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OUTLINE
EVALUATION OF THE OAK RIDGE
Y-12 PLANT
SOLID WASTE MANAGEMENT SYSTEM
DECEMBER 12, 1990
GROUP No. 5
FOR: ENVIRONMENTAL 555

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ACRONYMS and DEFINITIONS

DOE	Department of Energy
ID	Identification
IWLF IV	Y-12 Industrial Waste Landfill IV
MMES	Martin Marietta Energy Systems, Inc.
MSW	Municipal Solid Waste
NEPA	National Environmental Policy Act
ORNL	Oak Ridge National Laboratories
ORR	Oak Ridge Reservation
RCRA	Resource Conservation and Recovery Act
SLF II	Y-12 Centralized Sanitary Landfill II
SPAD	Steam Plant Ash Disposal Project
SPWTF	Steam Plant Wastewater Treatment Facility
TDHE	Tennessee Department of Health and Environment
TMS	Trash Monitoring Station
WTO	Waste Treatment Operations
WTSD	Waste Transportation and Storage Department

Class II -- refers to a facility or waste stream which, respectively, receives or includes waste which is generated by one or more industrial or manufacturing plants and is used or to be used for disposal as solid waste generated by such plants, which may include industrial wastes, domestic wastes, institutional wastes, farming wastes, demolition/construction wastes, discarded automotive tires, dead animals; and, additionally, ash from the incineration of municipal solid waste disposed of in a monofill.

Class IV -- refers to a facility or waste stream which, respectively, receives or includes demolition/construction wastes and or certain special wastes having similar characteristics as inert waste.

Solid waste -- means any garbage, refuse, including without limitation recyclable materials when they become discarded, or sludge from a waste treatment plant, water treatment plant, or air pollution control facility, and any other discarded materials, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sludge, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act as amended, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended.

Evaluation of The Oak Ridge Y-12 Plant's Solid Waste Management System

1.0 INTRODUCTION

1.1 Project Description

The purpose of this project was to provide team members with practical experience in application of Civil Engineering 555, Solid Waste Management principles.

Team #5, comprised of the following members:

George Crawford; Bechtel National, Inc.

Darrell Daugherty; Oak Ridge National
Laboratory

Chuck Hutzler; The Oak Ridge Y-12 Plant

Chris Smith; The Oak Ridge Y-12 Plant

Tony Willie; Adams, Draft, Hertz, and Waller

those to evaluate the functional elements of
The Oak Ridge Y-12 Plant's (Y-12's) solid
waste management system. The following
factors contributed to selection of Y-12's
system for evaluation: team members'
familiarity with the Y-12 system; knowledge

that the Y-12 Centralized Sanitary Landfill II (SLF II) was nearing capacity; and presence of the unique issues posed by special national security and potential radioactive contamination considerations.

1.2 Facility Description

Y-12 is one of five installations operated by Martin Marietta Energy Systems (MMES) for the Department of Energy (DOE). Y-12 occupies approximately 800 acres and is located immediately adjacent to the City of Oak Ridge in East Tennessee. In addition to the basic Y-12 work force of approximately 5,900, the plant also houses some 1,000 members of MMES Central Staff and Engineering, over 500 Oak Ridge National Laboratory employees, 100 DOE employees, and approximately 800 M. K. Ferguson employees, the prime construction contractor for the plant. Y-12 can be considered analogous to a small, exclusively, industrialized city.

The plant has four principle missions-

- Defense responsibilities: Y-12 is involved

in the production of components for every nuclear weapon system in the nation's defense arsenal. This effort includes the conversion of enriched uranium (U-235) compounds to metal and appropriate casting, rolling, and machining operations required to produce a finished product.

- Processing special material: Enriched uranium in the form of uranyl nitrate and uranium trioxide is sent to Y-12 from the Savannah River Plant and the Idaho Chemical Processing Plant for conversion to uranium metal. Y-12 also has an extensive system for recovering its own valuable U-235 waste byproducts incurred in production operations.

- Support to MMES Facilities: One of Y-12's major responsibilities is to provide support to the other MMES facilities. For example, Y-12 provides housekeeping, maintenance, and engineering support to several ORNL divisions. These facilities range from complex laboratory mice colonies to fusion energy experimental apparatus.

- Support to Other Government Agencies: An

additional Y-12 mission is to provide support and assistance to other government agencies whenever time and technology warrant the use of Y-12 capabilities. Such work is subject to the control and approval of DOE on an interagency agreement basis.

1.3 Report Description

This report was limited to evaluation of the solid waste management system for conventional solid waste; hazardous, radioactive, and radioactive mixed waste were not addressed. The report:

(1) describes each functional element

- waste generation (Section 2),
- storage, collection, and transport (Section 3),
- processing and recovery (Section 4), and
- disposal (Section 5);

(2) identifies and evaluates alternatives for each element; and

(3) summarizes system characteristics and

recommends opportunities for improvement
(Section 6).

2.0 WASTE GENERATION

2.1 Sources and Types of Y-12's Solid Waste

Due to the diverse nature of Y-12's mission, waste is generated from a wide variety of sources, ranging from residential or commercial garbage streams to highly specialized special wastes. Table 2.1 summarizes the sources and Table 2.2 lists the types of waste generated at Y-12. The amount of waste generated at Y-12 is expected to increase in the future as the number of employees increases and the number of facilities expands. The waste generated at Y-12 is directly related to the various activities and processes.

2.2 Composition of Y-12's Solid Waste

The waste generated at Y-12 is composed of a wide variety of materials, including organic, inorganic, and radioactive materials. The waste is generated from a wide variety of sources, ranging from residential or commercial garbage streams to highly specialized special wastes. The waste is generated from a wide variety of sources, ranging from residential or commercial garbage streams to highly specialized special wastes. The waste is generated from a wide variety of sources, ranging from residential or commercial garbage streams to highly specialized special wastes.

TABLE 2.1
SOURCES OF Y-12 SOLID WASTE

Generating Source

Maintenance Shops

- Garage
- Ironworkers
- Carpenters
- Electronics
- Laundry

Production Shops

- Assembly
- Metal Forming
- Plating
- Machine Shops

Field Maintenance

- Laborers
- Utilities
- Insulators
- Carpenters
- Electrical

Health Center

Research/Biology

Cafeteria/Canteens

Office Areas

- Quality
- Engineering
- Environment, Health,
and Safety
- Administration
- Computer Processing
- Security

Shipping/Receiving

Construction

Waste Management/Remedial
Activities

TABLE 2.2
TYPES OF Y-12 SOLID WASTE

Construction/demolition debris including rock, dirt, brick, concrete, asphalt, rebar, gravel, sand, block

Paper including office paper and shredded documents

Sludge from the Steam Plant Wastewater Treatment Facility

Wood including scrap lumber, sawdust, animal bedding, some garden trimmings, skids/pallets

Cardboard

Glass

Food waste

Plastics

Special waste including asbestos, beryllium oxide, empty hazardous waste containers, treated medical waste, flyash, petroleum tainted soil, non-hazardous laboratory chemicals

Non-ferrous metals including aluminum cans, scrap wire, metal siding

Filters and textiles

procedure based on common sense and random-sampling. Some waste streams such as sludge from the Steam Plant Wastewater Treatment Facility (SPWTF), crushed glass from Electrical Maintenance shops, reject coal from the Steam Plant, sawdust from the carpenter shop, food waste from the cafeteria, animal bedding from Biology research facilities, treated medical waste from the Health Center, paper from the classified paper shredder, construction debris, cardboard from transportation receiving, and asbestos waste are homogenous and would not typically be subject to field sampling. However, waste from office and production buildings are heterogenous. Additionally, on an average of once per month, an incoming "trash" dumpster from these areas has been segregated from the working face and individual components (by volume) have been estimated. This activity serves the dual purpose of verifying that waste delivered to ALF II meet the waste acceptance criteria and it also facilitates waste accounting for reporting and planning purposes.

2.2.2 Physical components of Y-12's solid waste stream are summarized in Table 4.10. General categories representing greater than 0.5 percent of the total by weight have been identified. Figure 4.1 graphically depicts the percentages by major component category.

2.2.3 Chemical composition

2.2.3.1 Moisture content was calculated from analytical composition data and textbook average values for moisture content of individual components. As shown in Table 4.11, Y-12's solid waste has a moisture content of approximately 14 percent. This is less than a typical municipal solid waste due to less quantities of high moisture containing food waste and paper materials.

TABLE 3
MOISTURE CONTENT OF Y-12'S SOLID WASTE

COMPONENT	% by Weight	H ₂ O Content	Water (lbs)*
construction/ demolition debris	43.8	8	3.50
paper	26.5	6	1.60
sludge	10.1	55	5.56
food	5.5	20	1.10
cardboard	2.8	5	0.20
glass	2.3	2	0.05
food waste	2.3	70	1.61
plastic	1.5	12	0.08
special waste	1.3	5**	0.07
nonferrous metal	1.3	2	0.03
filters/textiles	0.6	10	0.06
TOTAL water/100 pounds of waste			14.01

* Calculation based on assumption of 100 pounds of as-discarded waste.

** per handbook value. Assumed based on constituents of special waste.

3.2.3.3 Ultimate analysis

calculations were performed based on known composition and typical composition of typical constituents of carbon, hydrogen, oxygen, nitrogen, sulfur, and ash. An approximate chemical formula of $C_{475}H_{690}O_{219}N_4$ was determined.

2.2.3.3 Heating value of Y-12's solid waste was determined to be 4,124 BTU/lb using the modified Dulong equation;

$$\text{BTU/lb of waste} = 145.4(C) + 620(H - 1/8 O) + 41(S)$$

where C was 23.3 percent, H was 3.4 percent, O was 17.4 percent, and S was 0.2 percent.

2.2.4 Future Changes in Composition

- change in production and/or research
- change in construction/demolition efforts
- increase in remedial activities
- potential paper, wooden skid, and cardboard recycling
- aluminum can recycling
- diversion of class I/2 stream
- change from coal to natural gas
- additional dewatering of EPWTF sludge

4.3 Generation Rates

4.3.1 Measures of Quantities

Weight is the only accurate basis for records because tonnages can be measured directly; however the need to know tonnage is primarily for billing purposes and addressing transportation load restrictions. Since use of SLF II is restricted to DOE contractors and waste is transported only on DOE roads, a scale has not been procured. Therefore, quantities included are based on typical textbook densities and volumes estimated by the SLF II attendant who visually inspects each load as it is delivered. These estimates are extremely subjective and were not always carefully or consistently made. At least five technicians estimated quantities during FY90.

3.2.2 Expression of Generation Rate

Ideally, generation rates used for planning purposes can be tied to some repeatable measure of production (ie lbs/widget, lbs/employment level, lbs/budget). However, due to the sensitive nature of Y-12 production, a correlation between waste and production rates can not be evaluated. For planning purposes the daily average in Fiscal Year 1990 was 52 tons with a range from 28

tons/day in December to 87 tons/day in August. This variation is attributable to adjustments in production for inventorying and vacations and peak construction activity during the mid-summer months. As described in section 2.3.1, generation rates were determined by a load count analysis which was performed simultaneously with the visual inspection. The number of individual loads and the corresponding vehicle characteristics are recorded on a daily basis. This information is inputted to a database management system and rates computed based on this field data.

2.3.3 Factors Influencing Rate

Many of the same factors listed in section 2.2.4 affect not only the composition of the waste but may also impact the rate. With the primary indicators being, production schedules, construction work, season of the year (flyash and reject coal are temperature dependent, IPWTF sludge generation is precipitation dependent), plant attitude, funding levels, and degree of recycling.

2.3 STRENGTHS AND RECOMMENDATIONS

2.3.1 Strengths

The following strengths were identified during the evaluation of the waste generation function:

- 2.3.1.1 Data is maintained on computerized database.
- 2.3.1.2 Each load delivered is visually inspected.
- 2.3.1.3 Functional principles and concepts were understood and practiced.

2.3.2 Recommendations

The following recommendations are made for the waste generation functional element of Y-12's Solid Waste Management System:

- 2.3.2.1 Procure a scale for SLF II.
- 2.3.2.2 Improve quality of data collected.
- 2.3.2.3 Evaluate dewatering of SPWTF sludge.
- 2.3.2.4 Implement paper, cardboard, wooden skid, and full scale aluminum can recycling programs.
- 2.3.2.5 Divert mass of materials from SLF II.
- 2.3.2.6 Evaluate conversion from coal to natural gas.
- 2.3.2.7 Increase funding level for waste minimization program.

Section 3 COLLECTION

3.1 Plant Layout

The Y-12 plant is located in the northeast portion of the Oak Ridge reservation. The majority of the plant lies within an area of one square mile is boarded on the north by Bear Creek Road, to the south by Popular Creek, and to the east by Scarboro Road. The landfill which services the Y-12 plant and the rest of the Oak Ridge DOE complex is located 2.8 miles directly south of the plant. Because Y-12 and the landfill are physically separated by Chestnut Ridge, a 300 foot vertical rise and drop is required for transportation from the plant to the landfill.

As outlined in yellow on the map in figure 1, Y-12 is divided into two major areas: the Exclusion Area and the Nonexclusion Area (also known as the East End).

The primary purpose of the Exclusion Area is to provide facilities for the production and recycling of nuclear weapons. This area is fenced and ingress and egress are tightly controlled because of national security. Most operations involving the use of radioactive materials are located in the Exclusion Area. As discussed later there are particular problems introduced to a trash collection system because of the radioactive contamination potential and the controlled egress procedures.

The East End comprises the largest area of the plant and facilitates support functions as the cafeteria, engineering department, shipping and receiving and other administration departments. Secondary production type facilities such as Biology and Fusion Energy Research Buildings are also located in the East End.

The Exclusion Area solid waste is heavy industry related typified by metal parts and raw materials. The East End contributes the bulk of the commercial type waste such as paper and packaging. Because of the large amounts and/or nature of the waste several areas of the east end require

frequent collection of waste. This waste which requires frequent collection includes litter from the 200,000 rats housed in Biology research building, waste from the cafeteria, reject coal and flyash from the steam plant, and packaging from receiving.

3.2 Collection Tools and Resources

The Waste Management division is divided into two operational departments; Waste Treatment Operations (WTO) and Waste, Transportation, and Storage Department (WTSD). Besides responsibility for a long list of functions ranging from hazardous waste collection and RCRA storage operations to cutting the grass at certain plant facilities, the WTSD department also collects all of Y-12 solid waste and operate the SLF II landfill for the three plant reservation. Because of the multifunctions served by this department, the personnel designated to collect solid waste are occasionally reassigned to perform similar collections or deliveries to the radioactive burial ground or another plant.

WTSD has designated three trucks and four drivers to support the collection of routine solid waste. The trucks consist of two chain hoist trucks and one 40 cubic foot compactor truck. Certain special wastes are hauled in normal dump trucks by WTSD personnel. Most construction activities at Y-12 are performed by a separate contractor (M.K. Ferguson) and all collection and transportation of this waste is done by the contractor. The ORNL and K-25 plant haul their own waste to the SLF II landfill.

3.3 Pickup Points

There are 228 chain hoist type dumpsters and 69 compactor type dumpsters located throughout the Y-12 plant. The dumpsters range in size from 3 to 12 cubic yards. Some dumpsters are marked and dedicated to the collection of specific type wastes such as metal only, asbestos only, or

radiologically contaminated material. Many buildings will have two or more dumpsters so that waste can be segregated. Some buildings such as receiving have as many as 6 dumpsters at adjacent loading docks to handle large generation rates. The Exclusion area is a congested area due to proximity of the major construction activities and vehicle traffic. Access to the dumpsters is a frequent problem.

With increased liabilities for possibilities of hazardous waste being sent to the landfill a requirement to certify the contents of each dumpster has been imposed. Certification entails filling out a characterization form and signing verifying that the dumpster waste would not deviate from the waste listed. The first enactment of this policy was attempted November of 1990. Only 22 dumpster locations filled the required paper work. Typical problems associated with this program include how to prevent tampering with individually assigned dumpsters, responsibility for a dumpster, or how does a building janitor verify each trash can without a specific waste analysis at each placement.

3.4 Routes

Y-12 truck drivers do not follow specified routes when picking up waste. The plant is covered in three general passes. One hoist truck is dedicated to just the Exclusion Area. The compactor concentrates primarily on pickups from the East End and picks up a few certified non-radioactive containers in the Exclusion Area. The second hoist truck picks up the areas the compactor truck misses in the East End.

Because of the radioactive contamination potential and the security concerns, trash collection operations are unique in the Exclusion Area. To get to the landfill from the Exclusion Area the trash truck must pass through several security check points. These security checks range from a check of a ID badge to a complete inspection of the contents of the dumpster. All hoist type dumpsters leaving

the Exclusion Area must be checked for radioactive materials at the Trash Monitoring Station (TMS). See figure 3.2. At the TMS a uranium scan determination is made to determine whether to send the waste to the sanitary landfill or compaction then storage at K-25 pending future incineration. Much of the off-route factor for this collection system is due to the TMS monitoring requirement. First, the TMS is located in a separate security area which requires added security checks. Second, the TMS system is not drive through. The dumpsters are set down on the side and unchained for monitoring at a later time by the TMS technician. The truck driver will then check with the TMS technician to determine which dumpsters have been monitored and are ready to rehoist and transport over the ridge to the landfill. Because the TMS is not continuously manned, more often than not there are no dumpsters ready and the truck driver must return to the plant without an empty dumpster to replace at the buildings. There is not a surplus of dumpsters to take care of this problem.

The routes within the areas are not clearly defined. The drivers rely on past experience for pickup determination. There is a certain degree of cruising for full containers which adds to the off route factor. Approximately 10% of the dumpsters are picked up on a daily basis with a high percentage of the remaining picked up at least once a week.

3.5 Efficiency Calculations

Calculations were performed in figures 3.4, 3.5 and 3.6 to determine the time spent off route. Hauled container formulas were used in determining the W factor for the hoist trucks and stationary formulas for the compactor trucks. All time factors were determined from monitoring one day of collection. Pickups per day were determined from data collected over a month shown in figure 6.

The calculations for the Exclusion Area were modified to account for the previously mentioned operating concerns. A fudge factor(SC) of 5 minutes was added to account for the time spent carding

through security check points. The TM term is a factor to account for time required at the TMS. Basically the TMS operation is a second pickup therefore it is calculated similar to the Plics.

The results of the W off-route factor calculations shows a remarkable efficiency performed by the drivers in the WTSD department. The East End hoist truck showed the greatest off route factor of about 20%. This quantity could be knocked down by further investigating the time spent between containers. This area is spread out and more careful planning is required. A prescribed route would greatly enhance operations on the east end. The Exclusion area hoist truck had an off route factor of 11% after certain liberties were taken with the formula. Without the modifications to the formula the off-route factor would be 35%. This efficiency can further be improved by enhancing operations at the TMS, establishing routes, having spare dumpsters, and enforcing no parking in front of dumpster locations. A 4.8% W factor for the compactor truck is a clear indication of the effectiveness of this machine.

3.6 Recommendations

1. Enhance TMS operations by eliminating the TMS operator and have drive through operations performed by the truck driver.
2. Set up routes for all areas.
3. Get more waste certified non-radioactive in the exclusion area and fit one more compactor truck into the operations.
4. Enforce no parking or blocking in front of dumpster locations.
5. Locate the TMS near the landfill and cut a new road to decrease the number of security checks.
6. Have spare dumpsters available to replace ones taken from the plant.

FIGURE 3.1

FIGURE 3.2

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PICK-UP RATE FOR COMPACTOR TRUCKS

FIGURE 3.3

JOB	OFF ROUTE FACTOR (W)	REF. DWG. NO.
SUBJECT	EXCLUSION AREA	PAGE OF FIGURE 3.4
COMPUTATION	HAULED CONTAINER SYSTEM	NO.
COMPUTED BY	CHRIS SMITH	CHECKED BY
		DATE

MODIFIED FORMULA TO ACCOUNT FOR
SECURITY CHECKS AND RADIATION MONITORING (TMS)

$$N_d = \frac{(1-W)H - (t_1 + t_2)}{P_{hes} + s + a + bx + sc + T_m}$$

$$P_{hes} = p_c + u_c + d_{bc}$$

$$T_m = p_{ct} + u_{ct} + d_{bc_t} = \text{TIME SPENT AT TRASH MONITOR}$$

$$T_m = .0667 + .053 + .017 = .134$$

DIFFERENCE IN DATA
FOR EXCLUSION AREA

$$N_d = 9 \frac{\text{TRIPS}}{\text{day}}$$

$$t_1 = 10 \text{ min} = .16 \frac{\text{H}}{\text{day}}$$

$$t_2 = 12 \text{ min} = .2 \frac{\text{H}}{\text{day}}$$

$$X = 4.8 \text{ MILE/TRIP}$$

$$sc = \text{SECURITY} = 5 \text{ min} = .08 \frac{\text{H}}{\text{day}}$$

$$d_{bc_t} = \text{time to PICKUP PAPERWORK FOR MONITORED DUMPSTER} = 1 \text{ min} = .01$$

$$u_{ct} = \text{UNCHAIN DUMPSTER} = 3 \text{ min} = .05$$

$$p_{ct} = \text{PICKUP MONITORED} = 4 \text{ min} = .06$$

$$9 \frac{\text{TRIP}}{\text{day}} = \frac{(1-W)8 - (.16 + .2)}{.26 + .16 + .022 + (.02 \times 4.8) + .08 + .134}$$

$$W = 0.11$$

WITHOUT FUDGE FACTORS

$$9 = \frac{(1-W)8 - (.16 + .2)}{.26 + .16 + .022 + (.02 \times 4.8)}$$

$$W = 0.35$$

JOB

OFF ROUTE FACTOR (W)

REF. DWG. NO.

SUBJECT

EAST END

PAGE OF

FIGURE 3.5

COMPUTATION

HAULED CONTAINER SYSTEM

NO.

COMPUTED BY

CHRIS SMITH

CHECKED BY

DATE

$$N_d = \frac{(1-W)H - (t_1 + t_2)}{P_{hes} + S + a + bx}$$

$$P_{hes} = pc + uc + dbc$$

$$P_{hes} = .05 + .08 + .13 = 0.26 \text{ } \frac{\text{H}}{\text{TRIP}}$$

DATA

W = OFF ROUTE FACTOR

N_d = TRIPS / DAY = 10t₁ = TIME TO FIRST PICKUP = 4 min = .06 $\frac{\text{H}}{\text{TRIP}}$ t₂ = TIME BACK TO GARAGE = 12 min = .2 $\frac{\text{H}}{\text{TRIP}}$ P_{hes} = PICKUP TIME / TRIP = CALCULATEDS = AT SITE TIME / TRIP = 0.16 $\frac{\text{H}}{\text{TRIP}}$ a = 0.022 $\frac{\text{H}}{\text{TRIP}}$ b = 0.02 $\frac{\text{H}}{\text{TRIP}}$ X = ROUNDTrip HAUL DISTANCE = 5.6 $\frac{\text{MILE}}{\text{TRIP}}$ H = LENGTH OF WORK DAY = 8 $\frac{\text{H}}{\text{DAY}}$ pc = PICKUP TIME = 0.05 $\frac{\text{H}}{\text{TRIP}}$ = 3 minuc = UNLOAD TIME = 0.08 $\frac{\text{H}}{\text{TRIP}}$ = 5 mindbc = TIME BETWEEN CONTAINERS = 0.13 $\frac{\text{H}}{\text{TRIP}}$
= 8 min

$$10 \frac{\text{TRIP}}{\text{day}} = \frac{(1-W)(8 \frac{\text{H}}{\text{DAY}}) - (.06 + .2)}{0.26 \frac{\text{H}}{\text{TRIP}} + .16 \frac{\text{H}}{\text{TRIP}} + .022 \frac{\text{H}}{\text{TRIP}} + (.02 \times 5.6)}$$

$$11 = \frac{(1-W)8 - .26}{.554}$$

$$W = 0.20$$

JOB OFF ROUTE FACTOR (W)		REF. DWG. NO.
SUBJECT COMPACTOR TRUCK		PAGE OF FIGURE 3.6
COMPUTATION STATIONARY SYSTEM		NO.
COMPUTED BY CHRIS SMITH	CHECKED BY	DATE

$$T_{scs} = \frac{P_{scs} + S + a + bx}{1 - W}$$

$$P_{scs} = C + (UC) + (n_p - 1)(dbc)$$

$$P_{scs} = 30.5 \times .05 + (30.5 - 1)(.17)$$

$$P_{scs} = 7.3025$$

DATA

$$T_{scs} = \text{TIME/TRIP} = 8 \text{ HOUR}$$

$$P_{scs} = \text{PICKUP TIME PER CONTAINER}$$

$$S = \text{AT SITE TIME} = 10 \text{ min} = .17 \text{ H/TRIP}$$

$$a = \text{H/TRIP} = 0.02$$

$$b = \text{H/MI} = 0.02$$

$$X = \text{ROUND TRIP HAUL} = 5.6 \text{ MI/TRIP}$$

$$C = \# \text{ CONTAINERS/TRIP} = 30.5$$

$$UC = \text{TIME AT DUMPSTER} = 0.05 \text{ H/CONT}$$

$$n_p = \# \text{ PICKUPS/TRIP} = 30.5$$

$$dbc = \text{TIME BETWEEN CONT} = 10 \text{ min} = .17 \text{ H/TRIP}$$

$$8 \text{ hrs} = \frac{7.3025 + .17 + .02 + (.022 \times 5.6)}{1 - W}$$

$$1 - W = \frac{7.6152}{8}$$

$$W = 0.048 \quad \text{OR} \quad 4.8\% \text{ TIME SPENT OFF ROUTE}$$

SECTION 4.0 PROCESSING AND RECOVERY

4.1 General

The composition of the Y-12 waste stream differs from that of a typical municipal solid waste (MSW) stream in three major ways.

1. The physical composition of the waste stream is not the same as that of a typical community. Figures 4.11 & 4.15 illustrate the percentage difference between a typical municipal waste stream and that of the Y-12 Plant for the years 1989 and 1990.
2. Because the solid waste is collected in a manufacturing environment the process of separating the various components of the waste stream should be simplified because the same type of operation generally takes place in a building.
3. The danger of off site contamination with radioactive material is a situation that must be dealt with.

The available Class II landfill space at the Y-12 Plant is rapidly being exhausted. This is the major concern that is driving the Y-12 Plant toward an increased emphasis on resource recovery. A spinoff of solving the landfill space problem could be increased revenue to offset collection cost and enhancing the Energy System's image as a concerned member of the community.

4.2 Major Components of the Waste Stream

Figure 4.10 and figure 4.14 are characterizations of the Y-12 Plant MSW stream (MSW) for the years 1990 and 1989. Figure 4.11 and Figure 4.15 show the differences between the typical community MSW and the Y-12 Plant MSW. A review of this data indicates that the amount of material that can be recovered from the waste stream at the Y-12 Plant can be expected to be less (from a percentage standpoint) than that from a community that produced the same poundage of municipal waste. In 1990 Construction Waste and Sludges made up 54.9% by weight and 46.2% by volume of the MSW now being disposed of in the landfill. The sludges being disposed of are from the treatment of the Y-12 Steam Plant waste water and are not acceptable for any type of land application. The large amount of construction waste is caused by the amount of plant modifications currently going on at the Y-12 Plant.

4.3 Current Recovery Programs

4.3.1 Ferrous Metal

There is presently no ferrous metal in the Y-12 MSW stream. Hauled containers are placed around the plant at points where ferrous metal waste is being processed. Waste material from processing is hauled to the west end of Y-12 where it is processed. Currently the Y-12 Scrap Yard processes 300,000 to 400,000 pounds of ferrous metal a month. There are two radiation meters at the Scrap Yard manned by two Health Physics technicians working at the Scrap Yard placing "blue tags" on material prior to it being released from the

plant through public sale. Approximately 10-15% of the material now being disposed of is not approved for release from Y-12. This material is currently placed on the ground until the salvage yard moves to a new location.

Prior to the any materia being removed from Y-12 it needs to be weighed. This process involves loading the material on a truck and taking it back into the Y-12 security area to the scale. This process slows the operation of the Salvage Yard.

In the evaluation of material brought to the Scrap Yard, any material that is of a high quality (other than carbon steel) is taken to a location in the plant where it can be sold by sealed bids instead of to the service contractor. Currently most of the material sold is purchased through a service contract with Southern Alloy of Rockwood, TN.

4.3.2 Non-Ferrous Metal

At the present time the majority of non-ferrous material going into the Y-12 landfill is in the form of aluminum drink cans. It is estimated that 1,250,000 cans are brought into Y-12 each year. This number of cans is equivalent to 50,000 pounds of recoverable aluminum. Although, as can be seen from Figure 4.10 and Figure 4.3, this volume of material does not impact the life of the landfill it is a valuable resource that needs to be kept in circulation.

A test program is currently underway to check the feasibility of recovering aluminum cans. In the past there have been concerns that the cans may be contaminated with

radioactive material. Currently there are six containers in various areas of the plant where aluminum cans are collected and then checked for contamination. The program has collected 44,000 cans to date with no problems, and it is expected that a complete recovery program will start in early 1991.

4.3.3 Paper

Each year there is a one week "War on Paper" (WOP) at Y-12. This year the WOP took place from November 12 to 16, and 56.4 tons of paper were collected. Since 36.3% of the volume of Y-12 waste stream is associated with paper and cardboard (Fig. 1), this is an area of real potential for reducing the rate at which the landfill is filling.

4.3.4 Construction waste

This is the single most important item to be removed from the Y-12 waste stream. Construction waste constitutes 40.2% (54.7 in 1989) of the space used by the Y-12 Plant in 1990. As discussed in other portions of this report, every effort needs to be made to find an alternative disposal method for this material.

4.3.5 Other

Figure 4.3 shows that over three fourths of the volume used by Y-12 waste in the landfill comes from construction waste (40.2%), paper (28.0%), and Cardboard (8.3%). Glass (3.1%), plastic (1.6%), and non-ferrous metals (0.6%) are

areas where recovery activities could be used, but the impact on the disposal rate usage would be small. Sludges (6.1% at 80% water) could be dewatered either by use of an existing vacuum filter associated with the West End Treatment Facility or through the construction of some type of drying beds. This added expense would not be justified as there is only minor volume reduction associated with dewatering. The special waste (7.3%) portion can not be recycled because there is no market, and there is no processing that would significantly reduce the volume.

4.4 Proposed Changes to the Existing System

4.4.1 Ferrous Metal

The system currently operating is functioning adequately. The system could be stream lined by installing a scale outside the Y-12 restricted area. This scale would eliminate the need for material to be taken back into the secure area to be weighed.

4.4.2 Non-Ferrous Metal

The proposed 100% recovery and recycling of aluminum cans used in the plant should be started when possible. It appears reasonable that the concern about contaminated cans is overstated.

4.4.3 Paper

This item (paper and cardboard) is the one item that can most easily be dealt with in a way that could reduce the load on the landfill in addition to generating revenue. Every effort needs to be made to initiate a comprehensive program immediately. The first step is to insure that all computer paper is collected separately. Collection points should be provided in all buildings with extensive computer usage. Computer paper containers would be placed at all exits from Y-12 and personnel encouraged to use them. The buildings more likely to produce quality mixed paper waste need to be identified and collection routes modified to keep quality high. With high quality will come increased revenue.

The difference between Fig. 4 & 5 illustrates the impact of an aggressive recovery program for paper products. These figures assume 80% recovery for paper and 90% recovery for cardboard. Other than the elimination of construction waste, this is the single most important thing that can be done to improve the performance of the Y-12 landfill.

4.4.4 Other

As noted previously, this area has only limited potential for either monetary gain or significant reduction in the amount of material going to the landfill. There is a market for plastic and some attempt should be made to recover the items that are readily available. Figure 4.7 assumes 50% of the plastic in the waste stream is recycled. Figure 4.7 also

assumes that 50% of the wood waste can either be recycled or sent to the same place as the construction waste.

Although not dealt with in any of the charts, composting is an area that should be considered. In the Y-12 plant area are many surface impoundments that have been capped in the last several years. The quality of the vegetative cover on these caps is low due to poor soil quality. A composting program making use of the food waste from the cafeteria could pay dividends in improving the quality of cap vegetation in addition to a small reduction in material going to the landfill.

4.5 Discussion and Conclusion

4.5.1 Impact of Processing and Recovery

In considering processing and recovery the disposition of the construction waste is not truly part of the question. How to deal with the construction waste is an operations problem that deals with the timely availability of an adequate alternative place to dispose of the material. Figure 4.9 provides a graphic representation of the impact of various processing and recovery procedures on the amount of material being sent to the landfill. The material from Y-12 constitutes approximately 40% of the material being sent to the landfill. Elimination of construction waste would produce a 40.2% reduction in the material going to the landfill from Y-12, but only a 16.0% reduction in the total material going to the landfill.

Making the changes recommended in Section 4.4.3 of this report would reduce the Y-12 portion about 30% with the added benefit of some revenue. Changes to other parts of the waste stream would only have minor impact on the amount of material being sent to the landfill, but the recovery process would result in additional funds for the operation of the MSW section at Y-12.

4.5.2 Summary of Recommended Changes

The following items could have immediate impact on the Y-12 MSW operation either by reducing the volume of material to be disposed of or increasing revenues.

1. Provide a scale outside the restricted area to improve Scrap Yard operation and possibly reduce staff.
2. Implement an aggressive recycling program for paper waste. This should include segregation of computer paper from mixed paper. This program should include revising collection routes for compactor trucks to take advantage of natural material segregation.
3. Establish a small composting program for cafeteria food waste to improve surface impoundment cap vegetation.
4. Immediately implement existing plan for aluminum can recycling.
5. Consider a pilot program for recycling glass and plastic. Because of the minor economic imprudence of these materials and their small portion of the total waste stream, this program should go forward cautiously.

ENVR. 555 — SEMESTER REPORT — FIG. 4.1

Y-12 1990 SOLID WASTE STREAM BY WEIGHT

ENVR. 555 - SEMESTER REPORT - FIG. 4.2

Y-12 1990 SOLID WASTE-4.0% CONST. WASTE

ENVR. 555 - SEMESTER REPORT - FIG. 4.3

Y-12 1990 SOLID WASTE VOL. NORMAL COMP.

ENVR. 555 - SEMESTER REPORT - FIG. 4.4

1990 AS COLLECTED & NORMAL COMPACTION

ENVR. 555 - SEMESTER REPORT - FIG. 4.5

1990 NORMAL COMPACTION-NO CONST. WASTE

ENVR. 555 - SEMESTER REPORT - FIG. 4.6

1990 NORMAL COMPACTION-NO CW OR PAPER

ENVR. 555 - SEMESTER REPORT - FIG. 4.7

1990 NORMAL COMP.-NO CW, PAPER OR OTHER

ENVR. 555 - SEMESTER REPORT - FIG. 4.8

1990 NORMAL COMP.-REMOVE ALL BUT CW

ENVR. 555 - SEMESTER REPORT - FIG. 4.9

ALL WASTE COMPACTED IN LANDFILL

ITEM - 1990 (AS DISCARDED)	FT ³	Ø/FT ³	LB.	% BY WT.
FOOD WASTE	33,270	18.0	598,900	2.3
PAPER	1,349,290	5.1	6,881,400	26.5
CARDBOARD	318,190	3.1	986,400	3.8
PLASTIC	99,850	4.0	399,400	1.5
TEXTILES & FIBERS	13,140	11.9	156,400	0.6
RUBBER	0	8.0	0	0.0
LEATHER	0	10.0	0	0.0
GARDEN TRIMMING	0	6.5	0	0.0
WOOD	111,700	15.0	1,675,500	6.4
GLASS	49,900	12.1	603,800	2.3
TIN CANS	0	5.5	0	0.0
NON-FERROUS METAL	33,270	10.0	332,700	1.3
FERROUS METAL	0	20.0	0	0.0
CONSTRUCTION WASTE	455,520	25.0	11,308,000	43.8
SPECIAL WASTE	82,590	4.1	338,600	1.3
SLUDGES (80% WATER)	58,300	45.0	2,623,500	10.1
<u>TOTALS</u>	<u>2,605,020</u>	<u>10.0</u>	<u>25,984,600</u>	<u>100.0</u>

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Y-12 1990 SOLID WASTE QUANTITIES - REVISED FORMAT

FIGURE 4.10

DECEMBER 12, 1990

ITEM - 1990 (AS DISCARDED)	% BY WT. (Y-12)	% BY WT. (NORMAL)	PERCENT DIFFERENCE
FOOD WASTE	2.3	15.0	-12.7
PAPER	26.5	40.0	-13.5
CARDBOARD	3.8	4.0	- 0.2
PLASTIC	1.5	3.0	- 1.5
TEXTILES & FIBERS	0.6	2.0	- 1.4
RUBBER	0.0	0.5	- 0.5
LEATHER	0.0	0.5	- 0.5
GARDEN TRIMMING	0.0	12.0	-12.0
WOOD	6.4	2.0	+ 4.5
GLASS	2.3	8.0	- 5.7
TIN CANS	0.0	6.0	- 6.0
NON-FERROUS METAL	1.3	1.0	+ 0.3
FERROUS METAL	0.0	2.0	- 2.0
CONSTRUCTION WASTE	43.8	4.0	+39.8
SPECIAL WASTE (INCLUDES SLUDGE)	1.3	0.0	+ 1.3

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Y-12 1990 SOLID WASTE QUANTITIES - DIFFERENCE FROM STANDARD

FIGURE 4.11

DECEMBER 12, 1990

ITEM - 1990 NORMAL COMPACTION	FT ³	Vf/V1	COMPACTED VOLUME	% BY VOLUME
FOOD WASTE	33,270	0.35	11,640	1.2
PAPER	1,349,290	0.20	270,000	28.0
CARDBOARD	318,190	0.25	79,550	8.3
PLASTIC	99,850	0.15	14,980	1.6
TEXTILES & FIBERS	13,140	0.18	2,370	0.3
RUBBER	0	0.30	0	0.0
LEATHER	0	0.30	0	0.0
GARDEN TRIMMING	0	0.25	0	0.0
WOOD	111,700	0.30	33,500	3.5
GLASS	49,900	0.60	29,950	3.1
TIN CANS	0	0.18	0	0.0
NON-FERROUS METAL	33,270	0.18	5,990	0.6
FERROUS METAL	0	0.35	0	0.0
CONSTRUCTION WASTE	455,520	0.85	387,200	40.2
SPECIAL WASTE	82,590	0.85	70,200	7.2
SLUDGES (80% WATER)	58,300	1.00	58,300	6.0
<u>TOTALS</u>	<u>2,605,020</u>	<u>10.0</u>	<u>963,680</u>	<u>100.0</u>

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Y-12 1990 SOLID WASTE VOLUMES - NORMAL COMPACTION

FIGURE 4.12

DECEMBER 12, 1990

ITEM - 1990 (AS DISCARDED)	FT ³	#/FT ³	LB.	% BY WT.
CONSTRUCTION WASTE	455,520	25.0	11,031,000	43.8
PAPER	1,349,290	5.1	6,881,400	26.5
SLUDGE (80 % WATER)	58,300	45.0	2,623,500	10.1
WOOD	111,700	15.0	1,675,500	6.5
CARDBOARD	318,190	3.1	986,400	3.8
GLASS	49,900	12.1	603,800	2.3
FOOD WASTE	33,270	18.0	598,900	2.3
PLASTIC	99,850	4.0	399,400	1.5
SPECIAL WASTE	82,590	4.1	338,600	1.3
NON-FERROUS METAL	33,270	10.0	332,700	1.3
TEXTILES & FIBERS	13,140	11.9	156,400	0.6
<u>TOTALS</u>	<u>2,605,020</u>	<u>11.8</u>	<u>25,984,600</u>	<u>100.0</u>

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Y-12 1990 SOLID WASTE QUANTITIES - BASIC DATA

FIGURE 4.13

DECEMBER 12, 1990

ITEM (1989)	FT ³	#/FT ³	LB.	% BY WT.
FOOD WASTE	22,400	18.0	403,200	2.0
PAPER	819,430	5.1	4,179,100	20.7
CARDBOARD	156,600	3.1	485,500	2.4
PLASTIC	67,100	4.0	268,400	1.3
TEXTILES & FIBERS	7,500	11.9	89,300	0.5
RUBBER	0	8.0	0	0.0
LEATHER	0	10.0	0	0.0
GARDEN TRIMMING	0	6.5	0	0.0
WOOD	33,600	15.0	504,000	2.5
GLASS	33,600	12.1	406,600	2.0
TIN CANS	0	5.5	0	0.0
NON-FERROUS METAL	22,400	10.0	224,000	1.1
FERROUS METAL	0	20.0	0	0.0
CONSTRUCTION WASTE	441,240	25.0	11,031,000	54.7
SPECIAL WASTE	54,950	4.1	225,300	1.2
SLUDGES	52,100	45.0	2,344,500	11.6
<u>TOTALS</u>	<u>1,710,920</u>	<u>11.8</u>	<u>20,160,900</u>	<u>100.0</u>

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Y-12 1989 SOLID WASTE QUANTITIES - REVISED FORMAT

FIGURE 4.14

DECEMBER 12, 1990

ITEM (1989)	% BY WT. (Y-12)	% BY WT. (NORMAL)	PERCENT DIFFERENCE
FOOD WASTE	2.0	15.0	-13.0
PAPER	20.7	40.0	-29.3
CARDBOARD	2.4	4.0	- 1.6
PLASTIC	1.3	3.0	- 1.7
TEXTILES & FIBERS	0.5	2.0	- 1.5
RUBBER	0.0	0.5	- 0.5
LEATHER	0.0	0.5	- 0.5
GARDEN TRIMMING	0.0	12.0	-12.0
WOOD	2.5	2.0	+ 0.5
GLASS	2.0	8.0	- 6.0
TIN CANS	0.0	6.0	- 6.0
NON-FERROUS METAL	1.1	1.0	+ 0.1
FERROUS METAL	0.0	2.0	- 2.0
CONSTRUCTION WASTE	54.7	4.0	+50.7
SPECIAL WASTE	0.0	1.2	+ 1.2
SLUDGE (80% WATER)	0.0	20.7	+20.7

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Y-12 1989 SOLID WASTE QUANTITIES - DIFFERENCE FROM STANDARD

FIGURE 4.15

DECEMBER 12, 1990

ITEM - 1989 NORMAL COMPACTION	FT ³	V _f /V _i	COMPACTED VOLUME	% BY VOLUME
FOOD WASTE	22,400	0.35	7,840	1.1
PAPER	819,430	0.20	163,900	22.4
CARDBOARD	156,600	0.25	39,150	5.4
PLASTIC	67,100	0.15	10,070	1.4
TEXTILES & FIBERS	7,500	0.18	1,350	0.2
RUBBER	0	0.30	0	0.0
LEATHER	0	0.30	0	0.0
GARDEN TRIMMING	0	0.25	0	0.0
WOOD	33,600	0.30	10,080	1.4
GLASS	33,600	0.60	20,160	2.8
TIN CANS	0	0.18	0	0.0
NON-FERROUS METAL	22,400	0.18	4,030	0.6
FERROUS METAL	0	0.35	0	0.0
CONSTRUCTION WASTE	441,240	0.85	375,050	51.2
SPECIAL WASTE	54,950	0.85	46,700	6.4
SLUDGES (80% WATER)	52,100	1.00	52,100	7.1
<u>TOTALS</u>	<u>1,710,920</u>		<u>730,430</u>	<u>100.0</u>

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Y-12 1989 SOLID WASTE VOLUMES - NORMAL COMPACTION

FIGURE 4.16

DECEMBER 12, 1990

ITEM (1989)	FT ³	#/FT ³	LB.	% BY WT.
CONSTRUCTION WASTE	441,240	25.0	11,031,000	54.7
PAPER	819,430	5.1	4,179,100	20.7
SLUDGE (80 % WATER)	52,100	45.0	2,344,500	11.6
WOOD	33,600	15.0	504,000	2.5
CARDBOARD	156,600	3.1	485,500	2.4
GLASS	33,600	12.1	406,600	2.0
FOOD WASTE	22,400	18.0	403,200	2.0
PLASTIC	67,100	4.0	268,400	1.3
SPECIAL WASTE	54,950	4.1	225,300	1.2
NON-FERROUS METAL	22,400	10.0	224,000	1.1
TEXTILES & FIBERS	7,500	11.9	89,300	0.5
<u>TOTALS</u>	<u>1,710,920</u>	<u>11.8</u>	<u>20,160,900</u>	<u>100.0</u>

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Y-12 1989 SOLID WASTE QUANTITIES - BASIC DATA

FIGURE 4.17

DECEMBER 12, 1990

SECTION V.

DISPOSAL

1. Current Disposal Facility

Disposal is currently being performed in a single, Tennessee Department of Health and Environment (TDHE) permitted landfill. This landfill receives the sanitary, industrial, and construction waste from three (3) Department of Energy (DOE) facilities: Y-12 Plant Site, K-25 Site, and Oak Ridge National Laboratory. Waste is delivered to the landfill by truck from the respective facilities. The landfill is facing a problem of rapidly depleting volume. This rate of volume depletion coupled with the scheduled date of operation for the replacement landfill results in a projected nine (9) month period for which no landfill capacity will be available. For this problem, several alternatives to current and future disposal have been considered. Descriptive, design, and operational data for the existing landfill is furnished below.

A. Description

- 1) Name: Y-12 Centralized Sanitary Landfill II
- 2) Location: The landfill site is located in the confines of the Oak Ridge Reservation in Anderson County on Chestnut Ridge, approximately 3/4 of a mile southwest of the Y-12 plant.
- 3) Size: Approximately 20 acres
- 4) Permit: #SNL011030189 issued December 20, 1982 by the TDHE. This facility was permitted under the old TDHE regulations. The requirements of the permit make it comparable to a Class II facility under the new regulations effective March 18, 1990.
- 5) Operations: The landfill is designed and operated on a trench-and-fill method. Refuse is unloaded and incorporated into a working face in a confined area. The volume of in-place compacted refuse and soil cover as constructed each day constitutes a cell. A cell is constructed by spreading refuse in layers approximately two feet thick using a compactor for spreading. The maximum height of a cell is eight feet. The working face is maintained at a slope of no steeper than 3:1. To minimize blowing litter, the trenches are oriented perpendicular to the direction of the prevailing winds. The landfill is operated on an eight hour, five day workweek.

B. Logistics

- 1) Remaining capacity: As of November 1, 1990, the remaining disposal capacity was estimated to be 168,850 cubic yards.
- 2) Daily disposal: The average daily disposal has been estimated to be 350 cubic yards including cover.
- 3) Operational time: Based on this remaining capacity and daily usage rate, there are approximately 480 days of disposal operations remaining. Using a five day workweek, this calculates to 96 weeks.
- 4) Capacity complete: This equates to the remaining landfill capacity being totally consumed by the middle to end of September, 1992.
- 5) Planned replacement: The planned replacement for the Y-12 Centralized Sanitary Landfill II is the Steam Plant Ash Disposal (SPAD) Project which includes both a Class II and a Class IV landfill sites. However, this project is not scheduled to be complete and operational until July 1, 1993.
- 6) Dilemma: There is a period of approximately nine months (October 1992 thru June 1993) for which landfill disposal capacity will not be available.
- 7) Need: A viable plan must be developed to provide landfill disposal capacity until the SPAD project landfills are available.

2. Disposal Alternative #1: Expansion Of Existing Landfill

The first solution to be considered was the expansion of the existing landfill. This consideration held merit since it was a project previously initiated, and a large portion of the preliminary requirements have been completed. This preliminary work includes the National Environmental Policy Act (NEPA) documentation approval required from DOE Headquarters, a function having a long lead time. In addition, most of the geologic and hydrologic characterization for the expansion site has been performed. The TDHE regulators have performed a walkover of the of the expansion site and given approval of development of the site for a landfill in accordance with current regulatory provisions. Preliminary design and operational data is furnished below.

A. Description

- 1) Name: Y-12 Centralized Sanitary Landfill II Expansion
- 2) Location: This expansion facility would be located to the immediate northwest corner of the existing facility. This would result in the overall landfill site remaining within the confines of the Oak Ridge Reservation in Anderson County on Chestnut Ridge.

- 3) Size: The expansion site is approximately 4 acres of surface area. The fill depth (including cover) is projected to be 30 feet due to economical cut/fill restraints.
- 4) Capacity: The capacity of the expansion would be 193,660 cubic yards.
- 5) Operations: The expansion facility would be operated the same as the existing landfill. Due to the close proximity of both sites, this includes using the existing equipment for the expansion site also.
- 6) Permit: The expansion site would be permitted by the TDHE as an independent Class IV landfill. It would therefore, be closed independently of the existing Class II facility.
- 7) Need date: To extend the life of the existing landfill to the date that the SPAD landfills are to be available, the expansion site would have to be operational no later than November 1, 1991. This allows approximately six weeks contingency time.

B. Logistics

- 1) Capacity: 193,600 cubic yards
- 2) Daily disposal: Assume (from trend studies) that 50% of the daily volume (including cover) is Class IV and will be diverted to the expansion site. This is 175 cubic yards per day.
- 3) Operational time: Based on this daily usage rate, there will be approximately 1106 days of disposal operations available. This converts to 221 weeks based on a five day workweek (approximately 4 years and 3 months).
- 4) Utilization: The expansion site would have a capacity life beyond the SPAD project becoming operational. This capacity would be totally used, thereby extending the time frame of the SPAD Class IV facility life by delaying its beginning use date.

3. Disposal Alternative #2: Development Of Existing Construction Borrow Area Into A Class IV Disposal Facility

The second solution to be considered was the development of an existing construction borrow area into a TDHE permitted Class IV landfill facility. This is an area which has been previously excavated and will have to have a certain amount of topographic restoration. Therefore, site preparation would be minimal, construction time would be short, and the development would be relatively inexpensive. Most needed geologic and hydrologic characterization is available from adjacent projects. Developmental data, considerations, and findings are described below.

A. Merits

- 1) This is an existing construction fill borrow area which has been excavated and must be restored.
- 2) Only minimal development would be required.
- 3) Due to existing geologic and hydrologic data available, only minimal additional site characterization would be required.
- 4) The borrow area, with minimal development, would yield 57,000 cubic yards of disposal capacity (approximately 325 workdays).

B. Demerits

- 1) It could take up to one year to acquire the necessary National Environmental Policy Act (NEPA) documentation.
- 2) This site is also being considered as the location for a future waste management facility (building).

4. Disposal Alternative #3: Implement The Use Of A Synthetic Cover On The Operating Face Of The Existing Landfill

The third alternative considered was to implement the use of a synthetic cover on the face of the existing landfill facility in-lieu-of daily soil cover. This would only be an interim assistance to prolong the life of the existing landfill. This would decrease the time frame of no capacity between filling of the existing landfill and the availability of the replacement landfill. Developmental data, considerations, and findings are described below.

A. Merits

- 1) This feature would be easy and quick to implement.
- 2) Even though it would be small, an immediate savings in landfill capacity would be realized due to the decrease in daily cover required.
- 3) Four days worth of operating face cover, approximately 140 cubic yards, would be saved each week.
- 4) This synthetic cover could be installed and removed quicker and more economically than one installation of soil cover.

B. Demerits

- 1) This is only a minimal bandaid for one spot on a large problem.
- 2) This is a new concept with respect to the TDHE regulations, but the regulators seem to be open to trying some innovative methods.

5. Disposal Alternative #4: Development Of Construction Borrow Areas, Excavated Areas, Or Natural Depressions As Unpermitted Landfills

A consideration was given to the development of construction borrow areas, unused excavated sites, and natural depressions as unpermitted landfills in accordance with the current TDHE regulations. This would allow the disposal of certain rubble and construction waste without the need of a TDHE permit. This would divert a good portion of the Class IV type waste away from the Class II landfill. Developmental considerations are described below.

A. Merits

- 1) Little or no design development time or cost would be required.
- 2) Sites could be developed on an as needed basis.
- 3) No TDHE permitting functions would be required.
- 4) Sites requiring restoration/reclamation could be accomplished much more economically.

B. Demerits

- 1) Control over the deposition of waste in the facility would be more difficult than a operational landfill.
- 2) Verbal discussions with different TDHE regulators at different times have resulted in a difference of opinion as to the applicability of these provisions to the Oak Ridge Reservation and DOE facilities.
- 3) DOE determination of acceptability for this operational approach has not been formulated.
- 4) NEPA would require an Environmental Assessment.
- 5) TDHE would still have inspection and citation authority over the site.

6. Disposal Alternative #5: Utilization Of the Existing Industrial Waste Landfill IV

A consideration was given to the utilization of the existing Y-12 Industrial Waste Landfill IV. This is a TDHE Class IV permitted facility. It is administratively and functionally controlled and used for the disposal of "classified" waste. This facility was reviewed for two approaches: 1- upgrading to a Class II facility, and 2- disposal of nonclassified Class IV waste. Developmental considerations and results are described below.

A. Merits (Upgrading)

- 1) Very little if any additional geologic and hydrologic site characterization would be required.

- 2) Monitoring wells are already installed.
- 3) Background groundwater characteristics are known.
- 4) Access roads are already in existence

B. Demerits (Upgrading)

- a
- 1) The used portion of the landfill would have to be isolated and closed, or have additional work with respect to a liner, a leachate collection system, and gas venting system.
 - 2) This would be a high capital outlay.
 - 3) New equipment (loaders, dozers, scrapers, etc.) would have to be purchased to operate this landfill concurrently with other landfills due to its distant location.
 - 4) NEPA documentation could take a year or more to acquire approval.
 - 5) The TDHE permitting could take several months.
 - 6) Only about one and one-half years of disposal capacity could be gained.
 - 7) Provisions would have to be made for the "classified" waste stream.

C. Merits (Nonclassified Class IV Waste)

- 1) Some relief would be reaped for the current diminishing capacity.
- 2) Availability would be almost instantaneous.
- 3) Very little administrative or regulatory preparation would be required.
- 4) It can be used in a dire emergency if the replacement landfill is not operational when the current landfill is filled.

D. Demerits (Nonclassified Class IV Waste)

- 1) There is a potential that the "classified" waste stream will greatly increase in the near future.
- 2) Provisions would have to be made for the "classified" waste stream.

7. Disposal Alternative #6: Off-site Disposal - Commercial Landfill

Consideration was given to the utilization of off-site disposal in a commercial landfill. This would provide an immediate disposal capacity with out the requirements of NEPA or the TDHE permitting process. However, there are numerous concerns to be addressed before this could take place. The concerns and considerations are listed below.

- 1) A transfer station would have to be constructed to transfer the waste from site containers to the commercial haul vehicle.
- 2) It would not be cost effective to attempt to transport the waste to the landfill by company vehicle due to the small size of the containers and the long haul distance.
- 3) Due to potentials for radionuclide contamination and the public perspective, extensive monitoring of the waste before it left the site would be required.
- 4) Although a very good program is in place for the control of hazardous waste, a stronger and more cautious approach would have to again be implemented due to the public perspective.
- 5) Due to the potential liabilities for contamination from either a radionuclide or hazardous source, the commercial landfill operator would in all likelihood require an elevated tipping fee.
- 6) The commercial hauler would probably also require an elevated transport fee due to liabilities out of the ordinary.
- 7) NEPA documentation to construct the transfer station would require a long lead time.
- 8) In the event of an accident or contamination problem at the landfill or during transport, DOE would probably be cited as the primary responsible party (PRP) due to their large operating budget, regardless of whose fault it was.

8. Disposal Alternative #7: Request Non-Y-12 Disposers To Seek Other Disposal Alternatives

Consideration was given to request the K-25 Site and ORNL to independently seek alternatives to disposal at Y-12. To this extent, both sites have been requested to pursue aggressive waste minimization programs. Such a program has already been implemented at Y-12. Dependent upon future DOE and TDHE responses as the utilization of unpermitted disposal facilities within the ORR, both K-25 Site and ORNL should be requested to seek such a facility at their respective plant locations. This could very well be a bandaid approach to get through period before the SPAD Project landfill becomes operational. Each of the respective sites could pursue independent commercial disposal (incineration, landfill, etc.) also.

9. Recommendations

The following recommendations are made with respect to disposal needs/considerations at the Y-12 Centralized Sanitary Landfill II.

- A. Pursue Alternative #1, the development of the expansion of Y-12 Centralized Sanitary Landfill II.
- B. Implement Alternative #3, the use of a synthetic cover daily (four days a week) on the operating face of the existing SLF II.
- C. Pursue the feasibility of utilizing a small portion of Industrial Landfill IV on an emergency basis for Class IV type waste if SPAD is not operational as required.
- D. Request K-25 and ORNL to independently seek disposal methods other than the Y-12 landfill.

10. Figures

- A. Figure 5-1: Aerial View - Y-12 Centralized Sanitary Landfill II
- B. Figure 5-2: Aerial View - Construction Borrow Area 2
- C. Figure 5-3: Aerial View - Y-12 Industrial Waste Landfill IV
- D. Figure 5-4: SLF-II Remaining Life Calculations
- E. Figure 5-5: SLF-II Expansion Life Calculations
- F. Figure 5-6: SLF-II Expansion Need Date Calculations
- G. Figure 5-7: Borrow Area 2 Capacity/Life Calculations
- H. Figure 5-8: SLF-II Synthetic Cover Calculations

Figure 5-1
Aerial View: Y-12 Centralized Sanitary Landfill II
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HH7E L2

Figure 5-2
Aerial View: Construction Borrow Area 2

Aerial View: Y-12 Industrial Waste Landfill IV

Figure 5-3

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GENERAL DESIGN AND COMPUTATION SHEET

Figure 5-4

~~Attachment~~
SLF-II Remaining Life Calculations

JOB	DATE	SHEET
ESD NO.	COMPUTED	CHECKED BY

Existing SLF-II Capacity/Life

Remaining capacity as of 11/01/90: 168,850 cu yd Class II waste

Daily disposal from 3 plants: 350 cu yd including cover

$$\therefore \frac{168,850 \text{ yd}^3}{350 \text{ yd/day}} = 482.43 \approx 480 \text{ days of disposal capacity remaining}$$

SLF-II operates 5 days/wk

$$\frac{480 \text{ days}}{5 \text{ days/wk}} = 96 \text{ wks}$$

$$\therefore 96 \text{ wks from 11/01/90} \approx 09/10/92$$

At the current rate of waste disposal, SLF-II will be completely filled by 09/10/92. Factoring in holidays and reduction for slow periods, use date of 10/01/92.

GENERAL DESIGN AND COMPUTATION SHEET

Figure 5-5

JOB	DATE	SHEET
SLF-II Expansion Life Calculations		1 of 1
ESO NO.	COMPUTED	CHECKED BY

SLF-II Expansion Capacity/Life

Actual disposal area $\approx$ 4 acres for Class IV waste

$$\therefore (4 \text{ acres}) \times (43,560 \text{ sq ft/acre}) = 174,240 \text{ sq ft}$$

Assumed cut depth of landfill due to economics = 20 ft
Assumed fill to be 10 ft above grade

$$\therefore 20 \text{ ft} + 10 \text{ ft} = 30 \text{ ft depth of landfill}$$

$$\text{Volume of landfill} = \frac{(30 \text{ ft}) \times (174,240 \text{ sq ft})}{27 \text{ cu ft/cu yd}} = 193,600 \text{ cu yd}$$

Surveillance has indicated that 50% of the waste stream is Class IV material that could be diverted from SLF-II to the Expansion.

$$\therefore \frac{350 \text{ cu yd/day}}{2} = 175 \text{ cu yd/day disposal in Expansion}$$

Expansion will operate 5 days/wk

$$\frac{193,600 \text{ cu yd}}{175 \text{ cu yd/day}} = 1106.29 \approx 1106 \text{ days}$$

$$\begin{aligned} @ \frac{1106 \text{ day}}{5 \text{ days/wk}} &\approx 221 \text{ wks disposal capacity} \\ &\approx 4 \text{ years 3 months} \end{aligned}$$

This would give a capacity/life beyond the expected date of operational availability of the SLF-II replacement landfill on 07/01/93.

GENERAL DESIGN AND COMPUTATION SHEET

Figure 5-6

JOB SLF-II Expansion Need Date Calculations	DATE	SHEET 1 of 1
ESD NO.	COMPUTED	CHECKED BY

SLF-II Expansion Need Date

Expansion will divert approximately 50%, or 175 curd/day away from the Class II landfill.

Replacement Class I or II landfill in Steam Plant Ash Disposal (SPAD) Project is scheduled to be operationally available on 07/01/93.

As of 11/01/90, SLF-II had 480 days capacity @ 350 curd/day remaining.
 $\therefore$ SLF-II will be filled by 10/01/92.

10/01/92 to 07/01/93 $\approx$ 40 wks $\Rightarrow$ 200 workdays

$\therefore$ SLF-II Expansion must be available 200 workdays before 10/01/92 to salvage 200 days capacity @ 175 curd/day in the existing SLF-II Class II landfill.

Allowing approximately six-plus weeks for contingency purposes (construction delay, increase in disposal volume, etc), the SLF-II Expansion needs to be operational no later than 11/01/91.

Slippage in the SPAD available date, major delays in Expansion available date, or large increase in disposal rate will necessitate recalculation of need.

GENERAL DESIGN AND COMPUTATION SHEET

Figure 5-7

JOB: Borrow Area 2 Capacity/Life Calculations DATE: _____ SHEET: 1 of 1
 ESO NO. _____ COMPUTED BY: _____ CHECKED BY: _____

Construction Borrow Area 2 Capacity/Life

Preliminary survey and engineering calculations indicate that the borrow area will yield 26,000 cu yd capacity in the undeveloped state, and 57,000 cu yd if developed. Development would require the moving of 26,000 cu yd of dirt which would be used for berms and cover.

Assuming developed Borrow Area 2, for Class IV waste

$$\therefore \frac{57,000 \text{ cu yd}}{175 \text{ cu yd/day}} \approx 325 \text{ days capacity}$$

$$@ \frac{325 \text{ days}}{5 \text{ days/wk}} = 65 \text{ wks} \Rightarrow \text{1 year 3 months}$$

From 11/01/90 to 07/01/93 $\approx 139 \text{ wk} \Rightarrow 695 \text{ work days}$

$$168,850 \text{ cu yd} - 57,000 \text{ cu yd} = 111,850 \text{ cu yd disposal required beyond Borrow Area 2}$$

$$\frac{111,850 \text{ cu yd}}{350 \text{ cu yd/day}} \approx 320 \text{ days}$$

$$695 \text{ days} - 325 \text{ days} = 370 \text{ days} \Rightarrow \text{disposal time needed beyond Borrow Area 2}$$

$$370 \text{ days} - 320 \text{ days} = 50 \text{ days} = 10 \text{ wks additional disposal @ } 350 \text{ cu yd/wk needed.}$$

$\therefore$ Borrow Area 2 alone would not be enough additional disposal area.

GENERAL DESIGN AND COMPUTATION SHEET

Figure ~~5-8~~ 5-8

JOB NO. ~~SLF-II Synthetic Cover~~ Calculations
 ESO NO. ~~COVER~~

DATE

SHEET

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SLF-II Life/Capacity Extension Due To Use of Synthetic Cover

Current Operating Face: Approximately 4 to 1 slope
 Depth of cell 6 ft
 Width 50 ft
 Average cover 9" $\rightarrow$ 0.75 ft

$$\text{Volume of daily cover} = \frac{(25 \text{ ft} \times 50 \text{ ft}) (0.75 \text{ ft})}{27 \text{ cu ft/cu yd}}$$

$$\text{Volume} \approx 35 \text{ cu yd/day}$$

Assuming the synthetic cover would be used 4 days per week
 and an earth cover would be used on Friday,

$$(4 \text{ days}) \times (35 \text{ cu yd/day}) = 140 \text{ cu yd/wk}$$

$\therefore$ Use of synthetic cover would save 140 cu yd/wk
 of landfill capacity. Two days disposal @ 350 cu yd/day
 would be saved over 5 weeks.

6.0 SUMMARY OF RECOMMENDATIONS

The following recommendations are made for all elements of Y-12's Solid Waste Management System.

6.1 Install scale at SLF II and another outside the exclusion area for the Salvage Yard.

6.2 Improve quality of data collected.

6.3 Evaluate dewatering of sludges.

6.4 Evaluate conversion from coal to natural gas.

6.5 Increase emphasis and funding level for Waste Minimization Program.

6.6 Enhance TMS operation.

6.7 Establish collection routes and schedules for both areas.

6.8 If available, certify additional on-radioactive drums and add a second connector kit.

6.9 Eradicate "NO PARKING" in front of dumpsters and blocking of access to dumpster locations.

6.10 Relocate TMS nearer SLF II.

6.11 Remove old e-dumpsters.

6.12 Implement aggressive paper, cardboard, wood-pallet, and blue-bulk-recycling program.

6.13 Establish small waste and program for top level.

6.14 Establish a recycling program for all waste materials.

6.15 Establish SLF II I and II waste management program.

6.16 Establish SLF II waste management program.

6.17 Establish SLF II waste management program.

END

DATE FILMED

02 / 01 / 91