracking system (WITS); instead, continue to use existing ORNL system (WTS).

NARRATIVE:

The current LMES plan is to install WITS at each site by May 31, 1997 and then use the period between June 1 and August 31 to make necessary adjustments to achieve requisite functionality. WITS is to be fully operational by September 1, 1997.

The plan to install a common program at each site is the LMES approach to achieve the DOE objective of a single database from which to access waste management information. While the DOE objective is reasonable, there is more than one way to attain the goal. Although the current LMES approach is feasible, no formal assessment of options was ever made as to the BEST way to achieve this goal. Consequently, the LMES implementation approach may not be the best method for ORNL or even the best for all sites. Furthermore, the LMES plan was generated and initiated prior to the time when LM had decided not to pursue the contract for the environmental restoration work. Now that it's definite that a company other than LM will be awarded the contract, program control concerns are relevant in addition to the concerns about the implementation approach.

Switching to new system (WITS) will require the following activities;

- o running both the WITS and WTS concurrently for at least 3 months (with double entry of data), for checking/testing/validating the new system,
- o conversion of the existing data,
- o modification of operating procedures,
- o retraining to the new/modified operating procedures.

WMRAD staff working with the WITS developers have found that, to date, WITS functionality does not match WTS. Although WITS developers would likely claim functionality of WITS will equal WTS by September 1, 1997, the following functional shortcomings are anticipated based on what has been demonstrated to date;

- o editing capabilities nonexistent
- o no querying capabilities
- o no history editor to enable editing item/container histories
- o total per container for isotopes, weight, and volume not available

If the switch to WITS does occur, ORNL will be faced with the following vulnerabilities/concerns:

o Due to schedule constraints, the WITS team programmers were forced to use the same development tools (Uniface and C) and operating system (VMS) that they used during the development of the Y-12 WITS. VMS is not an operating system with a long-term future. Uniface is inefficient by today's standards. Thus, when WITS is deployed, it will exist on a dying operating system platform having been developed with an old, cumbersome tool. Consequently, it is highly likely the WITS team will be forced to begin the process of redeveloping WITS using another operating system, another database, and another development tool as soon as the new system is deployed. This will entail another round of system design, programming, testing, and dual operation. Additional changes to procedures necessitating more training would logically be required for implementation.

o Control of the program will reside with a non-LM company whose major concern is management of legacy wastes (not newly generated wastes) over a five site, three state program. There is no doubt that the ability to make TIMELY improvements or corrections to reflect process improvements and/or cost savings initiatives will be severely impaired. In fact, some worthwhile cost savings modifications unique to ORNL may have to be forsaken because the cost and time to implement would have to include impacts on both WITS and the other sites. Furthermore, it is possible that levels and types of programmatic work that can be accepted by ORNL could be constrained by the willingness or ability of the contractor controlling WITS to make the timely system modifications necessary to handle new wastes from new programs.

Adoption of the recommendation to continue to use WTS as opposed to shifting to WITS will result in a significant cost savings to DOE, assurance that a system of lesser functionality is not substituted for one of greater proven functionality, and elimination of system control vulnerabilities/concerns (giving ORNL better control of its own destiny) while still achieving the DOE objective.

COST SAVINGS:

Cost savings will be realized through avoidance of both one-time and annual costs.

One-time costs cover the impact on WMRAD caused by the shift from WTS to WITS. Costs for WMRAD adjustments caused by the shift to WITS are estimated to be $166,000.

The annual cost avoidance realized by having a "local" system instead of a five-site, three-state system is estimated to be $131,000 per year based on reduced staff time presently expended on requesting, negotiating, and documenting changes to the five-site system.

BARRIERS TO IMPLEMENTATION:

There are two major barriers to implementation of this recommendation.

1. Adoption of this recommendation would be inconsistent with the current EMEF plan for providing a centralized waste tracking database which can be used by DOE-OR by CY 1998. It is likely that a new approach to providing the centralized database would have to be renegotiated with DOE-OR. It should be recognized that DOE-OR did not dictate the concept of HOW the database was to be constructed - only that they wanted a central database that contained reliable information. The concept for database construction was determined by EMEF. It should also be noted that, in response to direct questioning, DOE-EM stated that the LMER reengineering could address the single database concept and propose an alternative, if cost-effective for ORNL.

2. It is likely that some adjustments to WTS would be required to achieve the DOE-OR objective of reporting to a centralized database. It is estimated that the cost to make these adjustments would total $160,000.

RECOMMENDATION #5: (Near-term)

Complete ORNL's barcoding system for electronic completion of Treatment, Storage and Disposal (TSD) forms and Waste Container Record (WCR) forms.

NARRATIVE:

Waste Operations personnel use two forms for recording transactions on waste and containers after waste has been picked up from the generator. These are the TSD form and the WCR form.

A TSD form is used by one person in one location to record multiple activities performed on waste items and/or waste containers. All operational activities tracked by the ORNL Waste Tracking System (WTS) can be recorded on a TSD. The most frequently performed activities are: STORE, MOVE, RTRINSP (real-time radiographic inspection), SHIP, DISPOSE, INVENTORY, LABPACK, BULK, RECYCLE, WEIGH and COMPACT. Every activity recorded requires at least one barcode identifier for either a waste item or a container. Other data may be required depending on the activity performed.

One WCR form is completed for a single outer container. If the container holds waste items, the WCR records either a LABPACK, COMPACT or BULK activity for each item. If the outer container holds other containers the WCR records either a COMPACT or OVERPACK activity for the inner containers. In addition to the list of items or containers on the WCR, it also records a significant amount of other information about the outer container including container type, location, weight, volume and health physics survey data.

After a TSD or WCR has been completed, it is hand-carried by field personnel to data entry personnel. The forms are then keyed into the WTS, requiring additional staff time and introducing the possibility of transcription or typographical errors. Waste Operations field personnel keep copies of the forms on file. The typical time frame from when a waste activity is performed to entry into WTS is 2 weeks. As a result, the WTS alone can not provide real-time inventories of wastes.

With the electronic TSD, the container and waste item identifiers can be entered faster and more accurately by using the laser barcode readers attached to Intermec Janus 2010 and/or built into Janus 2020 units. In addition to utilizing the barcode labels on waste items and containers, there are other benefits of electronic TSDs. The barcode reader's menus are structured to reduce repetitive entry of information in the columns for multiple activities. The reader's logic prevents many procedural errors from occurring in completing the form. The reader also includes several validation tables that come from WTS and allow only permitted values in the related fields.

Electronic WCRs will allow the outer container identifier and the inner objects' identifiers to be captured with the barcode reader. The other advantages discussed for the electronic TSD also apply, but not all data for a WCR will be captured with the barcode reader.

In addition to the barcode readers, the barcode system also has a personal computer (PC) component. Barcode readers will be docked in a hardware device connected to a personal computer in Waste Operations offices. The readers will transfer their data to the PC. The PC maintains a local database that allows review and approval by supervision before further uploading the data to the WTS. Certain information, such as HP survey data, will only be added after the barcode reader has uploaded its data to the PC. The PC's local database can replace the paper files currently maintained by Waste Operations. When the command is given to send data on to WTS, it is sent electronically over the network. This eliminates the task of transmitting the paper in person, and provides immediate delivery.

Benefits extend to WTS users outside of Waste Management. For example, OECD evaluation of data for the RCRA annual report can begin in early January rather than early February.

COST SAVINGS:

Cost savings will be realized in the areas of reduced data collection time for field personnel, the complete elimination of the data entry step, and reduced time to reconcile field versus paper inventory due to more accurate and timely inventory data. The estimated time saved for field personnel is 1120 hours annually. The estimated time saved for data entry is 965 hours annually. Reduction of time required to compare the physical inventory to the database is 1000 hours annually. The total annual time saved of 3085 hours equates to a cost saving of approximately $153,000 annually.

BARRIERS TO IMPLEMENTATION:

The implementation of the barcode system at ORNL has experienced several barriers in the past. One problem resulted from delays in networking the Hazardous Waste Storage Area, which was caused by miscommunication between the various telephone companies and the redirection of resources by DOE. Another barrier was label quality problems due to a vendor supplying mismatched labels and ribbons, causing frequent inability to electronically read labels. Another difficulty was in reading labels outdoors due to low contrast in bright sunlight. More than once, limited programming resources had to be reassigned to other critical tasks (such as six months for the GES import processor). Finally, the software, which was originally developed for Windows 3.1, is not fully supported by Windows 95, which is now used throughout WMRAD. These earlier barriers led to another one, lack of acceptance by most Waste Operations personnel of the existing system when originally available on a limited basis.

The full deployment of the barcode system still faces several of the original barriers, such as some poor labels still in use, sunlight, operational acceptance and conversion to Windows 95 compatibility. A new barrier is the reduction of ORNL's FY97 WTS support budget by DOE (from $770K to $330K) which has already resulted in cutting tasks, supplies and personnel. The programming cost to complete the conversion of the barcode system to Windows 95 and deploy it to the field is estimated at $9000 for 150 hours labor. An additional cost to replace old batteries is estimated at $5000.

RECOMMENDATION #6: (Near-term)

Provide the existing user base with a new end-user reporting tool with more powerful features and functionality.

NARRATIVE:

At the time of it's initial deployment, one of the restrictions of the Waste Tracking System was turn-around time on report requests. This was due to the lack of a completed network infrastructure and software products which would provide a user-friendly interface to support database access and report creation. The result was that all reporting requirements were provided by a small number of programmers using low productivity languages. As the infrastructure drew near to completion, commercially available off-the shelf products became available. A tool was selected and approximately 20 personnel were provided with on-site and off-site training. The deployment was successful in that a broad base of average users could create and generate basic reports with significantly shorter turn-around times. This freed the programmer staff for consulting/troubleshooting purposes on the more complex report requirements.

One side effect of this user empowerment is that in the 4 years since deployment, the user base has become significantly more skilled and the reporting needs have become more complex while the tool has become antiquated in comparison to today's technology.

Technology exists today which can provide numerous benefits while taking advantage of existing infrastructure and the established user base. The overall goal is to provide a seamless and fully automated mechanism for report creation and distribution. Specific benefits that would be realized include:

- More powerful reporting directly from the database with no duplicate data entry into another tool in order to achieve complex reports.

- End-user report scheduling enabling better system load distribution during off-hours.

- Automated report distribution via e-mail, run-time viewers and automated Web deployment.

- Customized, multi-level end-user access.

- Improved response time with reduced staff time.

- User shareable report 'object library' improving consistency between various reports.

- Reduced staff time for reconciliation of data differences between different reports.

- Elimination of the need for distribution of paper copies of reports.

This will result in greater user satisfaction at no cost to the waste generators. It will also allow users to share their work more easily among each other and, as the report library grows, eliminate much of the redundant efforts within a disbursed end-user reporting environment.

COST SAVINGS:

With the assumption that the user base remains the same number as currently exists and that a better tool with shared resources among users is used, it is estimated that end-user effort could be reduced by half. Focusing on the 'power users', Waste Management would save approximately 2.5 FTEs at $87,000 per FTE totaling $218,000. OECD would save .65 FTEs at $82,000 per FTE totaling $53,000. End-user batch scheduling would save an additional FTE in programmer support at $87,000 per FTE. The total savings of $358,000 is offset by an estimated annual software maintenance contract increase of $2,000 per year for a net savings estimate of $356,000.

INVESTMENT COST

The migration cost to a new reporting environment is primarily in obtaining the training necessary to ensure successful deployment and purchasing the necessary software upgrade. Specific estimates are:

Software upgrade: $8,000
Configuration: 160 hours x $60/hr =$10,000
Training: Off-site training (Administrators)
- 2 people x $2000 = $4,000
- Course and Travel Expenses = $4,000

On-site training (End-Users)
- WMRAD = 9 people x 24 hrs x $49.44/hr = $11,000
- Programmers = 3 people x 24 hrs x $60/hr = $4,000
- OECD = 3 people x 24 hrs x $47/hr = $4,000
- Trainer = $6,000

Training Subtotal = $32,000

Total Investment = $50,000

BARRIERS TO IMPLEMENTATION:

The standard barriers of obtaining investment funding and ensuring end-users allocate and schedule time for cost-effective on-site training exist .

The tool being recommended is not completely in alignment with ORNL computing policy as a supported software package. However, the ORNL End User Data Access Tool committee has looked at the software and does not object to it's use. Support will have to be provided internally by WMRAD resources just as is currently done with the existing software tool.

RECOMMENDATION #7: (Near-term)

Create a set of templates for commonly generated wastes for use with the Generator Entry System (GES).

NARRATIVE:

Generators can, at present, create templates in GES for their commonly generated wastes. The first form set submitted for the waste stream is reviewed by Waste Management and corrected and/or completed. Ideally, the revised form is then sent back to the generator for review and final signatures. The generator then makes a template for that stream and subsequent submittals only require that the generator enter new barcode numbers, dates, weights and volumes. Presently, the modified forms are not always returned to the generators, therefore, they are making templates from the original, often incorrect forms which again require review and change. To compound the issue, generators are sharing the incorrect templates.

The process team proposes that this GES option be utilized more effectively. WM and OECD will approve templates for common waste streams, especially commercially available products. The templates will be made available to all generators through the GES homepage. This option could also be used to give generators examples of correctly completed forms (e.g. correct formats for spent solvents, solvent contaminated solids, items containing underlying hazardous constituents).

Institution of this recommendation would (1) provide consistency in waste classification, (2) optimize ease and efficiency for generator entry, (3) decrease the constant need for rigorous review by WM in cases where the templates will be used, (4) increase communication between WM, OECD and the generator, thus increasing generators knowledge of the CORRECT way to classify wastes and (5) make the annual reporting easier and more accurate.

COST SAVINGS:

Cost savings will be realized in the areas of reduced time for WM review and annual report resolution. It is estimated that $11,000 will be saved per year on the review of approximately 1,300 items for which the template option will be used. In addition, OECD and WM will save 360 and 60 hours, respectively, in the year end review and resolution of the RCRA Annual Report (making sure that all cans of "X" are assigned the same RCRA codes). This translates to a savings of $15,000 for OECD and $3,000 for WM.

Total projected cost savings: **$29,000** per year.

BARRIERS TO IMPLEMENTATION:

Implementation of this project would require an initial investment of approximately $4,000 for programmers to orchestrate the templates. Initiation and review of the templates for accuracy would occur as a normal part of generator, WM and OECD operations. Templates will need to be periodically reviewed and updated when requirements change; however, this review will help ensure consistency by making changes in one place rather than by telling every generator.

Although not a barrier, one potential pitfall of templates is that generators may begin to rely on them too much. Rather than do complete characterization, they may just choose the closest template and not make modifications to it. It will need to be stressed to generators that the templates are not a substitute for adequate characterization, only a tool to simplify data entry when a characterized waste fits the template.

RECOMMENDATION #8 (Near-term):

Implement electronic inspection record keeping/validation system for WM storage or treatment units (RCRA and TSCA).

NARRATIVE:

WM is required to inspect waste storage areas and to maintain those records. Currently, WM maintains fairly extensive paper files of inspection logs for RCRA and PCB waste storage units. Most of WM's RCRA units are inspected weekly and monthly. A few of WM's units are inspected daily, biweekly, and/or annually. PCB areas are inspected at least monthly. RCRA and TSCA mandates that certain information items must be completed. Failure to fill in a required piece of data can lead to fines, penalties, and/or violations. Loss of an inspection log (paper copy) or failure to maintain the required operating log for the required time frame (three years from the time the last waste is disposed of) can result in more significant (higher) fines, penalties, and or violations. To minimize or eliminate operational errors or oversight, WM has implemented a system of supervisor review of each completed inspection form to ensure that inspectors have not inadvertently failed to fill in required data. WM maintains the paper files in their offices and periodically transfers those records to the WM Document Management Center to ensure long-term safekeeping.

Operators/generators are required to inspect 90-DAAs weekly and PCB areas monthly. Completion of and maintenance of the records (three years from the time the last waste is disposed of) are solely the responsibility of the operator/generator; accuracy of the log and/or long-term safekeeping are not always assured.

An electronic system for recording inspection information should be implemented for RCRA and PCB areas. The system could be configured to require all fields to be completed (eliminates operator oversight/error) and could even automatically assign the date and time the inspection was completed. The system could utilize existing bar code labels (on units and/or containers) to help record specific data; thereby minimizing problems related to transcription. By using the electronic validation to ensure completeness of the information, the extra field review of each inspection record by a WM supervisor could be eliminated. The inspection record could be automatically stored and maintained in a central file and eliminate the need for paper/file copies at multiple locations. An electronic notification system for unusual events (spills, roof leaks, or other problems) could be set up to provide immediate notification to appropriate supervisor(s) for prompt resolution.

COST SAVINGS:

The main cost savings within WM is for the elimination of the review step by the field supervisor. The annual cost savings to WM is estimated to be $17,000.

Implementation of this electronic inspection record keeping/validation system could avoid potential violations, fines and penalties issued by regulators for incomplete or missing inspection records. RCRA/TSCA fines and penalties could be $5000 per occurrence; limited largely to generator problems due to their less structured record keeping system. Annually, the new electronic inspection system could eliminate as many as five potential violations per year and an annual cost of $25,000 in fines.

Thus the total annual savings is estimated to be $42,000.

The investment costs to implement this system include costs to negotiate regulator approval of a paperless record keeping system and the costs to implement permit modifications that would document regulator approval of such a system. That cost for negotiations and permitting is estimated at $31,000. Additionally, internal procedures may need to be modified and affected staff must be trained to use the new inspection system at an estimated cost of $50,000. Equipment purchase and programming costs are estimated to be $17,000.

BARRIERS TO IMPLEMENTATION:

The primary barrier to implementation is ensuring regulator acceptance of the paperless system and ensuring their access to the inspection record system during any inspections by the regulators. Regulatory negotiations would need to be initiated and proof of concept would probably be needed to obtain their formal acceptance. Permit modifications may be required depending on the existing wording in the permit but also to formally document regulator acceptance of the electronic system. This cost is estimated to be $31,000.

Internal barriers include the shear number/variety of inspection forms involved. Changing to more standardized inspection forms could reduce this problem. Each inspection form would need to be put in the system and the validation/supervisor notification system developed. Procedures dealing with inspections may need be reissued and inspectors would have to be trained to use the new electronic system. The field logistics of the working system could be difficult; it could involve use of both a palm-top (hand-held) computers and bar code readers. It may be difficult to physically enter unique comments on the bar code readers. Costs for addressing these items are estimated at $50,000.

Programming and testing costs for purchasing the equipment, designing, and implementing the electronic inspection system is estimated at $17,000.

RECOMMENDATION #9: (Near-term)

Include the process knowledge (PK) form as an electronic form within GES.

NARRATIVE:

The PK form, UCN-20116, is a 2-page form with 5 sections addressing process area information, waste category and waste stream information, radioactive constituents, regulated (RCRA/TSCA) hazardous constituents, and other waste acceptance criteria (WAC) parameter determination methodologies. The form is currently only available on hard copy; no electronic version is available or planned by the official owner of the form. The Generator Entry System (GES) is the electronic platform used to complete the data form set for all wastes generated at ORNL other than liquid wastes treated at either the Process Waste Treatment Plant, the Liquid Low-Level Waste Plant, or the Nonradiological Wastewater Treatment Plant. GES has room for expansion and could easily accommodate the PK form.

Incorporating the PK form into GES as an electronic form would be tremendously beneficial to generators, OECD, and Waste Management. The person responsible for completing the form would have ready access to the form, would be able to complete and submit the form for review and approval real-time, would be able to receive comments back from the reviewer real-time, and would be able to respond to such comments real-time, thereby speeding up the process for final approval. Generators would also have the option of simply referencing the PK identification number on subsequent data form sets that use the PK form to assist with characterization, or actually forwarding the PK form along with the form set. Having the PK form available electronically would allow Waste Management to establish and maintain an electronic master file of the PK forms instead of a hard-copy master file. Waste Management would thus be able to "instantaneously" access the PK form when referenced on a subsequent form set. OECD would benefit from having the PK form available electronically because the forms could be accessed as needed when OECD compiles data for annual reports, such as the RCRA annual report, the Pollution Prevention annual report, and the PCB annual reports.

GES can be configured to assign a unique identification number to each PK form as it is generated, which would ensure uniqueness as well as consistency in the numbering format.

COST SAVINGS:

Generators currently spend about 3 hours completing, submitting, and revising PK forms for radioactive wastes, and 1-1/2 hours for hazardous wastes. It is expected that electronic completion and submission will cut this time to 3/4 hour for radioactive waste and ½ hour for hazardous waste. Approximately 30 PK forms are generated yearly for radioactive wastes and 200 per year for hazardous wastes. This equates to a savings of about $21,000 ((200 PK forms *1 hr + 30 PK forms *2.25 hr) * $80/hr). Waste Management estimates that approximately ½ hour will be saved per PK form for radioactive waste, but that nominal savings would be realized for PK forms for hazardous waste. This correlates to an additional savings of about

$1,000 (30 PK forms * ½ hr * $49.44/hr). OECD estimates that having access to electronic PK forms will save them approximately 80 hours during review for annual reports. This equates to an additional savings of about $4,000 (80 hr * $46.59/hr), for an annual net savings of $26,000.

An initial investment of approximately $5,000 is expected to be expended in programming the PK form and format into GES and actually testing the capabilities thereof.

Based on this limited initial investment and the estimated annual net savings, the payback period for this investment is 0.2 years.

BARRIERS TO IMPLEMENTATION:

LMES has opposed making the PK form electronically available in the past. LMES, as well as the other users of GES (K-25 and Y-12), will have to be informed of the proposed recommendation and will have to approve the addition of the PK form to the electronic GES system. Approval from the other users of GES is not typically a problem since GES can be configured to limit use of certain capabilities by Site, and therefore, even if the other users did not want this capability, they would not be automatically subjected to it and could even request that GES restrict their Site's use of it.

As mentioned above, an initial investment of approximately $5,000 will also be necessary.

APPENDIX

Team Charter

Team Roster

Meeting Notes

To: tfx
From: tfx@ornl.gov (Tom Scanlan)
Subject: R&R Subteam Charter
Cc:
Bcc:

DRAFT DRAFT DRAFT

ORNL Waste Management Reengineering Initiative

Reporting and Records Subteam Charter

The Reporting and Records subteam is charged with making recommendations to the ORNL Waste Management Reengineering Team that will ensure the most efficient process is used to acquire, employ, transfer, and store the waste characterization and status data used to prepare waste management reports and records, both now and in the forseeable future.

Activities to derive the recommendations may include the following:

o review and assessment of the current process

o review and assessment of the administrative concepts that drive the current processes.

o review and assessment of concepts used by other organizations that handle large quantities of data, both within LM and within the private sector.

o review of the drivers for what types of data are needed by whom for what purose.

o review and assessment of the boundary conditions placed on the process by the customer (DOE)

o review of the ability of the current process flexibility (ability to change with new waste streams or administrative situations)

o review of the contraints placed on ORNL missions/research by the current process

o review of the interaction between the waste management field operations and the current process

o review of the buisiness structures which facilitate waste Management's role as a service organization within ORNL

o review of WMRAD integration within ORNL's technical infrastructure

DRAFT DRAFT DRAFT

RECORDS/REPORTING PROCESS
TEAM ROSTER

Nancy Dailey	OECD
Betty Evans	Chem. Tech.
Jon Forstrom	Team Leader
Debbie Hensley	WMRAD
Lori Kampwerth	WMRAD
Jamie Maze	CIND
Jim Nix	LMES - ESWMO
Tim Rhyne	Comp. Phys. & Eng. - WMRAD
Tom Scanlan	WMRAD - Core Team Champion
Jim Slover	P&E
Kim Thomas	CASD
Barbara Wojtowicz	LMES - WMRAD

I N T E R O F F I C E   M E M O R A N D U M

Date: 07-Apr-1997 12:02pm EDT
From: Jamey Maze
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Dept:
Tel No:

TO: forstromjm (forstromjm@cosmail6.ctd.ornl.gov@SMTP

Subject: meeting notes
File: READ 034491

[Hope this help... jnm]

Concerns:

Are we tracking more data than necessary?

Are we collecting the right data?

Is our solution aligned with the ORNL technical architecture?

2109
- WAC document
- Inconsistency between WAC requirements and data collected on 2109
- Inconsistent guidance on completion
- Computerize or not - user friendly?
- Should service options be increased?
- Possible problem - transcription from generator to GES

Inconsistency between way generator codes things, Waste Mgmt. codes things, and OECD codes things to RLRA annual report.

Handwritten vs. electronic signatures

Communications between WM and generators

The new waste tracking system
- functionality
- adaptability to LMER
- flexibility
- compatibility
- technology base not compatible with ORNL

Must create new 2109's and reenter data to send waste to another site.

Paper copies - record keeping requirements - who has to keep what? Why?

Reporting tools for tracking systems; software doesn't do everything

WOCC/LERC redundant

Multiple data systems containing some data points - don't always agree, opportunity for errors - one gets corrected, others don't.

Financial system tin to tracking systems for unit pricing and generator chargeback

Routing reports distribution
- cost effective improvements?
- duplication of reports
- automation

Tracking system design
- Is it designed with reporting in mind
- multiple systems

Site-wide understanding of UHC's

Use of MSDS/HMIS informatin and multiple systems - interface with waste systems - RMMA

Bar code reader implementation

Retrieval system by PK Master File

Is paper copy only legal version - or can it be electronic?

HWOG weekly inventory printout

Inspection records

Paper copies of 2109 - can electronic signature eliminate paper form?

PK form electronic andd tied to 2109; not paper

90-day and satellite recorrd storage - what are generators keeping

Adoption of K-25 WICL vs. separate WID for every container

Automated rad calculations in GES

OECD 90-day inventory to track and prioritize

Waste Profile Sheet - RSN06 WAC - 6 pages - replaced PK

Change control - process/form/data/procedures/requirements; xxxxx - then changes to electronic systems forced to change

Data collection drives the WM process instead of process driving the data collection

Programming changes very frequent - should only certain things be computerized/asked for? At least by certain groups

Too much data? Costs?

Ownership of data systems and forms - many stake holders - who is collection what data for when?

--
Jamey Maze ORNL Network Computing Services Group

Custom	Reduce Costs	Improve	Compliance	Satisfy Custo	Future planning	Utilize Technology	Public Imag.
OECD	1	5	10	10	1	1	5
Generators	10	10	5	1	1	1	1
WMRAD	10	10	10	10	10	5	5
DOE	10	1	10	10	5	1	10
DEC/EPA	1	1	10	1	1	1	10
TSD facilities	1	1	10	1	1	1	1
Public	10	1	10	1	5	1	10
EMEF	10	10	10	10	10	5	10
m Corporation	10	10	10	10	10	5	10
nanagement	10	10	10	10	10	10	10
Jon-DOE Sponsors	10	1	1	1	1	1	1
ransportation	1	5	10	10	5	1	5
	84	65	106	75	60	33	78

4/8

GENERATOR

- •Obtain bar code labels for items/containers/ documents from WM
- •Characterization data PK-SAA
- •Logs SAA or 90-Day
- •PCB/TSCA inventory inspections 30-Day
- •Treatment logs
- •Sanitary 2109s
- •LLLW Annual Survey
- •LLLW Log Sheet
- •2109s form set
- •PK/profile sheet
- •HP data for cont/pkgs
- •WM Plans for projects

WM

RSWOG

- •Receive PK forms/ review-approve/keep master file
- •Receive 2109 form set -bar code unique identifier - item labels & container labels
  - paper and/or electronic (paper required for signature)
- •Log in to Waste Tracking System
- •Waste Review HC - in-house spread sheets - DOT/PA/DAC Cross container review
- •Initiate OSM & checksheet
- •TSDF form - operations Waste Container Records
- •If OK, send to WTS
  -Elect → elect Paper → Input
- •Data entry of waste review of container
- •Enter TSD Info
- •Daily log books at storage facilities
- •Inspection records - operating copies
- •Monthly take all paper copies to DMC

HWOG

- •90-Day Inventory Dbase
  - FoxPro
    - Updated weekly
    - Generator sends paper copy of inventory log sheet
    - OECD enters into dbase
    - Copy to HWOG to schedule pickups
    - Start date & who's got it
      - est. weight or volume
    - Also needed for RCRA annual - generated but not in "system"
- •Receive 2109 elect/paper
- •Review paper - PK form check completeness
- •Log into database
- •Sent to WTS
- •Waste review completed in WTS
- •Create WPO (Waste Pickup Order) to pickup waste
- •WPO completed in WTS
- •Waste stored - TSD completed
- •TSD entered - multiple
- •Preparing Off-Site Shipment
  ID what to ship
  Enter info into FoxPro dbase
  - drum # - ORNL, not bar code
  - DOT - may change
  - Bar code #s
  - Haz class - may change
  - Weight - re-weigh
  - TID
  - Start date
  - EPA codes - may change

  Print manifest and drum list from this database
- •Off-site shipment (off-site shipping list (OSL completed in WTS)
- •Daily inspection sheets
- •Facility logbooks - Issue ORNL drum numbers

REPORTING END POINTS

- •RCRA annual - TDEC
- •PCB annual - EPA
- •Corporate annual - LMCORP
- •Site treatment plan - TDEC/EPA
- •Mixed waste inventory report - EMEF
- •PCB FFCA - EPA
- •Monthly billing report - gen
- •GSEF Generator
- •Waste Min. Progress - TDEC
- •Monthly waste generation - Mgt.
- •Performance metrics - WMRAD
- •Contract metrics - DOE
- •Special requests - DOE, internal, TOA, Mgt., Non-DOE sponsor
- •Monthly storage
- •Weekly inventory reports - HWOG
- •Manifests/shipping list - TSD
- •LDR notification/cert - TSD
- •Bulk data downloads - ?
- •Performance assessment - DOE

4/8 + 4/9

Ideal Data Process

	Generator	Waste Management	Reporting
What	• Registration of SAA/90 day • Minimal Impact • Optimal Info - PK • SAA logs ? • 90 day inventories • Treatment log inspections	• Container management • Characterize • Classify • Shipment planning - terminal point, interim storage • Track waste through system - includes treatment • Facility inspections	• Minimal paper reporting • Prepare only necessary: value added reports • Reporting requirements built into data collection process - everything is there at the end. • End-user empowerment/user access ~~generate~~ • Generat own reports (end user).

← Quickly flexible/Versatile to adapt to changing rules →

	Generator	Waste Management	Reporting
How	• Electronic - Enterit • Bar Code - areas, containers items	• As much electronics as possible • Links to other Systems: - BMS - HMIS - MSDS - CAS - ESLIMS, Regulations calculation spreadsheet - Expert systems to classify waste - CLUE - E-mail systems - Cost accounting system Complete Bar Code System - Track containers - weights - Rad couters - Electronic inspections Electronic Inventory Control Electronic Signatures (If required)	• End user reporting tool - Color graphics • User friendly • WEB deployment • Push button reports • Data is correct/no rechecks necessary • Minimal human intervention • Fast • Computer generates hard copies - no retyping onto forms.

4/10 + 4/11

Same Time Process

Is it feasible?

Is it realistic?

Is there a system available to do this?

What are the benefits?

Reduce cost

- Eliminate:

multiple systems

multiple key-ins

many data validation steps

original key-ins - barcode readers

- reduce paper

Near real-time inventory - better inventory mgmt. | shipping

Increased flex / vers.

Happy customers - gen., WM, public, OECD, DOE,

TDEC, management

Improve response time - convenience / programming

More consistent waste codes | Classifications - cuts down on reviews and changes

Improved data quality - cuts down on review time + corrections

Generators do research

Improve resource allocations

Moves tracking closer to "cradle"

Improved communications

Let's generators do research

Improves resource allocations

Improves audit response - decrease findings

4/11

[illegible]w Could we get to ideal?
(Near-term objectives)

- Identify optimal generator requirements for WM to accept input from generators.
  ~~Accept~~ on GES · modify GES to accept. + Fast, relatively cheap, + Gen. happy + Elim. duplicate reviews + experts make decisions.
  Barriers: · Funding from LMES for programming
  - WM must define minimal set.
  - who provides the rest of data
  - WM mgt accepts concept of minimal and providing rest of info. and responsibility.
- 90 day and PCB inventory - key into GES when placed in area, GES performs inventory mgt function.
  Plus
  - + Eliminate OECD 90 day inventory
  - + Gets data flow started earlier
  - + More convenient for gen/everyone

  Barriers
  - Data consolidation mechanism
  - Link with OECD for area registration
  - Institutional acceptance of concept
- Container Management System – ?
- Don't go backwards - stay with WTS
  Plus
  - + Maintain current level of capabilities
  - + Don't go through data conversion - expensive
  - + Don't run double systems - double entry
  - + Don't have to rewrite operating procedures
  - + Don't have to do all the retraining.
  - + Don't get tied up in 5 site - inflexible system
  - + Out of LMER Control

  Barrier
  - DOE has dictated 1 ~~system~~ central system to get info.
  - EMEF determined that to be 1 system at all 3 sites - WITS - they hold funds.
  - Need to go forward with WTS upgrades
- Complete the bar code system

4/11

How Could We Get to Ideal: (Cont.)

- Complete the bar code system.

Paper & initial key-in

TSD Form - STORE, MOVE, INVENTORY, INSPECT, RTRINSP, DISPOSE, TREAT, OVERPACK, LABPACK, BULK
- ITEM/CONT ID, TARGET, ITEM/CONT ID, ACTIVITY, ACT. DATE, LOCATION, WT, VOL, SIGNATURES

WCR Form - LABPACK, OVERPACK, BULK, COMPACT, REGISTER,
- ONE CONTAINER, MANY ITEMS
- INFO ON CONTAINER - HP DATA, CONT. TYPE, WT, VOL, SIGNATURES
- LIST OF ITEMS

Pretty Fast
Pretty Cheap

4/14

(1)

Comments

- MS-DOS readers - flexible
- License Plate - not much information in code.
- Database on computer
- Capability for limited data on reader.
- Radio frequency readers would be great - future technology
- 2D bar codes - future technology

Plus

+ Efficiency - time saving (Eliminate forms and manual data entry)
+ Closer to real-time inventory - inventory resolution
+ Error rate reduced
+ Create interface with GES for 90-Day areas
+ Eliminates paper records
+ Tie back to container mgt. system
+ for generators - up to date inventory on what is in box - LLW - reduced exposure - ALARA
+ Reduced regulatory violations - ~~the~~ inventory checks permit limits before waste moved in

Barriers

- Operational - must locate labels so they can be read - sunlight interference
- Operational acceptance (Internal communications)
- Interlink upgrade to Windows 95
- Technology upgrades
- Personnel resources/budget
- Investment cost - readers, etc. - generators + WM

How Could We Get to the Ide? (Cont.)

- New end-user data aquisition tool :

  Plus

  + Web deployment
  + More powerful reporting
  + Greater user satisfaction
  + Customized, multi-level end-user access
  + Improved response time-reduced staff time
  + Consistency
  + Scheduled automated distribution-eliminate redundancy
  + Reduced staff time for reconciliation of data differences
  + Infrastructure already exists
  + No cost impact to generators.
  + No paper

  Concerns/Barriers

  - Too many end-users, query differently, get different answers for "same" questions.
  - End user training
  - Investment cost to upgrade - Software & programming. [Relatively cheap]
  - EMEF said not in alignment with Central Waste Strategies.
  - ? - Consistency with ORNL computing policy/supported software.

- Links to other systems - HMIS, MSDS, etc.

- Internal validation by computer - out of range info.

4/14 ②

How Could we get to the ideal? / Cont.

- Create set of templates for commonly generated wastes for use with GES

Plus
+ Consistency in waste classification
+ Efficiency - easy entry for generator, easier check by WM
+ Shared knowledge
+ Easier annual reporting
+ Fast & cheap to do
+ Makes Kim very happy!

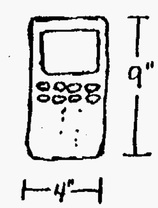
Generators are already doing this, but not necessarily sharing the "correct" templates

Barriers
+/- Templates must be periodically reviewed/updated when requirements change. But helps ensure consistency, changes made in one place vs. trying to tell everyone about it.
- Generators may use incorrectly because of ease of use.

- Electronic Inspections of TSDs and/or 90 day areas.

Plus
+ Electronic records instead of paper
+ Reduced regulatory violations - ensures all fields filled, signed, etc.
+ System assigns date & time - tie to barcode readers for input.
+ Less personnel time - computer reviews form for completeness, not supervisor

Barriers
- Logistics - may take "too many hands" to handle equipment
- Difficulty to enter comments on existing barcode readers.
- Regulatory acceptance of computer records.



4/15 ©

How Could We Get to the Ideal?

- Administrative Issue - Change approval to WTS/GES
  what is process for changes? who approves? SCR goes through 5 site review committee.
  "They" won't let us change

Suggested solution

- Need local (ORNL) system and support that feeds into the central system.
  "one size fits all" system not working.

Plus
+ More flexibility/control
+ Responsiveness to ORNL needs - tailored system

Barriers/Concerns
- Need better change system even with ORNL-specific system
- Resources
- Having rest of EMEF/WM agree to ORNL-specific system if they get what they want.

4/15 2

ORNL RE-ENGINEERING PROGRAM
WASTE MANAGEMENT

RECORDS AND REPORTING TEAM
PRELIMINARY DRAFT RECOMMENDATIONS

Recommendation #1: (Long-Term)

- Create the ideal data process

Benefits:

+ Reduce Cost
    - Eliminate:
      Multiple systems
      Many data validation steps
      Original key-ins-bar code readers
+ Reduce Paper
+ Near real-time inventory - better inventory management/shipping
+ Increased flexibility/versatility
+ Happy customers - gen., WM, public, OECD, DOE, TDEC, management
+ Improve response time - convenience/programming
+ More consistent waste codes/classifications - cuts down on reviews and changes
+ Improved data quality - cuts down on review time and correction
+ Generators do research
+ Improve resource allocations
+ Moves tracking closer to "cradle"
+ Improved audit response - decrease findings
+ Improved communications
+ Opportunity to do WEB deployment

Barriers:

– Initial investment - resources
– Mind set that you need a paper backup and signature to everything
– "One Size Fits All" mentality
– User acceptance/learning curve
– Complex, long-term problem to fix
– Changing requirements/moving target
– Hardware/software/people resources

– Unlikely there is COTS to do it all, but maybe multi-commercial pieces

Recommendation #2: (Near-Term)

- Identify optimal generator requirements for WM to accept input from generators on GES. Modify GES to accept.

Benefits:

+ Fast, relatively cheap
+ Generators happy - less impact on their work, better resource allocation
+ Eliminates duplicating reviews
+ Experts make decisions

Barriers:

– Funding from LMES for programming
– WM must define minimal set
– Who provides the rest of data
– WM management accepts concept and responsibility of minimal and providing rest of info

Recommendation #3 : (Near-Term)

- 90-Day and PCB inventory - key into GES when placed in area, GES performs inventory mgt. function.

Benefits:

+ Eliminate OECD 90-Day inventory
+ Gets data flow started earlier
+ More convenient for gen./everyone

Barriers:

– Data consolidation mechanism
– Link with OECD for area registration
– Institutional acceptance of concept

Recommendation #4: (Near-Term)

- Don't go backwards - stay with WTS

Benefits:

+ Maintain current level of capabilities
+ Don't go through data conversion - expensive
+ Don't run double systems - double entry
+ Don't have to re-write operating procedures
+ Don't have to do all the retraining
+ Don't get tied up in 5-site - inflexible system
+ Out of LMER control
+ WTS consistent with ORNL computing structure

Barriers:

– DOE has dictated 1 central system to get info.
– EMEF determined that to be 1 system at all 3-sites - WITS - they hold funds
– Need to go forward with WTS upgrades
– WITS not consistent with ORNL computing structure

Recommendation #5: (Near-Term)

- Complete the bar code system

Benefits:

+ Efficiency - time saving (eliminate forms and manual data entry) TSDF
+ Closer to real-time inventory - inventory resolution WCR Form
+ Error rate reduced
+ Create interface with GES for 90-Day areas
+ Eliminates paper records
+ Tie back to container mgt. system
+ For generators - up to date inventory on what is in box - LLW - reduced exposure - ALARA

Barriers:

– Operational - must locate labels so they can be read - sunlight interference
– Operational acceptance (internal communications)
– Interlink upgrade to Windows 95
– Technology upgrades
– Personnel resources/budget

Recommendation #6: (Near-Term)

- New end-user data acquisition tool

Benefits:

+ Web deployment
+ More powerful reporting
+ Greater user satisfaction
+ Customized, multi-level end-user access
+ Improved response time - reduced staff time
+ Consistency
+ Scheduled automated distribution - eliminate redundancy
+ Reduced staff time for reconciliation of data differences
+ Infrastructure already exists
+ No cost impact to generators
+ No paper

Barriers:

– Too many end-users, query differently, get different answers for "same" questions
– End user training
– Investment cost to upgrade - software & programming (relatively cheap)
– EMEF said not in alignment with Central Waste Strategies
– Consistency with ORNL computing policy/supported software

Recommendation #7:

- Create set of templates for commonly generated wastes for use with GES

Benefits:

+ Consistency in waste classification
+ Efficiency - easy entry for generator, easier check by WM
+ Shared knowledge
+ Easier annual reporting
+ Fast & cheap to do + makes Kim very happy!

(Generators are already doing this, but not necessarily sharing the "correct" templates)

Barriers:

– Templates must be periodically reviewed/updated when requirements change, but helps ensure consistency, changes made in once place vs. Trying to tell everyone about it.

– Generators may use incorrectly because of ease of use

Recommendation #8: (Near-Term)

- Electronic inspections of TSDs and/or 90-Day areas

Benefits:

+ Electronic records instead of paper
+ Reduced regulatory violations - ensures all fields filled, signed, etc.
+ System assigns date & time - tie to bar code readers for input
+ Less personnel time - computer reviews form for completeness, not supervisor

Barriers:

– Logistics -may take "too many hands" to handle equipment
– Difficulty to enter comments on existing bar code readers
– Regulatory acceptance of computer records

Recommendation #9: (Near-Term)

- Need local (ORNL) system and support that feeds into the central system - "one size fits all" system not working

Benefits:

+ More flexibility/control
+ Responsiveness to ORNL needs - tailored system

Barriers:

– Need better change system even with ORNL-specific system
– Resources
– Having rest of EMEF/WM agree to ORNL-specific system if they get what they want

Recommendation #10 - (Near-Term)

- Electronic capture of process knowledge - make PK form/process knowledge info part of GES, not a separate form

Benefits:

+ Make data collected accessible
+ Provide better consistency (a little)
+ Replaces PK master file - paper files

+ Generator and WM convenience - electronic entry vs. write up, type, mail, etc.
+ Faster to transmit info and get approval back

Barriers:

– Investment
– Approval to get GES changed

TABLE - IDEAL DATA PROCESS

<table>
<tr><th>GENERATOR</th><th>WASTE MANAGEMENT</th><th>REPORTING</th></tr>
<tr><td>• Registration of SAA/90-Day
• Minimal impact
• Optimal info - PK
• SAA logs?
• 90-Day inventories
• Treatment log inspections</td><td>• Container management
• Characterize
• Classify
• Shipment planning
- terminal point, interim storage
• Track waste through system
- includes treatment
• Facility inspections</td><td>• Minimal paper reporting
• Prepare only necessary & value added
• Reporting requirements built into data collection process - everything is there at the end
• End-user empowerment/user access
• Generate own reports (end user)</td></tr>
<tr><td colspan="3">Quickly flexible/versatile to adapt to changing rules</td></tr>
<tr><td>• Electronic - enter it
• Bar Code - areas, containers items</td><td>• As much electronics as possible
• Links to other systems:
- BMS
- HMIS-MSDS-CAS
- ESLIMS, regulations calculations spreadsheet
- Expert systems to classify waste
- CLUE - E-mail systems
- Cost accounting system
• Complete Bar Code System
- Track containers - weights
- Rad Counters
- Electronic inspections
• Electronic Inventory Control</td><td>• End user reporting tool
- color graphics
• User friendly
• WEB deployment
• Push button reports
• Data is correct/no rechecks necessary
• Minimal human intervention
• Fast
• Computer generates hard copies - no retyping onto forms</td></tr>
</table>

RECOMM. #2 - OPTIMAL GES

COST SAVINGS:

Generators now spend 1 hr per WID, approximately 13,000 WIDs per year, after will be 15 mins per WID (saving 0.75 hr per WID), generator rate is $80 per hour.

Generator savings = 0.75 hr/WID X 13,000 WIDs = 9,750 hrs X $80/hr = $780,000

WM now spends about 10 mins per WID, after will spend 15 mins per WID (increase of 0.083 per WID), WM rate is $49.44.

WM cost increase = 0.083 hr/WID X 13,000 WIDs = 1,083 hrs X $49.44 = $53,560

Net annual savings to DOE = $780,000 - $53,560 = $726,440

INVESTMENT COST:

Change of procedures X 8 hr/proc = hrs X $49.44/hr =

Change GES instructions = 8 hr X $49.44 = $396

Program GES changes = 4 hr X $60 = $240

Total Investment = $ + $396 + $240 = $

ROI/PAYBACK:

Investment cost of:	$	
	-------- =	years
Annual savings of:	$726,440	

RECOMM. #3 - ELECTRONIC 90-DAY AND PCB INVENTORIES (eliminate OECD dbase)

COST SAVINGS:

Generators now spend 15 min (0.25 hr) a week creating inventory for OECD, will go to zero, there are 20 90-Day Areas, rate is $80 per hr.

Generator cost savings equal 0.25 hrs/SAA/wk X 20 X 52 = 260 hrs X $80/hr = $20,800

Generators save approx. 50 hrs/plant yearly resolution = 50 hrs X $80/hr = $4,000

OECD now spends 5 hrs/wk on 90-D inventory, will be 0, OECD rate is $42/hr, also would save 80 hrs in annual resolution.

OECD savings = 5 hrs/wk X 52 wks = 260 hrs + 80 hrs = 340 hrs X $42/hr = $14,280

Annual savings to DOE = $20,800 + $4,000 + $14,280 = $39,080

INVESTMENT COST:

Programming timer logic and report = 60 hrs X $60 = $3,600

Testing = 6 hrs X $49.44 = $297

Total investment = $3,600 + $297 = $3,897

ROI/PAYBACK:

Investment cost of: $ 3,897
-------- = 0.10 years
Annual savings of: $39,080

RECOMM. #4 - STAY WITH WTS AND HAVE INDEPENDENT ORNL SYSTEM

COST SAVINGS:

One Time Costs to Convert from WTS to WITS:

Stop programming data conversion = 4.3 FTE X $87,000/FTE = $374,000

Stop central programming = 5 FTE X $87,000/FTE = $435,000

Don't rewrite 70 procedures = 70 proc. X 8 hr/proc. = 560 hrs X $49.44 = $27,686

Don't retrain on proc. =	20 heavy users X 80 hrs/heavy =	1,600 hrs
	30 light users X 40 hrs/light =	1,200 hrs
		2,800 hrs X $49.44 = $138,432

No 3 month system checkout = 15 HCU X 88 hrs/HCU = 1,320 hrs X $49.44 = $65,261

No double systems for yr = 6 data verifiers X 1/3 = 2 FTE X $87,000 = $174,000

Total One Time Cost Savings = $1,214,379

2nd "one time" cost for WITS to be rewritten because of obsolete platform estimated at 2/3 of the above = $809,000

Total Savings by NOT converting = $2,023,379

Annual savings of having local system instead of 5-site = 1.5 FTE X $87,000 = $130,500

INVESTMENT COST:

No investment required $ = 0

ROI/PAYBACK:

Because investment is 0, payback period is 0 years

RECOMM. #5 - COMPLETE THE CURRENT BAR CODE SYSTEM

COST SAVINGS:

Initial storage entry saves:	2 min/item X 17,000 = 34,000 mins
	4 min/drum X 800 = 3,200 mins
	1 min/cont X 2,500 = 2,500 mins
Eliminate data entry saves:	10 min/HTSD X 4,100 = 41,000 mins
	3 min/RTSD X 2,700 = 8,100 mins
	4 min/HWCR X 458 = 1,832 mins
	4 min/RWCR X 1,745 = 6,980 mins
Annual Inventory field saves:	1 min/item X 27,500 = 27,500 mins

Total = 125,112 mins /60 = 2,085 hrs

No comparison of annual inventories saves: 46 hrs

Total annual savings to WM = 2,131 hrs X $49.44/hr = $105,357

INVESTMENT COST:

$12,000

ROI/PAYBACK:

Investment cost of: $ 12,000
-------- = 0.11 years
Annual savings of: $105,357

RECOMM. #6 - NEW USER DATA REPORTING TOOL

COST SAVINGS:

(Assumption: same number of end-users before and after)

WM savings = 5 FTE current effort cut in half = 2.5 FTE X $87,000 = $217,500

OECD savings = 1.3 FTE current cut in half = 0.65 FTE X 74,000 = $ 48,100

Batch scheduling of jobs saves another FTE = 1.0 FTE X $87,000 = $ 87,000

Total Savings = $352,600
Annual cost increase for maint. contract = $ 2,000

Net annual savings = $350,600

INVESTMENT COST:

Upgrade software = $7,500

Configuration = 160 hrs X $60/hr = $9,600

Off-site training = $2,500 X 2 = $5,000

On-site training: WM = 9 X 24 hrs X $49.44 = $10,680
Pgm = 3 X 24 hrs X $60 = $ 4,320
OECD = 3 X 24 hrs X $42 = $ 3,024
Trainor = $ 6,000

Sub-total = $24,024

Total Investment = $46,124

ROI/PAYBACK:

Investment cost of: $46,124
-------- = 0.13 years
Annual savings of: $350,600

RECOMM. #7 - PREPARE GES TEMPLATES FOR COMMON WASTES

COST SAVINGS:

Save 10 mins per item for review = 1,300 items X 0.167 hr/item = 217 hrs X $49.44 = $10,733

Save on annual report resolution: OECD = 360 hrs X $42.00/hr = $15,120
WM = 60 hrs X $49.44/hr = $ 2,966

Total Annual Savings = $28,819

INVESTMENT COST:

Orchestrate the templates by programmers = 60 hrs X $60/hr = $3,600

ROI/PAYBACK:

Investment cost of: $ 3,600
-------- = 0.12 years
Annual savings of: $28,819

RECOMM. #8 - ELECTRONIC ENTRY AND QA INSPECTION OF STORAGE FACILITIES

COST SAVINGS:

Eliminate supervisor review of inspection sheet:

HWOG daily/wkly	= 5 hrs/wk X 52 wk	= 260 hrs
HWOG monthly	= 2 hrs/mo X 12 mo	= 24 hrs
RSWOG wkly	= 1 hr/wk X 52 wk	= 52 hrs
	Total	= 336 hrs X $49.44 = $16,612

Eliminate 5 noncompliances per year X $12,500 per = $62,500

Total annual savings = $79,112

INVESTMENT COST:

Purchase 3 palm-tops at $4,000 ea	= $12,000
Programming support = 80 hrs at $60	= $ 4,800
Train operators = 8 hrs at $49.44	= $ 396
Total investment	= $17,196

ROI/PAYBACK:

Investment cost of: $17,196

-------- = 0.22 years

Annual savings of: $79,112

RECOMM. #9 (old 10) - ELECTRONIC PK

COST SAVINGS:

(Assumption: Generators buy PK service from WM)

Generators currently spend 16 hrs per original haz waste PK, after will 1 hr, savings of 15 hrs with 200 new PK per year. Generators currently spend 40 hrs per new SLLW PK, after will be 2 hrs, savings of 38 hrs, with 30 new SLLW PK per year.

Generator savings:	for haz = 15 hrs/PK X 200 PK = 3,000 hrs X $80/hr		= $240,000
	for SLLW = 38 hrs/PK X 30 PK = 1,140 hrs X $80/hr		= $ 91,200

		Gross savings	= $331,200
WM cost increase:	for haz = 0.5 hr/PK X 200 PK = 100 hrs X $49.44		= $ 4,944
	for SLLW = 3 hrs/PK X 30 PK = 90 hrs X $49.44		= $ 4,450

		Cost shift	= $ 9,394

Net savings to DOE = $321,806

INVESTMENT COST:

PK onto GES programming = 80 hrs X $60/hr	= $4,800
testing = 8 hrs X $49.44	= 396

Total investment	= $5,196

ROI/PAYBACK:

Investment cost of:	$5,196
	-------- = 0.02 years
Annual savings of:	$321,806

APPENDIX J

REPORT
of the
PROCESS TEAM ON DISPOSAL ENDPOINTS
of the
WASTE MANAGEMENT PROGRAM RE-ENGINEERING TEAM

June 19, 1997

June 19, 1997 (Rev. 4)

REPORT
of the
PROCESS TEAM ON DISPOSAL ENDPOINTS
of the
WASTE MANAGEMENT PROGRAM RE-ENGINEERING TEAM

Team Members:		
	Allen Croff	Chem Tech (Team Leader)
	Linda Kaiser	LMES/EMEF Env. Rest.
	Don Lee	Energy
	Mac Roddye	DOE Site Office
	Leroy Stratton	WMRAD
	Martin Tull	WMRAD
	Doug Turner	LMES/EMEF Waste Management
	Bob Wham/Dick Schreiber	Chem Tech

SUMMARY

- ORNL has active endpoints for some of its least-hazardous wastes, but the endpoints for most of its wastes are (a) identified but not yet operational and (b) largely outside of present ORNL influence and control.

- In general, waste endpoints do not represent an opportunity for cost savings. Instead, additional investment will be required to minimize potential future costs and liabilities. One exception is to revise Y-12 Sanitary/Industrial Lanfill waste acceptance criteria so that incidentally contaminated wastes are acceptable, which could save ~$500K/yr.

- ORNL's pollution prevention and waste generation, treatment, packaging, storage, and certification activities should be systematically re-designed to achieve the objective: sending waste to highly reliable, low-cost endpoints.

- ORNL must become much more involved in the affairs of key external endpoints at technical and policy levels: local CERCLA processes, NTS, Hanford, and WIPP.

INTRODUCTION

- Purpose:
  = Identify endpoints for ORNL wastes
  = Assess the opportunities, vulnerabilities, and liabilities of waste endpoints
  = Provide recommendations on desired ORNL actions

- Approach: 8 x 2hr team meetings plus homework
  = Identify ORNL wastes
  = Identify potential endpoints

= Developed a matrix of wastes vs. endpoints with the cells indicating degree of activity/certainty and status (green/yellow/red)
= Prepared backgrounders on each endpoint
= Developed findings (conclusions) from backgrounders and discussions
= Developed recommendations based on findings

- Outline
  = Scope and limitations
  = Findings
  = Recommendations: Evolutionary and Revolutionary
  = Appendix 1: Matrix
  = Appendix 2: Endpoint background documents

SCOPE and LIMITATIONS

- Materials addressed: Focus on vulnerability, not ownership
  = Legacy wastes/sites/facilities at X-10 irrespective of ownership
  = Surplus nuclear materials (e.g., spent fuel, assorted actinides and sources) at X-10 irrespective of ownership
  = Newly generated wastes, including off-site receipts

- Endpoints: Disposition with no expectation of retrieval or return
  = Waste disposal/releases at X-10
  = Waste disposal elsewhere in Oak Ridge
  = Waste destruction (e.g., incineration)
  = Waste disposal off-site
  = Material transfers to other sites for disposition: Includes ORO/EM
  = Interim on-site storage is not an endpoint, just cost and liability

- Other boundaries: More or less
  = Excluded consideration of waste processing (parallel team)
  = Excluded pollution prevention (parallel team)

FINDINGS

- ORNL has operating end points for:
  = Gaseous, liquid, and diffuse releases ---> stacks and outfalls
  = Sanitary and industrial wastes ---> Y-12 landfill, Anderson County Landfill (cafeteria wastes)
  = Short-lived LLW acceptable under ORNL PA ---> IWMF until ~2003
  = Selected mixed LLW ---> Envirocare
  = Explosives ---> Chemical Detonation Facility (Bldg. 7667)
  = Selected sealed sources (Pu/Be, Co-60) ---> LANL, Hanford
  = HFIR Fuel ---> SRS and ultimately a repository

- ORNL has identified end points that are planned to accept the following ORNL wastes where there are not significant impediments but where shipment/transfer/operations are not presently occurring:
  - Hazardous chemicals that meet “no rad added” ---> commercial facilities
  - Legacy wastes (solid, tanks, MSRE heel, contaminated sites & facilities) ---> ORO/EM
  - Spent fuel pieces ---> SRS, INEEL

- ORNL has identified end points where ORNL wastes are potentially technically acceptable but where there are significant (primarily institutional) impediments to be overcome (in estimated decreasing degree of concern):
  - Newly generated RH TRU ---> WIPP
  - Newly generated mixed LLW ---> Hanford (NTS secondary)
  - Newly generated LLW; most sealed sources ---> NTS (Hanford backup)
  - CH TRU ---> WIPP
  - HPPR reactor core (at Y-12)

- ORNL has no identified end points for the following without extraordinary effort or budget:
  - Hard-to-characterize-or-treat (size, rad) LLW (reactor internals, RH LLW)
  - Hard-to-characterize-or-treat (size, rad) TRU (REDC equipment HEPA filters)
  - MSRE U-233 ---> Include in 3019 interim storage ---> ???

- ORNL now has little input or control over its endpoints
  - Most end points are not in Oak Ridge and we have not been instrumentally involved in their development
  - Current or future ORNL access to end points can be compromised by actions of others: local and afar

- Disposal is relatively inexpensive to ORNL; absence of disposal can be expensive and impact ORNL’s mission
  - The cost of disposing of our wastes is and will be relatively small
  - The potential cost and operational liabilities resulting from not being able to reliably and promptly send waste to an end point can be substantial
  - Characterization, treatment, and packaging are costly and can probably be reduced

- Most current and planned endpoints have significant limitations or uncertainties

Outfalls:	Potential for in-leakage to exceed release limits White Oak Creek Watershed restoration CERCLA decisions can compromise outfalls
IWMF	Limited capacity/lifetime of 6y or less
NTS	A number of institutional/policy/political impediments
Hanford	A number of institutional/policy/political impediments
Comm’l	Questionable practices of Envirocare Unreliable use of present permissive regulations Future liabilities if the site should require remediation Use of Barnwell might compromise new SE Compact site
WIPP	Will it open approximately on schedule?

Will our wastes have to be treated further?
Do our wastes qualify as defense wastes?
Will non-TRU alpha wastes be accepted?
Will WIPP really accept RH-TRU and, if so, when?

= Civ Repos — Will we have a repository in the foreseeable future?
What will the top-level regulations require of emplaced waste?
Will the requirements finally acknowledge non-HLW, maybe mixed?

= Bldg. 3019 — Old building with barely adequate financial support
"Hot potato" building among potential sponsors

= ORO/EM — Potential impacts of secondary remediation wastes (esp. liquids and gases)
Failure of privatization may impact ORNL mission and staff because they have unique expertise to address some legacy problems and could be diverted from their mission for this purpose
Willingness and continuing ability to accept legacy and orphan newly generated waste (e.g., proposed Alm freeze on accepting more legacy facilities)
Relatively short-term window to get material in a position to be accepted by ORO/EM
ORO/EM/Privatization of MVST remediation may not leave the capability for handling newly generated wastes

= DOE Sites — Irritable governors and reluctance to accept wastes into a state
Unbalanced state equity debits and credits: ORNL is a debtor

= Incinerate — Bad image leads to unreliable availability in general and TSCA problems

= In Situ — Which sites should and will be closed in situ and how could this affect ORNL's near-term operations and long-term mission

= Storage — Increasing costs to build more and maintain what we have
Limited tolerance by regulators

- Significant cost reduction in getting most wastes to end points is unlikely. The major issues are preserving the end points we have and establishing operating end points for the rest of our waste to avoid operating liabilities and significant cost increases from escalating storage requirements and re-characterization costs.
  = Potential exception: Revision of Y-12 Sanitary/Industrial landfill waste acceptance criteria so that most of our current LLW, which is incidentally contaminated with radionuclides, can go there

- In many cases ORNL wastes have not been managed with the end point in mind
  = Production of wastes with an unclear or infeasible end point (most wastes not road-ready)
  = Very limited involvement in end-point affairs, even close to home

- The implications of the proposed DOE waste management Order 435.1 and NRC regulation on endpoints are unclear

- Additional storage is likely to be needed if we do not open endpoints at NTS and Hanford in

the next few years
= Solid LLW
= Mixed solid LLW

- Many ORNL end points involve transfer of waste to others that will ultimately disposition it (see above). We are taking waste from others and may take more (sources, U-233, RH-TRU).

- ORNL must be concerned about on-site ORO/EM end-point activities because they may compromise lab operations. The closer to operating ORNL facilities, the greater the concern.
  = Primary: GAAT, Isotope Circle, BVEST, MSRE, Impoundments
  = Secondary: Releases to White Oak Creek

RECOMMENDATIONS: EVOLUTIONARY

- ORNL must invest more to ensure end points are available and to prevent escalating storage requirements
  = Work primary endpoints intensively
  = Identify and do not preclude secondary endpoints

- ORNL's contingency option to an end point that becomes inaccessible in the future should be to pursue WAC waivers at other disposal sites at the time the inaccessibility occurs.

- Beginning with waste generation, management of ORNL wastes should be focussed on getting rid of our wastes at a limited suite of end points or being road-ready for same instead of storage. Implementation: A systems analysis of current and planned ORNL waste generation, including contingencies, should be conducted to ensure that each waste stream is targeted to an endpoint and to provide the basis for optimizing the system.
  = Draft DOE Order 435.1 requires this
  = Initial activity should focus on maximizing the amount of legacy material transferred to ORO/EM for disposition

- Wastes should be produced with disposition as the foremost thought
  = Will require a team effort of multiple ORNL organizations instead of generators regarding WMRAD as the endpoint
  = Implementation: Require a permit to generate a new waste type that will not allow orphans
  = Implementation: Require newly generated waste has a pedigree and packaging at the time treatment is completed that will allow assay and shipment to an identified end point
  = Implementation: Revise requirements so that process knowledge is an acceptable basis for a waste pedigree if an established set of QA requirements are followed
  = Implementation: Consider the new Pu-238 program and/or the Spallation Neutron Source as the prototypes

- Implementation: ORNL should establish written agreements with ORO/EM concerning the extent and duration over which we will transfer specific wastes to them.

- ORNL should focus on generating wastes that are certified as they are produced for disposition at NTS (LLW) and Hanford (mixed LLW) with commercial sites as lesser alternatives. Implementation: This requirement should be reflected in the systems analysis and waste type permitting process
  = Implementation: Conduct an assessment of the pros and cons of sending LLW to NTS and mixed LLW to Hanford vs. pressing to send both to NTS

- ORNL must focus on WIPP for disposition of its TRU wastes, but must be prepared for long-term storage. Implementation: Perform a plausible worst case analysis of TRU storage requirements and take action to provide the required storage.

- Implementation: A study is required to identify the capability to characterize, treat, and package its wastes on a continuing basis, including some wastes that are potentially intractable, or to indicate that certain waste streams can no longer be produced.

- Implementation: ORNL staff members need to be instrumentally involved in ORO/EM activities where they could compromise ORNL operations: immediate and intensive participation in ongoing and future CERCLA processes
  = About half the sub-team endorsed "owning" the most critical problems

RECOMMENDATIONS: REVOLUTIONARY

- ORNL should adopt an activist role to assure timely and reliable access to waste end points
  = Implementation: Identify end point managers (not necessarily one FTE for each end point)
  = Implementation: Collaborate with other labs that have a similar situation (Strategic Lab Council?) to press for access to key end points and to influence potential barriers to their continued availability (e.g., PEIS, access to NTS, Hanford)
  = Implementation: Stay involved in advisory/technical/steering committees related to waste end points, especially WIPP, NTS, and Hanford
  = Implementation: Aggressively participate in important regulatory changes such as Order 435.1 and forthcoming NRC regulation

- Implementation: Promote the development of a Y-12 Industrial Landfill PA in order to establish WAC for landfill disposal that will include wastes with inconsequential levels of radionuclides.

- ORNL needs to actively recognize and manage its state equity balance (i.e., sending wastes off-site to other states vs. handling the waste of others here) to foster access to key endpoints such as NTS (LLW), WIPP (RH-TRU), and Hanford (mixed LLW)
  = Implementation: The Oak Ridge Reservation should become a treatment, storage, packaging, and shipping hub (but not disposal) for the Eastern U.S. DOE sites to gain their joint support for access to end points for their and our wastes, and to provide funding
  = Why us? On the way for many eastern sites
    Experts in some waste types (RH-TRU, heavy actinides)

Attuned to western site needs: minimum voids, max stability
Re-industrialize K-25

= Appropriate mix of privatization and prime contractor activities
= Provides leverage, lower unit disposal costs from large volume commitments, appropriate use of RD&D capabilities for intractable wastes with essentially no on-site disposal

- Implementation: Conduct feasibility studies of radically altering the wastes requiring end points to mitigate significant vulnerabilities
  = Outfalls: Eliminate all liquid discharged to the White Oak watershed
  = Mixed Waste: Minimize use of RCRA materials and make all wastes non-RCRA
  = RH-TRU: Separate RH-TRU into RH-LLW (to NTS) and CH-TRU (more reliably to WIPP)

- Implementation: Conduct a feasibility study of ORNL taking the lead in establishing a new waste disposal site for intermediate-level troublesome wastes such as RH-TRU, Greater-Than-Class C LLW, sources, large/awkward shapes (e.g., equipment racks), etc.
  = LM complex-wide initiative on government land at NTS?
  = LM commercial initiative on leased land at NTS?

- Implementation: Encourage the MVST/TRU solid waste contractor to use 3517 and 3525 to process the legacy waste leading to a continuing capability to handle newly generated wastes by intervening in TRU privatization contracting toward this end and, if unsuccessful, considering a complementary contract to make it cost-effective for the privatization contractor to establish this capability.

APPENDIX 1
STATUS MATRIX OF ORNL WASTES vs. ENDPOINTS

Waste Type			End-Point																				
Class	Type	Sub-Type	Stack	Outfalls	San/Ind Landfills	IWMF Eng. Disposal	SRS E-Area Vaults	ORNL Site Burial	NTS Site Burial	Hanford Site Burial	Comm'l Rad & Mixed Burial	Comm'l Chem Burial	WIPP	HLW Repos.	Bldg. 3019	Send to ORO EM or Y-12	Send to SRS	Send to INEEL	Send to LANL	Send to Comm'l Incin.	In Situ Closure	Interim On-Site Storage	Chem Det Fac
Release		Gas	C,G																				
		Liquids		C,G																			
		Diffuse		C,Y																			
Sanitary Indust.		Liquid		C,G																			
		Dry Sludge				C,Y																	
		Indust. & Sanit Solid			C,G																		
		Cafeter.			C,G																		
LL Rad	Solid	ORNL				C,Y																	
		Off-Site							P,Y	S,Y	S,Y												
		Special Case																				N,R	
	Liquid	Legacy														A,Y							
		Newly Gen							P,Y	S,Y	S,Y												
	Sludge	Legacy														A,Y							
		Newly Gen							P,Y	S,Y	S,Y												
LL Mix	Solid	Off-Site							S,R	P,R	S,R												
		Special Case																				N,R	
	Sludges	Legacy														A,Y							
		Newly Gen							S,R	P,R	S,R												
TRU	Solid	WIPP-Cert CH											P,Y										
		WIPP-Cert RH											P,R										
		Special Case																				N,R	

Waste Type			End-Point																				
Class	Type	Sub-Type	Stack	Outfalls	San/Ind Landfills	IWMF Eng. Disposal	SRS E-Area Vaults	ORNL Site Burial	NTS Site Burial	Hanford Site Burial	Comm'l Rad & Mixed Burial	Comm'l Chem Burial	WIPP	HLW Repos.	Bldg. 3019	Send to ORO EM or Y-12	Send to SRS	Send to INEEL	Send to LANL	Send to Comm'l Incin.	In Situ Closure	Interim On-Site Storage	Chem Det Fac
	Sludge	Legacy														A,Y							
EM-40		MSRE heel														A,Y							
		Tank contents														A,Y							
	Contam Sites	Legacy														A,Y					A,Y		
		White Oak Creek																				N,R	
		Newly Gen														P,Y					P,R		
Haz Chem		Solid & Liquid										A,Y											
		Explosiv																					C,G
Waste Rec'd		Sources							P,Y										P,G				
		RH-TRU Solid											P,R										
SNF & Nucl Mat		HFIR, ORR, BSR															P,G {1}						
		MSRE U-233																				N,R	
		SF Pieces															P,Y	P,Y					
		Tower Shield															P,Y						
		HPPR														P,Y							
		Unused Sources							P,Y														
		Pu, misc actinide											S,R			P,Y			P,Y				

Definitions

Liquid — Controlled liquid stream

Diffuse — Groundwarter, parking lot runoff, etc.

Legacy	Before M&I takes responsible for legacy waste
Newly Ge	M&I takes responsibility for legacy waste
Special C	No known disposition because of characteristics or lack of characterization

<u>Legend for Cell Contents</u>

C	Current active endpoint
A	Agreed-to/acceptable planned primary endpoint that has few impediments
P	Primary planned endpoint with significant impediments
S	Secondary planned endpoint with significant impediments
N	No endpoint without extraordinary effort
G	Green
Y	Yellow
R	Red

<u>Footnotes</u>

{1} Green until HLW repository opens, at which time we will have to certify and dispose of the fuel at that location

APPENDIX 2

BACKGROUND ON ENDPOINTS

CONTENTS

Rev. 0 (May 20, 1997)

STACKS and OUTFALLS

Name: These disposal end-points comprise those used for gaseous and liquid plant discharges via monitored, permitted discharge points. These discharges are accomplished via stacks and outfalls .

Description: Gaseous wastes are categorized in one of three general types; (1) process off-gas streams characterized as low-volume, potentially high-activity streams; (2) cell ventilation air streams characterized as high-volume, low-activity streams; and (3) laboratory hoods and individual vents that provide controlled ventilation for laboratory-type operations or exhaust from vessels that are vented through appropriate pollution control devices at the source location. The facilities used to discharge radioactive gaseous wastes include; (1) stacks 3039, 3020 and 2026 in the main ORNL plant area; (2) the 6010 stack located in the east end of ORNL main plant; (3) the 7025 stack east of the 7000 area; and (4) the 7911, 7512, 7830, 7877, and 7860 stacks in Melton Valley. Hazardous gaseous waste results primarily from the handling of leaking compressed gas cylinders (approx 25-30/yr).

Liquid wastes that are discharged via outfalls include X01, Sewage Treatment Plant (STP) effluent,; X02, Coal Yard Runoff Treatment Facility (CYRTF) effluent; X12, process waste from the Process Waste Treatment Complex (PWTC); X13, Melton Branch; X14, White Oak Creek; X15, White Oak Dam , Category I. II and III outfalls; cooling towers; and a number of miscellaneous outfalls.

Relevant Wastes: Gaseous Wastes:

1. Process Off-Gas
2. Cell ventilation
3. Hoods & individual vents
4. Leaking cylinders

Note, these wastes are all dispostioned as-generated and capabilities exist to handle all waste streams on a real-time basis, thus ranking them does not have significant meaning.

Liquid Wastes:

1. Process waste
2. STP & CYRTF effluents
3. Area runoff and other outfalls

Same note as above.

Applicable Regulations: NESHAPS, NPDES Permit, DOE Order 5400.5, RCRA Permit by Rule

Cost of End-Point: The costs associated with these end points are typically contained within the annual operating budget for WM and/or landlord funding requests. Since these systems and outfalls are critical to the continuing operation of the ORNL, it is expected that similar operational funding requests will continue to be part of the annual budget submission.

Cost of No end-Point: The cost (or consequence) of no end-point for wastes of this nature, since they result from central, process-oriented sources to a large degree, would be the cessation of Laboratory activity.

Status of End-Point: Current capability and capacity appears to be adequate for the foreseeable future. Some vulnerabilities do exist, sesmic concerns relative to the structural integrity of the 3039 stack as well as tangential issues arising from stakeholder discussions over emissons from other DOE facilities could adversely impact future releases via the various plant stack systems, and state regulatory tendencies to impose ever-more excessively restrictive discharge limits on some constituents regulated under the NPDES process (e.g. Hg) could prove problematic for the liquid outfall releases. Additionally, some potential may be present for the compromise of compliance with outfall release conditions resulting from either remedial action secondary wastes or the impacts of system in-leakage.

Most of the systems used to handle radioactive gas emissions has been in operation over 20 years, and although equipment that is accessible has been maintained in good working condition, the overall age of the system presents some degree of operational vulnerablity . In order to reduce the potential for adverse consequences, several initiatives have been pursued to upgrade our capabilities for gaseous waste management including: 3039 stack fan upgrades, waste operations control center expansion, hot off-gas system upgrade, and ventilation system upgrade.

The Outfall 302 Storm Sewer Rehabilitation GPP was initiated to repair/replace leaking 24-inch Storm Water Collection System to reduce the potential for large volumes of contaminated groundwater to be released to White Oak Creek via outfall 302. Other infrastructure improvements include: Process Waste Treatment System Upgrade, Contaminated Sumps Pumping modifications, and Chlorine Treatment for Cooling Water.

Opportunity Analysis: The ORNL must maintain an active, on-going dialogue with the regulatory community and DOE to ensure that the tendency to impose ever-stricter release standards on stack and outfall releases is balanced by the impact and cost of such restrictions along with the true net public health and safety gains resulting from the implementation of those same restrictions.

SANITARY/INDUSTRIAL LANDFILL

Name: Y-12 Industrial Landfill V (ILFV), and Y-12 Construction/Demolition Landfills VI & VII(LFVI& LFVII) are the disposal endpoints for ORNL-generated sanitiary/industrial wastes and construction debris respectively. ORNL Cafeteria wastes are currently disposed at the Anderson County Landfill as is mouse bedding from Biology Division. Coal Ash is being sent to Pincelli & Associates Inc. in Chattanooga for use as a cement additive. Asbestos resulting from remodeling and demolition are also typically disposed of at these facilities as a special waste covered under the associated permit.

Description: The Y-12 Industrial Landfill V is the current, active disposal location for the majority of ORNL-generated sanitary/industrial wastes. The ILFV is located south of the Y-12 facility. ORNL-generated construction/demolition debris is disposed at the Construction/Demolition Landfills VI and VII, located southwest of the Y-12 facility. LFVI is expected to be filled this year, with LFVII becomming the sole receipient of construction/demolition debris. The Anderson County Landfill is expected to continue to provide disposal capacity for cafeteria wastes and mouse bedding.

Relevant Wastes:

1. Cafeteria Wastes & Mouse Bedding
2. General Refuse
3. Construction /Demolition Rubble
4. Asbestos
5. Coal Ash

Applicable Regulations: Operating Permit in accordance with Tennessee Solid Waste Disposal Act, as amended and Rules Governing Solid Waste Processing and Disposal in Tennessee (TDEC Division of Solid Waste Management Rule 1200-1-7) and NPDES Permit.

Cost of End-Point: No disposal fees are charged by Y-12 to the user sites, the only costs experienced are for operation of the industrial waste control plan, collection and transportation. (Anderson County Rates and Pincelli Rates are to be added)

Cost of No end-Point: The consequences of no end-point for these wastes is significant. Operational impacts from the inability to disposition the relatively large volumes of general refuse, coupled with the public health issues related to a lack of timely disposal of sanitary wastes would render contined laboratory operation unlikely.

Status of End-Point: Y-12 ILF V has disposal capacity for 25-40 years, LF VII has disposal capacity for 35 years and the Anderson County Chestnut Ridge Landfill has adequate capacity for the forseeable future. The y-12 operations are vulnerable to some extent from the impacts of improper disposal of material not allowed by their operating permit. The largest source of this vulnerability comes from the inadvertant disposal of material contaminated with non-uranium radionuclides, or with uranium isotopes > 35 pCi/gm. The opportunity discussed later in this summary would not only result in a significant potential cost reduction, but would also serve to lessen the potential for a disruption or loss of this capability caused by a disposal of mildly contaminated refuse.

Opportunity Analysis: A significant volume of ORNL-generated wastes could be re-directed out of management as low-level waste and safely disposed via this end-point if a Performance Assessment-type analysis were conducted to establish a technical basis for the responsible disposal of inconsequentially contaminated wastes, similar to the approach utilized for this type of disposal operation at Padauch. Such an approach would have the potential to save millons over the life of the disposal end-point and lessen the potential for a disruption of this disposal activity. There are no technical obstacles preventing this from being accomplished, however, a number of political hurdles do exist, both internal and external, that would need to be carefully and skillfully worked.

May 19, 1997 (Rev.2)

IWMF ENGINEERED DISPOSAL

Name: The IWMF Engineered Disposal end point refers to the disposal of LLW at the Interim Waste Management Facility (IWMF) located in SWSA 6 at ORNL. This end point utilizes the tumulus technology which was developed by the French and adapted for use on the ORR.

Description: The IWMF is composed of six curbed concrete pads, which are one foot thick, with underdrains and a leachate collection system, that are loaded with sealed concrete vaults filled with LLW. Each concrete pad has a capacity of 330 vaults which are 6 ft. x 6 ft. x 8 ft. Each vault contains a 4 ft. x 4 ft. x 6 ft. steel box which is grouted between the steel box and the surrounding vault. The bitumen seal is placed between the vault and its lid prior to disposal. Packaged waste is contained within the steel box. The waste accepted for disposal satisfies the IWMF waste acceptance criteria, which is based on the performance assessment for SWSA 6.

Relevant Wastes: Waste disposed of at IWMF is LLW generated by ORNL operations, which includes trash, debris, processed sludge and other bulk contaminated waste, laboratory equipment, PPE, ion exchange resins, filter cake, biological waste, asbestos contaminated waste, D&D waste, and any other LLW which satisfies the IWMF WAC. Hazardous, mixed, high-level and TRU wastes are not acceptable for disposal at IWMF. IWMF is capable of accepting high concentrations of short-lived wastes, but has a limited capability of accepting long half-lived wastes.

Applicable Regulations: DOE O 5820.2A, 40 CFR 61, WM-SWO-505 (Waste Acceptance Criteria for Solid Low-Level Waste Treatment, Storage, and Disposal Facilities at Oak Ridge National Laboratory).

Cost of Endpoint: The disposal cost (tipping fee only) at IWMF is approximately $40/ft^3, depending on how the accounting is being done. This fee does not include the costs of closure or waste characterization.

Cost of No Endpoint: A storage cost for CH-LLW is approximately $1/ft^3/year, depending on how the accounting is being done, plus a future disposal cost which is indeterminate, because of the lack of available disposal endpoints.

Status of Endpoint: The IWMF is currently at 50% of its total volumetric capacity. The current rate of loading suggests the future availability of the facility will be six years. The availability could be extended with changes in waste operations, or reduced based on programmatic decisions. Uncertainties in continued operations include the perception of high costs for disposal at IWMF, long-term performance of SWSA 6, regulatory acceptability of SWSA 6 as a disposal facility, and overall contaminant loading of Melton and Bethel Valley from historical waste operations. The IWMF capacity cannot be reasonably expanded because limited space remains in SWSA 6 and the terrain of the land remaining is not suited for IWMF expansion.

Opportunity Analysis: The facility continues to operate, but has a limited lifetime that could be interrupted prior to complete utilization of the available capacity. Continued waste generation requires the development of alternative endpoints.

SRS E-AREA VAULTS

Name: The SRS E-Area Vaults end point refers to the Savannah River Site E-Area Vaults which are used for the disposal of wastes generated at SRS. The vaults are massive, monolithic vaults of SRS design, and are intended to perform over an extended period of time.

Description: The E-Area vaults are a complex of vaults for waste disposal at SRS. The complex includes 21 on-grade Low Activity Waste Vaults which are each 200 m long, 44 m wide and 8.2 m high. Exterior walls are 0.6 m thick with interior walls being 0.3 m thick. The floor slab is 0.3 m thick. Each vault has a capacity of 4.6×10^4 m^3 that will accommodate 12,000 B-25 boxes. Also included in the E-Area vaults are 20 below-grade Intermediate-Level Vaults each having a capacity of 1.6×10^3 m^3 - 5.7×10^3 m^3. These below-grade vaults are capable of accepting tritium crucible overpacks, crucibles, reactor hardware, fission products, and tritium wastes packaged in containers up to a size of 7.3 m high x 10.7 m long x 6.1 m wide. The complex also includes five trenches that are each 200 m x 6 m x 4.8 m for the disposal of potentially contaminated soil and lightly contaminated wastes, and a proposed 43 m x 43 m x 5.4 m Naval Reactor Component Disposal Area for the disposal of 100 waste casks. E-Area is also to include a 36 acre Hazardous Waste/Mixed Waste Disposal Facility that is being considered for development.

Relevant Wastes: SRS E-Area Vaults are intended for the disposal of LLW, Hazardous Waste, and Mixed Waste. SRS plans for the E-Area Vaults have changed since the preparation of the PA for the facility, that has been accepted by DOE. LLW is currently being loaded into the LAW Vaults, IL Vaults, and trenches. The construction of all 21 LAW Vaults and 20 IL Vaults is being reconsidered in light of the costs of disposal. The WAC limits for disposal of LLW in E-Area are higher than IWMF, but less than NTS. The Hazardous/Mixed Waste Disposal Facility has not been constructed.

Applicable Regs: DOE O 5820.2A, RCRA, Site WAC, State of South Carolina Regulations for groundwater protection (MCLs).

Cost of Endpoint: \$40/ft^3 (tipping fee) for Vault disposal, \$10/ft^3 (tipping fee) for trench disposal. Shipping costs are estimated to be about \$10/ft^3. These costs do not include waste characterization or packaging.

Cost of No Endpoint: Cost of continued storage at ORNL, estimated to be around \$1/ft^3/yr plus the potential for mission interruption if regulators deem open-ended storage unacceptable.

Status of Endpoint: SRS uses the vaults and trenches for site facilities and accepts wastes from the Navy, DOE-NR, and Pinellas. Pinellas waste shipments are nearly complete. SRS has accepted a few off-site wastes on a case-by-case basis and is not planning to receive wastes from across the DOE complex.

Opportunity Analysis: SRS has the capacity to accept wastes from ORNL, but there has been no effort by ORNL to make this a viable option. While SRS could accept a sizeable portion of ORNL LLW, if permitted, the costs are not attractive when compared to disposal at Hanford or NTS.

Allowable radionuclide concentrations in wastes at SRS are generally less than at NTS or Hanford. The increased costs of disposal and the limitations on the disposal of wastes makes SRS less attractive than NTS or Hanford.

May 19, 1997 (Rev. 1)

ORNL ONSITE BURIAL

Name: Site burial at ORNL refers to the development of additional disposal capacity for LLW for ORNL on the ORR. The additional disposal capacity would become operational once the disposal capacity at IWMF was exhausted.

Description: Additional capacity for the disposal of LLW on the ORR include the development of a Class L-II Disposal Facility and disposal at depth in competent rock formations. The Class L-II Disposal Facility has been designed for West Bear Creek Valley, utilizes the tumulus technology, and has a capacity of 36 pads sized similarly to those at IWMF. The design is complete and a draft performance assessment has been completed, but construction has been delayed indefinitely and the project may be canceled. The Class L-II Disposal Facility would only accept a limited amount of the waste generated at ORNL. Disposal at depth has not been investigated since the termination of Hydrofracture operations. Disposal of waste in the near-surface was discontinued on January 1, 1994 and is unlikely to be reconsidered.

Relevant Wastes: The Class L-II Disposal Facility is for the disposal of LLW generated by operations at ORNL. The Class L-II Disposal Facility also was designed to accept wastes from K-25 and Y-12. Disposal at depths of a few hundred meters could conceivably accept all LLW generated at ORNL.

Applicable Regs: DOE O 5820.2A, RCRA, Site WAC (undeveloped).

Cost of Endpoint: Costs for disposal have not been established, but they could be considered to be similar to the existing costs for IWMF disposal for the Class L-II Disposal Facility. Costs for disposal at depth are not available.

Cost of No Endpoint: Costs for storage of wastes which could be accepted that are approximately $\$1/ft^3$/year plus the potential for regulators to demand cessation of operations producing wastes with no apparent disposition.

Status of Endpoint: The Class L-II Disposal Facility is currently on hold with the expectation that the facility will be canceled. The only chance for the facility to be constructed would be if DOE prohibited the off-site disposal of waste from OR operations. In effect the Class L-II Disposal Facility becomes a disposal alternative of last resort. Disposal of wastes in the near-surface was terminated at SWSA 6 on January 1, 1994 and is not being seriously considered for any waste disposals in the future. Disposal of LLW at depth has technical as well as political issues that have not been addressed.

Opportunity Analysis: This disposal endpoint provides limited relief for the disposal of generated and stored wastes even if constructed. This disposal endpoint provides a limited and unrealistic alternative for managing LLW.

May 19, 1997 (Rev. 1)

NTS SITE BURIAL

Name: NTS site Burial refers to the end-point NTS Area 5 Disposal Facility in Frenchman Flat that disposes of LLW generated across the DOE complex. NTS also operates the Area 3 Disposal Facility in Yucca Flat that disposes of uranium/thorium waste from Fernald.

Description: NTS Area 5 is a 710 acre site for disposal of LLW and mixed waste of which 90 acres is actively managed for the disposal of LLW. The active area includes 17 landfill cells, 13 GCD boreholes, and a TRU Waste Storage Pad. Of these landfill cells, one pit has received mixed waste and three other pits are actively receiving LLW. Cells have differing dimensions but the large active cell is 350 m long, 61 m wide, and 6.1 m deep. The total volume is on the order of 10^5 m^3. Wastes are stacked in boxes (4 x 4 x 7 ft or 4 x 2 x 7 ft) or 55-gal drums with package limits of 9,000 lbs per box and 1200 lbs per drum. The site has an approved PA with WAC that allow for nearly all LLW to be accepted.

Relevant Wastes: LLW, possibly mixed LLW

Applicable Regs: DOE O 5820.2A, RCRA, Site WAC

Cost of Endpoint: NTS tipping fees are a function of the waste volume received. With adequate volumes NTS tipping fees are $6/ft^3 but have ranged to $12/ft^3 in years of low disposal rates. Transportation costs are on the order of $15/ft^3, with all other costs of characterization and certification borne by the shipper.

Cost of No Endpoint: Failure to use this endpoint results in continued storage of waste at approximately $1/ft^3/y for CH-LLW, with additional future disposal costs that are not defined.

Status of Endpoint: NTS currently accepts waste from across the DOE complex, but does not accept waste from ORNL, because ORNL is considered a new customer. For ORNL to ship waste, the ROD for the PEIS for waste management must be signed and legal issues surrounding disposal of LLW in Nevada must be resolved. Aside from these institutional hurdles, there are no other impediments to disposal of all LLW generated in OR at NTS.

Opportunity Analysis: NTS can accept any LLW that ORNL can ship. This can be accomplished once the institutional barriers blocking the shipment of wastes are resolved; however, the time required to resolve or dissolve these issues is uncertain. The capacity at NTS is so large that it can serve ORNL as well as the rest of the DOE complex for the foreseeable future.

June 19, 1997 (Rev. 1)

HANFORD SITE BURIAL

Name: The Hanford Site Low-Level Waste Burial Grounds (LLBG) and the Central Waste Complex (CWC), operated by Rust Federal Services, Inc. as a subcontractor to the M&I for Hanford, Flour Daniel.

Description: Hanford Site has an active near-surface LLW land disposal operation (the 200 West Burial Ground) and a long-term interim waste storage operation (the CWC) located on the 200 East plateau of the Hanford Reservation

Relevant Wastes:
1. LLW with specific activity exceeding the ORR performance acceptance limits for disposal
2. Other LLW if ORR disposal areas not available
3. Mixed LLW

Applicable Regs:
1. 5820.2A
2. RCRA
3. Site WAC (latest version not published externally but available by E-mail)
4. Strictly regulated by state of Washington environmental protection agency Washington Administrative Code (also uses acronym WAC) under a tri-party agreement with DOE

Cost of Endpoint: Not readily available but will likely be highest cost of any western disposal site because of distance and requirements: $20/ft^3 tipping fee and $15/ft^3 transportation, not including characterization costs.

Cost of No Endpoint: Could be very significant if on-site storage is limited; then programs generating RH-LLW could be heavily impacted

Status of Endpoint: Off-site LLW can be accepted for disposal at LLBG up to Class C package limits. In theory, GTCC waste can be accepted at DOE HQ direction. Hanford has its Part B RCRA perimit allowing for mixed waste disposal. WAC allows lead as shielding in RH-LLW; however, lead shielding will not be accepted at this time in order to avoid misunderstanding with state regulators. Interaction with the state regulations has resulted in somewhat overly conservative operations. Neither Rust nor DOE likely to challenge state interpretation of regulations.

Opportunity Analysis: The site should be immediately tested for acceptance of ORR waste as soon as possible. Disposal of RH-LLW sealed sources (Co-60) from ORNL should show advantages of routine off-site disposal of ORR-generated material and whether there will be any problems with the LLBG WAC.

Rev. 0(May 20, 1997)

COMMERCIAL RADIOACTIVE & MIXED WASTE DISPOSAL

Name: Envirocare of Utah, Inc. represents the primary commercial disposal end point for ORNL mixed wastes and some radioactive wastes that do not contain high concentrations of fission products. Waste Control Specialists, Inc. may provide a disposal capacity for these wastes in the future, however they are only to be considered as an out-year potential at this time. The Barnwell, South Carolina site may provide some, limited disposal capacity for low-level radioactive waste. U.S. Ecology (now called American Ecology) operates a site on the Hanford Reservation for commercial Low-Level Waste Disposal.

Description: Envirocare of Utah, Inc. provides multi-cell, engineered, shallow land disposal of low-level radioactive wastes and mixed wastes. The mixed waste disposal cell is separate from the straight low-level disposal cell. The proposed Waste Control Specialists, Inc. facility will be similar to the Envirocare facility, with the expectation of less restrictive operating waste acceptance criteria. The U.S. Ecology and Barnwell sites also provide disposal via shallow land burial technology.

Relevant Wastes: The Envirocare facility is capable of handling waste similar to the wastes resulting from uranium milling operations (mill tailings), RCRA and TSCA mixed wastes and low-level wastes that are only slightly to moderately contaminated with fission products. Many of ORNL's LLW streams are not suitable for disposal at Envirocare. The Barnwell site can handle a wider range of LLW, more typical of a number of ORNL generated wastes. The American Ecology site has not been investigated extensively, but their capabilities should be similar to the Hanford site capabilities, however, it is anticipated that wastes with non-commercial origin (i.e. DOE wastes) would not be a candidate for this facility.

Applicable Regulations: The regulatory framework covering all of these sites is 10CFR61, RCRA and TSCA regulations as appropriate, and the specific license conditions resident in the operating licenses of each of the facilities. All of the facilities are located in NRC agreement states, thus the actual regulation of radiological functions at the facilities is conducted by the cognizant state radiation control agency. The use of any of these facilities by a DOE site for the disposal of radiological wastes requires an approved exemption from the current requirements of DOE Order 5820.2A.

Cost of End-Point: The costs for disposal at these facilities can range from as low as \$5.00/ ft^3 for Envirocare under broad federal procurements such as the Corps of Engineers contract to as high as \$300/ft^3, the standard rate at Barnwell. All costs at commercial facilities are highly dependent upon the specifics negotiated in disposal contracts. The ability to commit to minimum disposal volumes can make a significant difference in the final disposal fee.

Cost of No end-Point: If commercial disposal end points are unavailable, then greater pressure is brought to bear on the ability of the DOE Complex to dispose of its own waste generation. Continued delay of accessibility to other DOE sites, without any commercial outlets will exacerbate the already increased life-cycle costs of waste management because of extended storage times.

Status of End-Point: Envirocare is available, two federal procurement are either in place or near placement. The Corps of Engineers contract's term expires at the end of 1997. A second procurement, out of the DOE Miamisburg, OH office is expected to be let at any time. The DOE-ORO office has not had a high degree of success with the COE contract and in fact, directed LMES to seek its own direct contract with Envirocare, which it has done. However, since LMES cannot commit to a guaranteed volume, the quoted disposal fee is substantially higher than the COE contract. Barnwell is available, however, concerns over the impact to the Southeastern States Low-Level Radioactive Waste Compact resulting from large quantities of DOE LLW entering the system and the extrodinarily high disposal fees have relegated Barnwell to an unlikely end point. The WCS facility does not yet exist, and in all likelihood is several years away at best.

A word of caution is appropriate concerning Envirocare of Utah, Inc. Considerable legal and political furor has been generated surrounding the allegation of inappropriate conduct by the former director of the state radiation control agency concerning the licensing of the Envirocare facility. The fallout from this situation could jeporadize the access to this facility by DOE sites, if in fact, undue influence was exerted which bore directly on the final conditions of the Envirocare facility's license. This situation should be monitored closely.

Opportunity Analysis: The best opportunities for commercial disposal are connected with the large federal procurement. A more aggressive presence in the national arena than has historically been associated with the Oak Ridge Reservation will be necessary to secure an acceptable portion of the use of the Miamisburg contract enabling those wastes meeting commercial disposal (Envirocare) requirements to be dispositioned.

April 22, 1997 (Rev. 0)

WCS DISPOSAL FACILITY

Name: Waste Control Specialists (WCS) LLC; Andrews County, TX Disposal Facility

Description: Newly opened 1400 acre landfill disposal facility on a 16,000 acre desert site in western Texas

Relevant Wastes:

1. Hazardous waste (all 2,000-plus RCRA waste codes, TSCA wastes (incl PCB), and combination RCRA/TSCA waste
2. Pending license under state review for near surface land disposal of exclusively US Government radioactive LLW (license will not include commercial LLW) up to Class C
3. Planning for eventual mixed waste disposal facility

Applicable Regs:

1. 5820.2A
2. RCRA
3. Site WAC (LLWAC not currently available, but expected to be the least restrictive WAC of any US LLW land disposal and storage facility)
4. Texas is an agreement state; facility will be licensed by the state; Texas Regulations for the Control of Radiation (TRCR) will be in effect

Cost of Endpoint: Not readily available but expected to be lowest of western disposal sites

Cost of No Endpoint: Not readily available, but likely to be difference between NTS & WCS costs

Status of Endpoint: The site is currently ready for hazardous waste. A license application to the state of Texas has been pending for one year for disposal and storage of US Government LLW up to Class C. No known vulnerabilities. License will probably allow disposal of mixed waste. License will probably allow storage of GTCC waste. Site publicity emphasizes strong financial backing, highly effective effort to recruit acceptance from local stakeholders, and large capacity. Battelle has formed an agreement to jointly operate a small waste research and development facility on the site with space for DOD/DOE/EPA research personnel. Generators can have their waste segregated from that of other generators if desired. There were no intervenors for the hazardous waste application.

Opportunity Analysis: The site should be immediately tested for acceptance of ORR waste as soon as possible. Disposal of large PCB-contaminated equipment from Y-12 Plant should show advantages of large disposal cells and any problems with WAC.

Revsion 1 (May 20, 1997)

WASTE ISOLATION PILOT PLANT (WIPP)

Name: Waste Isolation Pilot Plant, designated as the disposal facility for Defense generated Transuranic Waste

Description: The WIPP is a geological repository, located near Carlsbad, New Mexico, in salt beds approximately 2150 feet below groundlevel.

Relevant Wastes: ORNL waste planned for disposal at WIPP can be divided into five streams. These are defined below. (Note: presently any waste without a defined endpoint will remain the responsibility of EM. Accordingly, until the issues surrounding acceptance of ORNL TRU waste at WIPP, EM will be responsible for this waste. However, since the entire waste management transition to generators program is still not approved, this synopsis addresses waste as if it were ORNL responsibility.)

<u>RH TRU Sludge</u> - First stream planned for shipment to WIPP, provided WIPP implements a program to transport and accept RH TRU. (Note: The tank supernate has been declared defense waste, so there should be no issue having the sludge being classified at defense also.)

<u>CH TRU Solids</u> - Second stream planned for shipment to WIPP, provided defense categorization can be justified.

<u>RH Solids</u> - No schedule; highly dependant upon ability to repackage/certify.

<u>Nuclear Fuel Services (NFS) CH TRU</u> - Will need clarification on origin (DOE/nonDOE).

<u>Special Case</u> - Waste that doesn't meet the requirements of TRU waste, primarily due to shorter half lives (i.e., Cm 244)- This waste is presently commingled with TRU waste

Applicable Regulations:
<u>DOE Order 5820.2A</u> (to be replaced by 435.1) - Radioactive Waste Mangement
<u>RCRA</u> (for hazardous constituents)
<u>DOE/WIPP-069</u> - Waste Acceptance Criteria for WIPP: Presently addresses CH only; RH to be added
<u>Public Law 96-164</u> "National Security and Military Applications of Nuclear Energy Act of 1980" - Authorized WIPP, but also indicates WIPP is for defense waste only.
<u>Public Law 102-579</u> "Waste Isolation Pilot Plant Land Withdrawal Act - Defines TRU Waste (same definition as in DOE Order 5820.2A and indicates only waste meeting this criteria can be disposed at WIPP. This legislation also specifies maximum quantities to be disposed and maximum rad levels of waste packages.
<u>General Politics</u> - May ultimately defeat RH TRU disposal at WIPP. WIPP will likely get the go ahead for CH TRU disposal from EPA and New Mexico by FY98, however, S1 must also sign WIPP's readiness to accept waste. This could become highly controversial. Finally, if WIPP begins to accept CH TRU waste, they may lose focus on RH TRU. The primary pressure (and inventory) comes from Id., Wa., Co, and NM. Almost all of the inventory in these states is CH, so WIPP could decide to only accept CH TRU and still declare victory.

Cost of Endpoint: Total Lifecycle costs for repackaging, assaying and certifying all wastestreams to WIPP Waste Acceptance Criteria is estimated to be $350M. <u>The actual cost of the disposal of waste that meets the WIPP criteria is $0, since WIPP pays transportation costs and there is no disposal fee.</u>

Cost of No Endpoint: Little cost will be incurred during next 15-20 years. Storage Facilities are available for both CH and RH waste for the near future providing no upsets or regulatory impacts occur. <u>Obviously, the cost to repackage and certify the waste will have to be incurred before the waste can be disposed of regardless of the timeframe</u>.

Status of Endpoint: WIPP plans to open for CH TRU waste in FY98. Present WIPP schedule indicates RH TRU will not be accepted until FY02. The design for WIPP calls for placement of the RH TRU in the walls prior to placement of the CH TRU in the rooms. Obviously, if CH is accepted in FY98 and RH in FY02, a portion of the RH TRU disposal capacity is lost. Additionally, the design of the shipping package for the RH TRU has not been certified by NRC. Failure to have an approved shipping package could further delay RH TRU shipments past FY02.

The primary vulnerabilities for ORNL waste involve:
1. Requirement that waste be defense related. Presently this is being taken to mean DP activities (instead of a DOE versus civilian definition).
2. WIPP acceptance of RH TRU waste. The present criteria and transportation cask are for CH only. There are concerns that due to political pressures, RH will not be accepted.
3. Quantity of ORNL solids waste that is actually TRU. Previous reports have indicated anything from almost all waste is TRU to almost none is. (Note this does not impact sludge stream which has been determined to be TRU.)
4. Costs to assay and repackage waste, particularly the RH solids.

CH TRU - Need to be able to assay waste to verify it meets TRU definition. Also need to clarify defense origin (or change WIPP requirement).

RH Sludge - WIPP needs to establish the RH TRU system. (Note that EM-30 has declared the supernate in the Melton Valley Storage Tanks as "defense waste". Based on this, by association, the sludge should also be clearly "defense".)

RH Solids - WIPP needs to establish the RH TRU system. Additionally, high cost of repackaging/certifying may preclude this activity at ORNL.

NFS Waste - Need to verify defense origin.

Special Case Waste - Presently can not be differentiated from TRU waste. When segregated, will require congressional action to ship to WIPP, since present law precludes its disposal at WIPP.

Opportunity Analysis: WIPP can handle all of our waste that can be verified to meet the definition of TRU. Presently, ORO/EM is responsible for all wastes without an endpoint. Therefore until WIPP opens the existing and newly created TRU waste will be the responsibility of ORO/EM. Regardless of this, no waste can be shipped until it can be verified to meet the definition of TRU (through process knowledge or assay.). If assay is required, the costs increase considerably, particularly for the RH solids, possibly making this stream cost prohibitive to process. The definition of "defense waste" also needs to be clarified, however this issue is being worked by the National TRU program. It is questionable if Special case (can't meet definition of TRU typically due to short half lifes) can be shipped to WIPP. This waste should be planned for disposal elsewhere or held for decay.

The primary vulnerability is regulatory as specified above under "Applicable Regulations". Since ORNL is a small player in the total volume of waste destined for WIPP, and since ORNL waste is more controversial, due to its origin. It would be easy for WIPP to become the repository for only the DP labs and facilities. This would sit poorly with Tennessee regulators, who consider disposal of ORNL TRU waste as one of their priorities.

April 29, 1997(Rev. 1)

CIVILIAN DEEP GEOLOGIC REPOSITORY

Name: Deep geologic repository being build by DOE/RW (OCRWM)

Description: This will be a mined facility typically 300m to 1000m underground. Its purpose is for disposal of the "worst of the worst" radioactive wastes. The facility will dispose of heat generating wastes (e.g., civilian spent nuclear fuel) as well as non-heat-generating wastes that are unacceptable elsewhere. The site at Yucca Mountain, NV is the only site authorized to be evaluated for this purpose.

Relevant Wastes:

1. ORNL TRU wastes that are not acceptable at WIPP
2. ORNL special case wastes that have a combination of toxicity and longevity such that they are not acceptable for near-surface disposal
3. HFIR spent fuel after the repository opens
4. MSRE heel
5. MVST wastes if they were to be construed to be HLW

Applicable Regs:

1. 40 CFR 191 (General standard for SF/HLW/TRU disposal) which was promulgated but is now in remand
2. 40 CFR 197 (Yucca-Mtn.-specific standard): draft not yet issued
3. 10 CFR 60 (general NRC repository licensing criteria): promulgated expected to be revised after new EPA standards are issued. Now has stringent waste package requirements
4. Nuclear Waste Policy Acts of 1983, 1987, 1997(?): Legislation authorizing and micromanaging the repository project
5. RCRA: Not applicable. The first repository will not take RCRA wastes.
6. WAC: Written documents established for SRS DHLW and civilian spent fuel

Cost of Endpoint: If the current approach prevails, the cost of the repository and transportation thereto will be paid by direct appropriations (for governmental users). Our cost should be relatively small consisting of the cost of packaging the wastes appropriately and QA/certification costs.

Cost of No Endpoint: The direct cost would be the need to fund a continuing series of storage facilities for TRU wastes, spent fuel, etc. and to maintain those already in existence. Indirect costs could be the shutdown of major facilities (e.g., HFIR, REDC) by regulators on the basis that we should not continue generating wastes having no end point.

Status of Endpoint: The only site being investigated to potentially host a civilian repository is Yucca Mtn., NV which is on the western periphery of the NTS. Investigation of the site is proceeding and the exploratory shaft has been completed, allowing much more detailed subsurface characterization. A determination of site suitability (a lower hurdle than recommending the site and proceeding with licensing) is planned to occur in the next couple of years. The schedule calls for the repository to open in 2015. However, there are numerous uncertainties and concerns:

- The program continues to be underfunded by Congress. It is likely that the 2010 startup date will be further deferred.
- The State government continues to vigorously oppose a repository at this site. If the site is recommended, a State veto is likely which would require Congress to override it.
- The capacity of the repository is legislatively (no physically) limited to the equivalent of 70 Gg of heavy metal equivalent. Of this, civilian reactors have been allocated about 63 Gg. The legislated capacity is inadequate to accept all of the DHLW. Acceptance of wastes other than spent civilian fuel and DHLW is being deliberately ignored and this position will likely prevail until licensing seems assured. Alleviating the limit on the first repository requires a second repository (geographic equity issue) or enormous Congressional courage to declare that the first will be the one and only.
- The key regulations that drive repository licensing and WAC are not established and it will be at least a couple of years before this occurs. Final WAC will likely be established as a result of the licensing process many years hence and existing documents are speculative.
- The view of long-time observers of repository technology is that the licensability of Yucca Mtn. is uncertain at best. While the arid climate and remoteness are positives, the oxidizing environment is a major negative feature for spent nuclear fuel in a reduced condition. Also, the exploratory tunnel has confirmed the expected presence of a fast water pathway through fractures, but with higher than anticipated amounts of water. Licensing may have to depend on engineered barriers for millennia, the acceptance of which is unlikely.

Although the waste streams potentially destined for a repository are small, this leaves ORNL (and ORO/EM) in the unenviable position of having to (a) guess at the WAC, treat the wastes, and then store it for decades, or (b) store untreated waste for decades without treatment knowing that the form of storage may be much less than desirable.

For the foreseeable future the repository should be regarded as a secondary destination (S) for ORNL wastes. TRU waste should be able to proceed to WIPP. Most special case wastes should be able to use NTS or WIPP if suitably treated. The small MSRE heel should be an ORO/EM responsibility and, if not, might be granted an NTS exception or blended with SRS or HAN HLW for vitrification. MVST waste should be an ORO/EM responsibility and, if not, the dilution of the very old waste from R&D activities should may allow it to escape re-classification as HLW. The HFIR spent fuel endpoint is SRS for the foreseeable future and will only become an ORNL responsibility to get it to the repository when the repository is available and WAC are clear.

If the repository were to become the near-term end point for ORNL wastes, the many technical and institutional impediments to its success clearly indicate cause for major concern in terms of planning a strategy for treatment and storage, and increased involvement in repository affairs.

Opportunity Analysis: The "opportunity" to use the civilian repository as an endpoint should be avoided unless no other affordable alternatives can be found. The end point is unreliable, would probably involve extended on-site storage, and has significant shadow costs to deal with its myriad TBD requirements. The opportunities in this area area:

- Continue to allow a few key staff members to monitor the progress (or lack thereof) of the repository and attendant regulations through various external involvements. This is already being done to an adequate degree and represents *status quo*.

- Planning for generation, treatment, storage, and disposition of ORNL wastes should strive to avoid generating any waste that is destined for the civilian repository.
- Get as much of these wastes under ORO/EM responsibility as possible.

Rev. 1 (May 20, 1997)

U-233 STORAGE IN BUILDING 3019

NAME: Building 3019 Storage Wells

DESCRIPTION: Building 3019 is the National Repository for U-233. It's mission is to store the inventory and distribute U-233 on an as-needed basis. The U-233 is stored in containers which are welded shut and stored in special tamper resistant wells within the Building 3019 cell bank.

RELEVANT WASTES: The U-233 that will be recoverd by volatilization from MSRE charcoal beds, fuel salt, and flush salt by fluorination will be converted to an oxide, weld-sealed in storage cans, and included in the 3019 inventory for eventual disposition. A summary of the current inventory of uranium in 3019 and the small addition represented by the uranium recovered from the MSRE is shown below.

U-232 Content	Mass, kg
5 ppm	3
5 to 10 ppm	176
10 to 50 ppm	72
>50 ppm	176
Total U-233	427
Total U	1383

MSRE deposit removal will add ~31 kg of U-233, ~38 kg of total U to this inventory

It is also possible, and perhaps likely, that U-233 from other sites posessing small amounts may be centralized as a result of recent DNFSB recommendations discussed below. If so, these would probably be stored in 3019.

APPLICABLE REGS: Solids collected here are subject to 3019 packaging criteria for U-233. The application and outcome of DNFSB recommendation 97-1 is likely to determine final packing requirements. The DNFSB listed eight recommendations which are listed below:

1. Establish a single line project for ^{233}U safe storage.
2. Develop standards for packaging, transportation, and storage.
3. Characterize the items of ^{233}U in storage.
4. Evaluate the conditions and appropriateness of storage systems.
5. Assess current storage versus standards.
6. Initiate a program to remedy observed shortfalls.

7. Establish a plan to place the ^{233}U in safe and permanent storage.
8. Retain technical competence needed to ensure safe storage in the short and long term.

Regulations concerning the ultimate disposition will also be relevant, but have not yet been determined.

VULNERABILITY: The vulnerability to ORNL is that of the 3019 facility and its inventory because, unlike many other legacy facilities, there are no immediate plans for ORO/EM to assume responsibility for this DP-funded facility. Specific vulnerabilities are:

1. DP does not wish to continue funding this facility and EM does not presently appear to be willing to take additional facilities into its responsibility. The most desirable sponsor (MD) is avoiding being present. Thus, at best the sponsor support is grudging and at worst funding reductions or cessation is possible. Also, if the facility sponsorship is transferred the budget all-too-often falls between the cracks. If program budgets are inadequate ORNL will have to supply the shortfall.

2. 3019 is an interim storage location for U-233. However, the final disposition of the U-233 inventory is unknown. Because U-233 is not transuranic it does not qualify for disposal at WIPP unless waivers are granted. Even then if waivers are granted (a) all of the uncertainties regarding WIPP become relevant (see this backgrounder) and (b) the U-233 must be further processed so that it meets criticality and safeguards requirements. If WIPP WAC waivers are not granted, disposition options are not attractive. Some obvious possibilities are ship it to SRS or Hanford for blending in defense HLW glass logs, irradiate it as U-233 fuel in LWRs and dispose of it as spent fuel, or store it until a civilian repository can take it.

COST OF ENDPOINT: Cost is zero to ORNL as long as a sponsor exists and supplies adequate funding. The cost of ultimate disposition is unknown.

COST OF NO ENDPOINT: If programmatic funding is diminished or ceases, ORNL must pick up the slack in this high-hazard facility. This is currently around $5M/yr for just storage and would be much higher for actual operations.

STATUS: Building 3019 is currently open and storing U-233. ORNL staff are pursuing solutions to DNFSB recommendations 97-1 and MSRE resolution which, in part, involve discussion of who will be responsible for 3019 and its inventory. Funding is presently adquate for the storage mission. Ultimate disposition remains very uncertain and budgets grudging, which makes 3019 a major liability to ORNL.

OPPORTUNITY ANALYSIS: It appears that MSRE personnel and 3019 staff are aware of key issues and are working toward resolution. Engagement of upper management in assuring continued and desired responsibility for 3019 and in attempting to gain acceptance of U-233 at WIPP is highly desirable to minimize the liabilities.

June 19, 1997 (Rev. 2)

DISPOSITION BY ORO/EM

Name: Disposition by transferring waste to ORO/EM and presumably the new M&I contractor

Description: Many of the contaminated sites, inactive buildings, and legacy wastes at ORNL are or are planned to become the responsibility of ORO/EM (Environmental Management). Disposal of these wastes is the responsibility of ORO/EM, although in some cases agreements may be developed to use ORNL facilities for treatment or disposal. For waste generated by ER and D&D activities at ORNL, the CERCLA process will determine the disposal endpoint, and ORO/EM will be responsible for getting the waste to the disposal endpoint. ORO/EM activities on the ORR are currently managed by Lockheed Martin Energy Systems.

ORO/EM is evaluating/developing disposal endpoints for a wide variety of legacy and projected remediation wastes. Closure in place has been identified as one of the disposal endpoints to be evaluated by this re-engineering sub-team, and will be discussed in a separate background document.

Relevant wastes: Wastes associated with this endpoint are too numerous to list individually. The following list provides general categories of these wastes. (Additional summary level information to be added later.)

1) waste and debris from D&D projects
2) waste and contaminated media from remedial action projects
3) reactor primary system components
4) hazardous chemical waste
5) tank sludges and liquids
6) CH-TRU
7) RH-TRU
8) TSCA and Co-mingled wastes
9) mixed TRU
10) other

Applicable Regs:

Waste Management: All Federal and State regulations, and DOE orders, that are applicable to each particular waste stream.

CERCLA Activities covered by the FFA:
The USEPA Region IV, DOE and TDEC entered into a Federal Facilities Agreement (FFA) under Section 120 of CERCLA and Sections 3008 (h) and 6001 of RCRA. The agreement, effective January 1, 1992, is to ensure that all releases of hazardous substances, pollutants or contaminants as defined by CERCLA and all releases of hazardous wastes or hazardous constituents as defined by RCRA are addressed so as to achieve a comprehensive remediation of the site. The process outlined by the FFA provides for remediation of the sites under CERCLA, with RCRA and all other potential regulations considered as potential ARARs for each individual project. Final selection of the ARARs under CERCLA for the project determines the regulations what will govern the remediation. Federal (

CERCLA, RCRA, TSCA, CWA, NEP, etc,), State (TDEC regulations), Local regulations, and DOE Orders are considered when developing ARARs. Both D&D and remedial action activities are covered by the FFA.

Cost of Endpoint: The ORO/EM legacy remediation program is funded directly by DOE/EM. Cost to ORNL would be that of establishing an operational interface to ensure that on-site ORO/EM and ORNL activities are compatible. Also, the issue of payment for treatment of secondary wastes would have to be resolved.

Cost of No Endpoint: The ORO/EM endpoint will accept responsibility for wastes generated from CERCLA activities on sites and facilities currently "owned" by ORO/EM and for legacy and orphan wastes formally assigned to ORO/EM. If ORO/EM cannot immediately find disposal endpoints for all wastes, the cost of the delay will be borne by ORO/EM However, there is disagreement at DOE Headquarters as to whether ORO/EM will in the future accept new sites or facilities that may require D&D or remediation. If ORO/EM is not allowed to accept "new" scope in the future, ORNL will be solely responsible for D&D and remediation activities for sites and facilities that become inactive after the cutoff date for acceptance into ORO/EM. The cost of paying for a parallel program for D&D/remediation of non-ORO/EM sites would be very high. Additionally, even though the legacy wastes/sites would not be the responsibility of ORNL, inadequate progress for whatever reason could cause regulators and stakeholders to react unfavorably toward ORNL as well as ORO/EM.

Status of Endpoint: ORO/EM is actively planning for disposal of wastes generated by ORO/EM activities such as remediation and D&D. It should be noted that liquid and gaseous wastes from this source will probably be routed to ORNL newly generated waste treatment systems. ORO/EM is also actively planning for treatment/disposal of legacy waste that belongs to ORO/EM. Discussions are currently underway to finalize the ownership (ORNL or ORO/EM) of legacy waste and waste treatment/disposal facilities. Once this is finalized, ORO/EM will be responsible for operation of facilities and disposal of waste that "belong" to ORO/EM. If ORO/EM chooses to use an ORNL treatment facility or disposal endpoint, ORO/EM will pay for that use just as any other generator would.

The availability of the ORO/EM endpoint for disposal of "future" wastes and D&D/remediation of future inactive facilities is uncertain, and will be decided at the DOE-HQ level (see discussion above).

Opportunity Analysis:

1) ORNL can participate in maintaining this as an effective endpoint by:
   a) Active participation as a stakeholder in the CERCLA process for ORNL
   b) Petition DOE-HQ to allow ORO/EM to accept facilities that become inactive after the current cutoff date
   c) Maintaining/participating in ongoing formal communication between ORO/EM and ORNL concerning ongoing activities and future activities that may affect either ORO/EM or ORNL

April 24, 1997 (Rev. 0)

SAVANNAH RIVER SITE SPENT NUCLEAR FUEL DISPOSITION

Name: The Receiving Basin for Off-site Fuels (RBOF) at the Savannah River Site (SRS) has as its mission the receipt and storage of aluminum-clad spent nuclear fuel (SNF)

Description: A wet storage basin for Al-clad SNF awaiting transfer for reprocessing or disposition

Relevant Fuel: Aluminum-clad SNF packaged to meet the SRS Appendix A criteria

Applicable Regs:
1. SRS Appendix A criteria for SNF receipt
2. 10 CFR 71, DOT
3. Certificate of Compliance for selected shipping cask
4. Record of Decision (60 FR 28680) for the PEIS for SNF

Cost of Endpoint: There are no charges at SRS for receipt of SNF; the cost is in getting all preparations complete for making the shipments including the shipping cask.

Cost of No Endpoint: The cost of storing SNF until it could be shipped directly to the HLW repository; if there was sufficient SNF (ie HFIR) to require a dry cask storage facility to continue HFIR operations, the cost would be about $10M +.

Status of Endpoint: SRS has well-established program to receive, store and in some cases, process SNF. HFIR has been shipping 1 cask per month (on average) since July 96. SRS is limited to Al-clad SNF. NEPA documents are in place, agreements with SC state are in place. Biggest uncertainity is life of wet storage basins before new dry storage facility comes on-line (could be problem with SC if DOE delays project), and will DOE continue to fund the SNF reprocessing until the dry storage starts.

Opportunity Analysis: Another opportunity is that enriched U, depleted U and fission products could be packaged in aluminum canisters and sent to SRS for processing if they agreed and other disposition paths were not available.

April 24, 1997 (Rev. 0)

IDAHO NATIONAL ENVIRONMENTAL AND ENGINEERING LABORATORY

Name: The Idaho Chemical Processing Plant (ICPP) at the Idaho National Engineering and Environmental Laboratory (INEEL) has as a mission the receipt and storage of non- aluminum clad spent nuclear fuel (SNF)

Description: Dry storage facilities for storing SNF awaiting final packaging for disposition

Relevant Fuel: Non-aluminum clad SNF packaged to meet the INEEL FRC

Applicable Regs:

1. INEEL Fuel Receipt Criteria (FRC) for SNF receipt
2. 10 CFR 71, DOT
3. Certificate of Compliance for selected shipping cask
4. Record of Decision (60 FR 28680) for the PEIS for SNF

Cost of Endpoint: There are no charges at INEEL for receipt of SNF; the cost is in getting all preparations complete for making the shipments including the shipping cask.

Cost of No Endpoint: The cost of storing SNF in 7827 or other facility until it could be shipped directly to the HLW repository; the cost of preparing SNF to ship directly to a repository will likely be more expensive and difficult (~$2-4M).

Status of Endpoint: INEEL has well-established program to receive and, store non-AL clad SNF. NEPA documents are in place, agreements with State of Idaho are in place, but DOE must continue to meet milestones in agreement for INEEL to able to continue to accept SNF shipments.

Opportunity Analysis: The main opportunity would be to ship SNF early to INEEL to save some money and make sure SNF gets out of OR and into INEEL before their situation changes.

May 16, 1997 (Rev. 0)

LOS ALAMOS NATIONAL LABORATORY

Name: The Los Alamos National Laboratory (LANL) has been designated to receive and process neutron sources for recovery of the source material.

Description: LANL is taking plutonium(239)-beryllium (Pu-Be) sources for recovery of the Pu-239. ORNL is scheduled to send 3 Pu-Be sources to LANL this summer for recovery. Their capacity is limited, so shipments may be delayed somewhat. LANL hopes to be able to take Americium and Plutonium-238 neutron sources several years in the future.

Relevant Materials:
1. Pu(239)-Be sources currently
2. Maybe Am-Be and Pu(238)-Be sources sometime in the future

Applicable Regs:
1. Packaging and transportation regulations for sources
2. Acceptance criteria at LANL (eg being on LANL source registry)

Cost of Endpoint: Cost of dispositioning the sources is the cost to package, document, and ship the sources to LANL. LANL is currently funded to do the rest. If LANL funding to recover sources dries up, LANL might continue on a charge-back basis.

Cost of No Endpoint: Cost of no endpoint is the cost of storing the sources until there is a disposition end-point, and then the cost of that disposition. ORNL has the capability to dismantle and recover the source material if necessary, but the cost of doing so for a small number of sources might be significant.

Status of Endpoint: LANL is currently accepting and recovering Pu-239 on a limited basis. Since funding is limited for this activity, it may be discontinued in the future, or converted to be performed on a cost-recovery basis, which would probably be fairly expensive.

Opportunity Analysis: Since ORNL is planning to enter the Pu-238 Program, ORNL could offer the services of taking Pu-238 sources for recovery of the source material. It could be done on a partial cost recovery basis. This would be a service, and would not require much additional funding if any to initiate if ORNL is going to be handling Pu-238 anyhow. ORNL has existing facilities that could also offer recovery services for Am-Be sources, of which we have quite a few. But funding would be more difficult to arrange for Am recovery, and the facilities are not currently set up to do that.

Rev. 1 (May 20, 1997)

COMMERCIAL INCINERATION

Name: Commercial incineration capability is primarily provided by Scientific Ecology Group, Inc. (SEG), Diversified Scientific Services, Inc. (DSSI) and Rollins Inc.

Description: SEG provides incineration of LLW and low concentration TSCA-contaminated LLW, DSSI incinerates LLW. Rollins, Inc. Provides hazardous waste (RCRA/TSCA) incineration, no radiologically contaminated wastes.

Relevant Wastes: LLW, RCRA, TSCA, some mixed wastes.

Applicable Regulations: NESHAPS, RCRA and TSCA regulations, specific agreement state license conditions, NEPA (as it pertains to the use by DOE facilities), and in some cases, 5820.2A exemption if the incineration vendor is to dispose of the incineration residues.

Cost of End-Point: As with the commercial solid waste disposal, the incineration fees are highly dependent upon the specifics of the negotiated contract. SEG currently incinerates LLW for about \$2.50/lb. DSSI and Rollins fees are in the same general range, fees for hazardous waste destruction are typically somewhat higher.

Cost of No End-Point: The use of incineration greatly reduces the ultimate volume requiring solid waste disposal. Several economic analyses have been performed that support the use of incineration, especially for LLW, in lowering the life-cycle management cost Incineration is necessary as a treatment option for some hazardous wastes to meet LDR for the final disposal of those residues.

Status of End-Point: All of the above listed incineration options currently exist. It is anticipated that they will be available for the foreseeable future. The ability to utilize these services is dependent upon funding availability, with LLW being the most sensitive wastes to budgetary fluctuations.

Opportunity Analysis: The use of incineration when appropriately conducted can reduce the life-cycle management costs of managing waste streams. The typical consideration for incineration is to volume reduce, however, in some instances the major cost avoidance achieved comes from the homogenization of the waste, making statistically valid sampling possible and lowering the characterization costs considerably.

June 19, 1997 (Rev. 2)

IN SITU CLOSURE OF ORNL SITES AND FACILITIES

Name: In Situ Closure

Description: The remedial action and D&D activities at ORNL may result in contamination managed in situ rather than being moved to another location for disposal. Examples of proposed in situ closures include wastes in SWSA 4, SWSA 5, and SWSA 6; contaminated soil, impoundments, and underground tanks in the ORNL main plant area in Bethel Valley; contaminated groundwater; and the hydrofracture grout sheets. The CERCLA process will be used to determine where in situ closures can be used; the determination will be documented in a legally binding CERCLA Record of Decision signed by DOE, EPA, and TDEC. The CERCLA process considers criteria such as reduction of risk to selected receptors; protection of the environment; effectiveness, implementability and permanence of the remedy; applicable laws and regulations; and cost.

Relevant wastes: As stated above, CERCLA will determine what will be closed in place and what will be removed for disposal elsewhere. DOE, EPA, TDEC, and various stakeholders are currently involved in discussions concerning what types and levels of contamination are acceptable at which locations at ORNL. Once this determination is completed and documented in a ROD, the relevant wastes will be known.

Applicable Regulations: The USEPA Region IV, DOE and TDEC entered into a Federal Facilities Agreement (FFA) under Section 120 of CERCLA and Sections 3008 (h) and 6001 of RCRA. The agreement, effective January 1, 1992, is to ensure that all releases of hazardous substances, pollutants or contaminants as defined by CERCLA and all releases of hazardous wastes or hazardous constituents as defined by RCRA are addressed so as to achieve a comprehensive remediation of the site. The process outlined by the FFA provides for remediation of the sites under CERCLA, with RCRA and all other potential regulations considered as potential ARARs (Applicable, Appropriate, and Relevant regulations and laws) for each individual project. Final selection of the ARARs under CERCLA for the project determines the regulations what will govern the remediation. Federal (CERCLA, RCRA, TSCA, CWA, NEP, etc,), State (TDEC regulations), Local regulations, and DOE Orders are considered when developing ARARs. Both D&D and remedial action activities are covered by the FFA.

Cost of Endpoint: The ORO/EM legacy remediation program is funded directly by DOE/EM. Cost to ORNL would be that of establishing an operational interface to ensure that on-site ORO/EM and ORNL activities are compatible. Also, the issue of payment for treatment of secondary wastes would have to be resolved.

Cost of No Endpoint: If in situ closure at ORNL is determined to be unacceptable under CERCLA, the cost to ORO/EM will increase significantly, as it is nearly always much more costly to move waste than to manage it in situ. There would be a corresponding increase in the cost to ORNL for D&D or remediation of any "future" inactive sites that become inactive after the proposed cutoff date for acceptance by ORO/EM (if a cutoff date is mandated; see discussions under ORO/EM). All remediation/D&D activities, whether managed by ORO/EM or by ORNL, must comply with the requirements of the applicable CERCLA ROD if the contaminated media or facility is determined to be subject to the FFA.

Status of Endpoint: The availability of this endpoint for areas and facilities subject to the FFA is completely dependent on remediation decisions made through the CERCLA process. Four efforts are currently in progress to obtain CERCLA RODs for cleanups at ORNL. The first ROD addresses removal of the sludges in the Gunite tanks (to be moved to MVSTs). This ROD is projected to be approved in 1997. The second ROD will address the contaminated sediments in the four surface impoundments in the main plant area and is projected to be approved in late 1997. Two watershed RODs are projected to be approved by the end of FY 2000: one for Melton Valley and one for Bethel Valley. These watershed RODs will document the remedy selection for all of the remaining remediation and D&D projects subject to the FFA in the geographic areas covered by the RODs. The disposition of the Gunite tank shells will be addressed in the Bethel Valley Watershed ROD.

Opportunity Analysis: Efforts are currently underway to determine the end use conditions for ORNL after remediation is complete. The end use conditions will essentially define "how clean is clean" for ORNL, and will define the conditions under which closure in place is acceptable. As a very interested stakeholder, ORNL should maintain or increase participation in these efforts.

June 19, 1997 (Rev. 2)

INTERIM ON-SITE STORAGE

Name: Interim on-site storage should not be viewed as an end-point for waste, but rather a temporary storage location for waste until it can be dispositioned.

Description: There are several on-site storage locations at ORNL for difficult or special case wastes.

Relevant Wastes:

1. Special case and RH LLW which can not be shipped off-site yet
2. Mixed LLW that can not be shipped off-site, yet
3. Special Case TRU which is not acceptable at WIPP in present form

Applicable Regs:

1. 5820.2A
2. RCRA (if mixed)
3. Safety documentation and permits for selected storage facility
4. TDEC is very concerned about management of special case waste, that it could become defacto disposal at ORNL

Cost of Endpoint: The cost of interim storage of LLW has been running about $1/cubic ft/yr, but is misleading because it does not include transportation and disposition costs. This is really an additional cost to the transportation and disposal fees that will be necessary to disposition the waste.

Cost of No Endpoint: ORNL could bear the cost of interim storage, later characterization and repackaging for shipment to a final disposition location.

Status of Endpoint: This is the default end-point for those wastes not readily certified for disposition.

Opportunity Analysis The opportunity is for ORNL to proactively work with generators to minimize the generation of special case waste; that it only be generated with special approval that it is necessary to do so and that there is no current disposition available.

Rev. 0(May 20, 1997)

CHEMICAL DETONATION FACILITY

Name: Chemical Detonation Facility, Bldg. 7667 located in Melton Valley near the Health Physics Research Reactor

Description: The Chemical Detonation Facility is designed to treat explosive and/or shock-sensitive chemical waste generated in ORNL operations or R&D activities.

Relevant Wastes: The potentially explosive, shock-sensitive, or highly reactive chemical waste generated at ORNL consists primarily of old inventories of laboratory reagent chemicals. The following are the types of chemicals used/generated at ORNL that are dispositioned in this facility: picric acid, organic peroxides, silane compounds, nitro-aromatics compounds, nitrated alcohols, hydrazine-based compounds, nitrated cellulose, Ethers, dinitro and trinitro compounds, and alkali metal oxides. Additionally, small quantities of commercial or military grade explosives (Trinitrotoluene [TNT], Nitroglycerin, Nitroguanidine) have been used for various experimental projects.

Applicable Regs: RCRA, State of TN 1200-3-4-01,02,03,04,05

Cost of Endpoint: The cost associated with operation of the Chemical Detonation Site can vary from year to year depending on the amount of waste and the complexity of handling it. There is fixed cost associated with the operation of this facility (i.e. permits, inspections, maintenance, training, procedures, etc.). This year's budget of $150,000 plus overhead was based on an estimated amount of waste (280 lbs.) to be detonated this year. The number of pounds detonated will not give an indication of the number of items or detonations. The number of items can vary widely for one year to the next depending on the materials being detonated.

Cost of No Endpoint: It would be hard to put a cost on personnel injuries or damaged to facilities from an explosion of this material because it was not moved and detonated safely.

Status of Endpoint: Fully operational

Opportunity Analysis: Reduce usage of unstable chemicals

APPENDIX K

ORNL WASTE MANAGEMENT REENGINEERING

ON-SITE TREATMENT AND STORAGE
PROCESS TEAM REPORT

June 9, 1997

INTRODUCTION

The On-Site Treatment and Storage Process Team evaluated waste treatment and storage activities at Oak Ridge National Laboratory as chartered by the Waste Management Reengineering Core Team. The Process Team Charter is included as Appendix A, and team participants are listed in Appendix B. On-Site scope was defined to include all elements of current treatment and storage activities including treatment at Scientific Ecology Group, treatment and storage at the East Tennessee Technology Park (ETTP), and disposal at Interim Waste Management Facility (IWMF). On-site treatment conducted at the Generator's facility was not included in the evaluation.

During Team meetings, the current methods for implementing treatment, storage, and disposal functions were evaluated. This evaluation was performed through:

- Flow charting of current activities to provide an understanding of processes to team members;
- Modeling with SIPOC (suppliers, inputs, process, outputs, and customers) and Z-models to identify customer needs and interface points, current system inputs, required outputs or services, and constraints which may hamper the system; and
- Evaluating current philosophy and practices and identifying potential areas for technology improvements or modification/consolidation which would lead to increased efficiency and thus lower costs.

Operational unit costs were calculated for treatment of nonradioactive wastewater ($0.0076/gal) and storage of contact handled solid low level waste (CH SLLW) ($16.41/cubic foot for variable costs) by Liquid and Gaseous Waste Operations Section and Solid Waste Operations Section representatives respectively. Backup for these calculations are provided for nonradioactive wastewater in Appendix C and for CH SLLW in Appendix D.

Recommendations from the On-Site Treatment and Storage Process Team are:

(1) Replace the Process Waste Treatment Process - Building 3544. Options include (1) an electrochemical ion-exchange (EIX) unit operation, (2) zeolite columns, or (3) alternate technology to be added at the Nonradiological Wastewater Treatment Plant - Building 3608. Implementation decouples the PWTP from the liquid low level waste (LLLW) system and eliminates 1/3 of the annual LLLW concentrate and reduces operational costs.

(2) Negotiate with the Bargaining Unit to include chemical operators in the existing maintenance craft work agreement. Implementation saves dollars through more efficient work teams.

(3) Maintain continuous "around-the-clock" operations at the Process Waste Treatment Complex rather than implement "batch treatment". "Batch treatment" poses start up and shut down problems which make it an unattractive option.

(4) Modify existing SLLW management process to (1) maximize up-front on-site segregation. (2) use offsite "free release" service, (3) characterize waste streams initially to satisfy only DOT classification requirements, (4) maximize offsite volume reduction when supported by favorable benefit-cost analysis results, (5) use characterization data from ash analysis for profiling and scaling isotopic information for specific waste streams, and (6) optimize utilization of combined IWMF and offsite disposal. Implementation is consistent with ORNL as one Generator approach, makes characterization/certification of waste more efficient, and reduces SLLW volumes.

(5) Accelerate and maximize mixed waste shipments to ETTP for long term storage. Implementation will free up valuable storage capacity for newly generated waste.

(6) Accelerate and expand Generator implementation of No Rad Added Program. Implementation reduces the quantity of low level mixed waste produced.

(7) Reduce environmental permit requirement units through application of necessary and sufficient process. Implementation reduces operational costs and reduces vulnerabilities associated with minor permit infractions.

(8) Assign "dedicated" staff to LGWO Section to perform routine and special maintenance tasks. Implementation increases efficiency of maintenance service and saves dollars.

In the body of the report, each recommendation is followed by (1) a brief discussion of relevant information, (2) an estimate of cost savings expected to be realized, and (3) identification of barriers to implementation.

Recommendations 1 and 4 are particularly amenable to partial outsourcing and have significant potential for increased use of private sector resources.

The On-Site Treatment and Storage Process Team believe that acceptance and implementation of these eight recommendations will contribute to a cost-effective, customer-friendly, safe, and compliant waste treatment and storage function at Oak Ridge National Laboratory. Total potential combined cost savings and cost avoidances are estimated at $5,344,000.

A brief discussion regarding a Generator Chargeback Program is provided following the specific recommendations. In conducting this evaluation, additional activities which lie outside the specific scope of this charter, which require further evaluation, or which overlap with other Process Team charters were identified as areas with potential for cost savings. These "hand off" topics or "endorsements" are listed in Appendix E.

Appendix F contains a description of the electrochemical ion-exchange (EIX) process. Appendix G contains an evaluation of "batch treatment" at the Process Waste Treatment Complex.

RECOMMENDATIONS

Recommendation #1:

Replace the Process Waste Treatment Process - Building 3544. Options include (1) an electrochemical ion exchange (EIX) unit operation, (2) zeolite columns, or (3) alternate technology to be added at the Nonradiological Wastewater Treatment Plant - Building 3608.

Recommendation #1 Discussion

The PWTP produces over 1/3 of the ORNL liquid low level waste (LLLW) concentrate annually from regeneration of ion-exchange columns. PWTP LLLW produces sludges which commingle and increase the volume of TRU sludges in the LLLW system. Elimination of this LLLW would reduce future LLLW treatment costs substantially. If the new PWTP unit operations could be physically located at the NRWTP significant PWTP operational costs could be eliminated (operators and maintenance). Earlier attempts to acquire funding to replace the PWTP system with a zeolite process was rejected due to high capital construction costs and long schedule required for a line item to build a new PWTP facility at the NRWTP site. In 1995, EIX was identified as a possible alternative to zeolites. Installation and use of the process as described in Appendix F will eliminate LLLW and associated LLLW sludge production from the PWTP, regenerate ion-exchange column without the use of nitric acid and avoid nitric acid handling, and allow PWTP Complex operations to be consolidated at the NRWTP. Anticipating the difficulty in obtaining line item funds, the Team recommends that funding options include hiring a private firm to design and build the replacement unit operation. The firm would recoup their capital outlay expenses through annual operating expense lease payments.

Existing waste treatment unit operations are described in ORNL's NPDES permit. Any changes to the operations will need to be communicated by letter to TDEC. Since the change will not negatively impact ORNL's ability to meet the established discharge limits, TDEC approval of the change will not be required.

NOTE 1:

Zeolites could function similarly, but the intent is for EIX unit operations to be installed in the existing NRWTP building for less cost than zeolites. The zeolite system is also more labor intensive to operate.

NOTE 2:

If EIX is determined to be a nonviable option, replacement of PWTP with a zeolite or alternate system at NRWTP should be considered, including evaluation of use of the existing activated charcoal columns for housing the zeolite. Alternate mercury treatment will be needed to implement this option.

Recommendation #1 Cost Savings

Installation of EIX System at NRWTP (as estimated by LMES Engineering 9/96) is \$6.345M. Decontamination and decommissioning of the ion exchange columns and regeneration system at PWTP (as estimated by LMES Engineering) is \$2.7M; placing the Plant in "safe standby" would cost significantly less. Operation of the PWTP in FY97 (as estimated by LGWO Section) is \$3.91M. Of the \$3.91M, approximately \$2.16M/year are distributed fixed costs currently charged to PWTP and would require redistribution. Annual costs for EIX operations are estimated to be \$0.46M, therefore annual cost savings are estimated to be \$1.29M; including reduced LGWO Section labor and reduced maintenance. Avoided waste disposal costs are projected to be \$1.37M/year.

$$ROI = \{[S - (C/L)]X100\}/C \text{ or } \{[1{,}290 - (6{,}345/30)]X100\}/6{,}345 = 17\%$$

Barriers to Implementing Recommendation #1

Ability to obtain capital funding from DOE EM or Energy Research Programs.

The EIX process developed by AEA Technologies has not been used in an industrial application equivalent to the ORNL process waste stream. Key technical issues are (1) membrane durability and (2) regeneration efficiency.

Recommendation #2

Negotiate with the Bargaining Unit to include chemical operators in the existing maintenance craft work agreement.

Recommendation #2 Discussion

A Labor Contract exists between Lockheed Martin and Bargaining Unit personnel. The exisitng Contract contains a "maintenance craft work agreement" and consensus of the Team was that such an agreement will exist in the future. The general culture regarding division of labor at ORNL recognizes and strictly adheres to the Agreement. The Team believes a more cost effective service can be delivered through adding chemical operators to the Agreement. Therefore, chemical operators that are required to be at a job site can execute incidental actions after receiving the requisite level of task training. Examples discussed during Team meetings included, (1) a chemical operator should be able to satisfactorily perform incidental maintenance for some equipment without the aid of craft personnel, and (2) a hazardous waste technician and chemical operator should be able to satisfactorily package, load, and transport chemical waste without the aid of a laborer and truck driver.

The Team agree that the current level of laborers and truck drivers used to collect and transport solid sanitary and industrial waste was appropriate.

Recommendation #2 Cost Savings

The LGWO Section currently funds 20 maintenance and 7 instrumentation personnel. Based on subject matter expertise resident on the Team, activities equivalent to 1 FTE could be assigned to existing LGWO Section chemical operators roles and responsibilities. Estimated annual cost savings $135,000.

The SWO Section currently funds 17.5 P&E personnel to support waste collection and handling operations. Based on subject matter expertise resident on the Team, activities equivalent to 1 FTE could be assigned to existing SWO Section chemical operators and/or hazardous waste technicians roles and responsibilities. Estimated annual cost savings $135,000.

Barriers to Implementing Recommendation #2

Reluctance of bargaining unit personnel to expand the scope of the existing maintenance craft work agreement.

Recommendation #3

Maintain continuous "around-the-clock" operations at the Process Waste Treatment Complex rather than implement "batch treatment".

Recommendation #3 Discussion

Evaluation of "batch treatment" operations at the Process Waste Treatment Complex are included as Appendix G. In general, from an operational perspective, stacking water and working it off later is not a good idea unless a treatment system is grossly oversized or flows are typically very low. From a true economy cost perspective, "batch treatment" can sometimes be justified to lower the cost per gallon of water treated; therefore the Team felt a formal analysis of "batch" vs. "continuous" was warranted.

Radian conducted an evaluation of "batch treatment" at the Process Waste Treatment Complex. They concluded that the current PWTC can be run in batch mode 18 hours a day while retaining 24 hour system monitoring and flow balancing capability through the use of rotating shift Waste Operations Control Center and tank farm operators.

"Batch treatment" has the potential for severe operational impacts including startup and shutdown efficiency problems, shift rotation problems, waste storage problems, and lack of operator cross training and skill development with non standard rotating shifts. In light of these potential issues when compared to the potential savings (3 FTE's), the Team recommends that the PWTC continue to be operated in an around-the-clock mode.

Changes to current treatment modes need to be well planned and carefully implemented to be successful.

Recommendation #3 Cost Savings

No quantifiable cost savings are associated with this recommendation; however operational efficiencies are maintained through avoidance of problems created by startup and shutdown, waste storage concerns, and lack of operator cross training and skill development with nonstandard personnel shift rotations.

Barriers to Implementing Recommendation #3

Recommendation #3 is status quo. No further action required; changes to current treatment modes need to be well planned and carefully implemented to be successful.

Recommendation #4

Modify existing SLLW management process to (1) maximize up-front on-site segregation, (2) use offsite "free release" service, (3) characterize waste streams initially to satisfy only DOT classification requirements, (4) maximize offsite volume reduction when supported by favorable benefit-cost analysis results, (5) use characterization data from ash analysis for profiling and scaling isotopic information for specific waste streams, and (6) optimize utilization of combined IWMF and offsite disposal.

Recommendation #4 Discussion

The existing and proposed SLLW Management process flowsheets are shown in Figures 1 and 2, respectively. Implementation of the proposed system is consistent with the ORNL as one Generator approach; minimizes waste volumes in hard to dispose categories; maximizes use of available commercial waste management services; and greatly simplifies waste certification and characterization from a Generator perspective.

The On-Site Treatment and Storage Process Team endorses the Pollution Prevention and Waste Characterization Process Teams Recommendations to intensify up-front on-site segregation to maximize the amount of clean material recycled off site or disposed as sanitary/industrial waste.

Material that is not cleared as clean will be further sorted into "suspect radioactive" or CH SLLW categories.

The "suspect radioactive" category will be characterized to meet DOT requirements, packaged on-site, and transported to a commercial entity and surveyed for free release potential. Materials that are cleared by the Vendor will be free released and radioactively contaminated materials will be returned to ORNL for management as CH SLLW. Diversion of clean materials will save the variable costs associated with CH SLLW storage and disposal.

CH SLLW will not be verified through real time radiography. Verification and surveillance activities within the ORNL Waste Certification Program will be accepted as reasonable assurance that nonconforming items are not present in CH SLLW.

CH SLLW will be segregated into two categories: (1) volume reducible waste and (2) nonvolume reducible waste. Volume reducible waste will be characterized to meet DOT requirements and shipped to an off-site commercial entity for volume reduction in those cases where benefit-cost analysis results are favorable; currently 70% returns as ash, 15% as compacted SLLW, and 15% as metal slag. Incinerable waste will be broadly "profiled" based on like contaminants and contamination levels for campaigning. These broad waste streams will be established to control variability and resultant secondary streams. This approach is consistent with the concept to "catalogue waste streams and their major characteristics" as described by the Waste Characterization Process Team in their

SLLW
AS IS

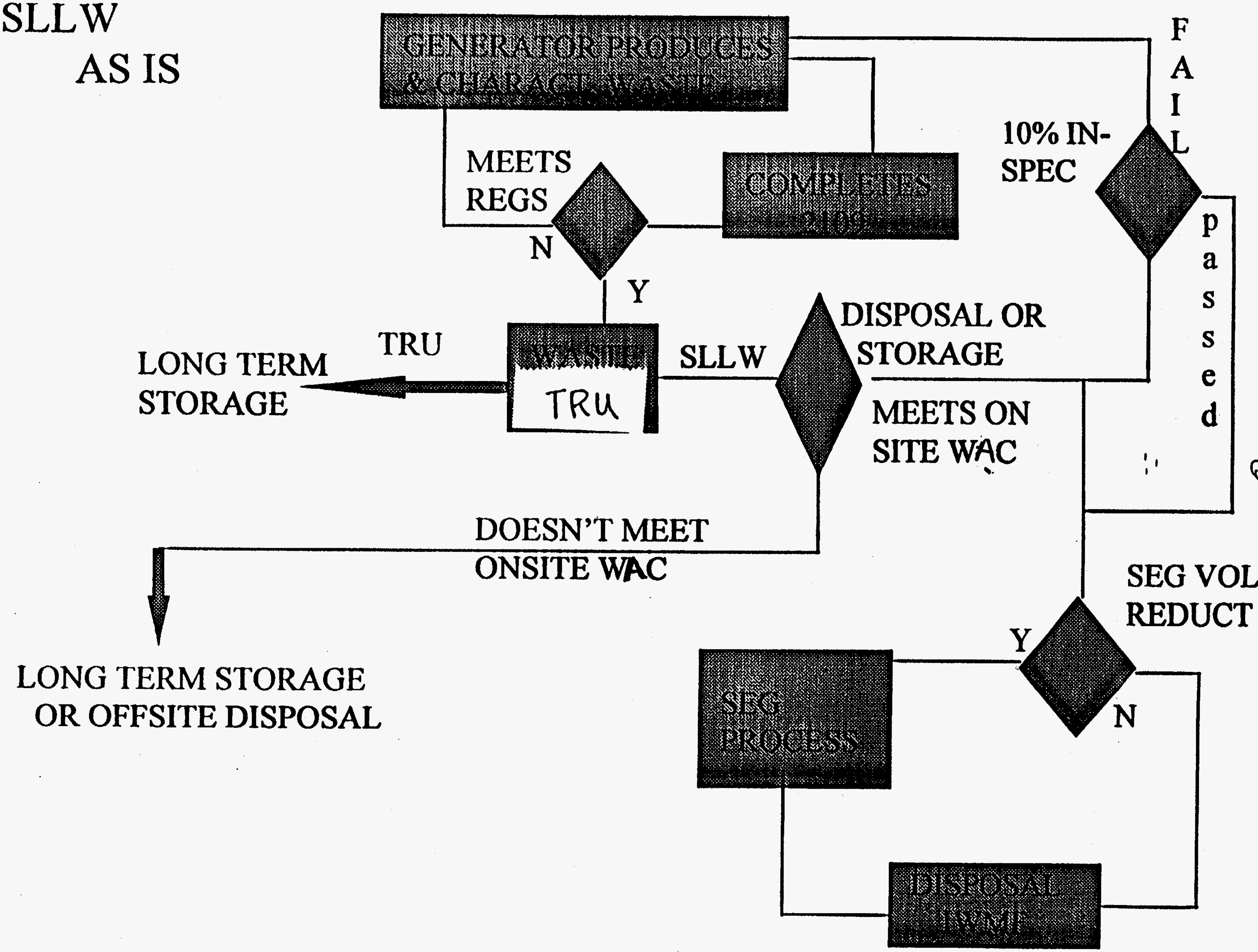


FIGURE 1

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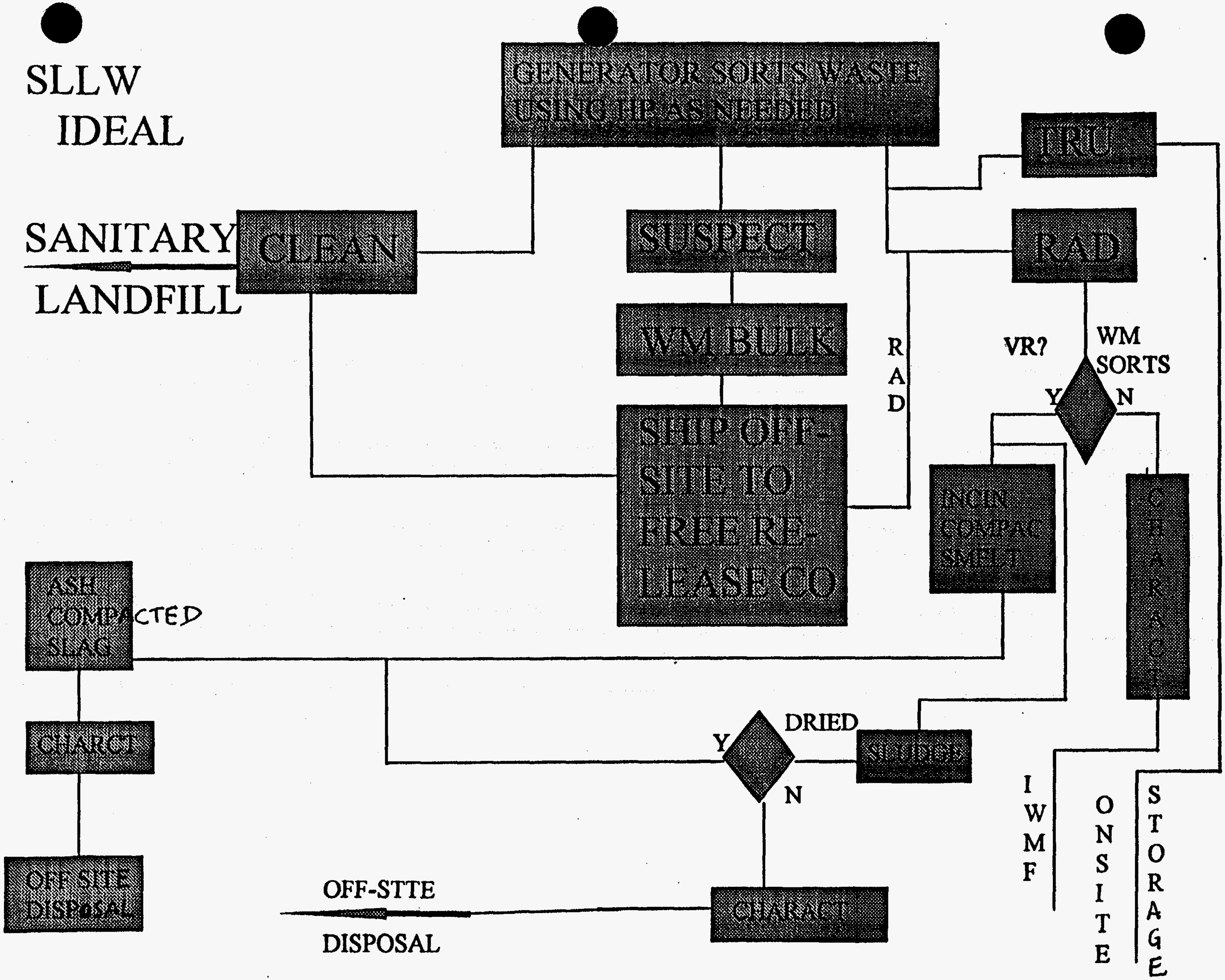


SLLW
IDEAL
GENERATOR SORTS WASTE USING HP AS NEEDED
TRU
SANITARY
LANDFILL
CLEAN
SUSPECT
RAD
WM BULK
RAD
VR?
WM SORTS
Y
N
SHIP OFF-SITE TO FREE RE-LEASE CO
INCIN COMPAC SMELT
CHARACT
ASH COMPACTED SLAG
CHARCT
DRIED
Y
SLUDGE
N
IWMF
ONSITE
STORAGE
OFF SITE DISPOSAL
OFF-STTE
DISPOSAL
CHARACT

FIGURE 2

Recommendation #1.

Treatment plant sludges will be dried for higher solids content and smaller volumes if IWMF or NTS is an available disposal option. If Envirocare disposal is available, current moisture content and isotopic distributions meet their acceptance criteria and additional drying will not be performed.

Following commercial treatment, the incinerator ash will be characterized by gamma spectroscopy and wet chemistry for radioactive constituents and distribution. Some additional characterization information will be needed from the commercial vendor since isotopic partitioning occurs during incineration. The combined analytical data will be used as the DOT characterization information for future shipments of the waste stream and also will be used as the necessary characterization scaling data for disposal at IWMF or an off-site facility. Through use of secondary waste characterization information and "generic waste profiles", the Generator will avoid significant characterization costs at the source. WMO will reduce the amount of time necessary to complete shipment specific DOT calculations.

Nonvolume reducible waste will be characterized for IWMF or off-site disposal.

Recommendation #4 Cost Savings

Approximately $1,211,000 of cost savings will be realized through initial investments of $36,000 and an annual expenditure of $40,000 for additional ash characterization:

4.A Reduced IWMF disposal cost compared to cost required to divert Clean and Suspect Rad from CH SLLW stream on the front end. Cost savings are estimated to be $400,000 annually.

4.B Reduced generator characterization cost/item compared to WM characterization cost for ash -- $200,000 savings annually. An initial investment of $20,000 to modify existing procedures and another $12,000 expense for purchasing Sea land containers (3 containers @ $4,000). Waste Management will incur additional ash characterization costs of $40,000 annually.

4.C Reduced collection & transport costs from diversion of clean. Cost savings are estimated to be $25,000.

4.D By eliminating the real time radiography verification step for CH SLLW, approximately $586,000 cost savings can be realized annually. This change will require a revision to the ORNL Waste Certification Program Plan which is estimated to cost $4,000 (40 hours @ $100/hour).

Barriers to Implementing Recommendation #4

4.A DOE acceptance of utilizing a commercial free release program.

4.B Ability to meet off-site DOT shipping requirements due to the potential variability in waste stream characterization data. Ability to establish broad, relatively consistent waste streams.

4.B Inability to obtain funding from DOE and LM Program Managers for offsite volume reduction.

4.C Willingness of Generator to sort clean from "suspect radioactive".

4.D Eliminating the RTR verification step increases potential for non conforming items to be shipped off-site or disposed on-site. Appropriate concurrences will be required by customer and stakeholders.

4.D WEAF operations are currently described in the RCRA permit application for TRU waste storage facilities (page C-6). Stakeholder interaction will be needed to modify existing application language.

Recommendation #5

Accelerate and maximize mixed waste shipments to ETTP for long term storage.

Recommendation #5 Discussion

Current on-site mixed waste storage capacity is nearly exhausted. Due to lack of storage space, HWOG schedules pick ups from 90 day areas on a case-by-case basis as driven by the RCRA less than 90 day clock. HWOG may visit a Generator storage area that has many waste items only to collect a single item or container that is bumping the RCRA storage limit. Downstream of collection, HWOG arranges shipments to ETTP to make specific storage space available based on wastes stored at the Generator's location. Moving the existing mixed waste legacy inventory to ETTP in total would create more than 5 years capacity for ORNL newly generated waste and would possibly allow closure of older RCRA storage units.

Recommendation #5 Cost Savings

Savings would be realized by reducing the number of trips required to move waste from 90 day areas and satellite accumulation areas (SAA) to permitted on-site storage or direct shipment to ETTP or the TSCAI.

Direct shipment off-site would result in eliminating some variable costs required for double handling through on-site storage and on-site transport.

Potential to close "legacy waste" storage facilities will reduce operational costs but will require "up-front" funds estimated to be $550,000 to prepare for and execute ETTP shipments. Additional RCRA closure costs will be incurred. Estimated annual operating cost savings from closure of Tank 7830a and Building 7823 will be $613,000.

Barriers to Implementing Recommendation #5

Radiological restrictions within the ETTP waste acceptance criteria for storage.

Lack of funding to characterize ORNL legacy mixed waste to meet DOT requirements for shipment to ETTP.

Lack of funding to conduct RCRA closures.

Uncertainty with ETTP's continued availability for day-to-day receiving operations and lack of service orientation by ETTP.

Recommendation #6

Accelerate and expand Generator implementation of No Rad Added Program.

Recommendation #6 Discussion

The ORNL No Rad Added (NRA) Program was established to meet a DOE policy and produce NRA certified waste. When fully implemented, it allows for off-site management of hazardous wastes. The Program provides the mechanism to certify wastes as containing "no rad added" if they originate from an area outside a Radioactive Materials Management Area (RMMA) and will provide avenues for characterization and certification of wastes generated in an RMMA. It is estimated that more than 75% of ORNL's hazardous waste is generated outside an RMMA. Since implementation of the ORNL Program in November 1996 less than 5% of newly generated waste is being certified "no rad added" by the Generator. If the waste is not certified as "no rad added", then it is managed as mixed waste or policy mixed waste. There are currently minimal outlets for mixed wastes from ORNL besides storage at ETTP or treatment at the Toxic Substances Control Act Incinerator.

There is a quantity of historical waste of "unknown" origin still at Generator areas that will be newly generated waste that will probably remain policy mixed.

Recommendation #6 Cost Savings

Life cycle management costs for hazardous waste are anticipated to be less than life cycle costs for mixed waste; qualitatively, mixed waste must be characterized for its radioactive component. However, since mixed waste disposal capacity and associated costs are unavailable today, it is not possible to quantify the savings realized through implementation of this recommendation.

In response to a Core Team inquiry, the costs for development and implementation of a sampling and analysis program for wastes originating within an RMMA have been estimated at $200,000. Implementation costs will be borne by the Generator, proportionately to the quantities generated. Cost for expanding the NRA Program for waste originating outside an RMMA is considered negligible.

Barriers to Implementing Recommendation #6

Perception of individual liability versus (1) accountability for mischaracterization of waste and (2) management liability and management's acceptance of liability. Current wording of the certification statement may need to be evaluated for addition of the "to the best of my knowledge" disclaimer.

Communication of requirements and expectations to the Generator.

Implications of Draft DOE Order 435.1 "Radioactive Waste Management" direction that DOE Field Offices will establish de facto, de minimis release limits; the Operations Office may be reluctant to establish independent release standards.

Recommendation #7

Reduce environmental permit requirement units (RU's) through application of necessary and sufficient process.

Recommendation #7 Discussion

WMRAD currently has 13 environmental permits containing approximately 1400 RU's. Although most regulations specify only "what" the environmental requirements are, the specifics of "how" those requirements will be addressed are committed to in the permitting process. Once a permit is approved, the conditions within the permit carry the penalty of their parent regulation. The Team believes that an immediate savings can be realized through reduction of inspection frequencies. Additional efficiency gains may be achieved through proposing changes to other aspects of "how" the work is done, and gaining Stakeholder concurrence through permit revisions. However, given the current relationship between Lockheed Martin and TDEC, it is recommended that permit revisions containing content changes be submitted following a favorable FY 98 TDEC annual inspection of LMER.

Recommendation #7 Cost Savings

Savings resulting from reduced inspections at RCRA permitted storage facilities are estimated to be $50,000, annually.

Costs for submitting revised RCRA permits are estimated to be $15,000.

Barriers to Implementing Recommendation #7

Decreasing inspection frequencies will increase the potential for larger more costly spills at storage facilities. An analysis of the benefit/costs should be conducted.

Will require concurrence of DOE and Regulators. The current relationship between LM and TDEC is strained due to recent operational nonconformances at K-25 and Y-12.

Recommendation #8

Assign "dedicated" staff to LGWO Section to perform routine and special maintenance tasks.

Recommendation #8 Discussion

In FY97, LGWO Section will fund approximately 20 P&E staff (craft, planner, and supervisors). Staff assignments are made daily by P&E supervision. Daily specific assignments to various locations throughout the Lab do not allow the same level of continuity as would exist with "dedicated" staff assignments to LGWO facilities.

Expected efficiency gains are summarized below.

- The current P&E arrangement is for general support for all WMRAD. A dedicated crew will provide focus on LGWO Section needs, both routine and special, without being dependent on Divisional priorities. Craft focus will be on a single customer instead of many.

- Since the crew will report to LGWO Section, there is more incentive to "take ownership" for the facilities and the associated maintenance support of those LGWO facilities.

- Intradivisional communication between customer and craft should be more effective than interdivisional communication.

- Since the major participants of projects will be available throughout all phases of scoping and planning the work, projects should be better planned and more efficiently executed.

- Multicraft job setup and planning should be streamlined since all required permits, operator support, craft support, materials, and equipment will be managed by a single Section.

Recommendation #8 Cost Savings

Efficiency gains were estimated by subject matter expertise resident on the Process Team. Assignment of a dedicated P&E crew to LGWO Section is expected to result in the reduction of 4 FTE's or save an estimated $540,000 annually.

Barriers to Implementing Recommendation #8

Usurps current degree of P&E flexibility in resource loading.

Ability to objectively divide P&E staff so that LGWO Section and P&E both maintain appropriate mix of skill level, experience, and performance.

The level of administrative and labor relations work load will increase for LGWO Section line management.

Generator Chargeback

If chargeback to the Generator is implemented, it should include multiple unit rates to ensure equity for the actual cost of managing special or unique waste, for example management of RH SLLW cost more than management of CH SLLW. Only the variable portion of the cost should be borne by Generator chargeback; the fixed costs should be funded by the ORNL Landlord or by EM base funding. Due to the difficulty in tracking and billing solid sanitary, sanitary sewage, gaseous waste, and process waste (including nonradiological wastewaters), consideration should be given to funding these streams by the ORNL Landlord and they should not be included in an individual Generator-specific Chargeback Program.

Appendix A

WM RE-ENGINEERING-ONSITE TREATMENT AND STORAGE PROCESS TEAM CHARTER

The Onsite Treatment and Storage process team for the WM re-engineering effort will evaluate the treatment and storage activities of the division and provide recommendations to the core team for a cost-effective, customer-friendly, safe, and compliant treatment and storage function. The focus of the process team will be on the following:

- Map current treatment and storage activities to provide understanding of the processes and to identify points of customer interface
- Evaluate treatment and storage processes for improved efficiencies and cost reductions
- Identify possible areas for technology improvements
- Evaluate current maintenance philosophies and practices
- Evaluate treatment and storage practices for generator charge back purposes
- Provide WM re-engineering core team a unit cost for treatment and storage of wastes (process team will determine which waste stream unit cost will be provided)
- Provide WM re-engineering core team with an estimate of the savings expected to be realized from the process team recommendations
- Identify barriers to implementation of re-engineering efforts as pertaining to storage and treatment
- Use bench marking information provided by the WM re-engineering core team and other sources in making recommendations
- Evaluate treatment and storage processes for possible outsourcing opportunities

Recommendations from the treatment and storage process team will be provided to the WM core team by May 1, 1997.

Appendix B

Name	Organization	Role
Ray Arp	ORNL P & E	Core Team Champion
Jeff Baldwin	WMRAD LGWO Section	Liquid/Gaseous Waste SME
Jerry Cunningham	WMRAD SWO Section	Radioactive Waste SME
Darrell Daugherty	EET TN Corporation	Team Leader
Dave Hall	WMRAD SWO Section	Solid Waste SME
Mike Hicks	ORNL P&E	Maintenance SME
Larry Jones	LMES Project Execution	Solid Waste SME
Jim Kain	Radian Corporation	Industry Liquid Waste SME
Jim Mathys	ORNL P&E	Sanitary Waste SME
George McRae	Y-12 WMD	Liquid Waste SME
Victoria Myers	SAIC	Facilitator
Sharon Robinson	ORNL Chem Tech	Liquid Waste SME
Chris Scott	WMRAD LGWO Section	Liquid/Gaseous Waste SME
Tony Sizemore	WMRAD LGWO Section	Labor Representative
Mark Sylvester	Radian Corporation	Industry Solid Waste SME
	Ad Hoc Members	
Doug Allen	Radian Corporation	Industry Solid Waste SME
Dave Drake	ORNL HWOG	Hazardous Waste SME
Butch Edgemon	ORNL SWO Section	Solid Waste SME
Kathy Johnson	ORNL CMO	Facilitator
Tim Kent	ORNL Chem Tech	Liquid Waste SME
Greg Larson	ORNL RSWOG	Radioactive Waste SME
Greg Livengood	ORNL Transportation	DOT SME
Tim Myrick	ORNL EM	Core Team Leader
Mark Saunders	EET TN Corporation	Solid Waste SME
Sylvia McGhee	ORNL Transportation	Rad Packaging SME

Appendix C

Liquid and Gaseous Waste Operations Department
Nonradiological Wastewater Treatment Plant Unit Cost

NOTE: In the following table, "UF" is an abbreviation for Utilization Factor. Overall, LGWOD assigns 20% of its departmental labor charges to operation of the Nonradiological Wastewater Treatment System. The table assumes that 90% of this is related to 3608 and the balance to the collection system. WMRAD labor rates have been reduced by 32% to remove division overhead from the unit cost.

Resource	Service	Cost Basis	Hours	Rate	Unloaded Cost
I. LGWOD					
Chemical Operator	Control room	24 hr/d, 365 d/yr, 1.0 UF	8760	25.67	224869
WOCC Operator	WOCC	24 hr/d, 365 d/yr, 0.18 UF	1576.8	25.67	40476
Tank Farm Operator	Patrol	24 hr/d, 365 d/yr, 0.18 UF	1576.8	25.67	40476
Shift Foreman	CO supervision	24 hr/d, 365 d/yr, 0.18 UF	1576.8	33.77	53249
Day Shift Chemical Oper.	Maint., misc ops	3 FTE, 8 hr/d, 260 d/yr, 0.18 UF	1123.2	25.67	28833
Maintenance Foreman	Maint. coord/oversight	8 hr/d, 260 d.yr, 0.18 UF	374.4	33.77	12643
Operations Supervisor	Ops/maint. management	1760 hr/yr, 0.18 UF	316.8	33.77	10698
Department Head	Management	1760 hr/yr, 0.18 UF	316.8	33.77	10698
Technical Support	Procedures, cost, field coord.	6.5 FTE, 1760 hr/yr, 0.18 UF	2059.2	33.77	69539
Adminstrative Support	Admin support	1760 hr/yr, 0.18 UF	316.8	33.77	10698
Data Entry Support	Data tracking, trending	1760 hr/yr, 0.18 UF	316.8	33.77	10698
		Subtotal			512877
II. Other WMRAD Labor					
General Management	Misc WMRAD cost, admin, etc.	Lump sum estimate		LOT	3000
SRIDS/PAAA	RU database maint	Lump sum estimate		LOT	1700
DMC	Documentation mgmt	FY97 budget, 90%		LOT	15475
Training	Procedure training	FY97 budget, 90%		LOT	12,375
ES&H	Operations ES&H oversight	1760 hr/yr, 0.1 UF	176	33.77	5944
SWOD	Solid LLLW disposal (var. cost)	1 B-25 box/mo, 96cf/box	1152 cf/yr	16.41	18,904
		Subtotal			57398
III. Other Intra-OU Labor					
Health Physics	HP tech support	3 FTE, 1760 hr/yr, 0.18 UF	950.4	44.5	42293
QA	QA oversight	1760 hr/yr, 0.05 UF	88	48.5	4268
P&E	Prog. & misc. maintenance	Actual FY96 cost for 3608	1803	45.94	82830
I&C	Prog. & misc. maintenance	Actual FY96 cost for 3608	1461	46.7	68229
CASD	Analytical support	FY97 budget, 25%		LOT	225000
Misc. (Env. Mgmt, etc)	Misc. services	Lump sum estimate		LOT	7500
		Subtotal			430120
IV. Materials					
Operating	Chemicals, PPE, B-25 box, etc	FY97 budget, 90%		LOT	4500
Maintenance	P&E and I&C maint. materials	Actual FY96 cost for 3608, 90%		LOT	66717
Shared Facility Cost	Non-waste stream fac. costs	FY97 budget, 25%		LOT	50000
Capital Equipment	Capital equipment	FY97 budget, 100%		LOT	50000
Utilities (Non-Exempt)	Electricity	FY97 budget, 100%		LOT	110000
		Subtotal			281217
V. Other					
Misc Central Labor	Bus&Fin, Procurement, etc	Lump sum estimate		LOT	6000
ASO	Sample analysis	FY97 budget, 100%		LOT	75000
Other OU Support	Misc K-25, Y-12 support svcs	Lump sum estimate		LOT	2000
		Subtotal			83000
	TOTAL COST				1364612
	AVERAGE ANNUAL VOL TREATED (GAL)				180000000
	UNIT COST			$/gal	0.0075812

Appendix D

CH-LLW UNIT COST
($ in K)

Fixed:		
Storage (- RH)	1266 - 342 =	924
C/T (- RH)	568 - 227 =	341
	Total Fixed	1265

Fixed Costs include:

Maintenance	218
ES&H	15
QA	12
Training	183
DMC	156
HP	5
Compliance	181
General Mgmt	495
	1265

Total CH Budget	2685
- Fixed Costs	-1265
Variable Costs	1420

Variable Costs include:

HP
P&E
Waste Mgmt
Materials

Quantities:		EOY Projection
CH-LLW received to date:	47,835	99,497
CH-LLW Disposed to date:	6,240	12,979
		86,518

1,265 (fixed) + $1,420/86,518cu.ft. (variable)
1,265 (fixed) + $16.41/cu.ft. (variable) * # of cu.ft.

Assumptions

SLLW disposal not included.

RH-LLW subtracted from cost proportionally:
RH-LLW C/T = 40%
RH-LLW Storage = 27%

Fixed costs incurred regardless of amount received.

Capacity of SLLW "fixed cost" system is 90,000 cu.ft. Updated 5/21/97.

Generation rate remains consistent with first half of FY 97.

Appendix E - Hand Offs, Endorsements, and Future Actions

1. The ORNL overhead rate adds 45.3% burden to "fully loaded" waste management unit costs: a decrease in ORNL overhead is critical to obtaining competitive unit costs.

2. The LMES 1997 Waste Management Organization's budget is $155 M. A primary focus of the Central LMES Program funded at $23 M is financial reporting and control. LMES program inquiries and "what if" exercises are currently excessive and not well organized. Response to these requests by technical and financial support staff contribute to higher costs. A decrease in Central LMES Program oversight is important to obtaining competitive unit costs. Both TBMS and PMTS represent a drain on resources with minimal useful returns.

3. WMRAD divisional overhead contributes another 5-10% burden; a decrease in WMRAD divisional overhead is important to obtaining competitive unit costs.

4. WMRAD's 1997 Operational Budget is $54.2 M. Sixty nine percent of that budget ($37.6 M) is utilized by treatment, storage, disposal, and divisional support activities, and the remaining $16.6 M is used for Programmatic and General Support (including FFA, TRU, P2, SNF, UST, Site Wide, and GPP/LI support). Those divisional, programmatic, and general support functions should be evaluated as a part of the overall Waste Management Reengineering effort.

Specific functions that should be evaluated for cost versus value-added include resources expended on (1) development and maintenance of the WMRAD Home Page and (2) maintenance of Standards/Requirements Identification Documents Program.

A consolidation option that should be considered is transfer of the FFA Program from a stand alone entity to report through the LGWO Section line management.

5. Approximately $2.5 M/year of the current treatment and storage budget is consumed by waste tracking related activities. A reengineered request for disposal form and associated waste tracking system could result in notable cost savings.

6. The On-Site Treatment and Storage Process Team endorses the Hazardous/Mixed Waste Process Team's recommendation to re-evaluate application of DOT equivalency to on-site shipments.

7. Definition of waste item should be re-evaluated. Waste item should be able to be interpreted broader than an individual waste packet within a larger waste container. The "waste item" definition should be consistent with the waste streams to be developed if Recommendation #4 is accepted. If accepted, multiple waste containers could be profiled as a single "waste item"/stream.

8. The WMO Document Control process is inefficient and not user friendly. Hand Off for the Reporting and Records Process Team.

9. Existing Bar Code Equipment is not functional. Hand Off for the Reporting and Records Process Team.

10. The On-Site Treatment and Storage Process Team endorses the current efforts underway at the Sewage Treatment Plant to (I) add an ozonation unit process to reduce NPDES violations and (II) obtain approval to participate in the ORR sludge landfarming project pending Stakeholder buy in. The risk associated with potential for CERCLA corrective actions for sludge landfarming is considered to be acceptable by a majority of Team members; however, stakeholders may react negatively to land application of material that would otherwise be emplaced on IWMF as a radioactive waste. Land application of sewage sludge is more cost effective than disposition as CH SLLW.

NOTE:

> Operation and management (O&M) of the Sewage Treatment Plant should be evaluated for outsourcing to a specialized private expertise provided under a well defined O&M contract. For the near term, no economic reason for transferring operating and management responsibility from P&E Division to WMRAD was identified.

11. The On-Site Treatment and Storage Process Team endorses the Waste Certification and Verification Process Team's assertion that ORNL (LMER) assume responsibility as corporate Generator rather than have 1500 individual Generators at ORNL .

12. The On-Site Treatment and Storage Process Team endorses the Haz/Mixed Process Team's Recommendation to ship directly from 90 day areas to off-site treatment and disposal vendors.

13. Steam Reforming technology is used in industry for volume reduction of dry active waste. This technology may be suitable for some portion of ORNL's radioactive solid waste; further analysis is required.

14. Samples from wastewater treatment operations are submitted to on-site laboratories for analysis. The current costing allocations by those labs to the LGWO Section should be further evaluated. Offsite analytical alternatives should also be identified and evaluated.

15. The On-Site Treatment and Storage Process Team endorses the continuation of pretreatment initiatives at the Radiochemical Engineering Development Center - Building 7920. It is estimated that 99% of the TRU activity entering the LLLW System is generated by REDC yet it represents only 4% of the flow. It is cost effective to source treat small volumes of concentrated isotopes at the source rather than to let this waste become diluted and settle to the tank bottoms within the treatment system.

16. Approach for implementation of Conduct of Operations should be further evaluated. If Nuclear Safety Requirements are being applied to operations at all WMRAD facilities regardless of Nuclear Facility categorization, graded implementation will yield reduced operational costs.

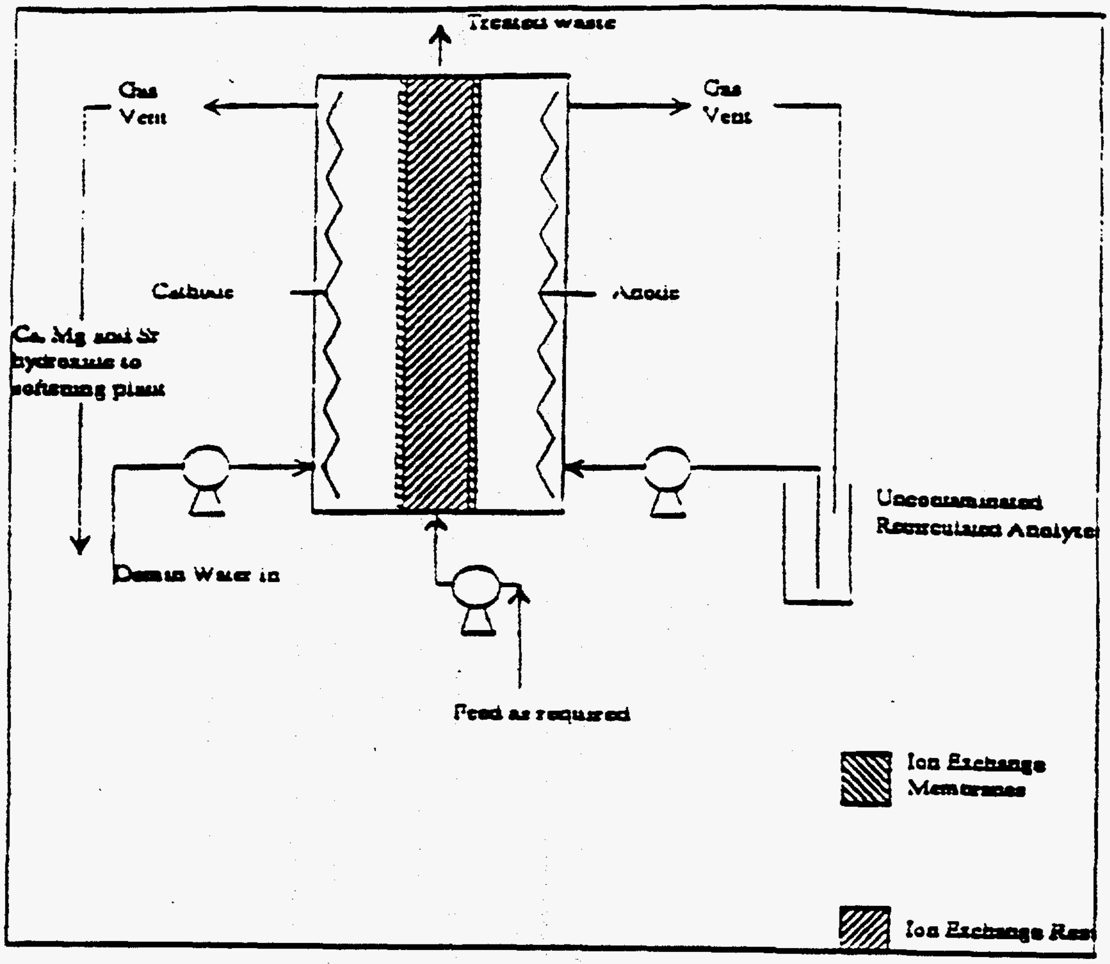
Appendix F

Process Description:

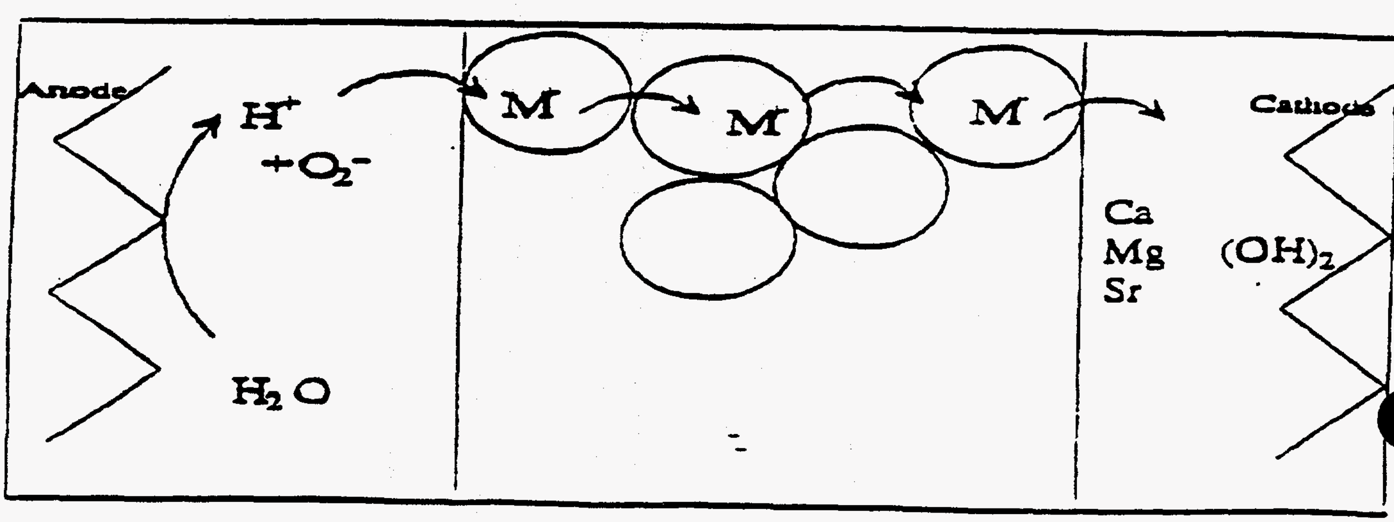
- Dowex HCR-S resin is incorporated into an electrochemical cell configuration.
- PW is routed through cell compartment containing the resin for normal treatment.
- Once exhausted, the resin is regenerated electrochemically
  1) Electrochemical potential is applied across anode and cathode
  2) Hydrogen ions generated in anode compartment diffuse across membrane into resin compartment
  3) H+ displaces Ca, Mg, Na, Sr, Cs, etc. which diffuse across membrane into cathode compartment
  4) Deionized water (catholyte) dissolves Ca, Mg, etc. and is routed to the PWTP feed tank.
  5) Catholyte is treated with PW in softener to produce filter cake

- Total volume of filter cake increases by about 20%
- LLLW is not produced

Fig 1. Diagram of the EIX operating scheme*



When the cell is energized, protons (H+) are generated in the anode compartment and migrate through a membrane into the resin bed to displace the metal cations (M+) from the ion-exchange resin. The displaced cations (Ca, Mg, Sr) migrate through a membrane to the cathode compartment.



* Provided by AEA Technology

Appendix F (cont)

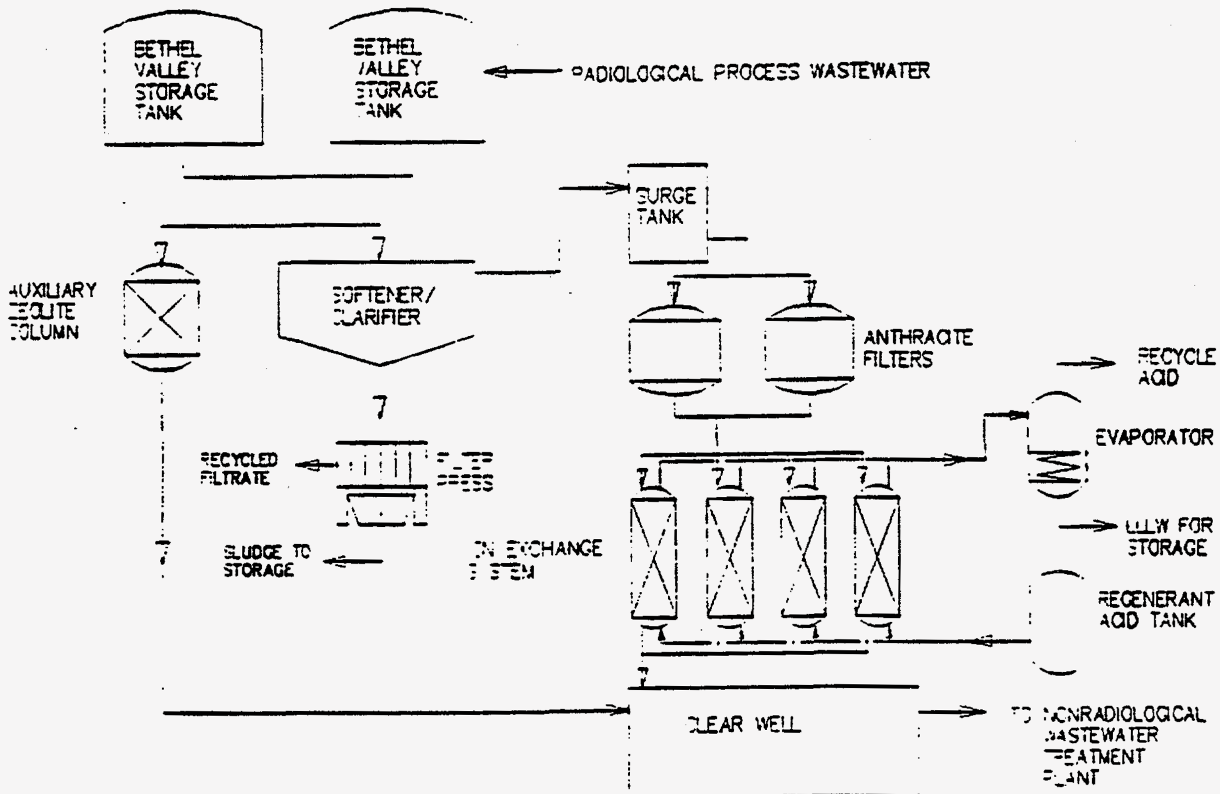
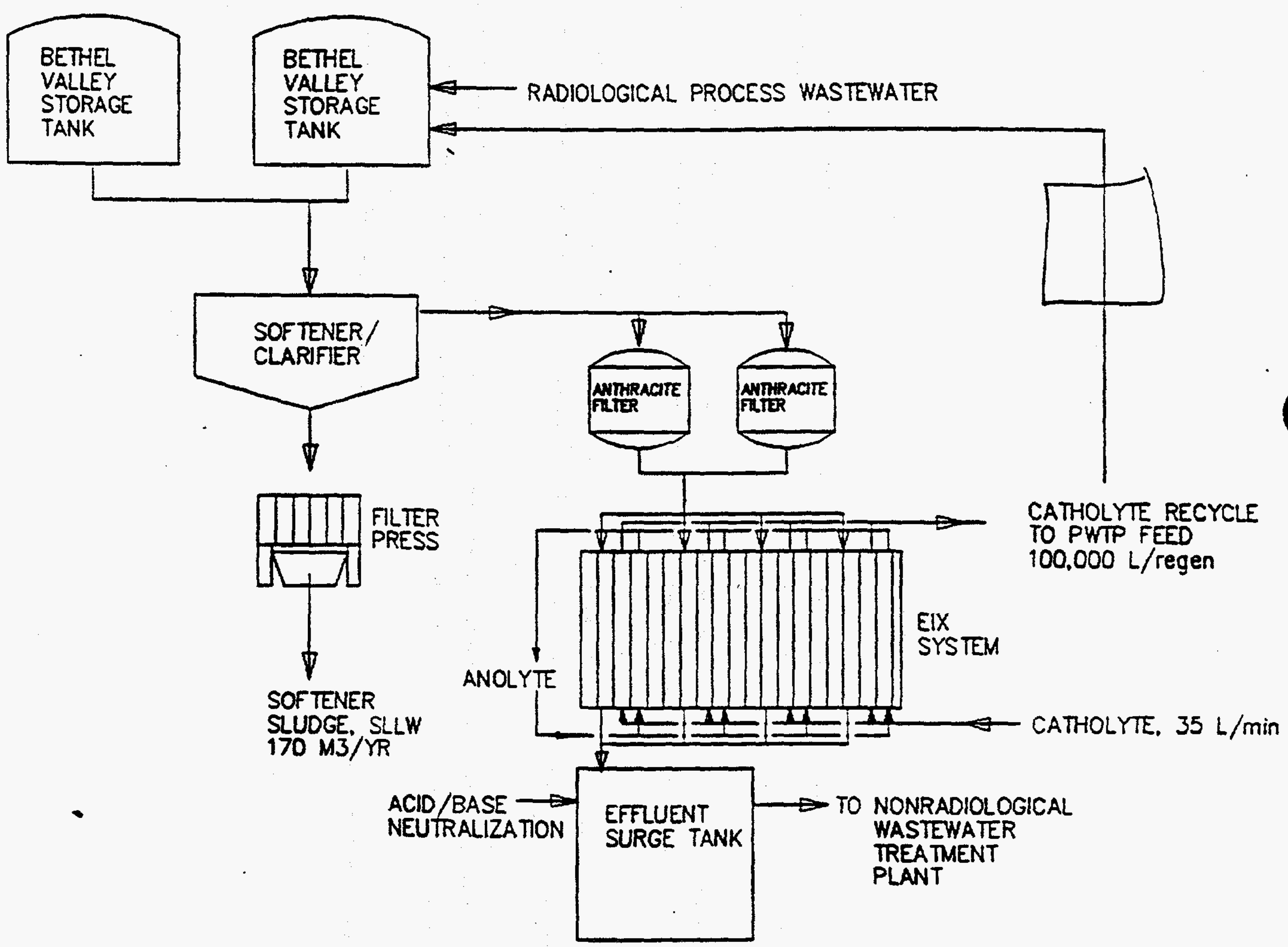


Fig. 1. Existing PWTP process flow diagram.

Fig 2. Flow diagram for full-scale operation of the EIX system at the ORNL Process Waste Treatment Plant



Appendix F (cont)

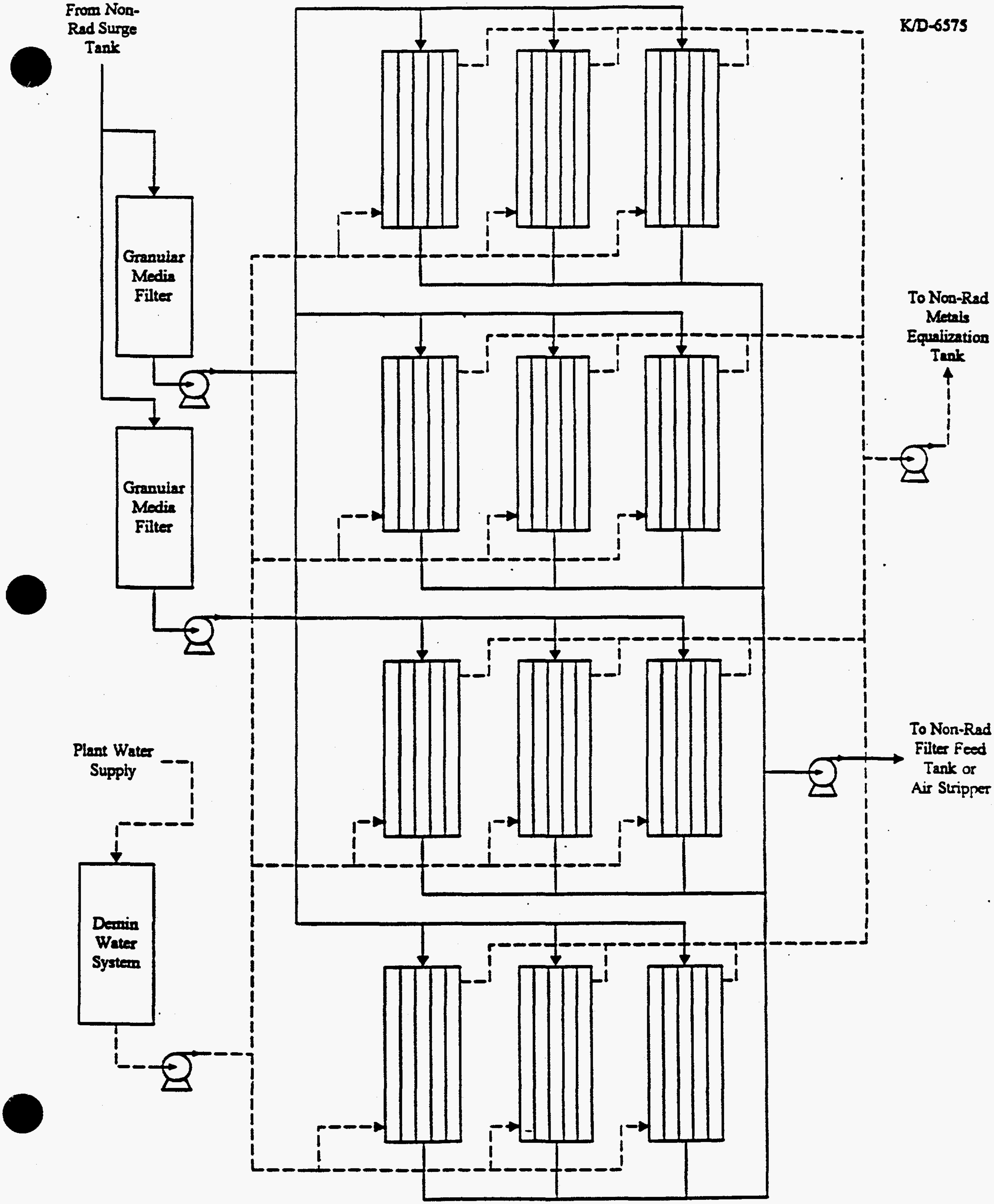


Figure 3. Schematic Diagram of the EIX System for use at the Non-Rad Treatment Plant

Appendix G

PROCESS WASTE TREATMENT COMPLEX

Batch Treatment?

In general, from an operational perspective, stacking water and working it off later is not a good idea unless a treatment system is grossly oversized or flows are typically very low. From a true economy cost perspective, batch treatment can sometimes be justified to lower the cost per gallon of water treated.

Advantages

1. Potentially decreased unit costs.
2. Better utilization of equipment capacities.
3. Low flow conditions may require batch treatment.
4. Applicable to physical-chemical processes; i.e., not biological.
5. Planned waste volume transfers can be controlled.
6. Automation/instrumentation requirements sometimes not as critical.
7. It may be cheaper to pay personnel overtime for infrequent periods when treatment time must be extended than to retain personnel not chargeable to other duties during periods of non-treatment.

Disadvantages

1. Often inefficient.
2. Startup and shutdown problems may occur.
3. Equipment left idle may degrade.
4. May not able to handle flow variations if upstream storage of water is limited.
5. Creates problems in personnel shift rotations.
6. For some energy intensive processes, frequent startup and shutdowns may actually minimize savings.

Appendix G (cont)

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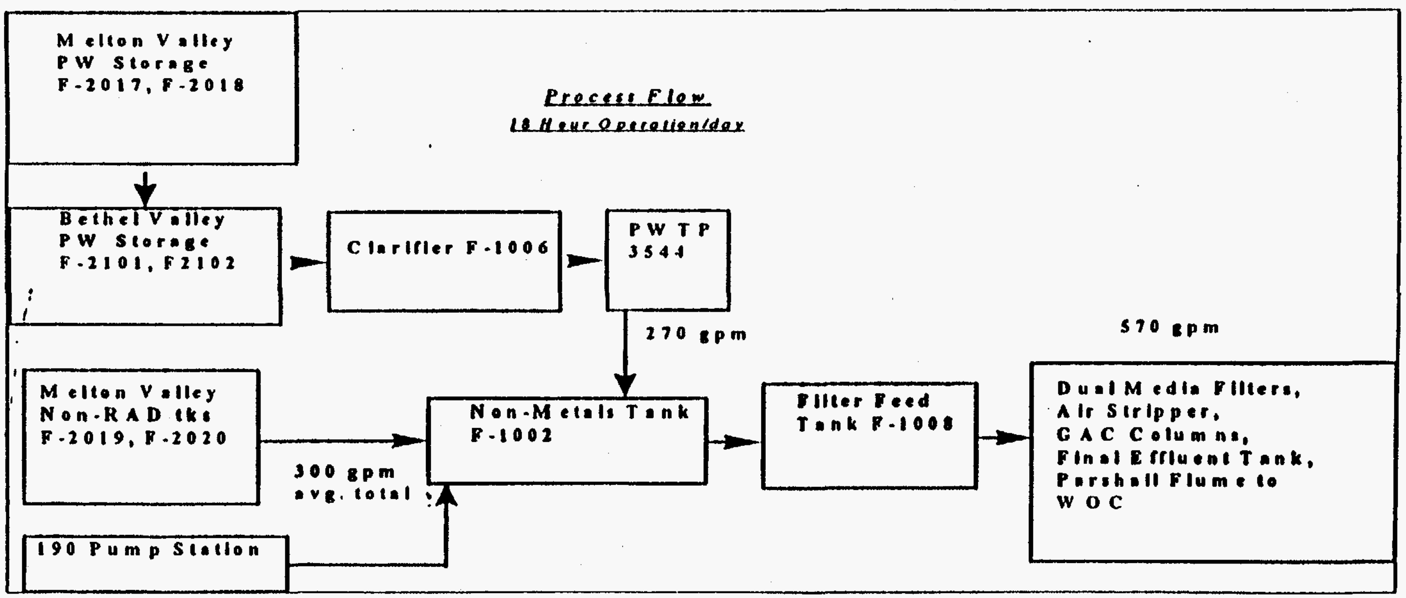
ORNL PROCESS WASTE SYSTEM

Year	Annual Rainfall Inches	TOTAL 3544 PWTP Flow 10^6 gal.s	24 Hour Average PWTP Flow Gal/min	3544 18 Hr Shift 16 Hr trt. Period * Flow Gal/min	Sludge Productio 55 Gal. Drums	TOTAL 3608 NRWTP Flow 10^6 gal.s	24 Hour 3608 NRWTP Flow Gal/min	3608 18 Hr Shift 16 Hr trt. Period * Flow Gal/min
1990	68.27				706			
1991	59.46	75.47	143.6	215.4	705			
1992	47.91	68.54	130.4	195.6	604			
1993	48.97	69.05	131.4	197.1	610			
1994	68.93	79.56	151.4	227.1	625	189.5	360.5	540.8
1995		70.97	135.0	202.5	591	179.6	341.7	512.6
1996		87.01	165.5	248.3		198.8	378.2	567.4
1997		93.98	178.8	268.2		188.9	359.4	539.1

* 18 hour shift assumes 1/2 hour startup, 1/2 hour shutdown, and 1 hour for filter backwash.



ORNL PROCESS WASTE SYSTEM

Appendix G (Cont)

Notes/Assumptions:

1. Upgraded capacity of the 30 ft. diameter NRWTP clarifier (F-1006) is 300 gpm. This will provide softening before ion exchange at PWTP 3544. Clarifier rise rate = 0.45 gpm/sq.ft at 300 gpm influent flow.
2. Polishing filters (L3A, L3B) at PWTP are each rated 170 gpm/unit for a total flow capacity of 340 gpm. Filters to be backwashed at end of shift for clean operation the next day.
3. Four ion exchange columns, each rated 100 gpm are available. Typically one is in service in dry weather periods; two may be used in heavy rain periods. Use and rotate three columns in staggered operation. Keep one spare.
4. Two zeolite columns are available to aid in cesium removal. The columns reportedly average 50 gpm but may achieve closer to 100 gpm/unit capability if new without any solids accumulation. Solids accumualtion can occur if flow is pumped direct from Bethel Valley PW Storage tanks rather than recycling from the L5 clearwell.
5. The 3608 NRWTP is permitted based on 760 gpm capacity. The 3,200 gallon filter feed tank (F-1008) has two centrifugal pumps (J-1008 A,B) each rated 760 gpm. One pump can feed the two dual media filters.
6. The Remedial Systems 8 ft diameter air stripper is rated 760 gpm.
7. The three GAC columns can operate in a single mode or series with one lead, one lag, and one standby. Each 10 ft diameter filter has a surface area of 78.5 sq.ft. At higher flows, use two staggered in parallel, one as a spare to rotate in as required.
8. Continue to keep neutralization plant (3518) flow segregated and treated elsewhere.
9. Expand capacity of existing Perrin filter press from 29 chambers to 39 chambers if not already done.
10. Backwash F-1009, F-1010 dual media filters every day if possible; otherwise one every other day.
11. Bleed in any flow from F-1001 Metals tank as required.
12. Use tank farm operator and WOC operator on 12 hour shifts as presently done. Use day and night shift operating groups on 9 hour shift. Use one relief group or shift breaker working 10 hours/day.
13. Monitor sludge blanket level in F-1006. Add capability for pumped internal recycle of underflow sludge back to the flocculation well in the clarifier.

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Hypothetical

Wastewater Operator Shift Revision
18 Hour Operation

Current Conditions: 28 days x 24 hours = 672 hours operator coverage/position
Four sets of Five Operators (A,B,C,D) on rotating 12 hour shifts, four shift foremen
Four relief operators plus relief foreman

Use: 28 days x 18 hours = 504 hours operator coverage/3544 or 3608 position
One WOC operator on 12 hour shifts as currently done. Rotate as usual
One Tank Farm operator on 12 hour shifts as currently done. Rotate as usual.
Day Operator at 3544: 9 hour shift: Monday through Friday = 45 hours/week; No Rotation (except to 3608)
Day Operator at 3608: 9 hour shift: Monday through Friday = 45 hours/week; No Rotation (except to 3544)
Night Operator at 3544: 9 hour shift: Wednesday night through Sunday night = 45 hours/week. No Rotation (except to 3608)
Night Operator at 3608: 9 hour shift: Wednesday night through Sunday night = 45 hours/week. No Rotation (except to 3544)
Shift Break Operator at 3544: 10 hour days on Saturday, Sunday; 10 hour nights on Monday Tuesday.
Shift break Operator at 3608: 10 hour days on Saturday, Sunday; 10 hour nights on Monday Tuesday.

Appendix G (Cont)

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Note:
1. Nine hour per shift operators will get 5 hours of overtime per week.
2. A minimum one hundred and sixty-eight (168) hours saved per 3608 & 3544 position per month.
   The above overtime differential will reduce the actual savings
3. Actual coverage is 18 hours on Wednesday, Thursday, Friday, and 19 hours on Saturday through Tuesday.
4. Implementation problems may exist with existing union agreements.
5. Cross training of job duties will be reduced.

June 9, 1997

Tim. Myrick

On-Site Treatment and Storage Process Team Report

Attached is the subject Final Report.

Core Team comments on the May 9, 1997 Draft have been addressed. In some cases quantitative responses could not be provided with currently available data; in those instances, qualitative responses have been incorporated into the Report text.

Should you have follow up questions, please contact me (1-4752), Darrell (1-2036), or any Process Team member.

Ray App Jr.

Ray App
On-Site Treatment and Storage Process Team, Core Team Champion

cc: Jeff Baldwin
Jerry Cunningham
Darrell Daugherty
Dave Hall
Mike Hicks
Larry Jones
Jim Mathys
George McRae
Sharon Robinson
Tony Sizemore

APPENDIX L

OAK RIDGE NATIONAL LABORATORY
WASTE MANAGEMENT PROGRAM
RE-ENGINEERING

BENCHMARKING REPORT

WESTINGHOUSE COMMERCIAL
NUCLEAR FUELS DIVISION
COLUMBIA, SOUTH CAROLINA
July 1997

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INTRODUCTION

Westinghouse Commercial Nuclear Fuels Division of Columbia, South Carolina has been in operation since 1969, fabricating nuclear fuel for approximately 60% of the nuclear fuel market. The starting material for the chemical conversion process is uranium hexafluoride (UF_6) which is received from enrichment facilities around the world. The Columbia Plant is licensed to process UF_6 up to a maximum of 5.0 weight percent U_{235}. The product from this process is UO_2 powder. Westinghouse operates a process incinerator here to recover the uranium on site. The plant employs 500 hourly and 400 salary workers at this 550,000 square foot facility.

I. POLLUTION PREVENTION

Organization of Pollution Prevention Program
Pollution Prevention is a function of the Plant Engineering group, made up of four process engineers and one technician. The group leader, Mr. Jim McCormac, has authority to assign and accomplish tasks. He has the primary responsibility of radioactive waste minimization. He has been with the company for over 20 years and is known as "Dr. Waste." Performance Integrating teams, representing a cross section of workers and the next level up manager, operate to observe what is being generated, in order to suggest methods for minimizing waste. The four teams are: the Non-Combustible Team, the Combustible Team, the Uranium Team, the Liquid Waste Team. The teams meet frequently and tour the plant looking for ways to reduce waste.

Acceptance of Pollution Prevention Program
Pollution Prevention has been accepted at all level within the facility. It is a managed approach with support from all levels of management.

Cost Savings
The solid radiological waste disposal costs have been reduced from $6,000,000 in 1985 to $500,000 in 1996. Recognition programs encourage workers to offer waste minimization suggestions. Quality recognition awards are offered, such as a dinner certificate, $25, and/or photo on the bulletin board. The plant publishes a weekly newspaper, "The Pellet," which recognizes workers for their reduction in waste products. Articles are published in this weekly publication that highlight waste minimization topics. Posters are placed on the door at the step-off pads that indicate the current cost of a drum of waste. This information is communicated to the managers. Meeting their waste management goals directly influences merit. Approximately 35% of the managers' performance rating is determined by their group meeting waste management goals.

Cafeteria or Restroom Waste Reduction
Cafeteria waste is considered as sanitary waste and is disposed of accordingly. Hand dryers are used in place of paper towels and dissolvable mops are being considered for use in contaminated areas.

Reducing Chemical Inventory

No procedures are in place for reducing chemical inventory, but a central chemical stores exists for general plant use. Analytical laboratories manage their own chemicals.

Pollution Prevention Benchmarking

There has been no formal benchmarking for the pollution prevention process, however, managers frequently participate in conferences and visit other facilities with similar operations.

II. WASTE CHARACTERIZATION

Characterization Procedures

Segregation up front and throughout the process is essential to successful hazardous waste characterization/classification. Waste that has not entered radiological areas is not sampled for radioactivity. For hazardous waste coming from radiological areas, 100% is analyzed for radioactivity. Only necessary items enter contamination areas. Such items as packing, boxes, pallets, etc., are not taken into the controlled areas and are therefore disposed of as sanitary waste. Very little hazardous waste is generated, no mixed waste is generated, and this facility handles no high activity waste.

Who Characterizes Waste?

Characterization of the waste depends heavily on process knowledge and front end segregation. Waste is characterized by the waste management organization, but is very dependent upon the other process groups for segregation and minimization. For hazardous waste, they do not sample waste to prove the *absence* of hazardous constituents.

Heterogeneous Solid Radioactive Waste

Heterogenous waste does not contain complex radioactive constituents and all has good process knowledge.

No-Rad Added

Westinghouse CNF Division's approach to "No Rad Added" is quite simple; if the material has not been in a radiological area, it is not surveyed (with the exception of screening performed by "microR" truck monitor as it leaves the site going to the scrap metal recycler). If the material has been in a radiological area, it must be surveyed prior to release. Noteworthy is the fact that all releases are based on health physics type surveys. "Less Than" values are considered to be the amount that can not be detected by health physics instruments.

On-Site Transport

No extra requirements are imposed for on-site transport of waste.

III. WASTE CERTIFICATION/VERIFICATION

Type of Generator
Although the Westinghouse Commercial Nuclear Fuel (CNF) Division Plant has several sources of waste (i.e., the various process groups), the site is considered one generator. The facility is separated into two sections: a "contaminated side" where the conversion and pelleting takes place, and a "clean side" where assembly and inspection is conducted. The clean side has a hazardous waste program for the acetone and perchloroethylene. Behind the "wall" there are three groups who generate most of the radioactive waste - Maintenance, Conversion, and Pelletizing., with Maintenance producing at least 50%.

Waste Certification Costs
Certification costs are not well defined here, however, burial cost is well documented and tracked consistently. The cost of waste management for low level waste burial is at $250,000 - $500,000.

Waste Certification/Verification Benchmarking
Some attempts at benchmarking have been made, however, there are not many facilities that have similar operations to make benchmarking useful. The facilities which have similar operations do not place the same emphasis on waste that the Westinghouse CNF facility does.

Waste Streams
From a characterization and certification standpoint, this facility represents a very simple and straightforward challenge. Uranium, which is the only radiological contaminant, is very well assayed prior to introduction into the process. Final assay is performed by simple NDA techniques using a Sodium Iodide detector and extrapolation to quantify other, non gamma emitting isotopes. Much more effort is required on waste streams with complex radioisotope makeup. The process itself is very well defined and lends itself nicely to "Process Knowledge" type approach to characterization. This is especially true since close tracking is required for accountability reasons, and the contaminant is a valuable resource that represents a financial loss when introduced into the waste stream.

Waste Minimization
Waste minimization is a key factor in the operation of this fuel reprocessing plant. Approximately $20 million is spent within the plant on waste-related handling. The waste minimization driver for now is the concern that Barnwell may be closing. Additionally, factors such as product recovery and accountability push them to minimize waste generation, regardless of the cost effectiveness. While this full blown approach would not be effective for the Oak Ridge National Laboratory (ORNL), some of the techniques and philosophies may be useful.

Recycling
Recycling is used extensively and most parts and components are refurbished until they can no longer be reused. If any future use can be assumed for the material, it is salvaged. This type of "hot tool" and equipment storage area is useful. Metallics, such as flanges, valves, pumps, and actuators are sent to a Rebuild/Reuse Storeroom. Approximately 10% by total weight of the metallic waste generated is reused. This inventory is maintained on a computer database and checked by procurement prior to ordering new equipment. Contaminated respirators are cleaned onsite and reused. Contaminated laundry is sent off site to a decontamination facility.

Decontamination of radioactive metallics is accomplished by one of several processes, including liquid honing, ultrasonic cleaning, hot wash, and/or mild nitric acid. Free release and metal melt are also used for metallics. Non-metallic waterglass is handled by minimization, nitric leaching, weak acid wash, and free release, while non-metallic solvent extractions are neutralized and free released. Free release is a primary emphasis - 10,000 pounds/month on average, which is 50-60% of total waste that could not be reused. Before an item can be free released, a 100% survey is required.

This year approximately $2-3 million is budgeted for recycling. Oil, nickel plating, and zirconium wastes are reclaimed and cardboard is recycled.

Substitution is considered by each generator as a method of reducing radioactive waste. For example, the health physics technician switched from metal to cardboard plauchets, which can be incinerated.

Contaminated Recycled Waste
Contaminated metals and sludge are sent to Manufacturing Sciences, Chem Nuclear, and SEG. Levels of allowed contamination are based solely on the buyers' limits. Waste for off-site shipment is characterized once, just prior to shipment.

Radiological Area Control
The "wall" between the clean process and the contaminated process provides the barrier to allow a process knowledge decision on No-Rad Added for hazardous waste shipments.

IV. HAZARDOUS/MIXED WASTE

The clean side of the process produces two hazardous wastes that can not be reused, reclaimed, recycled, or sent to the sanitary landfill - acetone and perchloroethylene. There is no known mixed waste at the site because the uranium is recovered, through treatment onsite. Combustible waste is ground and incinerated and the residue is checked by TCLP tests to show it is non-hazardous.

Storage
There is no treatment, storage, and disposal of hazardous waste on site. Only 6-7 drums are kept in the 90-day storage area at any one time. The clean side of the process is not checked for radiation because process knowledge is used for hazard characterization, keeping all radioactive materials isolated to the other side of the wall. The clean side waste is free released and the trucks are checked when leaving the plant. M&M Chemical disposes of the hazardous waste.

Procedures
Waste generated during a shift are taken care of by the shift which generated it and not left for the next shift or for the next day. Waste for off-site shipment is characterized once just prior to shipment. Hazardous waste is picked up at the 90-day area. NDA is used for assay before shipment to SEG which has a 250g limit.

Cost
There is an effort to place the cost of waste disposal back into each manager's budget, thereby giving each of the groups incentive to reduce waste disposal. There was no information on the specific cost of hazardous waste disposal.

V. GENERATOR/WM COMMUNICATION

Waste Forecasts
How are waste forecasts made at this facility?

Charge Back
Individuals responsible for the various waste streams are part of the planning process for project work, maintenance, and operation. In project work, waste disposal is funded up front, they do not overrun estimates. There is a charge back system for maintenance and charge back to the generators is at the gross operating level only.

Management Involvement
Senior management reviews performance quarterly. Waste minimization has been directly related to each manager's performance plan.

VI. REPORTING/RECORDS

Record Keeping
Bar code technology is used extensively in managing and entering information directly into the manufacturing data base. The fuel cladding is permanently marked by a laser-etched bar code process prior to introduction of the cladding into fuel assembly manufacturing. The material is

accounted for at least semiannually. Waste tracking paperwork begins only as waste is leaving the plant. Waste handoffs have no paper, and waste pickups of metal are by WAC receiving team.

Compliance
Accountability is checked by the NRC twice each year.

Manifests
Nondestructive assay is required for uniform manifest to SEG or Chem Nuclear.

VII. DISPOSAL END POINTS

Off Site Disposal
The plant uses SEG and Chem Nuclear for volume reduction of metal and they dispose as free release (at 5000 dpm) or as LLW. Hazardous waste is picked up by M&M Chemical.

On Site Disposal
There is no on site disposal of hazardous waste.

VIII. WASTE TREATMENT, STORAGE, AND DISPOSAL

Type of Facility
The plant has no storage for waste except for one 90-day RCRA area. Primary focus of treatment is recovery of raw material used in the process. Disposal is accomplished through subcontract. They maintain their own sewage treatment facility and have an NPDS permit with one licensed pipe. The plant treats 50,000 - 60,000 gallons per day of sanitary and an equal amount of process liquid waste daily.

Costs
Disposal of solid radioactive waste is $400/cubic foot at Barnwell. They have not shipped direct to Barnwell in over 2 years. For density above 75lb/ft, they send waste to SEG.

Treatment
Treatment to reclaim chemicals used in the processes is designed in each operational unit. Contaminated HEPA filters are a major concern. If a filter is contaminated above 5g U_{235}, it is dismantled, the paper and wood are incinerated, and the aluminum is melted. A central PWPT is used for the liquid stream prior to discharge to the environment.

Procedures
Operating procedures exist for the processes. They are written and updated every three years by the engineers assigned to the various operating units. Operators are trained to the procedures which are on computer, they have no paper copies of procedures.

Conduct of Operations
A detailed conduct of operations for all waste treatment/storage operations is maintained, as well as a very tight configuration control. Their compliance staff consists of the following personnel: Staff Manager, Criticality Engineer, Environmental Engineer, Safety Engineer, and Regulatory Engineer.

Wastewater
The wastewater treatment plant treats sanitary sewage and process waste which removes uranium and calcium carbonate. Calcium carbonate is sold and uranium is routed back to the process. After the aerator, the waste is dechlorinated through sulfur dioxide system to < 1 ppm. Operational costs were not identified. There is no automation, four operators each shift operate the plants.

Training
All wastewater operators have a South Carolina class "D" license. One class "A" licensed person is required.

Waste Stream Changes
The waste stream is consistent. Ammonium fluoride is the only liquid discharged from plant.

OAK RIDGE NATIONAL LABORATORY WASTE MANAGEMENT PROGRAM RE-ENGINEERING

BENCHMARKING REPORT

LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL MANAGEMENT ORGANIZATION
LOS ALAMOS, NEW MEXICO
June 1997

Table of Contents

The Oak Ridge National Laboratory (ORNL) Waste Management Re-engineering Team has been tasked to determine the criteria that measure performance, to recognize problematic aspects of waste management services, and to improve service delivery. The Team began its efforts by identifying areas for improvement in the waste management program. Those areas were then evaluated according to seriousness, urgency, and growth, resulting in the following eight categories: pollution prevention; waste characterization; waste certification/verification; hazardous/mixed waste; generator/waste management communication; reporting/records; disposal end points; and waste treatment, storage, and disposal.

Process teams were established to study each of the target areas. To assist with this process, three sites were visited to benchmark best practices of waste management in both private industry and government. The three sites chosen for this study included the following:

- Westinghouse Commercial Nuclear Fuels (WCNF) Division, Columbia, South Carolina,
- Los Alamos National Laboratory (LANL), Los Alamos, New Mexico, and
- Dow Chemical, Midland, Michigan.

A benchmarking team of five people, representing ORNL, visited the Los Alamos National Laboratory (LANL) on June 5-6, 1997: Jonathan Forstrom, Office of Environmental Management Programs; Karl Haff, Chemical Technology Division; John Norman, Chemical Technology Division; Kimberly Thomas, Chemical and Analytical Services Division; and Susan Duncan, PrSM Corporation.

Daniel Brennan served as the LANL contact and prepared the following agenda: Waste Management Overview, Environmental Stewardship, Hazardous Waste Operations Overview, Radioactive Liquid Waste Treatment Facility Overview, TRU Waste, Closeout and Discussion.

By analyzing the waste practices of ORNL against those of the three sites visited, the ORNL Waste Management Benchmarking Team will be able to identify specific process improvements and provide recommendations for best management practices. This report describes the process of waste management at LANL.

INTRODUCTION

Los Alamos National Laboratory (LANL) is operated by the University of California (UC) for the U.S. Department of Energy. The University manages a large multi-program laboratory on the 43 square mile site with approximately 6,850 UC employees plus 3,500 contract personnel. The Fiscal Year (FY) 1997 budget is approximately $1.0 billion, and 90% of the funding is from the Department of Energy.

LANL programs include the following: nuclear weapons stockpile stewardship and management, energy research, nuclear safeguards, biomedical science, environmental protection and clean up, computational science, and materials science. Nuclear Weapons Science and Technology is the largest program and generates the largest amount of waste. Environmental Management (EM) is the second largest program, receiving 15% of the total budget.

The EM Organization includes Waste Management, Environmental Restoration, Environmental Stewardship, Integrated Science and Technology, Rad Liquid Waste, and Solid Waste Operations. Waste Management manages the following waste types at LANL: Radioactive, including low level, transuranic, and liquid radioactive; Chemical and Toxic, including RCRA waste, non-RCRA chemical waste, PCBs, asbestos, and medical/biological waste; and Mixed, treating all TRU waste as if it is mixed.

I. POLLUTION PREVENTION

Organization of Pollution Prevention Program

According to the Site Pollution Prevention Plan for Los Alamos National Laboratory, LAUR 97-1726, the laboratory management is organized in a matrix of program and technical/support divisions. Technical divisions contract with support divisions and subcontractors for products and services. Technical and support divisions are responsible for pricing their products such that the cost of avoiding environmental impact is included.

The Laboratory Director has delegated responsibility for leading pollution prevention to the Director of EM for the Laboratory. EM has established an Environmental Stewardship Office (ESO) to integrate the Laboratory's pollution prevention effort into a systems framework.

Acceptance of Pollution Prevention Program

Pollution Prevention acceptance varies by facility. It is somewhere between a managed approach and a natural transition with moderate support from management. The term "zero discharge" has been changed to "substantial reduction" to make the program more accepted.

Cost Savings

There are four lawsuits pending which serve as a driver for the pollution prevention program. In addition, there are three performance measures in the LANL contract that are based on volume only.

By 2007, presently available technology will have been implemented, so that waste and pollutant releases will be technology-limited. By 2010, the Laboratory will approach zero waste generation and pollutant release.

LANL has a pilot generator set-aside fee (GSAF) program that collects a fee, equal to 5% of treatment, storage, and disposal (TSD) costs, for all waste generated on site. Proceeds are used to fund pollution prevention investments. In FY 1996, $719,000 was collected, and seven projects were funded at a cost of $399,000.

The Laboratory is currently meeting many of the DOE Goals for 1999. There has been a consistent reduction in volume for all waste types from 1993 to 1996.

Cafeteria or Restroom Waste Reduction
The cafeteria is outsourced and pollution prevention is the subcontractor's responsibility. ESO is working with the subcontractor to increase their recycling. Restroom waste reduction is also handled by a subcontractor, Johnson Controls, Incorporated (JCI), and they have a coordinated waste minimization program.

The Laboratory currently recycles ~80% of its total sanitary waste. This high percentage is due largely to the County Landfill using a large volume of concrete rubble as fill for a land bridge between two canyons.

In years FY 1997 and beyond, a continued downward trend of routine sanitary waste generation is expected due to increased emphasis on source reduction opportunities available to administrative, custodial, and canteen personnel; and introduction of a more inclusive, but streamlined recycling/reuse program.

Reducing Chemical Inventory
Chemical inventory has been falling for the past several years due to the pollution prevention emphasis and management support, however, there is no formal mechanism set up for reducing chemical inventory.

The Laboratory has implemented a number of measures to achieve the culture change to prevent pollution. One of the notable projects is the CHemical Exchange Assistance and External Recycle Program (CHEAPER) - which accepts materials that would otherwise be disposed of. Hazardous wastes are not generally disposed of or stored on-site, but are shipped off-site or reused through the CHEAPER program. They would like to improve the CHEAPER program by integrating it into the procurement system, moving CHEAPER inventory closer to point of use, and increasing CHEAPER manpower.

Pollution Prevention Benchmarking
There has been no formal benchmarking for the pollution prevention process.

II. WASTE CHARACTERIZATION

Presently, most characterization is based upon information obtained from the Waste Profile Form

(WPF). The WPF is well suited to gather yearly information on predictable waste streams but not from waste generated from research projects which are inherently coupled with frequent changes in waste stream profiles.
Evidence suggests that LANL Waste Services is presently undergoing transition to a system of greatly increased rigor regarding characterization/certification. The recently generated Interim Laboratory Implementation Requirement (Waste Acceptance, Characterization, and Certification Program) (under review), the formalization of what constitutes acceptable knowledge (in development), and their vigorous and laudable TRU Program to meet Waste Isolation Pilot Plant (WIPP) requirements is evidence of this transition.

The "end of pipe" management style of LANL Waste Services is dependent on "waste coordinators" which are individuals from the line divisions who act as interface between Waste Services and the generator. These individuals appear to act as "expediters" and are not used to enhance characterization rigor or the certification process. Waste coordinators are made up of 25% full time and 75% part time members. They are predominately from the technical areas of the research divisions. Several comments from Waste Service personnel led one to believe that significant unrest and criticism exists among the waste coordinators. Requests were made to interview representatives of the waste coordinators. After several discussions with Waste Services personnel, the topic was not pursued further.

Characterization Procedures

There are presently no guidelines or procedures for the characterization of hazardous waste. Characterization is primarily based on generator knowledge and is evaluated on a case-by-case basis, prior to pickup, without benefit of written guidelines. However, TRU waste is fully characterized with guidelines and procedures in preparation for impending disposal at WIPP.

Generators have the responsibility for characterizing their waste using their own funding - this is not funded by EM30. The generators have the best knowledge of the process and the waste management coordinators have the best knowledge of the paperwork. Therefore, a Waste Management Coordinator (WMC) serves each division or facility that generates waste, either as full-time or part-time for that group, as needed. The WMCs are made up of research staff members (technicians) who carry out waste management functions. Their salary is paid by the division they service. There is currently 75 WMCs, but they are making changes to the program to reduce the number to 30. It is anticipated that the WMCs will become full-time employees and will be housed in EM and matrixed to groups, as needed.

WMCs complete the Waste Profile Form and tag the waste with an item identification number. They package for WAC, however, lab packing is done by the Transportation Group. Another valuable service provided by the WMCs for the researchers is their searching for chemicals in the chemical inventory database.

Who Characterizes Waste?

The generator, with assistance from Waste Services, classifies the waste based on process knowledge and sample analysis, when process knowledge is not sufficient. An acceptable knowledge document providing guidelines for consistent classification is currently in draft form. In addition, an Interim Laboratory Implementation Requirements document (ILIR404-00.01.0) which outlines the "Waste Acceptance, Characterization, and Certification Program" is undergoing lab-wide review.

If the waste is sent off site, it is fully characterized to the criteria of the accepting facility. The Laboratory maintains a graded characterization for on-site disposal.

Heterogenous Waste
Since the material will be disposed of on-site, very little rigor is applied to its characterization. There is a heavy reliance on available information from the generator with little effort to fill in the blanks.

Waste Stream Knowledge
The Waste Services Organization operates under the assumption that all waste streams are predictable and uses the Waste Profile Form (Form 1346) for the generators to register all the physical and chemical characteristics of their waste streams. This information is acceptable for one year and must be revised if "major" changes occur in the waste stream.

Mobile/Portable Characterization
LANL has developed mobile and portable units for waste characterization to comply with regulations for transport, storage, and burial at the WIPP. The technical efforts and the capabilities developed by LANL in the area of waste characterization have revolutionized mobile characterization and have led LANL to be recognized by the National TRU Program Office as a leader in the field. LANL developed the following mobile/portable characterization units:

- Mobile Passive/Active Neutron Interrogation (PAN) System
- Mobile Segmented/Tomographic Gamma Scanner (S/TGS)
- Mobile Real Time Radiography (RTR) System
- Portable Drum Venting System (DVS)
- Portable Characterization Glove Boxes
- Portable Drum Coring System
- Drum Head-Space Gas Analysis System
- Mobile VOC-SVOC System
- TRU computer modeling software

No-Rad Added
There is no formal No-Rad Added program at LANL. Since the waste goes to a temporary storage, the generators were educated and quickly brought on board because they had to get their waste out of their areas.

The LANL No-Rad Added "program" is not a program at all, but rather an inherent part of the waste management process. The generator simply notes on the Waste Profile Form whether or not the waste originated in a radiologically controlled area (RCA) and whether it is radioactive, and then certifies it "based on knowledge of the waste." If the generator certifies the waste as non-radioactive, Waste Management accepts the waste as such, and no further evaluations and/or reviews of the radiological status are conducted, except a Health Physics survey of the shipping containers prior to offsite shipment. Sampling and analysis is rarely done and questionable waste is treated as mixed. A high GSAF tax is placed on mixed, thereby keeping the use of this option to a minimum.

On-Site Transport
As a Best Management Practice, DOT regulations are imposed for on-site transport of waste. If this can not be satisfied, then the roads are closed to traffic while transporting waste. TRU waste, which meet DOT requirements for packaging, etc., are shipped on-site without road closure.

III. WASTE CERTIFICATION/VERIFICATION

Type of Generator
Each individual generator is considered a generator.

Certification
Legal certification is done by the generators who have classified it. Certification for all waste streams, except TRU, consists of the waste generator's signature on the Waste Profile Form (Form 1346).

WIPP WAC
LANL has the capability to certify waste according to the WIPP Waste Acceptance Criteria (WAC), Revision 5 (Rev. 5). The required capability to support certification includes procedural control of waste generating and characterization processes, associated record keeping and documentation processes and facilities, an identified Waste Certification Official (WCO) and Transportation Certification Official (TCO). These officials must evaluate waste characterization and packaging information to make certification determinations. Waste stream profiles, data packages, and transportation manifests necessary to enable shipment are prepared. The WCO and TCO coordinate all activities that ensure that the waste is certifiable and able to be shipped.

Laboratory TRU waste generators maintain procedural control of TRU waste generating processes, and as part of the process of revising attachments, generator procedures will also be modified where necessary for generated waste to be certified. Characterization requirements of WIPP WAC Rev. 5 are being phased in for newly generated TRU waste.

As of December 31, 1995, the total volume of TRU waste recorded in the TRU database was

11,167 m^3. Of this volume, 2,596 m^3 could potentially be reclassified as "buried" TRU and be removed from the inventory of waste to be sent to WIPP. Their remaining volume of 8,571 m^3 is considered retrievably stored.

Waste Certification Costs

The Laboratory plans to ship ~ 2500 drums the first year. Complete workoff of the entire inventory is estimated to require 17 years while shipping 2500 drums per year with a total cost of $277 million. The cost estimates include retrieval, storage, on-site transportation, characterization, repackaging, treatment as required, and certification for all retrievably stored TRU wastes.

Waste Certification/Verification Benchmarking

The Chemical and Mixed Waste Management Group has benchmarked CEBA-GEIGY Corporation, Motorola's Government and Space Technologies Group, Enterprise Advisory Services, and the Waste Management Division of DOE-Nevada Operations for the purpose of evaluating the efficiency of the paperwork process required for waste acceptance, transportation, and disposal at LANL.

Rad Waste Reduction

The Site Pollution Prevention Plan for LANL highlights several targets for reduction, both legacy waste and newly-generated waste, including waste minimization improvements to the TA-55 nitric acid process line. In CY 1996, the Plutonium Facility at TA-55 generated 76% of the TRU/MTRU waste at the Laboratory.

Radiological Area Control

Material originating from non-rad areas is considered non-rad with the generators signature on the Waste Profile Form. Material from rad areas is considered non-rad if the generator provides acceptable process knowledge. Sampling and analysis are seldom used. No other controls are available.

IV. HAZARDOUS/MIXED WASTE

The hazardous/mixed waste process currently followed at LANL was very similar to that presently followed at ORNL. Unfortunately, that means they are struggling to deal with some issues which are similar to those being dealt with at ORNL, however, ORNL could certainly benefit from their example in a couple of areas.

One of these is the timeliness in which they can pick up hazardous/mixed waste from generator areas because they have sufficient storage space, the result of making timely offsite shipments to vendors for disposal. This ability is a direct result of their no-rad-added "program," as described in Section II.

Another worthwhile example is the recognition that the generators should not be asked to classify waste (determine EPA and DOT codes, etc.), but rather this is more appropriately a function of Waste Management Services. This is precisely what the ORNL Hazardous/Mixed Waste process team has recommended, and LANL is proving on a daily basis that it works more efficiently that our current approach.

The "legacy waste team" provides a method of clearing out abandoned wastes and materials that is worth considering. The team consists of personnel from various organizations and they go "door to door" to identify unknowns. LANL has laboratory overhead funding appropriated for this operation. Because it is laboratory funded and expertly implemented, it prevents "closet stuffing" of abandoned materials.

Storage
Hazardous wastes are not generally disposed of or stored on-site, but are shipped off-site or reused through the CHEAPER program. Hazardous wastes managed through EM/SWO are mainly disposed of through one of two primary Laboratory sub-contracting operations (Rollins Chempak, Inc. and Chemical Waste Management, Inc.). Radioactive asbestos, and PCB contaminated soils and containers are disposed of on site. Solid low-level waste (SLLW) is disposed of on site. A 35-acre expansion of the present burial grounds is presently in the approval cycle. This expansion will provide LANL with approximately 100 years of disposal space for SLLW at current generation rates.

Procedures
90-day areas are managed by generator organizations and their waste coordinators. Generator requests pickup, waste management transport group picks up the waste, using University of California employees or JCI employees, depending upon logistics. LANL ensures that hazardous/mixed waste stream management begins at the point of generation by Environment, Safety, and Health (ES&H) procedures, generator training, and the Waste Coordinator program. They provide a quality assurance check to ensure waste streams are not co-mingled and incompatible wastes are not routed to common collection points by relying on the generator not to co-mingle waste at the point of generation. This then ensures Waste Management of compatibility when the waste is picked up.

The individual waste generator, working with the WMC, completes the Waste Profile Form (WPF) and Chemical Waste Disposal Request. Waste Management then classifies the waste according to EPA and DOT regulations. Waste Management picks up the packages and transports the waste to storage. Large volumes of hazardous wastes are shipped directly off-site from 90-day areas.

Cost
The disposal fees are charged back to the Laboratory at commercial rates specific to the disposal circumstance. The actual cost of disposal varies with circumstances, however, the average cost is \$8.17/kg.

V. GENERATOR/WM COMMUNICATION

Waste Forecasts
The Environmental Stewardship Office disseminates data on the generation of waste and pollution, establishes incentives for pollution prevention, and brokers pollution prevention investment projects. Each major waste or pollution-generating division is responsible for organizing its own pollution prevention plan, process, and implementation.

Charge Back
Management of newly generated and legacy waste is directly funded by DOE/EM. In FY 1999, waste generating programs will assume the cost of waste. Management of air emission systems and effluent outfalls is funded by the emission/effluent generating programs. Management of regulatory permitting and inspection of emissions and effluents is funded either directly by mission programs or through the general and administrative (G&A) overhead charge.

Management Involvement
The highest management involvement comes from the division director level. Even then, it only happens in negotiations between Environmental Management Organization and the Chemical Science and Technology group.

VI. REPORTING/RECORDS

Record Keeping
Waste Services manages the Waste Management Coordinator Program. They assign all the codes and perform the classification using the Waste Profile Form. This form is not yet on an electronic generator entry system, so it is manually completed and entered into a database by Waste Management. In addition, they keep hard copy versions of everything in order to retain signatures. LANL uses bar coding to track waste containers with direct bar code linkage to their database. Also, some of their inspection records are captured electronically with palm-top computers, but these are printed out for QA verification and signatures.

Compliance
The Environmental, Safety and Health Division monitors and supports environmental compliance. The EM/SWO and EM/RLW groups and the TRU waste team in Chemical Science and Technology (CST) Division manage waste data, end-of-pipe waste minimization, and also processing of legacy wastes.

Manifests
Bar coding is used to track waste movement, however, hard copies are printed for signatures. A combination of hard copy and electronic recording is used, but only the hard copy is considered the "record" copy.

Waste Management ensures that manifest hand-offs occur at interface points with generators by picking up the waste at the generator site. All on-site shipments are manifested according to DOT regulations as if being transported offsite. If this can not be accomplished, the roads are closed to traffic while transporting waste. Presently, there are only two EPA identification numbers for the main laboratory and "hot rock" area, but they expect this will change to a separate identification number for every Technical Area in the future.

RCRA unit inspection records are kept via hard copy for quality verification and signatures. Former CST division units are doing inspections with hand-held computers, but former Waste Management units are not.

VII. DISPOSAL END POINTS

Off-Site Disposal
LANL uses off-site disposal for a number of materials. TRU materials are presently stored awaiting the opportunity for shipment to the Waste Isolation Pilot Plant. An extensive characterization program (discussed in Section II of this report) for this material has been developed by LANL in preparation for shipment of this material to WIPP. Some SLLW is shipped to Scientific Ecology Group (SEG) for size reduction (incineration) and then shipped to a final disposal site. LANL no longer does any incineration on-site. Materials are compacted prior to shipment to SEG. The LANL contract with SEG calls for the materials to be shipped directly to the final disposal site, which is currently Envirocare. The materials are not returned to LANL as in the case of materials currently shipped by Energy Systems to SEG in Oak Ridge. LANL also used the Los Alamos County, New Mexico landfill for disposal of materials which are not radioactively contaminated. LANL does not send any materials to the Nevada Test Site (NTS).

On-Site Storage
LANL has some materials for which no disposal end point is defined at the present time. These include mixed wastes and some few other wastes which can not be characterized. While the team did not get a volume of these materials, we were led to believe that the volumes were very low for these materials.

On-Site Disposal
On-site disposal is mainly used for SLLW and some TRU materials.

VIII. WASTE TREATMENT, STORAGE, AND DISPOSAL

The following information was distributed to the team by Ken Hargis, Waste Management Manager of Operations, and summarizes Waste Treatment, Storage, and Disposal.

Type of Facility
LANL operates six facilities that characterize, treat, store and dispose of waste with a staff of 250 funded through the Waste Management budget of $50 million for FY 1997. In FY 1996, LANL collected, treated, and released more than 5,200,000 gallons of liquid radioactive waste. In FY 1996, LANL managed the following:

- Low-Level Mixed Waste 54 m^3
- Low-Level Waste 3,600 m^3
- Transuranic Waste 112 m^3
- Chemical Waste 714 m^3

As of October 1996, the amount of Legacy Waste managed was:

- Low-Level Mixed Waste 729 m^3
- Transuranic Waste 8,683 m^3

The 10-year Plan projects a workoff rate for the low-level mixed legacy waste of the year 2003, and the TRU by 2005.

Most waste types are treated, stored and disposed of on site. At LANL, management of TRU waste has been directed toward storing and preparing the waste for eventual shipment and disposal at the Waste Isolation Pilot Plant in Carlsbad, New Mexico by April of 1998. Chemical and Toxic Waste and Mixed Waste are disposed of offsite.

Table 1. Treatment, Storage, and Disposal Practices at Los Alamos National Laboratory

Waste Type	Present Practices
Low-Level Waste	On-Site Disposal
Transuranic Waste	On-Site Storage
Liquid Radioactive Waste	On-Site Treatment and Disposal
Chemical and Toxic Waste	On-Site Collection, Storage, and Repackaging Off-Site Disposal
Mixed Waste	On-Site Storage Off-Site Treatment and Disposal

Wastewater
All process water goes to the same system as the non-process. They are currently charging a flat fee for hook-up, but this operation goes back to the Defense Program funding in FY 1999. Each

generator completes an annual survey for certification. The treated effluent discharged has dropped from 52.8 million liters in 1980's to 17 million liters in FY 1996.

Waste water is treated by a precipitation/filtration process and the liquid effluents are sent to an out-fall and must meet Clean Water Act (CAA) requirements for discharge to a dry stream bed. The precipitate is dried and stored for shipment to WIPP as a solid TRU waste. The current process is monitored by an extensive computerized system. Most system operations are performed by hand, however capability exists to operate the system remotely. Waste is not pretreated except by one area in LANL. The area which pretreats the liquid waste is TA-55 and is the largest liquid waste generator in the Laboratory. The precipitation/filtration process is being replaced by a membrane, reverse osmosis process. The reverse osmosis process will cut the volume of solid waste generated by the liquid waste treatment significantly.

IX. SUMMARY

Overall, LANL was found to be strikingly similar to ORNL in the waste management process, program organization, implementation, and current issues. In some cases they are already implementing some of the proposals we have made during this re-engineering effort, proving that those recommendations are realistic and can be implemented.

Generally, Characterization and Certification are interpreted by LANL Waste Services to mean a gathering of available process knowledge from the generator. There is very little pressure to conduct Sampling and Analysis or require quality based certification. The entire certification process, except TRU, consists of the generators signature under a "to the best of my knowledge" statement on the Waste Profile Form. It is believed that this luxury exists because of the historical availability of adequate on-site disposal facilities.

The LANL waste coordinator program, is presently made up of about 75 individuals from the generator organizations. The staff is made up of 25% full-time, and 75% part-time personnel. They are evolving toward a group similar to the ORNL Generator Interface Group. They would like to have about 30 full-time waste coordinators working for waste management and providing a service back to the generator organizations.

Efforts that have made a noticeable impact at LANL are as follows:

- Pollution Prevention - LANL has raised the profile of pollution prevention, calling the program Environmental Stewardship. It appears to have high visibility at Los Alamos, at least in part due to environmental activism in New Mexico. This is one of our recommendations.

- CHEAPER Program - a Pollution Prevention program for reuse of laboratory chemicals and equipment. This seems to pay big dividends with minimal investment. Part of this success may be primarily due to one individual's initiative and commitment. This is one of our recommendations (Chemical Stores).

- "Green is Clean" Program - segregation of waste from radiological areas to be surveyed and free-released to the local landfill. With the cooperation of DOE and the county, they have been able to re-implement this program even after three separate incidences of contamination in the county landfill. It reduces their solid low-level waste stream by about 70%. This is one of our recommendations.

- TRU Waste certification to WIPP - LANL will be the first to ship to WIPP. It will clearly be of benefit to ORNL to do some in-depth benchmarking of this particular program so that when ORNL is ready to ship TRU Waste to WIPP, it will be properly characterized and certified to meet the WIPP Waste Acceptance Criteria.

The LANL TRU Waste Characterization and Certification Program is vigorously being implemented and appears to be a top-notch program which warrants further study. The program is on track for the shipment of ~ 2500 drums beginning April of 1998. Estimates predict a complete work-off of inventory in 17 years at a total cost of 277 million dollars. The annual budget for this initiative is 17 million dollars and estimates predict the shipment of ~ 2500 drums per year.

Most noteworthy in the TRU Program is the development of mobile and portable characterization capabilities which greatly increase operational flexibility and provide characterization at a lower cost than the traditional fixed facility. The mobile facilities consist of a drum venting system, passive active neutron interrogation, segmented or tomographic gamma scanning and real time and digital radiography, plus large scale mobile glove box facilities for compaction and segregation. The whole of LANL's TRU Program and waste minimization efforts are laudable.

OAK RIDGE NATIONAL LABORATORY
WASTE MANAGEMENT PROGRAM
RE-ENGINEERING

BENCHMARKING REPORT

DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN
June 1997

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The Oak Ridge National Laboratory (ORNL) Waste Management Re-engineering Team has been tasked to determine the criteria that measure performance, to recognize problematic aspects of waste management services, and to improve service delivery. To assist with this process, three sites were visited to benchmark best practices of waste management in both private industry and government. The three sites chosen for this study included the following:

- Westinghouse Commercial Nuclear Fuels (WCNF) Division, Columbia, South Carolina,
- Los Alamos National Laboratory (LANL), Los Alamos, New Mexico, and
- Dow Chemical, Midland, Michigan.

ORNL Waste Management involves the following eight areas of responsibility: pollution prevention; waste characterization; waste certification/verification; hazardous/mixed waste; generator/waste management communication; reporting/records; disposal end points; and waste treatment, storage, and disposal.

A benchmarking team of five people, representing ORNL, visited the Dow Chemical Research and Development facility (hereafter referred to as Dow) on June 12, 1997: Nancy Dailey, Office of Environmental Compliance and Documentation; Tim Myrick, Office of Environmental Management Programs; M. L. Poutsma, Chemical and Analytical Sciences Division; John Trabalka, Chemical Technology Division; and Susan Duncan, PrSM Corporation.

Dave Long, ES&H Compliance Technical Leader, served as the Dow contact and prepared the following agenda: Welcome and Safety Orientation, EH&S Organization and Structure, Description of Hazardous Waste Program, Tour of the Dow Incinerator Complex, Tour of Labs and Accumulation Areas, Questions and Answers.

By analyzing the waste practices of ORNL against those of the three sites visited, the ORNL Waste Management Benchmarking Team will be able to identify specific process improvements and provide recommendations for best management practices. This report describes the process of waste management at the Dow facility in Midland, Michigan.

INTRODUCTION

Dow Chemical Company was founded in 1897 and is the fifth largest chemical manufacturing company in the United States with $20 billion in sales. Dow Chemical Company employs 39,400 people worldwide. The company was reorganized in 1995 into 15 Global Businesses with a research and development (R&D) group for each business. Of the total 5,200 R&D employees, 1,600 work at the Midland facility with a budget of $800 million, using activity based costing, including charge back on waste. They strive for full cost recovery (including capital expenditures) for all wastes.

The Site R&D Environmental, Health, and Safety (EH&S) organization, at the Midland operation is responsible for waste management. The group has been restructured to include 18 full time equivalents (FTEs) serving as compliance specialists, badged to EH&S, but housed in their laboratory buildings. They are generally associates or bachelor degreed with in-the-field RCRA experience. The designation of Compliance Specialist combines the role of Safety Coordinator, Waste Coordinator, Chemical Hygiene Officer/Industrial Hygiene contact, and TSCA Coordinator into full-time positions leveraged over several facilities/organizations. EH&S costs are distributed by service purchased, by the dollar amount per capita allocation.

They estimate that one-fourth of their time is spent on waste issues, which would approximately equate to the ORNL "GI concept" of 4.5 FTEs for an R&D staff of 1600. (Note: they have limited radiological contamination concerns). Dow emphasizes a tough internal self-assessment program to protect against regulatory non-compliances.

Although Dow has not yet adopted the new ISO 14000 environmental standards, the EH&S Compliance Technical Leader indicated that the DOW environmental management standards matched it point for point, thus facilitating future compliance if that is deemed necessary.

The waste management goals for 2005 (1994 Base) include:

- 75% reduction in emissions of priority compounds
- 50% reduction in other chemical emissions
- 50% reduction in waste per pound of production
- 50% reduction in waste water per pound of production
- 20% reduction in energy used per pound of production

Their waste disposal issues are predominantly hazardous waste with no significant component of radioactive or mixed waste. For their minimal radioactive waste generation, which is dominated by tracers used in lab and animal studies, they have a "store for decay" system when appropriate. The strategy and approaches to waste disposal from R&D functions are dominated by two factors: (a) the existence on-site of full treatment and disposal capabilities (incinerator, waste water treatment, and landfill), and (b) their co-location with production facilities, which dwarf the R&D functions in terms of waste volumes and off which the R&D function can piggy-back. They do not experience any great amount of local opposition to landfills or the incinerators which are onsite.

I. POLLUTION PREVENTION

Organization of Pollution Prevention Program
There is a formalized program and management emphasis in their production facilities for minimizing continuous process waste, but not at the labs. The R&D staff views their "Pollution Prevention role" as performing R&D on new process concepts that will reduce production waste ("green chemistry"). In this context, waste actually produced from lab operations is a small stream that "it is easier and cheaper to incinerate than worry about."

Cost Savings
Cost consequences and capital investment needs are given high priority in the earliest reviews of proposals for new or revised production processes, but do not seem to be addressed explicitly for lab operations. In the production arena, there is a corporate Pollution Prevention goal of a 50% reduction in waste generated per pound of production by 2005 (base 1994).

Cafeteria or Restroom Waste Reduction
The approach seems to be that, given the captive presence of the operating incinerator, these are not significant targets to address. However, they do seem to have an accepted and active recycling program for aluminum cans, paper, plastics, etc, which starts with generator segregating at the source but is handled by the janitorial staff.

Reducing Chemical Inventory
They have regularly scheduled "lab cleanout" days in which excess commercial chemicals are purged with the assistance from the ES&H Compliance Specialists. Also, there is "best intentions" guidance to avoid purchasing more of a chemical than needed and to share when possible. However, there is no formal program to control inventory, to force exchanges, or recycle small volumes of solvents. Their benchmarking convinced them that this would be too expensive and would meet too much resistance [they noted Kodak as the most aggressive in having such a program]. Individual researchers can procure hazardous materials with a "credit card" with no formal restrictions related to MSDSs. The Aldrich-Sigma MSDS data base is used internally.

Pollution Prevention Benchmarking
There has been no formal benchmarking for the pollution prevention process. However, the EH&S Compliance Technical Leader participates in a Chemical Manufacturer's Association ad hoc committee that meets twice a year. This started as an industrial hygiene group and has expanded into other EH&S topics. The group consists of two representatives from each of the following companies: Dow, Kodak, 3M, Monsanto, DuPont, General Electric, and Rohm & Haas. Clearly this group does not want to broaden its membership or share specifics any further, for fear of losing their "collegiality of information exchange."

II. WASTE CHARACTERIZATION

The R&D operations produce routine and nonroutine hazardous waste as a by-product of mission operations. Hazardous waste commonly generated at the Midland R&D facilities includes many types of laboratory research chemicals, solvents, acids, bases, carcinogens, compressed gases, metals, and other solid waste contaminated with hazardous waste. This may include equipment, containers, structures, and other items intended for incineration and contaminated with hazardous waste. It also includes substances regulated under the Toxic Substance Control Act (TSCA), and/or CAA/NESHAPS, such as asbestos.

Characterization Procedures

Dow uses process knowledge, virtually exclusively, to characterize waste. They have three waste characterization standards, based upon on-site treatment/disposal: wastewater system, incinerator, and landfill. For process waste, they have developed a list of about 18 generic waste characterizations, which are based on compatibility groups for EPA compliance. The groups are: dilute acids and compatible organics, dilute bases and compatible organics, cyanides and sulfides, oxidizers, air and water reactive, epoxide monomers, olefinic monomers, concentrated acids, and concentrated bases. Unused commercial-grade product that meets specific criteria will have a “P” or “U” code and are treated individually by the EH&S Compliance Specialists. High energy, explosive or reactive wastes are handled individually through the EH&S Compliance Specialists and go to the incinerator by bottle drop.

Who Characterizes Waste?

Waste generators characterize waste with assistance from the EH&S Compliance Specialist, as needed. Individual containers are characterized by the person(s) generating the waste. Completion of the waste disposal forms is done at the department or building level rather than on an individual basis.

Laboratory generators are responsible for proper segregation. Bench-top waste labels in SAAs are structured by RCRA codes, rather than a running "chemical inventory." These labels "evolve" as individual generators add wastes to "their" collection container.

On-Site Transport

There are no transport requirements for onsite transport, however, shipments of incinerator ash/residuals to local Dow-owned and operated landfill are manifested under DOT requirements because public roads must be crossed to access the landfill.

III. WASTE CERTIFICATION/VERIFICATION

Type of Generator

Each lab (within a building) is used for satellite accumulation and there are approximately 1000+ satellite areas. Individual generator's name and origin location are required on the waste container labels.

There is a process in place for segregating waste properly at the bench. Every lab pack has to have an inventory sheet - RCRA, chemical inventory, physical, BTU.

Waste Certification Costs
Individual generators "certify" that their waste characterization is accurate via signing the waste disposal form. Kelly Services is a contractor that is used for day-to-day operations for waste handling. They collect waste from labs, pack wastes in fiberpacks, complete inventory sheets for the waste they pack, and ensure all regulations and incinerator requirements are met. Approximately 70% of the generators use this service for lab packing. The contractor costs are about $15/hour. It was noted that using a contractor was a management decision, but some would prefer these workers be Dow employees because of the potential for frequent turnover.

Waste Streams
Dow Chemical R&D Division produces chemical waste, RCRA Regulated, State Regulated, TSCA 5(e) agricultural waste, and sanitary waste. Some of the special waste streams are mercury, small amounts of radioactive materials, and compressed gases in lecture bottles. Most of the elemental mercury is recovered by processing on-site to form a zinc amalgam and then shipping it to Bethlehem Steel in Pennsylvania, and they are working to obtain the services of a contractor to bleed lecture bottles held in storage, before incineration.

Waste Minimization
They have tried to set up a chemical exchange program to promote reuse, but have decided against it because of the cost of implementing the program and largely because of resistance from the researchers. They have discussed this with two companies that have a successful program, Kodak and Rohm & Haas.

Recycling
Recycling pallets, scrap metal, etc. is done by the manufacturing part of organization

IV. HAZARDOUS/MIXED WASTE

Storage
Waste is stored at the Central Accumulation Area (CAA) for less than 90 days. These areas are operated by the Kelly Services/EH&S staff. Dow designates each individual laboratory as a Satellite Accumulation Area(SAA), with no attempt to further localize the waste collection area within that lab. There is no time limit for the SAA, but the maximum volume is 55 gallons or 1 quart of "P" waste. Once containers are filled, the EH&S staff pick up the waste and move it to a

building waste staging area for consolidation with other building wastes. Wastes may be "staged" at this point for up to three days before it is packaged and moved to the CAA. The 90-day clock starts when the waste enters the CAA. The Dow response to the "lids problem" has been the evolution of a myriad of "amateur designs" for "stoppers in funnels" and flip-top cans.

Scheduling Waste
Each labpack has an Inventory Sheet designed to ensure compatability. When the packs are full, the EH&S Compliance Specialists schedule with the Incinerator. Pickup from the 90-day area is triggered by 80% capacity via electronic transmission of container numbers. They have recently gone to a bar coding system.

Cost
Incineration cost is currently $0.13/lb, and off-site disposal is higher, depending upon the item. No waste leaves the site without the signature of the site manager, which is a rare event.

Quality Assurance
Approximately 10% of the lab packs are checked on a random basis. They expect 90% accuracy on waste characterization for lab packs. Once a quarter, lab pack validation is conducted with 20% noncompliance for researcher-filled lab packs, 100% compliance with labs that use the contractor for lab packing.

Waste Analysis Plan
They conduct little or no waste analysis. The early stage EH&S review generally catches problematic wastes.

V. GENERATOR/WM COMMUNICATION

Forecasting
There did not seem to be a major emphasis on forecasting at the lab operations level, although there is a process to stagger "lab cleanouts" to avoid overloading the incinerator. In contrast, major changes in process streams from the production facilities would have been addressed early in the overall planning and capital commitment process for any new production processes. They have a generic template for Chemical Hygiene Plans, which is then tailored for each laboratory complex.

Waste Generators Interface
The interfacing seems quite localized in the EH&S Compliance Specialists who serve as the bridge from the researcher to the waste operations and regulatory compliance personnel in terms of characterization, labeling, pickup, etc. There does seem to be rather good staff acceptance of their approaches to generic groupings of waste categories and labeling.

Housekeeping inspections of labs are done monthly and address improper waste accumulation; "second offenses" are reported to management.

Waste Charges
There is an element of direct charging of, for example, incinerator costs to the generating organization, as well as some spreading through "overheads." The waste management costs are a noticeable part of the research divisions budgets, and these costs must be included in their planning each year. Their charge back mechanism seems to be reasonable, and is working well for them.

Senior Management Involvement
The establishing of the EH&S Compliance Specialist.program two years ago, to replace a more dispersed set of part-time assignments, clearly had management support. However, it appears to have been driven by a need to improve QA on waste characterization ("verification"), both to address concerns of State regulators and incinerator operators.

Waste Stream Changes
Fluctuation in waste streams does not seem to be a problem at the laboratory level which generates small quantities of diverse wastes. The concern level regarding waste generated by on-site subcontractors seemed low and "under control" through contract arrangements.

VI. REPORTING/RECORDS

Record Keeping
The Environmental Information System (EIS) data base, managed by the incinerator, maintains records of all the characterized waste. The EIS data base is used to track waste and automatically generates a RCRA report twice a year. They have just started bar coding for lab packs and this information is put into the EIS data base for volume tracking.

Each waste container has a label affixed and the generator checks off the waste as it is put into the container. The generator is responsible for completing a Waste Characterization Form. Waste disposal forms are completed at least every 3 years for incinerator wastes, 2 years for wastewater, and annually for landfilled wastes. Characterization must be updated whenever the generation process changes, but they allow up to a 20% variability. The Waste Characterization Form (16 pages) is generated electronically, but a hard copy is used for signature. A copy of the form is maintained by the generator for 3 years. Every lab pack must have an inventory sheet which is kept at the incinerator for 5 years.

Compliance
Internal assessments for EH&S are rolled together, then quarterly stated on OSHA audit. The site is not going towards ISO 14000, but are ready whenever management decides to implement.

Wastewaters, including cooling water is characterized and re-certified every 2 years. RCRA inspections require a hard copy record.

Manifests
Bar coding is used to track waste movement onsite, however, no DOT transport compliance is required for onsite transport. Almost no hazardous waste goes offsite for disposal, but they do manifest when transporting to their landfill which is located nearby.

VII. DISPOSAL END POINTS

Off Site Disposal
Mercury amalgams are shipped off site for mercury recovery and recycling at Bethlehem Environmental in Pennsylvania. Dioxins were formerly shipped off-site for treatment and disposal but these wastes are no longer generated at the Midland complex.

On Site Disposal
All waste is disposed on site by incineration, landfill, or waste water treatment, with the exception of mercury. They are required to have permits for RCRA, state of Michigan, National Pollutant Discharge Elimination System (NPDES), and air permits.

VIII. WASTE TREATMENT, STORAGE, AND DISPOSAL

Type of Facility
Dow operates two hazardous waste incinerators, a wastewater treatment plant, and landfill with sanitary and hazardous waste cells for treatment, storage, and disposal (TSD). Although they have RCRA permits, they were unaware of any EPA-issued Hazardous and Solid Waste Amendments (HSWA) permit for initiating corrective actions under RCRA.

Dow uses only centralized facilities. Solid or liquid hazardous wastes are sent to the incinerators as they are generated; requiring interim storage only. The Midland operations are permitted to receive hazardous wastes from other Dow sites.

Dow has evaluated--and rejected--outsourcing of their TSD operations because of concerns about regulatory liability and potential for industrial espionage.

Costs
The cost for TSD is \$0.13/lb for hazardous wastes, which are sent almost exclusively to the incinerators. Radioactive waste generation is too small to require special attention. Those that contain ^{14}C and ^{3}H are burned in the incinerator (22 mCi/day burn rate permitted). Short-lived

materials (e.g., ^{32}P, ^{35}S) are held for radioactive decay. They use the 10 half life decay rule for decay-in-place storage and use a twice background determination for rad/nonrad.

Procedures

The TSD facilities have established standard operating procedures for continuous operation. These procedures, some of which are very detailed, "live" in the source codes that are part of the automated control system for the facilities. An operator will access these directly from the main control panel when responding to an alarm or performing a routine operational activity. Operators are exposed to these procedures during a 6-8 week on-the-job-training period while working with experienced staff and through Dow's In Plant Training program. Other safety oriented procedures require use of check sheets to ensure that these are followed, and operators learn about these through both on-the-job-training and monthly safety meetings. (Safety meetings focus on specific job needs in contrast to the ORNL situation.)

Process Flows

The process flow information was not readily available in detail for TSD, although the Dow TSD complex is a highly integrated, self-sufficient system which is not dependent on access to off-site facilities.

Wastewater

The specific waste streams are: cooling water; low-toxicity, low-hazard wastewaters; landfill cell leachates; and contaminated groundwater collected in the Regional Groundwater Interceptor System, which is designed to limit discharges into the Tittabawassee River.

Virtually all aqueous waste from a lab goes to the incinerator, not the wastewater treatment plant. The only exceptions are for low-toxicity, low-hazard wastewaters.

Secondary Waste

They do not treat for radioactivity and/or heavy metals. The wastewater treatment plant is basically a biological treatment plant akin to a sewage treatment system. Clarification and filtration is followed by aerobic digestion, settling, and discharge to a large pond for tertiary treatment and polishing. Dried sludges and filter cake residues are sent to the incinerators. This currently includes sludges from the Tertiary Treatment Pond, which is being remediated under a Consent Order under the terms of their NPDES permit. Remediation is being driven by aesthetic (odor) and other reasons, and is projected to continue for approximately 3 years.

Automation

The wastewater treatment plant is highly automated. An impressive central control system exists for all treatment operations, and reduces the number of operating staff as well as provides monitoring of all operations and releases.

Personnel

Personnel assigned to the wastewater treatment plant on the day shift includes the following: a

foreman and 5 operators (two of whom are “floaters”). Three operators only are used on the off shifts. Two-to-three EH&S specialists and three engineers are also available to support the entire TSD complex.
The ratio of supervisors to operations personnel is approximately 1:11. The plant is operated continuously, 3 shifts/day.

Dow has specific job classification called Alternates or Spares. These individuals receive higher pay because they are available to cover different types of jobs and thus help to provide vacation or sick relief. These are usually more senior individuals, who typically are one of the “floaters” on day shifts. If one of these individuals is not available, recourse is made to overtime to provide shift relief.

Training
Training is provided in-house, for all staff, and is updated annually (also see Section on Procedures). Most operators have high school equivalency, but are not degreed individuals. There is an increasing tendency, however, for newer staff to have some college education.

Waste Stream Composition Change
Dow’s Early Stage EH&S Review Process catches impending changes early in the process. Major changes occur infrequently, and are well controlled.

Maintenance
A multi-tier approach based on priorities and urgency is used for maintenance and is implemented through an automated work order system. Necessary routine daily maintenance receives the highest priority. There is also a site-wide Preventive Maintenance Program. A local maintenance facility supports the incinerator complex, the waste water treatment plant, and one production facility. It is staffed by 4 pipefitters, 3 millwrights, 3 instrument technicians, and 3 electricians. On a routine basis approximately half of the facility staff’s time is devoted to the EH&S facilities. Access is also available to a site-wide rigging group for assistance with maintenance activities requiring heavy equipment such as cranes.

IX. IMPLICATIONS TO ORNL/WMRAD

At Dow, laboratory generators are responsible for proper segregation. Bench-top waste labels in SAAs are structured by RCRA codes, rather than a running "chemical inventory." These labels "evolve" as individual generators add wastes to "their" collection container. We at ORNL tend rather to keep a log by chemical constituent and then later put the RCRA codes on the final forms in a separate step. They seem to have eliminated this step. Whether we could do this for off-site shipments, rather than for a captive incinerator, should be considered.

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