START

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Conceptual Design
for the

Waste Receiving And Processing Facility Module 2A

9413227.0011

Conceptual Design Report

Prepared for

U.S. Department of Energy
Richland Operations Office
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10.0 IDENTIFICATION AND ANALYSIS OF UNCERTAINTIES

1. The WRAP 2A conceptual design has established a project scope that satisfies the FDC requirements. The process and facility systems established represent a feasible configuration to attain the necessary performance level and provide a reliable cost estimate and construction schedule for the project.

2. To advance the conceptual design to the stage that can provide a technical baseline for the definitive design to proceed on, requires a considerable optimization effort to resolve technical uncertainties. The technical areas that require additional evaluation are listed in **Table 10-1**.

3. A major prerequisite to the technical area evaluations identified in **Table 10-1** is the confirmation from the waste form qualification tests being conducted by WHC for the proposed polymer encapsulation process for high soluble salt wastes complies with the full spectrum of waste acceptance criteria mandated by the Washington Administrative Code for LLMW. The nature of the test results will determine if the suggested areas of evaluation should continue as presented or if a course correction and/or additional evaluations are warranted.

4. The design presented in this CDR meets all known functional requirements but is not fully optimized. It is, therefore, recommended that a value engineering assessment be undertaken on this CDR early in the ACDR phase which will involve DOE-RL, WHC and UE&C personnel. This assessment will identify areas of opportunity both in terms of requirements, and in the design, which will then form a sound basis upon which to rigorously evaluate the CDR within the ACDR phase.

5. Several areas within the WRAP 2A facility present themselves as candidates for safety analysis. It is proposed that this analysis take the form of a Hazard and Operation (HAZOP) study. The study will use the flow diagrams as currently developed to perform the analysis. The key areas which the CDR identified as sensitive to safety issues can be summarized as follows:

a. The Polymer Encapsulation Process: Explosion, toxicological, radiological, and operational risks need to be explored for the entire process.

b. Size Reduction: Explosion risks associated with the use of shredders and other spark making equipment in a dusty environment.

c. Special Processes: Explosion and fire risks associated with the evaporation of mercury and the treatment of reactive metals (zirconium, beryllium). Toxicological risks associated with the processing of mercury and beryllium.

6. The feasibility of polymer encapsulation as an acceptable immobilization matrix must be further explored. A wasteform qualification program is currently underway to justify the use of the vinyl ester styrene polymer as a suitable encapsulation medium. After the first phase of this program, which limits the treatability scope to those wastes designated for polymer immobilization, there is a need to extend the waste not only to cover the entire spectrum of wastes but to explore ways in which certain wastes may be successfully grouted as an alternative. If the WRAP 2A facility must include both grout and polymer processes, it would be advantageous if there was an overlap capability such that as many wastes as possible could be acceptably immobilized by either process.

7. In addition to treatability, the operability and maintainability of the polymer process must be investigated to ensure that it is compatible with the requirements and strictures imposed by the radioactive environment. The ACDR will explore the potential problem areas of storage, distribution and mixing the polymer and its associated chemical constituents.

8. A Fire Protection Study covering the whole facility will be undertaken with special emphasis on the polymer and the special waste processes. The polymer process utilizes various solvents in addition to the vinyl ester styrene in its process and the special waste area will handle

zirconium and will include a mercury evaporation stage. Each of these represents a significant fire risk and will draw a significant proportion of the analysis during the study. The study will identify all aspects of plant and building design necessary to allow the facilities to be safely operated.

9. Shredding has been identified as the most suitable method to size reduce large items of drummed waste to a size which is acceptable for immobilization in either a grout or polymer matrix. However, due to the diversity in size and material properties of the waste to be size reduced, further work is required to investigate the capabilities of commercially available shredding units in order to ensure the optimum equipment can be identified to size reduce the specified wastes. Further engineering work will then be required to ensure the shredding equipment can be safely incorporated, operated and maintained within a radioactive environment.

10. In order to achieve satisfactory repacking of waste into new drums, further work is needed to ensure that waste can be metered into a weigh hopper to the required degree of accuracy such that the required mass of waste can be batch deposited into new drums for immobilization. Work is also required to assess the drum handling requirements for new drums which are being loaded with waste (clamp band removal/replacement, fitting of waste antifloatation plates, etc.).

11. In order to size reduce large items within the box breakdown cell, a number of size reduction tools will be required to be operated by the power manipulator. Investigations will be required as part of the ACDR to investigate commercially available cutting equipment and identify which of these are most suitable for size reducing boxed waste. Further work will also be required to ensure these tools can be remotely changed by the power manipulator.

12. The CDR identified the requirement to cater for three different types of samples within the WRAP 2A facility. It produced a schedule which gave a preliminary indication of the number of samples in each category which in turn provided enough information to size and equip the Sample Management Area (SMA). The aim of this work was to minimize the extent of sampling within the SMA without compromising process continuity. The development of this work will seek to identify the means of sample taking, the method of transporting samples to the SMA and through it to external analytical facilities, and optimize sampling objectives to meet process requirements.

13. Additionally, the ACDR will answer some of the uncertainties surrounding the role of sampling in the certification procedure. Currently, the design caters for the sampling of a proportion of all incoming and outgoing waste but further optimization of these steps is required, especially in terms of sample frequency in order to meet regulatory and process demands. The influence of sample frequency on material movement and storage volume will be studied with the Time and Motion Study during the ACDR.

14. The results of the Value Engineering Assessment and HAZOP analysis will potentially influence the scope of work being undertaken in other areas, e.g, conclusions made to alleviate the ignition potential in size reduction environments are likely to have an impact on optimization studies for this area. For this reason the value engineering and HAZOP studies should take place as early in the ACDR program as possible.

15. Beyond the areas of technical uncertainty identified above, there is a need for optimization of the whole process and equipment in general. **Table 10-1** identifies those areas where further evaluation is considered appropriate. A particular issue which will be considered during this optimization phase will be the question of whether a single process could be utilized for all the wastes within the WRAP 2A scope. This will be investigated as the initial part of the grout and polymer encapsulation studies, and would obviously result in the elimination of one area from further assessment should a single process be chosen.

TABLE 10-1
UNCERTAINTIES

AREA OF UNCERTAINTY	RESOLUTION	COMMENTS/ANALYSIS
1. **Value Engineering:**	ACDR Study	There is a need to perform a value engineering study, to identify any areas of change to requirements, or to the design which are worthy of further consideration. This study will involve the participation of DOE-RL, WHC and UE&C.
2. **Safety Assessment:** Provision of input to WHC Preliminary Safety Evaluation.	ACDR Study	There is a need to perform a HAZOP type structured safety and operability assessment on the design concept in order to validate it and to provide input into the PSE to be prepared by WHC. This will utilize the Flow Diagrams.
3. **Polymer Feasibility:** Feasibility of the polymer process, including identification of acceptable operating envelopes and optimization of equipment.	WHC development work, supported by ACDR Study.	The WHC Integrated Development Program to establish acceptable encapsulation envelopes for all of the identified waste streams to be polymer encapsulated will be progressed during the period of the ACDR. Part of this program will determine the necessary mixing and cure times. These times will be incorporated into the simulation model, which will determine if more equipment is required. There will be a need to support this program and to utilize it's results to optimize the equipment design. Particularly, there is a need to optimize the pretreatment (e.g., waste dehydration), metering, mixing (in-drum vs. out-of-drum and nonactive mixing of constituents), the issue of two containment barriers for the exiting waste form, filling process, equipment and curing.
4. **Size Reduction:** Optimization of size reduction equipment and configuration for both drums and boxes.	ACDR Study	The concept design includes specialist equipment to size reduce drums of concrete, large boxes, and other smaller miscellaneous wastes, and to produce a fairly uniform output for encapsulation. There is a need to optimize equipment and equipment configuration in these areas, to attempt to reduce the number of stages of operation, and to further detail out required equipment and cell arrangement. Additionally, the optimization study will specifically include consideration of empty drum disposal viability, sludge repackaging requirements, and box breakdown tooling.
5. **Sampling:** Identification of requirements and methods.	ACDR Study	The CDR includes a figure summarizing sampling requirements for the facility. Specialist equipment for sampling requirements are specified in the FDC, which may not be cost effective. There is a need to optimize the sampling schedule; identify analyses required; identify appropriate location to take samples; identify appropriate methods and hardware; identify the means of transporting samples from source to SMA; identify any lag storage requirements awaiting analysis.

TABLE 10-1
UNCERTAINTIES

AREA OF UNCERTAINTY	RESOLUTION	COMMENTS/ANALYSIS
6. Fire Protection: Assessment of requirements and consideration of specific problem areas	ACDR Study	Fire risks will be identified during the structured and rigorous HAZOP assessment for the entire facility These areas of risk will then be further evaluated during this Fire Protection assessment. A particular area of concern is anticipated to be the materials utilized in the polymer encapsulation process. Further specific areas of concern are associated with provision of a secondary source of fire water, and the need to assess the combustible contents of drums. DOE Order 6430.1A, Section 1530-99.0 requires two separate reliable sources of fire protection water. Project B-604 is being planned to provide a second source. During Title I design a decision will need to be made: submit a criteria deviation to DOE, or assume Project B-604 will provide the second source prior to startup. If the contents of the drums need to be included as combustibles for the Maximum Possible Loss scenario, the loss (including cleanup) will exceed $75M. Tests need to be performed to show that the drum contents do not propagate the fire. This question also exists on other solid waste facilities and the possibility of such tests are being discussed.
7. Grout Encapsulation: Identification of appropriate grout formulations and optimization of equipment.	ACDR Study, possibly including WHC development work.	There is a need to further detail each waste stream, to define an appropriate grout formulation for each waste stream, and to define the formulation envelope for each stream. The objective will be to optimize the formulation envelope to achieve the widest applicability (i.e., one formula for all waste). This task may involve some further development work on certain waste streams, to either further characterize the stream or to define the grout formulation where no comparable experience can be identified. Equipment and cure storage space will then need to be optimized.
8. Waste Transfers: Optimize methods of material transfers between enclosures.	ACDR Study	There are a significant number of waste transfers taking place within the process, between different enclosures. There are also new containers being entered and filled within the process. There is a need to consider all of these transfers with a view to identifying appropriate equipment, development needs, containment requirements and minimization of secondary waste arisings.
9. Material Handling: Modelling and optimization of the internal transport system.	ACDR Study	There is a need to further develop the plant-wide process material movement Time and Motion model for Module 2A, including optimization of stabilization materials delivery logistics, optimization of lag storage areas within the process, evaluation of alternative handling systems, interfacing with W-112, assessment of maximum throughput capacities and optimization of material routings.
10. Special Waste Treatment: Optimization of equipment.	ACDR study	The design concept includes a large enclosure for this relatively small waste stream. There is a need to optimize process comparing operations and configuration, and to attempt to combine all special waste operations into a smaller enclosure.
11. Decontamination: Verification of needs and optimization of equipment.	ACDR Study	The design concept includes relatively extensive decontamination systems. There is a need to rationalize requirements which should include waste minimization. Then appropriate equipment can be identified and evaluated to meet these needs.
12. Process Automation: Optimize the degree of automation of the process.	ACDR Study	In conjunction with the shielding assessment, time and motion study and dose exposure assessment, and taking the process equipment identified, an evaluation needs to be undertaken to assess the "fitness for purpose" and proposed degree of automation and mechanization of the process. The man machine and work environment interface will also be considered in this assessment.

TABLE 10-1
UNCERTAINTIES

AREA OF UNCERTAINTY	RESOLUTION	COMMENTS/ANALYSIS
13. Off-Gas System: Clean air act consideration	ACDR Study	There is a need to consider proposed off-gas treatment process, and to evaluate requirements per the Clean Air Act.
14. Facility Optimization: Optimization of facility systems.	ACDR Study	The facility optimization studies consist of evaluating the facility functional layout in terms of adjacency relationships, life safety code compliance, etc. The optimization studies will also address the building structure, HVAC, computer control/data management systems, and electrical system configuration. The studies to be performed include: • Facility Layout Optimization • Building Structural System Optimization • HVAC Confinement System Optimization • Overall Electrical System Optimization • Plant Data Acquisition and Computer System Configuration Optimization • Facility Utility Systems Optimization • Warm Maintenance Requirements Definition and Configuration
15. Site Development: Site grading tie-in and finished landscaping	WHC Coordination	Grading and site development of the WRAP 2A site is indicated on the Grading Plan, Drawing No. H-2-104721 and is limited to the area defined by the "limit of work" boundary. Tie-in of the surrounding site development, including W-112 connection and access roads, requires coordination with other HCWC projects. Also not included in estimate are costs to bring into the WRAP 2A the following: • The fiber optic HLAN cable including all fiber optic equipment and IVDTS system which includes telephone, PAX, evacuation alarm system, etc. • The overhead 13.8kv transmission line extension from WRAP Module 1. WRAP 2A interface will be at government furnished overhead pole approximately 350 feet from WRAP 2A north east corner.
16. Shielding Assessment: Shielding and dose exposure optimization	ACDR Study	On completion of the process studies, there will be a need to further evaluate shielding requirements and dose exposure to operators.
17. General: Proposed RCRA LDR for debris type waste	WHC evaluate impact of such ruling and modify criteria followed by A/E evaluation of CDR impact	According to these proposed rules, expected to become law in near future, waste that is considered debris with mostly organic composition, i.e., wood, paper, cloth, rubber, plastic, etc., would not be amenable to treatment by immobilization or solidification as is currently planned in the CDR. Other BDATs, e.g., thermal incineration, may be mandated. These proposed new rules would affect feedstreams 3, 4 and possibly 1. Criteria changes will then be necessary for treatment of such waste.

APPENDIX A

PRELIMINARY ENERGY CONSERVATION REPORT
WASTE RECOVERY AND PROCESSING BUILDING, MODULE 2A

9413224.0017

A.1 EXECUTIVE SUMMARY

1. Since the building system design is at a conceptual level, a detailed computerized energy analysis was not performed.

2. The building configuration and mechanical system design is very similar to WRAP 1 facility. WRAP 2A facility is larger in area and volume in comparison to WRAP 1 and has higher air change rate per hour.

3. During the Title I design an energy conservation analysis will be performed in accordance with DOE 6430.1A.

4. Conceptual design for HVAC system has adopted the following energy conservation features:

   a. Administration and support area will utilize variable volume system with economizer controls.

   b. Chilled water system for plant cooling will utilize water-cooled centrifugal chillers and cooling towers.

   c. Process exhaust air system will be provided with heat recovery equipment utilizing run around coil.

   d. Locker room exhaust air system will be provided with heat wheel for heat recovery.

   The above energy conservation concepts are chosen for WRAP 2A Facility as a result of WRAP 1 energy conservation analysis.

5. The energy conservation analysis for the Title 1 design activity will be performed to confirm the design configuration adopted in the conceptual phase.

6. This report depicts the approach and methodology which will be utilized for the follow-on energy conservation analysis.

A.2 INTRODUCTION

A.2.1 Background

1. The Waste Receiving and Processing Building (WRAP) Module 2A, will be located within the #200 West Area of the Hanford Reservation, near Richland, Washington, which is controlled by the U.S. Department of Energy, Richland Operations office.

2. DOE Order 6430.1A, "General Design Criteria," Section 0110 and DOE Architectural Engineering Standards, Section 5.4.7, mandates an Energy Conservation Report shall be prepared for each new building and building addition where total energy consumption is expected to exceed 500 MBTU/yr or when building is larger than 10,000 gross sq. ft. or when required by the DOE Energy Management Coordinator. DOE Order 6430.1A also requires the Preliminary Energy Conservation Report shall be included as part of the Title I Design and updated at the Title II Design phase, when final selection of energy conservation features or renewable energy sources are made.

A.2.2 Purpose

1. The purpose of the Energy Conservation Report is to evaluate energy and design alternatives and develop capital cost estimates of the alternatives which, though they are more expensive on a capital cost basis, may be cost effective on a life-cycle cost basis, so that capital cost estimates of such alternatives can be used in the updated project cost estimates. The Energy Conservation Report will be based on the building energy analysis. This analysis will:

a. Determine the annual heating and cooling loads for alternative architectural, mechanical, and electrical system combinations based on site weather data.

b. Simulate the operation of various mechanical, electrical, and environmental systems using thermal load analysis to determine monthly and annual energy consumption.

c. Economically evaluate, as appropriate, the annual owning, operating, and maintenance expenses for the projected building life for each of the systems or system combinations (life cycle costing technique).

A.2.3 Site Conditions

1. The following provides parameters of the site conditions utilized in the Energy Conservation Study:

■ Latitude	46°16′
■ Longitude	119°07′
■ Altitude	450 ft.
■ Prevailing Wind	SSW Summer
■ Annual Heating Days	4,892 degree days/yr.
■ Process Design Temperatures	9°F Winter
	101°F Dry Bulb-Summer
	68°F Wet Bulb-Summer
■ Indoor Design Temperatures	76°F Summer
■ Nonprocess Areas	72°F Winter
■ Process Areas	75°F Year-round
■ HVAC Equipment Room	50°F Min. Winter
	105°F Max. Summer

A.3 ENERGY CONSERVATION ANALYSIS

A.3.1 General

1. The Total Energy Consumption in a building includes both Building Energy Consumption and Process Energy Consumption. Building Energy Consumption refers to that energy used primarily for heating, ventilation, cooling, domestic hot water and lighting. Process Energy Consumption is energy used in a process, production or research program.

2. The Energy Conservation Analysis will be performed utilizing computer analysis employing the "TRANE TRACE" software to estimate the Total Energy Consumption on an annual basis. The Energy Conservation Analysis will be performed for the "Base-Case" features as well as for the "Modified" System alternatives.

3. The Base-Case Building Annual Energy Consumption will be determined and utilized to analyze the cost-effectiveness of the effects of modifications to the "Base-Case" Energy Conservation features.

A.3.2 Building Energy Consumption Systems

1. The energy consumed in the building will be primarily for:

   - Heating, Ventilation and Cooling (HVAC)
   - Lighting
   - Process Equipment Power
   - Domestic Hot Water

A.3.2.1 HVAC System

1. Base Case HVAC System

   a. Process Area: One hundred percent (100 percent) outside air will be utilized via make-up air unit which will supply conditioned air to the space. Heating coils will be electric type and cooling coil will be chilled water type (glycol mix).

   b. Shipping/Receiving New Drum and Transfer Area: Constant volume air handling unit with economizer controls will supply conditioned air to the space. Heating coils will be electric type and cooling coils will be chilled water type (glycol mix). Return air fan will be utilized for bringing return air back to air handling unit.

   c. Administration Area: Constant volume air handling unit with economizer controls, will supply conditioned air to the space. Variable air volume boxes will be utilized to save energy for the areas experiencing varying load conditions. Heating coils will be electric type and cooling coils will be chilled water type (glycol mix) to conserve heating energy and to maintain room temperature at 50°F.

   d. HVAC Equipment Room: Single air handling unit will be utilized to supply air to equipment rooms (heating only). Electric heating coils in the unit will provide heat in winter. During summer, 100 percent ventilation air will be utilized to cool the rooms without the use of refrigeration. A variable speed fan drive will supply reduced airflow.

   e. Other System Features: Two water cooled reciprocating chillers will supply chilled water (glycol) to various cooling coils. Cooling tower will be utilized for heat rejection. Building insulation will be per minimum Hanford standard requirements.

2. Modified HVAC Systems

   a. Modified Alternate I Process Run-Around Heat Recovery System: This alternate consists of "base case" HVAC system plus the following modified features. Air to glycol coils located in the process exhaust air stream (filter trains) will recover heat. Glycol at room temperature will be pumped to air to glycol coils located in the process outside make-up air stream, and make-up air will be preheated or precooled, thus saving heating and cooling energy.

   b. Modified Alternate II Heat Recovery Wheel: This alternate consists of "base-case" HVAC system plus the following modified features. A rotating metal wheel will recover heating or cooling energy from the locker room exhaust air. The wheel will transfer this energy to the incoming outside make-up air stream, and make-up air will be preheated or precooled, thus saving heating and cooling energy.

   c. Modified Alternate III Domestic Hot Water Heat Recovery: This alternate consists of "base-case" HVAC system plus the following modified features. A double bundle heat exchanger located in the chiller area will recover refrigerant hot gas heat and will preheat incoming cold potable water for use in the hot water system.

d. Modified Alternate IV: This alternate consists of "Base-Case" HVAC system plus alternate I and alternate II.

e. Modified Alternate V: This alternate consists of "Base-Case" HVAC system plus alternate I, alternate II, and alternate III.

A.3.2.2 Lighting System

1. The normal building interior lighting will be provided from 277-volt fluorescent fixtures switched in sections from wall switches.

2. Outdoor lighting will be from photocell controlled 277-volt high pressure sodium fixtures.

3. Design lighting levels will be as follows:

- Work Stations 50 foot candles
- General Lighting 30 foot candles
- Storage Areas 10 foot candles

A.3.2.3 Domestic Hot Water System

1. Based on the ASHRAE recommendations, the following parameters will be used in the analysis:

2. Total calculated storage tank = 700 gallons

3. Based on four-hour recovery heating load = 204,780 Btu/hr
= 60 kW

4. The heating media will be electricity. The building energy consumption estimate includes the domestic hot water load for their respective alternative systems.

A.3.3 Methodology

A.3.3.1 Energy Conservation Analysis

1. Cooling and heating loads will be calculated using TRANE "Trace 600" software.

2. Base case annual energy consumption will be calculated for a building meeting the ASHRAE 90 standards with exterior insulation meeting the Hanford Plant Standards. i.e., R wall = 9.1 and R roof = 17.2, and the "base-case" HVAC system.

3. Annual energy consumption will be calculated for the three modified alternate HVAC systems.

Modified Alternate I	"Base Case" + Run-around heat recovery coils
Modified Alternate II	"Base Case" + Heat wheel
Modified Alternate III	"Base Case" + Domestic hot water, heat recovery
Modified Alternate IV	"Base Case" + Alternate I + Alternate II
Modified Alternate V	"Base Case" + Alternate I + Alternate II + Alternate III

4. Total energy consumption of the building system in Btu/Hr per square foot will be calculated for "base-case" and modified alternative systems.

The total energy consumption includes energy for:

- Cooling
- Heating
- Lighting
- Process Equipment Power
- Domestic Hot Water

A.3.3.2 Life Cycle Cost Analysis

1. Life cycle cost analysis will be performed to determine total net present worth value considering capital cost, maintenance cost and annual operating cost.

2. Total net present worth values of capital cost, maintenance costs, and operating cost will be calculated for the "base-case" and three modified alternative systems.

3. The Life Cycle Cost Analysis will be performed using dynamic computer analysis. The computer analysis software developed by TRANE Co. complies with 10 CFR 436A.

4. Analysis Parameters

- Design Life: 30 years
- Discount rate: 7 percent
- Capital costs and maintenance costs for each system will be based on $ per square feet figures provided by TRANE Co.
- Operating cost will be derived from computer output results of each alternate system annual energy consumption.
- Escalation factors: factors used in computer software are based on latest figures available from 10 CFR 436A for Region 10 (Washington).
- Hourly weather data for the Hanford area as collected by NOAA will be utilized.

A.3.3.3 Recommendation Criteria

1. The criteria utilized for the selection of the energy source and applicable alternative will be based on the Life Cycle Cost Analysis as well as considerations for environmental, safety and health. Likewise, Life Cycle Cost Analysis will be utilized for evaluating the cost effectiveness of the "Modified" Alternative Systems features when compared to the "Base-Case."

A.3.4 "TRANE TRACE" Software Description

1. "TRANE TRACE" is a family of computerized energy and economic analysis computer software programs designed to assist engineers in evaluating energy conservation features of new and or existing buildings.

a. The software is organized into five (5) calculation phases:

1) Load Phase
2) Design Phase
3) System Simulation Phase
4) Equipment Simulation Phase
5) Economic Analysis Phase

b. Each of these calculation phases perform distinct functions and provide intermediate results.

c. Results of the Energy Consumption calculated by the "TRANE TRACE" programs are utilized to perform Life Cycle Cost Analysis (LCC) using the "TRANE Government Economics" software. The LCC software complies with 10 CFR 436A. It also utilizes the latest energy escalation factors and current cost factors in accordance with NBS Handbook 135.

A.4 "BASE-CASE" BUILDING SYSTEM ANALYSIS

A.4.1 General Requirements

1. "Base-Case" Energy Usage is defined as the fraction of the building energy consumption attributable to lighting, cooling, heating, domestic water heating, energy distribution and ventilation. The "Base-Case" energy usage will be determined by simulating the "Base-Case" building through use of computerized energy analysis techniques developed by "TRANE" Co.

2. The WRAP Module 2A "Base-Case" Energy Conservation Analysis will be based on the architectural Floor Plan.

3. The analysis input will comprise of the building envelope characteristics including R-values, areas, building orientation, window/wall/roof thermal characteristics, and infiltration characteristics. The analysis will includes input of all building internal characteristics including lighting demand and usage schedules, occupancy demand and schedules, HVAC equipment and miscellaneous heat gains, building usage schedules and ventilation rates and schedules. The economic analysis will also include input of energy and maintenance costs. The HVAC system will consist of "Base-Case" system as described in paragraph 2.2.1.

A.4.2 "Base-Case" Building Envelope Parameters

1. Thermal heat transfer resistance (R) of the Building Envelope Insulation:

	R	Thickness of Metal Sandwich Panel with Foam Insulation.
Walls:	9.1	2"
Roof:	17.85	2 1/4"

2. Fenestration in percent of wall area: (double glazing, fixed sash)

North 1.6 percent
South 0 percent
East 0.0 percent
West 1.0 percent
Skylights N/A

Note: Double glazing is utilized for all windows and a well sealed exterior was selected to conserve energy.

3. Building orientation:

   a. Orientation determined based on functional site requirements

4. Building Type:

   a. Pre-engineered metal building.

A.4.3 "Base-Case" Total Energy Consumption

1. The "Base-Case" Total Energy Consumption for the HVAC system will be determined and tabulated as follows:

HVAC System	(A) *Btu/Sq.Ft/yr Bldg. Consumption	Btu/Sq.Ft./Yr **Source Consumption	(B) Sq. Ft.	Annual Total Bldg. Energy Consumption (Btu) = (A) x (B)
Base-Case				

*Energy figure indicates heating, ventilation, cooling, domestic hot water and lighting.
**Source consumption includes total fuel source energy utilized.

A.4.4 "Base-Case" Total Net Present Worth

1. The "Base-Case" Total Net Present Worth based on the Life Cycle Cost Analysis for the HVAC system will be tabulated as follows:

HVAC System	Capital Cost $	Energy Cost $	Maintenance Cost $	Total Net PW Values $
Base-Case				

Note 1: Exterior wall insulation was selected with slightly less R value than Hanford Plant Standards since the exact R value was not available in standard wall panels.

A.4.5 Energy Use Distribution

1. The energy usage for the "Base-Case" system will be tabulated as follows:

HVAC System	Energy Allocation Type and Percentage of Total Usage			
	Cooling	Heating	Lighting	Pumps/Fans
Base-Case				

* Energy figure indicates heating, ventilation, cooling, and lighting.

A.5 "MODIFIED" SYSTEM ANALYSIS

A.5.1 General Requirements

1. Upon completion of the "Base-Case" Energy Consumption, modifications to "Base-Case" as described in paragraph 2.2.1 will be factored into the computerized analysis and the estimate of the total energy consumption of modified alternatives systems will be calculated.

2. Energy saving will be determined and Life Cycle Cost Analysis will be performed to enable selection of the Recommended Energy Conservation features.

A.5.2 "Modified" System - Total Energy Consumption

1. Total Energy Consumption for each of the modified HVAC system alternatives will be tabulated as follows:

HVAC System	(A) *Btu/Sq.Ft/yr Bldg. Consumption	Btu/Sq.Ft./Yr **Source Consumption	(B) Sq. Ft.	Annual Total Bldg. Energy Consumption (Btu) = (A) x (B)
Alternate I				
Alternate II				
Alternate III				
Alternates IV				
Alternates V				

A.5.3 "Modified System" - Total Net Present Worth

1. Total Net Present Worth based on the Life Cycle Cost Analysis for the modified HVAC system alternatives will be tabulated as follows:

HVAC System	Capital Cost $	Energy Cost $	Maintenance Cost $	Total Net PW Values $
Alternate I				
Alternate II				
Alternate III				
Alternate IV				
Alternate V				

A.5.4 Energy Use Distribution

1. The energy usage for the modified alternative systems will be tabulated as follows:

HVAC System	Energy Allocation Type and Percentage of Total Usage			
	Cooling	Heating	Lighting	Pumps/Fans
Alternate I				
Alternate II				
Alternate III				
Alternate IV				
Alternate V				

* Energy figure indicates heating, ventilation, cooling, and lighting.

A.6 RECOMMENDATIONS

A.6.1 Recommendation

1. Based on the results of the Energy Conservation Study for WRAP 1 Alternate IV had the lowest total net present worth value. This alternate consists of Base-Case HVAC system which utilizes water cooled chillers with cooling tower, and incorporates process heat recovery using run around coil and heat wheel.

2. Based on the detailed computer energy analysis for WRAP 2A during Title I design, final recommendation will be made.

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APPENDIX B

RISK ASSESSMENT

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B.1.0 GENERAL

1. The facility or activity operating risk is defined as a function of the consequences of postulated accidents and the associated probabilities of occurrence of the accidents. The risk is determined in two phases. The first phase uses a variety of techniques to identify the potential credible accident event sequences which could occur at a facility and estimate the likelihood of each sequence. (Credible event sequences are those with annual probabilities higher than 10^{-6}). The second phase uses various techniques to determine the consequences of each accident event sequence, interms of potential impact to people and the environment. The result of this risk assessment is compared with the risk acceptance guidelines.

2. The risk acceptance guidelines are presented in WHC-CM-4-46 as a series of curves for radiological risk acceptance and toxological risk acceptance.

3. This preliminary risk assessment consists of a qualitative assessment of construction and operation risks associated with the WRAP Module 2A Facility. During the ACDR study a preliminary HAZOP analysis will be conducted comprising of an overall facility appraisal to identify the broad range of potential event sequences and to assign a measure of perceived risk to each sequence. The barriers within the facility which prevent or mitigate the consequences of the accident will be assessed, and a rough estimate of the magnitude of the consequences of the accident, assuming that the preventive barriers fail, and the estimated likelihood of the event sequence occurring as stated, will be determined.

4. The Preliminary Safety Evaluation (PSE) included in **Appendix J** evaluates the probabilities and consequences i.e., the risks of inadvertent release of radioactive and toxic materials as a consequence of credible accidents. The credible accident scenarios are identified in the PSE. Based upon these accident (DBA) scenarios and evaluation of associated risks, facility systems will be designed to mitigate any consequences.

B.2.0 FACILITY AREAS

1. For evaluation of risk, the WRAP Module 2A Facility is considered to be subdivided into a number of different areas, based on the waste inventory present, the operations undertaken, the potential for radioactive and toxic material releases and the physical boundaries which exist. The facility areas include the following:

- Waste Receiving and Shipping Area
- Size Reduction/Open/Sort/Sample/Repackage Area
- Special Waste Process Area
- Grout/Polymer Process Area
- AMU/Liquid Waste Collection and Treatment Area
- Non-Destructive Assay Area
- Sample Management Area
- Lead/Lag/Cure/Sample Storage Area
- Outside Bulk Solids and Bulk Liquids Storage Area
- Administrative and Personnel Support Areas
- Facility Support Areas

B.3.0 PRINCIPAL OPERATIONS HAZARDS

1. The principal hazards and risks that are encountered during facility operation include potential accidents and predicted consequent of

- Natural Phenomena
- Process Operations

2. Forces of nature may precipitate and or contribute to the release of radioactive and hazardous materials. There forces referred to as forces due to natural phenomena hazards consist of

- Earthquakes
- Severe Wind
- Flooding

On account of climatic conditions prevalent at the Hanford site, precipitation (in the form of rain or snow) can be adequately accommodated in the design of the building and surrounding terrain, and is not considered a hazard. Likewise flooding is discounted as a hazard as the facility is located above the flood plane.

3. Operations within the facility could also contribute to the potential for release of radioactive and hazardous materials. Human error and equipment malfunctions comprise the major categories for such accidents, along with explosion/fire which may be caused by chemical, electrical, human or natural sources. Whereas natural forces are considered to be applied externally to the facility, accidents from theses latter categories originate within the facility and releases would normally be into the confines of the facility except where such accidents would breach the facility confinement barrier.

B.4.0 PRINCIPAL RISK REDUCTION FEATURES

1. The principal safety goal of the WRAP Facility Module 2A consists of avoiding release of radioactive and hazardous materials to the environment and avoiding exposure of workers to radiation and hazardous chemicals. The design of the WRAP Module 2A Facility utilize, a multiple confinement barrier concept to prevent releases to the environment and to prevent spread of contamination in occupied areas.

2. The primary confinement is provided by the process enclosures (gloveboxes) and the associated ventilation system up to and including the HEPA filters.

3. The secondary confinement is provided by the building housing the process enclosures, including the associated building ventilation system.

4. Principal design, construction and operating features of the WRAP Facility Module 2A are selected for preventing accidents and or reducing risks as a result of these accidents to acceptable levels.

B.4.1 Structural/Mechanical Features

1. The structural elements of the WRAP Module 2A Facility include all floor, roof and wall framing members, slabs, columns, footings, basement walls and all other substructure and superstructure elements. These elements are proportioned on the bases of stress, strength and deflection requirements. The design considerations include use of codes and standards per DOE Order 6430.1A and SDC-4.1, use of appropriate materials of construction, and appropriate design procedures for confinement integrity and structural/mechanical safety per UCRL-15910, and use of appropriate quality assurance features per NQA-1 for design, fabrication, construction and inspection activities.

B.4.2 Confinement Features

1. The confinement systems are designed conceptually inaccordance with DOE Orders 6430.1A and 5481.1B. Confinement capabilities include confinement enclosures and associated ventilation systems which maintain, a controlled, continuous airflow pattern from the environment into the facility, and then from noncontaminated areas of the building to potentially

contaminated areas and finally to normally contaminated areas. The exhaust airflow is passed through multiple stages of filtration and is subsequently monitored during its release to the outside atmosphere.

2. All spaces within the WRAP Module 2A Facility are evaluated and assigned HVAC zones according to the potential for contamination. The design basis includes provision of HVAC confinement control through negative pressurization.

3. The ventilation systems confine hazardous materials by providing controlled airflow and pressure differential between zones of varying contamination potential under normal and upset operating conditions.

4. The confinement systems for the WRAP Module 2A Facility are designed to ensure they can safely withstand the effects of natural phenomena hazards and human generated events, including postulated DBA's and DBF's initiated by these events, and remain functional to the extent that the WHC guidelines for releases from Low Hazard Safety Class 3 facilities are not violated.

B.4.3 Facility Layout Features

1. The layout of the WRAP Module 2A Facility has incorporated the following risk reduction features.

- Provisions of optimized transportation routes for wastes, which are based on a "once through" principle where possible.
- Minimization of the confinement zoning requirements by grouping together those activities where "raw" waste is exposed to the environment.
- Minimization of internal storage requirements and utilization of external storage for potentially hazardous materials such as the polymer constituents. Also minimization of piping lengths to transport such materials.
- Utilization of gravity flow of materials where practicable.
- Optimization of the potential requirements for shielding, with respect to the location of lag storage areas for waste.
- Provision for shielding sources of radiation.
- Provision of a "nonactive" transfer corridor giving the capability to link W112 with W100 and with future WRAP modules, to the west of W100.
- Provision of appropriate personnel access routes to facilitate process operations.
- Provision of internal recycle of radioactively contaminated liquids by utilization of such liquids within the in-drum mixing grout process.

B.5.0 ASSESSMENT OF OPERATION RISKS

1. The principal hazards associated with operation of WRAP Module 2A are radioactive and hazardous material releases, and inadvertent exposure of personnel to radiation and hazardous substances. The hazards associated with electrical, mechanical, or thermal energy are similar to those for other industrial operations. Due to the relatively large quantities of chemicals in the Mixed Waste Treatment Area, the potential for toxicological incidents exist. Release of radioactive or hazardous material might occur outside the process areas as a result of container

handling accidents or natural events. Due to the large percentage of containers that will be processed, exposure of personnel might occur as a result of loss of shielding or container handling accidents. Operations involving waste processing will take place within shielded process enclosures with leaded glass viewing windows to minimize exposure to operators.

2. The preliminary safety evaluation considers releases of radiological and hazardous materials during (a) normal operations, (b) upset (abnormal) but anticipated conditions and (c) accident conditions.

B.5.1 Normal Operations

1. The radiological and toxicological impacts during normal operations are those associated with very small quantities of radioactive and toxic materials that may be released through the scrubber system and the HEPA filtered HVAC system under routine operating conditions.

2. During normal operation, minimal release is expected from WRAP Module 2A Facility as a result of waste processing activities. Previously characterized waste enters the WRAP Module 2A Facility from the W112 transfer corridor and is handled by fork lift truck into a staging area within Shipping and Receiving. Drums are de-palletized here and fed to the size reduction and repackaging area via drum conveyors on to the entry airlock. Boxes and larger drums are also fed directly into the Size Reduction and Repackaging area except through a separate entry port and into a separate dedicated area for box breakdown. Waste is then fed through the appropriate Size Reduction and repackaging enclosure to be repackaged into new 55-gallon drums, which are transferred by the AGV to the lag storage area. Drums are then selected for feed to the appropriate encapsulation process (cement grout or polymer) and are transferred by AGV via the Non-Destructive Assay (NDA) area. Waste requiring special treatment (e.g., mercury, reactive metals) are routed to the Special Waste Treatment enclosure, which is located adjacent to the size reduction and repackaging enclosures, for necessary pre-treatment and then transferred by AGVs to the lag storage area to await encapsulation process. Drums containing immobilized waste are returned via the lag storage areas to Shipping and Receiving for transfer to the onsite disposal facility, via W112.

3. The annual releases to the atmosphere from routine operations of the WRAP facilities have been estimated in the Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Final Environmental Impact Statement and are well below the limits established by DOE for release to uncontrolled areas.

B.5.2 Abnormal and Accident Conditions

1. The abnormal occurrences considered in the PSE are those that might result from equipment failures, operator errors, or unplanned process variations that may be expected to occur sometime during the lifetime of the facility. The PSE provides a general overview of the potential hazards during abnormal conditions at the facility. Probabilities and consequences are evaluated on a qualitative basis and classified according to the criteria established in the Nonreactor Facility Safety Analysis Manual, WHC-CM-4-46.

2. The PSE also includes an evaluation of highly improbable but high consequence accidents that could occur during the plant operating lifetime. Since these accidents are credible, an analysis is justified by their potential consequences.

3. The WRAP Module 2A Facility is classified in the PSE as a "Low Hazard", "Safety Class 3" facility based on the waste characteristics and the process defined in the CDR for treatment of low-level radioactive mixed waste.

4. Releases of radioactive materials can occur in the form of solids, liquids, or airborne releases. The mechanisms for release of solids are limited and have been addressed by facility design. Both the probability and consequences of solid material release are small. Likewise, liquids can be expected in various areas of the facility and the facility design has incorporated features to accommodate the control of these liquids. Since airborne contamination is the most prevalent health and safety risk, the accident analysis provided in the PSE focuses primarily on airborne releases.

5. Human error and equipment malfunctions during process operations represent the major causes of accidents. Fire and explosion may contribute to the severity of an accident and may be caused by chemical, electrical, human, or natural sources. Accidents which originate within the facility are normally confined by the facility. Releases to the environment from accidents within the facility normally occur only after filtration through the various confinement systems. The exceptions would be only if the filter system is damaged or, if the confinement system integrity is breached.

6. The potential for a nuclear criticality accident within this facility is extremely remote on account of very small quantities of fissile materials expected to be present in the waste.

7. The potential for chemical explosion exists, however operating procedures and segregated areas for storage of chemicals minimize the potential for inadvertent mixing of incompatible liquids, thereby reducing the possibility of explosion.

8. There are no process operations conducted in the WRAP Module 2A Facility which require continued electrical power to maintain safety. In the event of a loss of power all process operations including Zone I and Zone II ventilation system would stop, the resulting release will be within the low-hazard limits. Material handling equipment will be designed to not drop load upon loss of power. A solid state uniterruptible power supply with static transfer switch and long-lasting batteries will provide back-up power to the following:

- Data Management System
- Operator Consoles
- Air and Radiation Monitors
- Emergency Evacuation System

9. In addition to process operations, natural forces may also contribute to possible releases of radioactive material. These natural forces include earthquakes, high-velocity winds and floods. Because of climatic conditions which prevail at the site, precipitation can be adequately accommodated in the design of the facility and the permeability of surrounding terrain dismiss precipitation caused flooding as a significant safety hazard.

B.6.0 ASSESSMENT OF CONSTRUCTION RISK

1. Routine construction hazards will exist while the new systems are constructed. Field operations will be conducted in conformance with recognized safety codes (YOSHA, WISHA) and practices to ensure a safe working environment. All construction activity will be controlled to permit compliance with the Environmental Compliance Manual, WHC-CM-7-5. Where construction is to be performed within excavations, adequate safety precautions such as barricades, maximum side slopes of 1.5:1 for unshored excavations, etc., will be employed to prevent personnel from falling in, and to prevent personnel in the excavations from cave-ins and falling objects. Onsite radiation monitoring and surveying services will be provided to reduce exposure to ALARA.

9413227.0033

APPENDIX C

DAVIS BACON RULING

WHC

Westinghouse Hanford Company
P.O. Box 1970, Richland, WA 99352

PLANT FORCES WORK REVIEW

Plant Forces Work Review No.

Date 4/23/92

REQUESTER FILL IN

Title	Project Work Order or A.R. No.	Area	Bldg. No.
Waste Receiving and Processing Facility Module 2A	W-100	200W	N/A

Description of Work: Briefly state the reason for this work activity and fully describe the work to be performed. Discuss all programmatic or physically associated work planned, underway, or recently completed in the work area. Include labor costs and crafts involved other than Westinghouse forces. Describe and estimate the cost of any work on foundations, structures, utility systems, or other construction-type activity.

This project will involve the design, procurement and construction of an approximately 50,000 s.f. facility that will treat Low Level Mixed Waste at Hanford. Design will start in FY 94, with construction completing in FY 98. The building will be designated a "Non-Reactor Nuclear Facility," and will be constructed of concrete/steel.

Estimated Cost of Work:

*1.	Procured Equipment	$11,000,000
*2.	Materials or Equipment Purchased for Shop Fabrication	$
*3.	Job-Site Material	$40,800,000
4.	Shop Labor	$
5.	Job-Site Labor	$
6.	Other Costs (design, field inspection, and contingency allowance)	$13,200,000
7.	General Overhead	$
	Total Job	$65,000,000

*Include estimated fair value of material or equipment acquired on site

Requester's Signature J. E. Flip Date 4/24/92

Name, MSIN and Phone No. J. E. Flip, G6-46, 6-0947

WHC

Reviewed By:

Area Work Review Agent Jim Adrian per telecon Date 7-8-92

Company Work Review Agent NA Date

DOE

The following determination has been made regarding applicability of the Davis-Bacon Act, as amended, to the work described above:

Applicable [X] Not Applicable [ ]

Chairman RL-Labor Standards Board NA Date

9413227.0034

APPENDIX D

HANDICAP ASSESSMENT

9413227.0045

RRW

ACCOMMODATIONS OF PHYSICALLY HANDICAPPED

PROJECT NO. W-100

PROJECT TITLE WASTE RECEIVING AND PROCESSING, MODULE 2A

LOCATION 200 West (area) BUILDING N/A

Prepared By J. E. Filip Title Project Engineer

Date 05/22/92

Type of Project:

- [X] New Building (or Building Addition)
- [ ] Building Alteration
- [ ] Site Development (Grading, Walks, Parking Lots)
- [ ] Other

Application of Regulations:

DOE Order 6430.1A, "General Design Criteria," General Requirements 0101-4, "Handicapped Provisions."

41 CFR, Public Contracts and Property Management, Subtitle C, 101-19.6, "Accommodations for the Physically Handicapped."

- [ ] All Regulations
- [ ] Limited Application (indicate in comments section)

Exceptions:

DOE Order 6430.1A, "General Design Criteria," General Requirements 0101-4, "Handicapped Provisions."

- [X] Not intended for occupancy or use by the handicapped
- [ ] Alteration not involving existing stairs, doors, elevators, toilets, etc.
- [ ] Not structurally possible

General Comments:

Signature D. R. Lucas Date 05/22/92

A-6000-806 (11/91)

9413227.0006

APPENDIX E

ENVIRONMENTAL STRATEGY

9413227.0067

07/31/92 12:50 ☎509 376 7943 WRAP & SWP →→→ UE&C ☑002

PROJECT OR ACTIVITY: U-100
AREA/FACILITY: 200 West
START OF CONSTRUCTION: March 1996

ACTIVITY	REGULATORY PROGRAM	APPLICABLE (Y/N) *	REGULATIONS	AGENCY	CONSTRAINTS	NOTES
AIR EMISSIONS	RAEP (Radioactive Air Emissions Programs)	Y	WAC 246-247	WA. DEPT. OF HEALTH	construction operation	
	NESHAPs	Y	40 CFR 61 (SUBPART H)	EPA	construction	
	PSD	N	WAC 173-400-141	ECOLOGY	construction	40 CFR 52
	NSR	Y	WAC 173-400-110 WAC 173-460-040	ECOLOGY	construction	
	TAPs	Y	WAC 173-460	APCA or ECOLOGY	construction	
INDUSTRIAL WATER DISPOSAL	SWDP	N	WAC 173-216	ECOLOGY	construction	
	NPDES	N	40 CFR 121 to 125 & 129	EPA	operation	(WAC 173-220)
	UNDERGROUND INJECTION CONTROL (UIC)	N	WAC 173-218	ECOLOGY	operation	
DOMESTIC WASTE WATER DISPOSAL	SEPTIC SYSTEM (<14,500 gpd)	Y	WAC 246-272	DOH-Spokane	construction	
	SEPTIC SYSTEM (>14,500 gpd)	N	WAC 173-216	ECOLOGY	construction	
SOLID WASTE	SOLID WASTE HANDLING FACILITY PERMIT	N	WAC 173-304	BFDHD	construction	
DANGEROUS WASTE	DANGEROUS WASTE PERMIT (RCRA - A/B)	Y	WAC 173-303 40 CFR 264, 265, 270	ECOLOGY	construction	
MISC. PERMITS	DREDGE AND FILL PERMIT	N	33 CFR 325	CORPS OF ENGRS	construction	(in river)
	HYDRAULIC PROJECTS PERMIT	N	WAC 220-110	WA FISHERIES	construction	(in river)
	SHORELINE PERMIT	N	WAC 173-14 to 20	BENTON CO.	construction	(near river) (islands)
	AQUATIC LANDS LEASE	N	WAC 332-30	WA DEPT OF NAT RESOURCES	construction	
	HANFORD REACH STUDY ACT	N	PUBLIC LAW 100-605	U.S. PARK SERVICE	construction	(within 1/4 mile of river)
	WATER QUALITY MODIFICATION	N	WAC 173-201	ECOLOGY	construction	(in river)
OTHER	Public Water Supplies	N	WAC 246-290	DOH		

* For an explanation of this column, please see enclosed text.

THIS EVALUATION IDENTIFIES ALL APPLICABLE PERMITS FOR PROJECTS AS DESCRIBED BELOW.
PERFORMED BY: [illegible] for T.L. Powers Date: 7/21/92 CHECKED BY: [illegible] Date: 21 July 92
DOCUMENTATION/BASIS: (See Enclosed Description Sheet)
Note: This permitting evaluation contains dated material. Permitting needs may change without notice due to changing regulations and/or project modifications.

Air Emissions

Project W-100 will involve the construction of the Waste Receiving and Processing (WRAP) Facility Module 2A, which will provide treatment for low level and low level mixed waste. There is a potential that, during treatment of these wastes, radioactive and toxic air emissions may be generated. Pre-construction approval of a Radioactive Air Emissions Program (RAEP) permit by the Washington Department of Health will be required. If the potential dose to the offsite individual exceeds 0.1 mRem using the methodology given in 40 CFR 61 Appendix D, pre-construction approval of a NESHAPS permit by the U.S. Environmental Protection Agency will also be required.

No criteria pollutants will be emitted at levels approaching those defined as significant in 40 CFR 52.21, therefore no Prevention of Significant Deterioration (PSD) of Air Quality approval is required. The facilities constructed by this project are not subject to the New Source Review (NSR) process pursuant to WAC 173-400-100. Waste processed in WRAP 2A will contain some of the toxics included in the list of Toxic Air Pollutants (TAPs) in WAC 173-460, and pre-construction approval of a TAPs permit by the Washington Department of Ecology will be required.

Industrial Water Disposal

The facilities constructed as a part of this project will not be discharging liquids to a surface water (e.g. Columbia River) or to an Underground Injection Well. Consequently, neither the National Pollutant Discharge Elimination System (NPDES), nor the Underground Injection Control (UIC) requirements apply. The septic upgrades will involve discharges below 14,500 gallons per day; therefore the State Waste Discharge Program (SWDP) does not apply.

Domestic Waste Water Disposal

The facilities constructed by this project will be serviced by a sewage system with a flow of less than 14,500 gallons per day. Consequently, the requirements of WAC 246-272 will need to be met for the whole system to be in compliance with domestic waste water disposal regulations.

Solid Waste

The facilities constructed as a part of this project are not subject to the Solid Waste Handling regulations of the State of Washington.

Dangerous Waste

The WRAP 2A facility will provide treatment for dangerous wastes (i.e. low level mixed wastes). Therefore, the Dangerous Waste portion of the Resource Conservation and Recovery Act (RCRA) is applicable. If WRAP Module 2A is not granted interim status, an appropriate Permit will be required prior to construction.

9413227.0059

Miscellaneous Permits

None of the regulations listed under miscellaneous permits are applicable to activities taking place solely on the 200 Areas plateau.

National Environmental Policy Act (NEPA)

A Supplement Analysis has been prepared for WRAP Module 2 (consisting of submodules 2A and 2B) and submitted to DOE-RL for review. A Supplement Analysis (previously called a C.2 Analysis) is a DOE document used to determine whether the existing National Environmental Policy Act (NEPA) documentation meets the Council on Environmental Quality (CEQ) regulations in Title 40 Code of Federal Regulations (CFR) Parts 1500-1508, if a Supplemental Environmental Impact Statement (SEIS) is required, or to support a decision to prepare a new EIS.

This Supplemental Analysis compares and discusses the differences between WRAP Module 2 (i.e. 2A and 2B) and the WRAP concept as it was originally presented in the Hanford Defense Waste (HDW) EIS Record of Decision (ROD) in Federal Register (FR) Volume 53, No.72, pages 12449-12453, April 14, 1988. This analysis also compares and discusses the differences between the HDW-EIS ROD and the cumulative effects of WRAP Modules 1, 2A, and 2B. The results of this analysis will be used by DOE to determine whether a supplemental or new EIS is required.

A determination on which, if any, further documentation is required to comply with the CEQ regulations has not yet been made. After evaluation of the Supplement Analysis, any additional NEPA documentation determined by DOE to be necessary will be prepared in accordance with the DOE NEPA Implementing Procedures in 10 CFR 1021 (FR 57 Vol. 15189, No.80, pages 15122-15189, April 24, 1992).

References

Functional Design Criteria for Waste Receiving and Processing (WRAP) Facility Module 2A, WHC-SD-W100-FDC-001, Rev. 1 (DRAFT)

Conceptual Design for Waste Receiving and Processing Facility Module 2A, (DRAFT)

Hazard Classification and Preliminary Safety Evaluation for Waste Receiving and Processing Facility Module 2A, Project W100 (DRAFT)

APPENDIX F

WASTE FORM QUALIFICATION

9413227.0011

F.1 INTRODUCTION/BACKGROUND

1. A majority of the waste feedstreams requiring treatment at WRAP 2A contain high percentage (> 10 percent) of soluble salts, viz., sulphates and nitrates. These salts are natural inhibitors to the conventional cement grout curing and the need to explore alternate technologies was acknowledged early on during the pre-conceptual studies of WRAP 2A.

2. This document presents the waste form qualification test plan for determining the suitability of polymer immobilization technology on certain waste streams that will be accepted for treatment in WRAP Module 2A. The process has been successfully used to immobilize ion-exchange resins, decontamination sludges, pyrophoric materials, aqueous liquid wastes and incinerator ash. This test plan is intended to be a three phase program to determine if further investigation of the process is warranted for specific waste feedstreams.

3. The waste streams proposed for treatment by the technology fall into three main categories. These waste streams represent the high-volume streams that are suspected to be incompatible with conventional cement-based grout formulations.

4. The first two streams are associated with the Basin 183-H wastes. This includes the sludge wastes and the crystalline solids. The high nitrate content of these streams is expected to have adverse effects on the ability of conventional cement grout to cure properly. Concerns about the potential oxidizing nature of these streams will also be investigated, to determine if the final polymer form is adversely affected by high nitrate waste loadings.

5. The third stream is the anticipated solid waste stream from LEFT project C-018H. This stream will be composed primarily of ammonium sulfate crystals. The high pH of cement grout would cause a chemical reaction with this material, releasing ammonia gas. Since an acidic catalyst is used in the polymer process, this type of chemical incompatibility would not be expected when treating this waste stream.

6. The test program will be conducted in three phases. The Phase 1 tests, already completed, were performed with commercially available chemicals to screen the processes for gross incompatibility with the wastes. Initial screening tests were positive and, as such, will allow the second phase of testing to be initiated.

7. Phase II will involve preparing qualification samples of the waste form, using surrogate materials representing the major characteristics and important chemical constituents of the waste streams, and subjecting them to rigorous testing to determine waste form stability, leachability characteristics, radiation resistance and structural properties. The results of the testing will be used to evaluate the suitability of the process for inclusion in WRAP 2A.

8. The final phase of testing will be initiated only if the process passes the Phase II qualification tests. This phase will consist of pilot plant tests using a full scale mockup of the process proposed for inclusion in WRAP 2A. Process parameters will be varied to determine the envelope within which acceptable waste forms can be produced. Operational aspects of the process will also be studied to identify and correct any design deficiencies that may surface.

F.2 PHASE I TREATABILITY SCREENING TESTS

F.2.1 Purpose

1. Treatability screening tests were performed to demonstrate that a vinyl ester styrene (VES) resin could successfully solidify selected surrogate wastes. This phase was performed solely to demonstrate compatibility between the binder and surrogate wastes and was not intended to perform, in depth, qualification testing.

F.2.2 Test Procedure Summary

The following is a summary of the Phase I treatability screening test procedure. A detailed description is given in UE&C trip report TR92001.006 (Reference 2) and WHC trip report dated 3/4/92 (Reference 3).

1. Surrogate wastes were prepared representing the following waste forms:

   a. LETF crystalline solids

      - Ammonium sulfate crystals (with and without water)

   b. Basin 183 H crystalline solids

      - Sodium sulfate (fully hydrated)
      - Sodium nitrate

   c. Basin 183 H sludge

      - Sodium sulfate (hydrated)
      - Sodium nitrate
      - Celite 545 (diatomaceous earth)
      - Water

2. These wastes were encapsulated in polymer in small stirred batch 125 gram sample sizes under a laboratory hood. VES resin, chemical additives, and waste were added, allowed to mix, and the mixer was removed to allow the resin to gel. Gel time, exotherm temperature, and monolith characteristics were noted during the subsequent curing stage. If the solidification was successful, it was duplicated in larger quantities to produce a final sample for the record.

F.2.3 Test Results/Summary

The following test results summarize the significant fundings in the screening program. A detailed listing of test results is given in UE&C trip report TR92001.006 (Reference 2) and WHC trip report dated 3/4/92 (Reference 3).

1. Basin 183 H sludge surrogate was solidified at varying moisture contents at a 60 wt% loading in resin. Despite changing waste loading and polymer formulation, there was a small amount of free water which formed during the exotherm on the monolith surface which was in the range of 2 to 2 1/2 wt%.

2. Basin 183 H crystalline solids, simulated by pure sodium nitrate crystals, provided a free standing monolith at 60 wt% loadings with no free water and good structural integrity. Crystalline solids, simulated by 100 percent hydrated sodium sulfate crystals, formed a monolith with some free water present. Reformulating the polymer resin minimized the free water formation to less than 0.5 wt% by controlling the maximum exotherm temperature.

3. LETF crystalline solids simulated by ammonium sulfate crystals provided a free standing monolith at 60 wt% waste loadings with good structural integrity. No free water was formed during solidification of dry or wet crystals (10 wt% H_2O).

F.2.4 Conclusions and Recommendations

1. The major conclusion of the Phase I treatability screening test program was that initial test results for the polymer encapsulation process were promising. As such, it was recommended that further test work be planned under the phase 2 portion of qualification testing.

F.3 PHASE II QUALIFICATION TESTING

F.3.1 Purpose

1. The purpose of this phase in the test program is to develop polymer formulations to immobilize four surrogate waste forms. These waste forms are targeted because of particular characteristics which make them unsuitable for immobilization in many binder matrices. The final waste forms will then be subjected to a total of eight testing procedures to verify that the treated waste will meet all regulatory requirements for LLMW disposal.

F.3.2 Test Plan

1. The four surrogate wastes are to be prepared by WHC and shipped to the Vendor's facility for testing. The four surrogates are as follows:

a. LETF salts
b. Basin #1, #2 sludge
c. Basin #3, #4 sludge
d. Basin crystalline solids

2. Approximate chemical compositions for each surrogate waste are given in **Table F-1**. These compositions represent a target for formulating surrogate wastes which reasonably match actual data (excluding radionuclides) available for the basin sludges and crystalline solids as given in DOE/RL-88-04, basin 183H closure plan. LETF crystalline solids surrogate compositions match those predicted in WHC report WHC-SD-C018H-EP-003.

3. Enough of each surrogate must be produced to allow successful polymer formulations to be developed for eight test procedures performed in triplicate. The surrogate waste will be solidified in polymer to produce approximately 125 ml total volume per sample. The samples will be prepared using processing techniques similar to those employed in the Phase I testing program.

4. Key process parameters will be monitored and recorded during the sample formulation and preparation so that the results can be duplicated, if required. These process parameters are as follows:

a. Mixer speed, RPM
b. Mixer power, watts
c. Batch weight, grams
d. Batch volume, cc
e. Curing exotherm, °C
f. Waste loading, wt%
g. Matrix composition, wt%

5. After preparation of the treated waste forms, each specimen will be prepared for specific laboratory testing requirements. Depending upon the complexity of the test, facility requirements, and need for certification, these tests may be performed at the Vendor's facility or subcontracted to an outside laboratory.

TABLE F-1
SURROGATE WASTES TARGET COMPOSITION

COMPONENT	WASTE TYPE 1 LETF SALTS	WASTE TYPE 2 BASINS #1, #2 SLUDGE	WASTE TYPE 3 BASINS #3, #4 SLUDGE	WASTE TYPE 4 BASIN CRYSTAL SOLIDS
Silver (ppm)		218	190	
Barium (ppm)			24	100
Beryllium (ppm)		6	2.3	
Cadmium (ppm)			6	
Chromium (ppm)	187.50	900	390	500
Copper (ppm)	201.00	130,000	112,000	63,000
Mercury (ppm)	9.20	1.3		
Nickel (ppm)	46.50	100	130	400
SUBTOTAL (ppm)	444.20	131,225.30	112,742.30	64,000.00
Ammonium (%)	22.83			
Fluoride (%)		6.0	1.3	7.1
Nitrate (%)	1.10	13.5	26	1.6
Sodium (%)		20.0	24	22.9
Sulfate (%)	64.61	20.2	3.7	35.5
Water (%)	10.00	21.58	25.03	24.5
SUBTOTAL (%)	98.54	81.28	80.03	91.60
Inerts (%)	1.42	5.6	8.7	2.0
TOTAL (%)	100.00	100.00	100.00	100.00

6. The following is a listing of testing requirements and test methods:

Test Requirement	Acceptance Criteria	Test Method
Compressive Strength	Strength > 60 psi	ASTM D695
Leachability Index	Index > 6, Short Term: 1-2 weeks Long Term: 90 days	ANS 16.1
Biodegradation	Strength > 60 psi, Long Term	ASTM 621 and 622 ASTM D695
Thermal Cycling	Strength > 60 psi, After 30 Cycles	ASTM B553 ASTM D695
Radiation Stability	Strength > 60 psi, After 10^8 RAD, Long Term	ASTM D695
Water Immersion	Strength > 60 psi, After 90 days	ASTM D695
Free Liquids	Free Liq. < 0.5 wt%	ANS 55.1
Toxic Characteristics	TCLP < EPA Limit	EPA 1311 EPA 6010

7. All tests will be performed at Vendor's facility except for radiation stability and TCLP which require special analyses or certification.

F.3.3 Test Schedule

1. The forecasted schedule for the test program is anticipated to support the CDR effort. However test results will not be available for all test requirements prior to issue of the finalized CDR. The following is the tentative schedule:

Begin Production of Sample	Late June 92
Complete Samples	Mid-July 92
Begin Specimen Testing	Mid-July 92
Issue Test Report for Compressive Strength Short Term Leachability Free Liquids TCLP	Late July 92
Issue Test Report for Thermal Cycling Radiation Stability	Late August 92
Issue Test Report for Water Immersion Biodegradation Long Term Leachability	Sept. - Oct. 92

F.4 PHASE III PILOT PLANT DEMONSTRATION

F.4.1 Purpose

1. Full-scale pilot plant demonstrations of the polymer encapsulation process will be performed on formulated waste at the Hanford facility. The purpose of these demonstrations is to prove that waste can be mixed, directly in 55-gallon drums, as proposed for the conceptual design. Additional process parameters will also be evaluated to assist in design of the full scale facility.

F.4.2 Test Plan

1. The test program will be developed, in detail, as Phase II progresses which may identify problem areas. However, the intent of Phase III will be to demonstrate full-scale in-drum mixing on multiple waste forms. The process proposed in the CDR will be simulated as closely as possible in the pilot plant. An assessment of all critical process parameters required for design of the equipment will be made. A partial listing of these parameters are as follows:

a. Effect of preloading waste or polymer in drum

b. Methods and sequence of addition of catalyst, promoter,and other additives

c. Mixing technique effect on mixing time and performance

d. Mixing requirements vs. waste type

e. Waste loading optimization

f. Gel and curing time requirements

g. Curing exotherm temperature and duration

h. Waste form testing properties vs. process parameter variations

2. These parameters will be identified and the ranges bracketed based upon Phase I and Phase II testing. Design of the pilot facility will result from input form WHC, UE&C, and Vendors familiar with mixing systems and the polymer chemistry.

F.4.3 Test Schedule

1. Design of the polymer encapsulation pilot plant will be initiated as soon as preliminary interim results are available from Phase II testing. Procurement of equipment and fabrication of the pilot plant will be carried forward through the beginning of fiscal year 1993. Operation of the pilot facility and assimilation of data will occur prior to initiating Title design in 1994.

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APPENDIX G

BUILDING CODE EVALUATION

G.1 APPLICABLE CODES

1. Uniform Building Code (UBC), 1991 Edition
2. National Fire Protection Association (NFPA)
3. Uniform Fire Code (UFC) 1991 Edition

G.2 UNIFORM BUILDING CODE

1. Occupancy Classification

   a. CHP. 5 TBL 5A

   - Process Areas: Occupancy Group H-7
   - Office/Change Areas: Occupancy Group B-2
   - Lunch: Occupancy Group A-3

   b. CHP. 6 Group A-3

   - Assembly Room; Occupancy < 300; w/o stage

   c. CHP. 7 Group B-2

   - Offices/Workshops/Accessory Spaces; Using materials not highly flammable or combustible

   d. CHP. 9 Group H-7

   - Occupancies having quantities in excess of TBL 9-13 that are health hazards; including toxic materials and "other health hazards".
   - TBL 9-B exempt amounts:

Storages	Closed System	Open System
Solids/Liquids	Solids/Liquids	Solids/Liquids
5000 lbs/500 gal	5000 lbs/500 gal	1000 lbs/100 gal

   - Amounts Exceeded in Storage and Closed Use

   e. SEC 503 Mixed Occupancy:

   - Distinct occupancies shall be separated per TBL 5-B

     A-3/B-2: No Requirement
     B-2/H-7: 1 HR FR

     Note: DOE 6430.1A, paragraph requires adjacent occupancies of "Non-Compatible groups to be separated by 2 HR FR - interpretation controlled areas (SWP) vs non-controlled areas shall have 2 HR FR separation.

2. Type Of Construction

   a. CHP. 17 Construction - Metal Building System

   b. CHP. 19 Construction Type II-N:

      - Structural elements shall be of non-combustible materials
      - Walls and permanent partitions shall be of non-combustible materials
      - TBL 17-A

Building Elements		Type II-N
EXT BRG walls	N	No Requirements
INT BRG walls	N	
EXT Non-BRG walls	N	
Structural frame	N	
Partitions permanent	N	
Shaft enclosures	1 HR FR	
FLRS - CLGS/FLRS	N	
Roof - CLGS/Roof	N	
EXT DRS/WDWS	Sect 1903 (b)	
Stair Const	Sect 1905	

   c. SEC 505

      - Area separation wall

        Type II-N construction - 2 hr. fire-resistive construction required

        Construction - from foundation to 30 in. above roof

        Exception: 2 HR wall may terminate to underside of a non-combustible roof assembly

3. Location On Property

   a. SEC 504

      - Building shall adjoin public way on at least one side
      - Building eaves < 30 in. from side and rear property line (consider center line of public way as property line)

   b. TBL 5A Fire Resistance of Walls: Ref TBL 9C

H-7 ; Type II-N	Exterior Wall and Opening
Protection	No Requirements > 20 ft. to property line
BRG wall	No Requirements > 20 ft. to property line
Non-BRG wall	No Requirements > 20 ft. to property line
Openings	No Requirements > 20 ft. to property line
Minimum distance for property line	N/A

No Walls used for Explosion Venting

- WRAP Module 2A > 20 Ft. set back from assumed property line

  Note: Location of future W-112 construction must comply with separation and construction requirements.

4. Allowable Floor Area

   a. TBL 5-C Allowable area - one story

   - Total combined area for multistory building may be 2 x allowable one story area occupancy H-7, construction II-N

   - Basic allowable = 12,000 SF

   b. SEC 506 Area increases

   - Separation on 2 sides increase area 1 1/4 percent each Ft > 20 Ft; maximum 50 percent increase

     Yards > 60 Ft
     Add :6,000 SF

   - Automatic sprinkler system through-out double basic area in > one story building-allowable area x 2

     Area increases may be compounded
     Total allowable - one story area:

Basic allowable H-7	12,000
Separation (50%)	6,000
Subtotal	18,000
	x 2
Sprinklers	36,000

WRAP Area of GRD floor = 35,458 < 36,000 OK
Total allowable 2 story area (x 2) = 72,000
Total H-7 area including silos and cooling tower = 37,833 SF < 72,000 OK

   - Allowable floor area

     2 story building with area separation wall with 2 side yards II-N SPK

Basic Allowable B-2	12,000
Separation (50%)	6,000
Subtotal	18,000
Sprinklers	x 2
	36,000

Total allowable 2 story area (x2) = 72,000

Basic Allowable A-3	9,100
Separation (50%)	4,550
Subtotal	13,650
Sprinklers	x 2
	27,300

Total allowable 2 story area (x2) = 54,600

- B-2/A-3 Mixed occupancy ratio

$$\frac{25,409}{72,000} + \frac{1,071}{54,600} = .35 + .02 < 1$$ OK

5. Maximum Height and Number of Stories

a. SEC 507 WRAP MOD 2A

- EAVE HT 48'-6"
- RIDGE HT 50'-6"

b. SEC 409 Average building height 50'-6"

c. TBL 5-D 2 Stories

- Max allowable HT: 55 > 50'-6" OK
  Max allowable Stories: 2 OK
  Automatic sprinkler increase does not apply

6. Occupancy Requirements

a. CHP. 9 Floors Shall be Non-Combustible, Liquid-Tight

b. SEC 902 Construction

- When required by fire code:

  Spill control drainage, and containment requirements:

  Raised sill (curb) minimum of 4 in. high to contain volume of largest single container plus design flow from sprinkler system for 20 min.

  WRAP MOD 2A - 6 in. curb provided at all waste handling areas OK

  Smoke and heat vents shall be provided in areas containing hazardous materials N/A

  Standby power Not required by FDC, Not required by H-7

  Emergency power shall be provided for "all required electrical equipment"

  Egress lighting ~ Batteries OK
  PA system ~ UPS OK

  Exhaust system may be designed to operate on 1/2 normal fan speed on emergency power

  Exhaust system not required for safe shutdown ∴ no emergency power required

c. SEC 905 Light, Ventilation, Sanitation

- All occupied spaces shall be provided with natural or artificial light and mechanical ventilation system capable of supplying 5 cfm outside air, total circulated or 15 cfm/occupant

- A minimum of one water closet shall be provided. Toilet room shall have a mechanical exhaust system capable of supplying one air change every 15 minutes

d. SEC 906 Exits

- Exits shall be enclosed per CHP. 33 Shafts and Floor Openings shall be enclosed per TBL 17-A: 1 HR FR

e. SEC 907 Automatic Fire-Extinguishing System Required per CHP. 38 [SEC 3802 (f)].

f. SEC 908 No "Special Hazards" Identified Energy Source for Heating WRAP MOD 2 is Electrical

g. SEC 909 Where Required by Fire Code:

- Automatic smoke detection shall be provided for rooms used for storage and handling of hazardous materials

h. SEC 910 Explosion Control not Applicable

7. Exit Requirements

a. CHP.33

b. SEC 3301 Changes of Elevation of Less than 12 in. Along any Exit Serving > 10 shall be by Ramps

c. SEC 3302 Occupant Load

- Exception: Accessory use areas shall be provided with exits but need not be included in total load of building. Assembly rooms with occupancy > 50 shall have occupancy load capacity posted. Required WRAP lunch room

TBL 33A Occupant Load/Exits

Ground Level	Load Factor SF/Person	Code Occupant Load	Actual EST. Load	Min. Exit 2 Required
OPEN OFFICE	100	31	20	2 > 30
OFFICE	100	2		1 < 30
OFFICE	100	2		1 < 30
OFFICE	100	1		1 < 30
OFFICE	100	1		1 < 30
OFFICE	100	1		1 < 30
OFFICE	100	1		1 < 30
FILE ROOM	300	1		1 < 30
COPY ROOM	100	1*		1 < 30
CONFERENCE	15	41		1 < 50
TELCOM	100	2		1 < 30

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Ground Level	Load Factor SF/Person	Code Occupant Load	Actual EST. Load	Min. Exit 2 Required
RECEPTION/WAITING	100/15	1/19		1 < 30 1 < 50
RPT OFFICE	100	1		1 < 30
LUNCH ROOM	15	71 *	60*	2 > 50
CLEAN LAUNDRY	100	3 *		1 < 30
SOILED LAUNDRY	100	2 *		1 < 30
MECHANICAL ROOM	300	1 *	0	1 < 30
ELECTRICAL ROOM	300	4 *	0	1 < 30
MEN'S LOCKER	50	36 *		2 > 30
WOMEN'S LOCKER	50	18 *		1 < 30
PROCESS	200	67	40	2 > 30
SAMPLE MANAGEMENT	100	5		1 < 30
SHIPPING AND RECEIVING	300	8		1 < 30
PROCESS EXHAUST	300 (MECH)	11 *	0	1 < 30
CLEAN DRUM STORAGE	300	7		1 < 50
DECONTAMINATION	100	1 *	0	1 < 50
JANITOR	100	1 *	0	1 < 50
GROUT PREP	200	3 *	0	1 < 30
Upper Level	**Load Factor SF/Person**	**Code Occupant Load**	**Actual EST. Load**	**Min. Exit 2 Required**
GROUT PREP	200	8 *	0	1 < 30
COMPUTER ROOM	100	3	2	1 < 30
CONTROL ROOM	100	5	4	1 < 30
HVAC EQUIPMENT	300	20*	0	1 < 30
OFFICE	100	1		
CHILLER ROOM		2 *		
BOX OBSERVATION	100	2 *		
		200 TOTAL BLDG	66	

* Not included in building occupant load.

d. SEC 3303

- Second story shall have 2 exits for occupancy > 10 OK

  Total bldg occupant load 200 2 exits OK
  Group "H" occupancy : over 200 SF required 2 exits OK
  Total exit width 200 x 0.2 = 40 in.

  Arrangement - exits apart not less than 1/2 max diagonal of space

- Basements shall have 2 exits

  Exception 4: Basements used exclusively for the service of the building.

- Exit Distance: To exit door, horizontal exit passage way or enclosed stair: 200 ft with sprinkler system, increase 100ft. if last distance is within 1 HR FR corridor. Group H-7 occupancy areas: Travel distance to exit shall be $\leq$ 100 ft (UBC SEC 3319) OK

- One exit may be through adjoining or intervening room (shall not be through store rooms etc.)

- Rooms with occupant load < 10 may exit through more than one intervening room. Foyers, lobbies, reception if constructed as corridor are not intervening rooms

e. SEC 3304 Doors

- Exit door shall swing in direction of travel if serving > 50

- Special egress control devices may be installed when approved in B-2 occupancies

- Exit door width: 36-48 in.

- Exit door shall have landing each side. Landings shall be width of door and a length of 44 in. in direction of travel

f. SEC 3305 Corridors (Exit > 10 persons)

- Minimum width - 44 in. WRAP MOD 2: 6'-0" min OK

- Serving < 49 - 36 in.

- Clear height - 7 ft. OK

- Access: More than 1 exit required - go either direction to exit max dead end - 20 ft. OK

- Construction: Corridor serving > 30 - walls and ceiling 1 HR FR.

  Exception: Walls and ceiling in office spaces with occupancy < 100 need not be FR const. if entire floor has sprinkler system and corridor has smoke detectors

- 1 HR FR corridor doors shall be tight fitting smoke - draft control with 20 min FR rating

- Openings other than doors and ducts shall have 3/4 HR FR fixed glazing and total of openings shall not exceed 25 percent of corridor wall area

g. SEC 3306 Stairways:

- Minimum width of stairs - 44 in. except serving < 49 can be 36 in.

- Step rise to be 4-7 in. Step tread shall be no less than 11 in.

- Stair landing shall be not less than width of stair. Vertical distance between landings shall not be greater than 12 ft.

- Stairways shall have handrails on each side
  Exception: Stairways less than 44 in. in width may have 1 handrail

h. SEC 1712 Unenclosed floor and roof openings and open sides of stairs more than 30 in. above grade or floor level shall be protected by a guardrail, 42 in. high (36 in. at open sides of stairs)

i. SEC 3307 Ramps:

- Minimum width of ramps - 44 in. except serving < 49 can be 36 in.
- Maximum slope of ramp in accessible route shall be 1/12 - other areas 1/8. (WRAP accessible area limited to office area)
- 5 ft. landing shall be provided at top and 6 ft. landing at bottom of all ramps steeper than 1/15. Intermediate landings shall be provided every 5 ft. vertically
- Handrails shall be provided at ramps steeper than 1/15

j. SEC 3309 Stairway Enclosures

- Interior stairways shall be enclosed - ok - exception: other than "H" occupancy enclosure need not be provided if serving only one adjacent floor
- Enclosure construction shall be not less than 1 HR FR
- All openings into enclosures shall be limited to serving the enclosure
- Enclosure shall include a corridor on the ground floor from the stairway to the exterior of the building
- Smoke proof enclosure requirements do not apply
- Barrier to prevent persons from accidently continuing into the basement

k. SEC 3321 Special Hazards

- Does not apply - WRAP MOD 2 was no fuel fired equipment

l. SEC 3303 Group "H" occupancies shall be accessible per requirements

- No accessibility has been provided to process, or facility service areas nor second floor operations control/computer room spaces per WHC directive 12/88

m. SEC 3319

- Doors leading to corridors of fire resistive construction shall be maintained self-closing and shall open in the direction of travel

n. SEC 3803

- Standpipe requirements - none

APPENDIX H

BUILDING FUNCTIONAL ANALYSIS

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H.1 INTRODUCTION

H.1.1 Background and Scope

1. The WRAP Module 2A Facility functional requirements are described in the Functional Design Criteria (FDC, Ref. 1).

2. Other Engineering Studies which focus on specific aspects of the Module 2A Facility are in varying stages of development, and will impact the final Building Floor Plan.

3. The scope of this study is to:

   a. develop the stated design requirements derived from the design basis documents,

   b. document design assumptions and priorities,

   c. identify outstanding uncertainties,

   d. incorporate the information, recommendations and conclusions contained in the on-going engineering studies as they become available into a schematic building floor plan.

H.1.2 Purpose and Need

1. To clearly identify the functional and spatial relationships between the areas within the facility, Affinity Diagrams were prepared for each distinct area. These diagrams indicated functional envelope requirements; boundary information; and personnel, material, and utility affinities. These distinct areas are as follows:

   a. Office Administration and Facility Support
      - Administration
      - Personnel Support (change rooms, storage room, laundry rooms and janitor)

   b. Process Area
      - Waste Process
      - NDA
      - Step-off
      - Decon Room
      - Sample Management

   c. Process Support Area
      - Shipping/Receiving
      - Grout Prep
      - Transfer Corridor
      - Control/Computer Rooms

   d. Facility Support Areas
      - Mechanical Room
      - HVAC Equipment
      - Process HVAC
      - Electrical, UPS, Telecommunication Spaces

2. These area diagrams were integrated into an overall Facility "Affinity" Diagram illustrating required confinement barriers, area boundaries, personnel circulation, material flow, and main utility distribution scheme. A comparison will be made to the relationships indicated by the CDR layout.

3. Following analysis and input to arrive at the "preferred" relationships and priorities illustrated by the Facility Affinity Diagram and optimized, schematic floor plan for the building was prepared.

H.2 SUMMARY AND CONCLUSIONS

H.2.1 Facility Affinity Diagrams

1. The individual area diagrams have been integrated into an overall facility diagram to facilitate study and analysis of their inter-relationships.

2. An affinity analysis was prepared to assist in analyzing the relationships and circulation paths inherent in the CDR design.

3. The Facility Affinity Diagram is included as **Exhibit A** at the end of this Appendix.

H.2.2 Proposed Schematic Floor Plan

1. A building floor plan arrangement was developed from the proposed affinity diagram. This proposed, schematic plan constitutes the recommended layout to be used in developing the WRAP Module 2A design, and is included as **Exhibit B**.

H.3 RECOMMENDATIONS FOR FUTURE WORK

1. The relationship of the WRAP Module 2A Facility to the future W-112 Storage Facility is to be examined as the W-112 facility develops to ascertain the manner in which waste product might be handled between the two facilities, and the personnel exchange to be anticipated.

H.4 UNCERTAINTIES

1. The recommendations from several engineering studies are reflected in the proposed layout. Alterations of these key areas are anticipated as the design effort progresses.

Study	Building Spaces Affected
Automated Storage	■ Lag Storage ■ Shipping and Receiving Area ■ Control/Computer Rooms

Study	Building Spaces Affected
Polymer Process	■ Polymer Prep
Grout Process	■ Grout Prep ■ Vibro Grout
Sampling and Certification	■ Shipping and Receiving
Special Waste Process	■ Special Waste Handling

2. In lieu of substantiated program information or equipment selection being complete, the size of certain spaces included in the proposed floor plan were obtained from current available information. As the Conceptual design progresses, the size of these spaces will be subject to verification. The spaces are:

- Sample Management
- HVAC Equipment Rooms
- Electrical Communication Rooms
- NDA

H.5 DESCRIPTION OF DESIGN REQUIREMENTS

H.5.1 Criteria

1. The proposed floor plan shall meet the criteria set forth in the referenced documents (Section 7.0) which form the basis for Design of the WRAP Module 2A Facility.

a. The only potentially high radiation areas currently identified in the facility is a limited area in shipping and receiving, the lag storage area, and radiation associated with NDA equipment. These areas will require shielding and alarm, guarded entry.

b. The Waste Process and Process HVAC Spaces constitute the controlled areas in the facility. The building layout and construction in conjunction with the ventilation system shall serve as secondary confinement for the controlled areas.

c. The floor plan arrangement should control the traffic flow of personnel and material within the facility. Normal personnel traffic should be routed through uncontrolled areas.

d. The facility layout shall minimize the possibility for co-mingling of personnel (with and without protective equipment/clothing) in the controlled areas (SWP areas) with personnel in non-controlled areas.

1) The Tank Room shall be located in a lower level to facilitate gravity draining and be constructed such as to serve as secondary containment for the liquid waste products.

H.5.2 Assumptions/Approach

1. There are no site imposed conditions which influence vehicular traffic patterns within the boundaries of the Module 2A site.

2. The siting of the Module 2A Facility shall consider the transfer of waste between itself and the future W-112 storage facility to be located east of the site. Provision shall be made to accommodate a future transfer corridor between the two facilities.

3. The severity of the site climatic conditions are not such as to limit the directional exposure of the facilities loading or exterior storage areas.

4. Process exhaust emissions are not such as to dictate the location of the stack relative to the rest of the facility. Note that the prevailing winds are from the southwest.

5. A single location is desirable for control of all radioactive, solid waste product and materials entering or leaving the facility. This will be the Shipping and Receiving area via building W-112 storage except for samples to be sent to the lab which is done directly by Shipping and Receiving.

6. A single point entry is desirable for all personnel normally entering or leaving the controlled areas, which should be through the SWP change area.

7. A centralized location for the control room which will tend to minimize the length of process control and data links.

8. Construction of the facility will consist of a metal building system; and that economies can result from the layout conforming, where feasible, to a regular structural span and bay spacing within the standards of the industry.

H.6 DISCUSSION OF DESIGN

1. A centralized control room has been provided on an upper level.

2. Waste material flow and personnel circulation have been separated to the greatest extent possible.

3. WRAP Module 2A has been located such as to facilitate the flow of waste product with the future W-112 Storage Facility.

4. The building footprint conforms to a standard bay spacing utilized in the metal building industry.

H.7 REFERENCES

1. Functional Design Criteria, Westinghouse Hanford Company, January, 1992 (DRAFT).

2. Project Design Basis: United Engineers and Constructors, March 12, 1991 (DRAFT)

3. WRAP 2 Preconceptual Design, Additional Follow-on Activities, United Engineers and Constructors, January 10, 1992.

EXHIBIT A
AFFINITY DIAGRAM

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2. The simulation model includes two AGVs for the WRAP 2A facility. The AGVs have dual roller decks to allow for more efficient drum handling. However, the simulation software can not represent a dual roller deck AGV. The program only allows the AGV to load an item at one station and unload at a second station. The program can not allow the AGV to load one item at one station and then load a second item at a different station. Once an item is loaded on the AGV it must be unloaded before another item can be loaded. Consequently, the AGV is required to make extra transfers and travel further distances to complete its transfers. This constraint in the program decreases the throughput of drums in all the operating areas in the facility. Therefore, The WRAP Module 1 Time and Motion Study manually calculated the number of loads and travel distance of the AGV in the NDA/NDE area and were compared against the results from the model. From this calculation, it was determined that the speed of the modeled AGV should increase by an average of 15 percent. This speed factor was incorporated into the WRAP Module 2A model.

3. The simulation model was based on 5,259 drums entering the WRAP 2A facility per year for 25 years. This amount includes 1,724 drums per year of campaign waste. During normal operations of the plant, the campaign waste would be processed at different interval and most likely never at the same time. The actual maximum input to the WRAP 2A facility would occur when the main feed streams and stream 5C (lead) were processed simultaneously for fourteen years. Then, the actual maximum input equates to only 4,174 drums per year and results in an output of 8,768 drums. Therefore, the results that were generated by the simulation model were analyzed and modified to take into account the effects the campaign waste had on the model. The results from this analysis are summarized in **Table I-1**.

4. Each major area was isolated and simulated at maximum input. At maximum input, the maximum output was calculated to determined whether each area has the capability to meet its required throughput. The maximum input results are included in **Table I-1**.

5. The simulation model processed the waste in the order specified in Section I.5.2.6. This order was generated randomly and modified only slightly to improve the operation of the model. However, the order in which the waste streams enter the facility is not optimal and creates inefficiencies in the model. When the input streams arrive in large lots and are not fed optimally into WRAP 2A, some operations are operating while others are idle. For example, if stream 2A is fed into WRAP 2A, the polymer and repack areas are the only areas operating. If other streams that required shredding and proceed to the grout area do not enter the facility at the same time, the output of the facility is greatly impacted. The grout and polymer areas are only designed to process their required throughput of 3,086 drums and 6,429 drums per year, respectively. Consequently, the two areas do not have the capacity to process the total daily input of the facility and need to operate simultaneously to meet the facilities throughput requirements.

6. When the input streams, including the lead stream, are optimized to provide the best operating efficiencies, it requires the polymer and grout areas to operate simultaneously 92 percent of the time. This percentage is based on the maximum capacities of the polymer and grout areas of 9,544 drums per year processing 8,768 drums per year. Therefore, as part of the ACDR simulation model effort, the optimal order and the number of drums of the different waste streams needs to be determined.

7. The number of drums fed into the WRAP 2A facility are based on a 25 year operating life of the facility. The 25 year operating life of the facility is conservative when the actual operating life as stated in the facility is 30 years. A facility with a operating life of 30 years would decrease the input requirements of the non-campaign waste by approximately 17 percent.

8. Analysis of each area of the WRAP 2A facility, indicated that each area has sufficient capacity to process its required throughput. As summarized in **Table I-1**, each area had the capacity to process its required throughput at maximum input. However, these areas are impacted by the random order and size of "lots" of the incoming waste streams.

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9. An illustration of the impact that the waste streams have on the facility when streams are fed randomly can be seen in the polymer area. The polymer area only processed 3,815 drums per year compared to its maximum requirement (excluding the campaign waste) of 4,778 drums per year, since the polymer stations were idle over 29 percent of the time. At maximum input, the polymer area can manage 6,160 drums per year, which is greater than its required throughput of 4,778 drums per year.

10. Analysis of the Polymer operations and cycle times (**Table I-12**), reveals that the four polymer stations would require 5.4 hours to process the maximum required throughput of 6,429 drums. This total process time 5.4 hours is based on 4 stations operating at the mean fill time of 35.9 minutes. The 5.4 hours does not include the time required for the material handling system to transfer drums to and from the polymer area, which during a typical day may add at least 0.5 hours. During a shift, the available operational manpower is expected for 5.5 hours per shift. Therefore, it was anticipated that before the model provided any results, a bottleneck could exist in the polymer area at maximum input and could impact the other operations in the facility.

11. The grout area throughput is impacted by the order of waste streams similar to the polymer area. The grout area only processed 2,131 drums per year compared to its maximum requirement of 3,087 drums per year, since the grout area was idle 46 percent of the time. As shown in **Table I-1**, the grout area at maximum input has the capacity to handle 3,384 drums per year.

12. The Size Reduction and Repack area can achieves its required throughput of 7,864 drums per year. As **Table I-1** illustrates at a maximum input this area can manage 11,527 drums per year.

13. The Special Waste area can achieve its required throughput of 1,651 drums per year. **Table I-1** illustrates that the area for a maximum input can manage 2,613 drums per year.

14. The operation of NDA area is effected by the polymer and grout operations. The NDA area processes drums when after the two treating areas have requested drums from the storage area. The NDA area processed 6,003 drums per year compared to its maximum required throughput (excluding campaign waste) of 7,864 drums per year. **Table I-1** shows that at maximum input the area can manage 12,180 drums per year, which greatly exceeds its throughput requirements.

15. The Receiving area has sufficient capacity to easily handle the required 5,259 drums per year. **Table I-1** illustrates that at maximum input, this area can process 25,130 drums per year. The Receiving area can process a large number of drums since the number of operations are small and the duration of these operations are short.

16. The Shipping area has the capacity to handle more than its maximum required output of 9,515 drums. At maximum input, the Shipping area can handle 12,110 drums per year. But, the number of drums the shipping area processes is dependent upon the activities in the treating areas. The results of the model illustrate this fact because the model only had an output of 5,941 drums per year. Since, the input streams were not optimized, which caused the treatment operations to have a lower throughput, the number of drums shipped was lower.

17. The main storage area is impacted by the operations in the treatment area. As stated earlier, the impact on the storage area is due to the order of the input streams. From the model data, the number of drums greatly fluctuated. At times, the storage area would have 316 drums stored, then drop to 10 drums when the input stream changed. The optimal size of the storage area can not be determined until the a number of uncertainties are answered and an optimal input feed plan is developed.

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TABLE I-1
WRAP MODULE 2A FACILITY ANNUAL THROUGHPUT PER OPERATING AREA[1]

OPERATING AREA		FDC REQUIREMENTS (OUTPUT)		PROJECTED BY WITNESS MODEL	
		WITH CAMPAIGN	WITHOUT CAMPAIGN	BASE CASE[2]	AT MAXIMUM INPUT[3]
Receiving		5,259	4,041	4,463	25,130
Size Reduction and Repack		7,864	7,591	4,867	11,527
Special Waste		1,218	0	1,274	2,613
NDA		9,515	7,591	6,003	12,180
Polymer		6,429	4,778	3,815	6,160
Grout	Agitate	1,632	1,632 2813	925 2131	1,686
	Vibro 3086	1,454	1,181	1,206	1,698
Shipping		9,515	7,591	5,941	12,110

9544

3384

Notes:
1. This table shows required and projected annual throughput for each operating area, but does not show drums in storage or other work-in-progress. Therefore, totals for each area do not agree with each other.
2. Base case throughput is based on the assumptions given in Section I.5.2. Base case outputs are interdependent and are not optimum.
3. This column indicates maximum output without any input constraints (each operating area was isolated to do this and is the optimum throughput for that area).

I.3 RECOMMENDATIONS

1. The simulation model processed the waste in the order specified in Section I.5.2.6. This order was generated randomly and modified slightly to improve the operation of the model. As discussed in Section I.2.0, the order the waste enters the facility and the size of the lot has a tremendous impact on the material throughput of the WRAP 2A facility. Therefore, as part of the ACDR simulation model effort, the optimal order and the size of the lot of the different waste streams needs to be determined.

2. As part of the Advance Conceptual Design effort the following items should be addressed in the future time and motion analysis:

a. Determine the mix and cure times of the polymer stations during the WHC Integrated Development Program.

b. Based on the results from above, modify the simulation to include the optimal feed stream order and optimize the treatment operations so that facility does not have any bottlenecks which impact the material throughput.

c. Determine whether the size of the lag storage area is adequately sized at a capacity of 182 drums.

d. Reinvestigate and confirm that the interactions between the main operating areas and the material handling system do not create constraints in the facility which results in a decrease in throughput.

I.4 UNCERTAINTIES

1. The uncertainties in the compilation of this analysis are summarized below:

   a. The duration of polymer mix and cure times. As part of the WHC Integrated Development Program for the polymer area, the duration of these activities should be determined.

   b. The impact the duration of the mix and cure times will have on the design facility, including the number of polymer stations required and the size of the lag storage area.

   c. A number of uncertainties are listed in Table 10-1 in Volume I, which will be addressed during the ACDR effort. The uncertainties listed will be resolved by a number of engineering studies and WHC development work. The impact on the facility design and the simulation model can not be determined at this point.

2. Since the compilation of this model, changes have been made to the cure time allowance for the grout product and the material handling and storage requirements of the polymer product. The impact of these changes on the workability of the overall facility should be explored as a matter of priority during the ACDR phase of development.

I.5 DESCRIPTION OF ALTERNATIVES/SOLUTIONS

I.5.1 Criteria

1. The number of drums and boxes processed per year are based on the FDC Rev.1. The model is based on Table I-2 and the total input feed is as follows:

   a. Drums - 5,259 per year.
   b. Boxes - 1 per month.

2. The drawings used as a basis for this analysis are:

   a. H-2-140598 Overall Facility Block Flow Diagram.
   b. H-2-140606 Shred/Grout Facility Block Flow Diagram.
   c. H-2-140608 Vibro Grout System Process Flow Diagram.
   d. H-2-140609 Agitated Grout System Process Flow Diagram.
   e. H-2-140619 Polymer Facility Block Flow Diagram.
   f. H-2-140621 Polymer Encapsulation Process Flow Diagram.
   g. H-2-140628 Size Reduction and Repack Process Flow Diagram.
   h. H-2-140648 Special Waste Treatment Block Flow Diagram.
   i. H-2-140649 Special Waste Size Reduction Process Flow Diagram.
   j. H-2-140650 Mercury Pretreatment Process Flow Diagram.
   k. H-2-140651 Reactive Metals Pretreatment Process Flow Diagram.
   l. H-2-140665 Material Handling Block Flow Diagram.
   m. H-2-140670 Receiving and Shipping Process Flow Diagram.
   n. H-2-140673 Drum NDA Process Flow Diagram.
   o. H-2-140599 Overall Equipment General Arrangement
   p. H-2-140666 Material Handling Equipment General Arrangement - Plan

TABLE I-2
WRAP 2A REQUIRED THROUGHPUT AND WITNESS MODEL THROUGHPUT

STREAM NO.	DAILY FLOW	VOLUME INCREASE	VOLUME RATIO	ANNUAL FLOW	ANNUAL INCREASE	WITNESS		
						ANNUAL FLOW	ANNUAL INCREASE	VOLUME RATIO
1A	0.64	1.82	2.84	112	319	108	324	3
1B	1.01	1.82	1.80	176	317	160	320	2
1C	1.09	2.07	1.90	190	361	184	368	2
1D	0.30	0.30	1.00	52	52	52	52	1
2A	8.08	17.13	2.12	1414	2998	1500	3000	2
2B	1.66	1.66	1.00	290	290	292	292	1
2C	2.36	4.72	2.00	413	826	412	824	2
2D	0.27	0.27	1.00	48	48	48	48	1
3	1.63	1.63	1.00	284	284	288	288	1
4	0.90	0.90	1.00	156	156	160	160	1
5A	3.33	3.92	1.18	582	685	684	684	1
5B	0.17	0.35	2.06	30	62	32	64	2
5C	3.46	5.16	1.49	606	904	608	1216	2
5D	1.56	1.56	1.00	273	273	272	272	1
6	1.32	2.83	2.14	230	493	248	496	2
7	1.78	3.56	2.00	311	622	312	624	2
8	0.53	1.06	2.00	92	184	92	184	2
EMPTY DRUM	3	3	1.00	525	525		525	
EMPTY BOX	0.66	0.66	1.00	116	116			
TOTAL	30.09	54.42		5259	9515	5452	9741	

3. The waste streams are size reduced, repacked and treated as follows:

Stream No.	Size Reduction Area	Treatment
1A	Shred	Polymer
1B	Pug mill	Polymer
1C	Pug mill	Polymer
1D	Shred	Vibro Grout
2A	Repack	Polymer
2B	Repack	Polymer
2C	Repack	Agitated Grout
2D	Shred	Vibro Grout
3	Shred	Vibro Grout
4	Shred	Vibro Grout
5A	Special Waste	Polymer
5B	Special Waste	Polymer
5C	Special Waste	Polymer
5D	Shred	Vibro Grout
6	Pug mill	Polymer
7	Repack	Agitated Grout
8	Repack	Agitated Grout

I.5.2 Assumptions

1. The model assumes a facility availability of 70 percent or 175 days per year.

2. The model assumes that the NDA area, material handling system, and storage/retrieval system, operate for 7 hours per day, whereas, the other operating areas (Receiving and Shipping, Size Reduction and Repack, Special waste, Polymer, and Grout) operate 5.5 hours per day. The operating time of 5.5 hours is based on criteria from WRAP Module 1.

3. The Sampling of drums for lot verification and destructive testing are not included in the model. The sampled drums for lot verification are sampled previously before the drums are processed with the main lot.

4. Labor is not included in this model. The shift patterns of the labor are included, which takes into account the break times and change times for labor.

5. Incoming waste drums arrive from W-112 with bar code labels already applied. The labels are read in the Receiving area before entering the Size Reduction area.

6. The following are assumptions used in the WITNESS simulation model:

a. Waste streams are processed in "lots" quarterly. The order of the waste streams was determined randomly. The order of the waste streams used in the model was 1D,2A (half), 6, 7, 3, 2A (half), 1B 1A, 5A, 5C, 2C, 5B, 8, 5D, 2B, 2D, 1C, and 4

b. Waste drums entering the WRAP 2A facility are not surveyed.

c. Treated drums proceed directly to the shipping area. If the shipping discharge conveyors are filled, the drums are sent to the lag storage area until the conveyor becomes free.

d. Empty drums are processed in parallel to the main waste stream. Constraints are built into the model so that the empty drums and the waste streams that are shredded do not intermix.

e. The Lead waste stream (5C) consists of lead bricks and lead contaminated solids. The large portion of this waste stream consists of lead bricks, approximately 95 percent. Therefore to simplify the model, the lead contaminated solids were not modeled and stream 5C was assumed to be all lead bricks.

f. The elemental mercury recovered after the evaporation process, approximately 1 percent of the total waste stream, is not sent to amalgamation, but is loaded out into a drum.

g. The model does not differentiate between polymer mixing or polymer vibration and these operations are assumed in the model to be identical.

h. Sixty (60) new drums are delivered to WRAP 2A on a truck once a day.

i. Thirty (30) waste drums are delivered on pallets to WRAP 2A from W-112 in blocks of 8 pallets one day and 7 pallets the following day.

j. The operations for preparing the grout and polymer bulk materials for the encapsulation process are not included in the model. It is assumed that the encapsulation material is in place for filling the drum when the drum arrives at the fill area.

k. The box breakdown area is not included in the model, since only one box enters the facility per month. This low frequency allows adequate time for the box to be sized reduced.

I.6 CYCLE TIMES OF MAJOR OPERATIONAL STEPS

1. The cycle times for the major operational steps for each operating area are summarized on the following tables. The tables include a description of the step, the WITNESS code name and the cycle time of the stop. The cycle times for the forklift, AGVs, conveyors, transfer car, storage retrieval stacker and drum lift elevators indicate "varies" since its cycle time is dependent upon the distance the drum travels. The travel speed of the AGV, transfer car, forklift, and storage/retrieval stacker, plus the conveyor speed are based on vendor data. The distances these items must travel and the length of the conveyor are based on the equipment general arrangement drawings in the CDR package. The WITNESS program calculates the cycle time for these items based on the above mentioned parameters.

TABLE I-3 - RECEIVING AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
WASTE DRUMS			
1.	Unload pallet from W-112 vehicle	UNLOAD1	2
2.	Transfer pallet to conveyor via forklift	FORK	varies
3.	Transfer pallet via conveyor to depallet	C1	varies
4.	Depalletize drums	DEPALLET	5
5.	Load drum onto conveyor	LOADCON	2
6.	Read bar code label	BC1	1
7.	Weigh drum	WEIGH1	2
8.	Enter drum data into DMS	ENTERDAT	2
9.	Transfer drum via conveyor to Size Reduce and Repack Area	C2	varies
NEW DRUMS			
1.	Unload new drums from truck	UNLOAD2	2
2.	Transfer new drum to storage	NEWSTOR	varies
3.	Transfer new drums to infeed conveyor	FORK	varies
4.	Transfer drum via conveyor to airlock	C3	varies
5.	Transfer drum through airlock	C92	varies
6.	Transfer drum via conveyor for AGV pickup	C93	varies

TABLE I-4 - NDA AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
1.	Transfer drum from Lag Storage via AGV to PAN conveyor	AGV2	varies
2.	Transfer drum into PAN via conveyor	C81 or C82	varies
3.	PAN	PAN1 or PAN2	10
4.	Transfer drum from PAN via conveyor for AGV pickup	C81 or C82	
5.	Move drum to GEA conveyor	AGV2	varies
6.	Transfer drum into GEA via conveyor	C83 or C84	varies
7.	GEA	GEA1 or GEA2	10
8.	Transfer drum from GEA via conveyor for AGV pickup	C83 or C84	varies
9.	Transfer drum via AGV to Grouting, Polymer or Lag Storage	AGV2	varies

TABLE I-5 - SIZE REDUCE AND REPACK AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
REPACKED WASTE			
1.	Transfer drum from Receiving via conveyor	CC1	varies
2.	Transfer drum via conveyor to transfer car pickup station	CC4	varies
3.	Transfer drum to repack enclosure infeed conveyor	TRCAR	varies
4.	Transfer drum to enclosure	CC5	varies
5.	Read bar code label	BC2	1

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TABLE I-5 - SIZE REDUCE AND REPACK AREA

Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
6.	Raise drum to containment	SIZEIN1	1
7.	Open entry door/remove drum lid		1
8.	Lower Grab and engage drum		2
9.	Lift drum and close Entry Door		1
10.	Transfer drum to Entry Door		1
11.	Open door and lower drum through opening		1
12.	Release drum from grab		
13.	Move drum to drum Elevator	C4	varies
14.	Grip drum with Elevator Grip	DELID1	3
15.	Cut lid clamp band and remove		
16.	Remove lid		2
17.	Raise drum to Repack Sorting Table	RAISE1	varies
18.	Slide Sorting Table under Tipper	TIP1	1
19.	Tip drum and slide table to Sort Area		1
20.	Raise empty drum to Shredder Table	RAISE2	varies
21.	Slide table and unload empty drum	UNLOADE	1
22.	Tip empty drum into Shredder	TIP2	1
23.	Shred empty drum	SHRED	1
24.	Inspect waste on Sorting Table	SORT1	5
25.	Remove Non-compliant Items	REMOVE1	1
26.	Tip waste into Vibrating Conveyor	TIP3	1
27.	Vibrate waste to Weigh Hopper	VC1	3
28.	Fill Weigh Hopper and weigh	FILLHOP1	1
29.	Open Double Lid Door	OPENHOP1	1
31.	Transfer new drum from Receiving	AGV1	varies
32.	Transfer new drum via conveyor for waste load out	C5A	varies
33.	Lower Hopper and discharge waste	DISCHRG1	1
34.	Transfer drum via convey to AGV	C5B	varies

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TABLE I-6 - SIZE REDUCE AND REPACK AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
SHREDDED WASTE			
1.	Transfer drum from Receiving via conveyor	CC1	varies
2.	Transfer drum via conveyor to transfer car pickup station	CC4	varies
3.	Transfer drum to repack enclosure infeed conveyor	TRCAR	varies
4.	Transfer drum to enclosure	CC5	varies
5.	Read bar code label	BC2	1
6.	Raise drum to containment	SIZEIN1	1
7.	Open entry door/Remove drum Lid		1
8.	Lower grab and engage drum		2
9.	Lift drum and close Entry Door		1
10.	Transfer drum to Entry Door		1
11.	Open door and lower drum through opening		1
12.	Release drum from Grab		
13.	Move drum to drum Elevator	C4	varies
14.	Grip drum with Elevator Grip	DELID1	3
15.	Cut lid clamp band and remove		
16.	Remove lid		2
17.	Raise drum to Shred Sorting Table	RAISE1 AND RAISE2	varies
18.	Slide Sorting Table under Tipper	TIP4	1
19.	Tip drum and slide table to Sort Area		1
20.	Inspect waste on Sorting Table	SORT2	5
21.	Remove Non-compliant Items	REMOVE2	1
22.	Unload empty drum on table	UNLOADE	1
23.	Tip waste into Shredder	TIP2	1
24.	Shred waste	SHRED	1
25.	Vibrate waste to Weigh Hopper	VC1	3
26.	Fill Weigh Hopper and weigh	FILLHOP1	1

TABLE I-6 - SIZE REDUCE AND REPACK AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
27.	Open Double Lid Door	OPENHOP1	1
28.	Transfer new drum from Receiving	AGV1	varies
29.	Transfer new drum via conveyor for waste load out	C5A	varies
30.	Lower Hopper and discharge waste	DISCHRG1	1
31.	Transfer drum via convey to AGV	C5B	varies

TABLE I-7 - SIZE REDUCE AND REPACK AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
	PUG MILL WASTE		
1.	Transfer drum from Receiving via conveyor	CC1	varies
2.	Transfer drum via conveyor to transfer car pickup station	CC4	varies
3.	Transfer drum to repack enclosure infeed conveyor	TRCAR	varies
4.	Transfer drum to enclosure	CC6	varies
5.	Read bar code label	BC3	1
6.	Raise drum to containment	SIZEIN2	1
7.	Open Entry Door/remove drum lid		1
8.	Lower Grab and engage drum		2
9.	Lift drum and close Entry Door		1
10.	Transfer drum to Entry Door		1
11.	Open door and lower drum through opening		1
12.	Release drum from Grab		
13.	Move drum to drum Elevator	C6	varies
14.	Grip drum with Elevator Grip	DELID2	3
15.	Cut lid clamp band and remove		
16.	Remove lid		2
17.	Raise drum to Sorting Table	RAISE3	varies

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TABLE I-7 - SIZE REDUCE AND REPACK AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
18.	Slide Sorting Table under Tipper	TIP5	1
19.	Tip drum and slide table to Sort Area		1
20.	Transfer empty drum to Shredder Table	TRANEMP	2
21.	Tip empty drum into Shredder	TIP2	1
22.	Shred empty drum	SHRED	1
23.	Inspect waste on Sorting Table	SORT3	5
24.	Remove Non-compliant Items	REMOVE3	1
25.	Tip waste into Pug Mill	TIP6	1
26.	Pug Mill	PUG MILL	3
27.	Fill Weigh Hopper and weigh	FILLHOP2	1
28.	Open Double Lid Door	OPENHOP2	1
29.	Transfer new drum from Receiving	AGV1	varies
30.	Transfer new drum via conveyor for waste load out	C7A	varies
31.	Lower Hopper and discharge waste	DISCHRG2	1
32.	Transfer drum via convey to AGV	C7B	varies

TABLE I-8 - SPECIAL WASTE AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
1.	Transfer drum from Receiving via conveyor	CC1	varies
2.	Transfer drum via conveyor to transfer car pickup station	CC4	varies
3.	Transfer drum to repack enclosure infeed conveyor	TRCAR	varies
4.	Transfer drum to enclosure	CC7	varies
5.	Read bar code label	BC9	1

TABLE I-8 - SPECIAL WASTE AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
6.	Raise drum to containment	SIZEIN3	1
7.	Open Entry Door/remove drum lid		1
8.	Lower Grab and engage drum		2
9.	Lift drum and close Entry Door		1
10.	Transfer drum to Entry Door		1
11.	Open door and lower drum through opening		1
12.	Release drum from Grab		
13.	Move drum to drum Elevator	C19	varies
14.	Grip drum with Elevator Grip	DELID3	3
15.	Cut lid clamp band and remove		
16.	Remove lid		2
17.	Raise drum to Sorting Table	RAISE4	varies
18.	Slide Sorting Table under Tipper	TIP7	1
19.	Tip drum and slide table to Sort Area		1
20.	Inspect waste on Sorting Table	SORT4	5
21.	Remove Lead Brick and transfer for discharge	LEADBRK	30
22.	Transfer Elemental Mercury to Mercury Amalgamation	MERCAMAL	20
23.	Tip waste into Shredder	TIP8	1
24.	Shred waste (3 drums at a time)	SHRED2	60
25.	Transfer Shredded Mercury to Evaporator (1/2 day)	MERCEVAP	210
26.	Transfer recovered Mercury to Mercury Amalgamation	MERCAMAL	20
27.	Fill Weigh Hopper and weigh	FILLHOP3	1
28.	Open Double Lid Door	OPENHOP3	1
29.	Transfer new drum from Receiving	AGV1	varies
30.	Transfer new drum via conveyor for waste load out	C20A	varies
31.	Lower Hopper and discharge waste	DISCHRG3	1
32.	Transfer drum via convey to AGV	C20B	varies

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TABLE I-9 - STORAGE/RETRIEVAL AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
1.	Transfer drum from Size Reduction or Special Waste area	AGV2	varies
2.	Transfer drum from AGV to the Lag Storage Entry Conveyor	C40	varies
3.	Convey drum to Stacker pickup area	C41	varies
4.	Transfer drum via stacker into storage	ASRS	varies
5.	Store drums to be processed	LAGIN	varies
6.	Store treated drums awaiting shipping	LAGOUT	varies
7.	As requested, transfer drums from storage to Storage Exit Conveyor	ASRS	varies
8.	Convey drum to Discharge Conveyor	C42	varies
9.	Convey drum to the AGV	C43	varies
10.	Transfer drum to NDA or shipping area	AGV2	varies

TABLE I-10 - VIBRO GROUT AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
1.	Transfer drum to the Grout Enclosure	AGV2	varies
2.	Read bar code label (outside box)	BC6V	1
3.	Convey drum into Airlock	C8	varies
4.	Convey drum to Fill Station	C9	varies
5.	Remove drum lid fastener	REMFASTV	2
6.	Remove drum lid	REMLIDV	2
7.	Fill drum with grout	FILLV	15 to 25
8.	Relid drum	RELIDV	2
9.	Reattach fastener without tightening	RATTCHV	2
10.	Transfer to conveyor for curing	C10	varies
11.	Cure store drum for 24 hours	CURE	420
12.	Transfer drum via conveyor to Inspection Station	C11	varies
13.	Inspect grout	INSPECT	10
14.	Remove excess water, if required (10%)	EXCWTR	2

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TABLE I-10 - VIBRO GROUT AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
15.	Monitor and decon drum, if required (1%)	DECON	35
16.	Convey drum through Airlock	C13	varies
17.	Read bar code label	BC5	1
18.	Transfer drum to AGV	C70	varies

TABLE I-11 - AGITATED GROUT AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
1.	Transfer drum to the Grout Enclosure	AGV2	varies
2.	Read bar code label (outside box)	BC6A	1
3.	Convey drum into Airlock	C14	varies
4.	Convey drum to Fill Station	C15	varies
5.	Remove drum lid fastener	REMFASTA	2
6.	Remove drum lid	REMLIDA	2
7.	Attach agitator to mixer	ATTACH	1
8.	Fill drum with grout	FILLA	20 to 30
9.	Relid drum	RELIDA	2
10.	Reattach fastener without tightening	RATTCHA	2
11.	Transfer to conveyor for Curing	C16	varies
12.	Cure store drum for 24 hours	CURE	420
13.	Transfer drum via conveyor to Inspection Station	C11	varies
14.	Inspect grout	INSPECT	10
15.	Remove excess water, if required (10%)	EXCWTR	2
16.	Monitor and decon drum, if required (1%)	DECON	35
17.	Convey drum through Airlock	C13	varies
18.	Read bar code label	BC5	1
19.	Transfer drum to AGV	C70	varies

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TABLE I-12 - POLYMER AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
AGITATED OR VIBRATED DRUMS[1]			
1.	Read bar code label (outside box)	BC7A	1
2.	Remove drum lid fastener	ENTRYP1	1
3.	Position drum		1
4.	Raise drum to containment		1
5.	Open drum Entry Door		1
6.	Attach agitator to mixer or clamp vibrator to the drum	MIXATTP1	1
7.	Fill drum with Polymer	FILLP1	4.9[2]
8.	Mix or vibrate Polymer	MIXP1	10
9.	Disconnect agitator or Vibrator	DISCONP1	1
10.	Gel Polymer	GELPOLY1	10
11.	Relid drum	EXITP1	1
12.	Lower drum		1
13.	Reattach drum lid fastener		2

Notes: 1. The Polymer area has four enclosures. Each enclosure has the capability to vibrate or mix waste depending on the type of waste. The table shows the sequence and cycle times for the first enclosure only. The four enclosure are identical to the first enclosure shown above.

2. The fill cycle time of 4.9 minutes is the mean time based on the distribution of cycle times from 2.0 minutes to 8.7 minutes.

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TABLE I-13 - SHIPPING AREA			
Operation Step No.	Operational Step Description	WITNESS Code	Time (Minutes)
1.	Convey drum from AGV to Airlock	C90	varies
2.	Convey drum through Airlock	C91	varies
3.	Convey drum from Airlock to Pallet Building Station	C17	varies
4.	Read bar code label on drum	BC8	1
5.	Weigh drum and enter data into DMS	WEIGH2	2
6.	Build pallet for drums	BLDPLLT	15
7.	Transfer pallet to W-112 Transfer Area	FORK	varies
8.	Transfer pallet to W-112	W-112OUT	1

I.7 SUMMARY REPORTS OF WITNESS GENERATED DATA

CDR REPORT

PART STATISTICS REPORTED BY TOTAL SIMULATION TIME

Name	Number Entered	Number Shipped	Number Scrapped	Number Assembled	Number Rejected	W.I.P	Av. W.I.P	Av. Time
S1A	84	0	0	84	0	0	0.31	128.42
S1B	80	0	0	80	0	0	0.37	161.28
S1C	88	0	0	88	0	0	0.31	124.03
S1D	32	0	0	32	0	0	0.07	79.75
S2A	840	0	0	816	0	24	4.84	203.07
S2B	72	0	0	72	0	0	0.63	311.15
S2C	208	0	0	208	0	0	1.35	229.53
S2D	13	0	0	13	0	0	0.28	767.93
S3	144	0	0	144	0	0	0.57	139.38
S4	40	0	0	40	0	0	0.45	397.86
S5A	272	0	0	272	0	0	6.35	824.00
S5B	0	0	0	0	0	0	0.00	0.00
S5C	312	0	0	312	0	0	3.71	419.21
S5D	136	0	0	136	0	0	0.67	173.93
S6	120	0	0	120	0	0	0.48	140.69
S7	160	0	0	160	0	0	0.67	147.35
S8	56	0	0	56	0	0	0.29	181.80
EMPTYDRM	2110	0	0	2096	0	14	10.55	176.41
NEW	3960	0	0	2807	0	1153	498.40	4440.3
BOX	0	0	0	0	0	0	0.00	0.00
PALLET	510	0	356	0	0	154	62.97	4356.2
DRUM	3175	0	0	3173	0	2	3.89	43.22
AGROUT	424	0	0	423	0	1	35.01	2913.5
POLYMER	1794	0	0	1744	0	50	107.98	2123.4
VGROUT	589	0	0	551	0	38	35.38	2119.2
LLWFINAL	2726	679	0	2037	0	10	6.79	87.91

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BUFFER STATISTICS — REPORTED BY TOTAL SIMULATION TIME

Name	Total in	Total out	Now in	Max	Min	Average Size	Average Time	Av. after Delay No.	Av. after Delay Time
LAGIN	2806	2747	59	316	0	154.67	1944.63		
CURE	990	974	16	36	0	12.07	430.15	0.38	13.90
LAGOUT	35	31	4	24	0	1.88	1896.34		

MACHINE STATISTICS — REPORTED BY TOTAL SIMULATION TIME

Name	Number of Ops.	%Idle	%Cycle		%Stopped		%Waiting	
DEPALLET	356	8.13	Busy :	5.05	Blocked :	65.40	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
UNLOAD1	591	70.16	Busy :	3.35	Blocked :	5.06	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
LOADCON	1423	8.47	Busy :	4.03	Blocked :	66.06	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
BC1	1422	7.18	Busy :	4.03	Blocked :	67.37	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
WEIGH1	1421	6.59	Busy :	8.06	Blocked :	63.93	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
ENTERDAT	1420	6.25	Busy :	8.05	Blocked :	64.27	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
UNLOAD2	2520	69.67	Busy :	3.57	Blocked :	5.33	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
BC8	2720	60.19	Busy :	7.71	Blocked :	10.67	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
WEIGH2	2720	46.91	Busy :	15.42	Blocked :	16.24	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
BLDPLLT	679	48.70	Busy :	23.11	Blocked :	6.77	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
W-112OUT	679	98.08	Busy :	1.92	Blocked :	0.00	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
NEWL	1410	68.62	Busy :	0.20	Blocked :	9.75	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
NEWSPLT	1410	52.98	Busy :	0.20	Blocked :	46.82	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
BC2	935	43.39	Busy :	2.65	Blocked :	32.54	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
SIZEIN1	934	46.48	Busy :	18.53	Blocked :	13.56	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
DELID1	932	46.88	Busy :	13.21	Blocked :	18.48	Setup :	0.00
					Setup :	0.00	Cycle :	0.00

					Down	:	0.00	Repair	:	0.00
TIP1	694	52.70	Busy :	3.93	Blocked	:	21.94	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
UNLOADE	1763	73.32	Busy :	5.00	Blocked	:	0.25	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
TIP2	1999	58.61	Busy :	5.67	Blocked	:	14.29	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SHRED	1998	53.64	Busy :	5.66	Blocked	:	19.27	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SORT1	694	68.74	Busy :	9.84	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
REMOVE1	694	76.45	Busy :	1.97	Blocked	:	0.16	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
TIP3	694	65.69	Busy :	1.97	Blocked	:	10.91	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
FILLHOP1	929	73.23	Busy :	2.63	Blocked	:	2.71	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
OPENHOP1	1939	67.81	Busy :	5.50	Blocked	:	5.26	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
DISCHRG1	1937	72.88	Busy :	5.49	Blocked	:	0.20	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SIZEIN2	144	75.71	Busy :	2.86	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
DELID2	144	76.51	Busy :	2.04	Blocked	:	0.02	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
TIP5	144	77.53	Busy :	0.82	Blocked	:	0.22	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
TRANEMP	144	77.33	Busy :	1.22	Blocked	:	0.02	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SORT3	144	76.53	Busy :	2.04	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
REMOVE3	144	78.16	Busy :	0.41	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
TIP6	144	78.09	Busy :	0.41	Blocked	:	0.07	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
PUGMILL	144	76.99	Busy :	1.22	Blocked	:	0.35	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
FILLHOP2	144	77.00	Busy :	0.41	Blocked	:	1.17	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
OPENHOP2	288	76.27	Busy :	0.82	Blocked	:	1.48	Setup	:	0.00

					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
DISCHRG2	288	77.56	Busy :	0.82	Blocked	:	0.19	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
BC3	144	75.58	Busy :	0.41	Blocked	:	2.58	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
BC9	328	41.76	Busy :	0.93	Blocked	:	35.89	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SIZEIN3	328	72.06	Busy :	6.51	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
DELID3	328	44.14	Busy :	4.65	Blocked	:	29.78	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
REACTMTL	0	100.00	Busy :	0.00	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
TIP7	328	42.52	Busy :	1.86	Blocked	:	34.20	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SORT5	0	100.00	Busy :	0.00	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
TIP8	100	59.35	Busy :	0.28	Blocked	:	18.94	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MERCAMAL	72	74.49	Busy :	4.08	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
LEADBRK	156	65.13	Busy :	13.27	Blocked	:	0.18	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SHRED2	50	55.10	Busy :	0.85	Blocked	:	22.62	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
FILLHOP3	410	76.35	Busy :	1.16	Blocked	:	1.06	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
OPENHOP3	582	75.16	Busy :	1.65	Blocked	:	1.76	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
DISCHRG3	582	76.80	Busy :	1.65	Blocked	:	0.12	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
TIP4	928	50.93	Busy :	5.26	Blocked	:	22.38	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
REMOVE2	236	77.90	Busy :	0.67	Blocked	:	0.01	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SORT2	236	75.23	Busy :	3.34	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
FILLHOPE	176	78.07	Busy :	0.50	Blocked	:	0.01	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00

PAN1	1607	44.34	Busy :	45.56	Blocked :	10.10	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
PAN2	1137	62.48	Busy :	32.24	Blocked :	5.29	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
GEA1	1568	36.13	Busy :	44.44	Blocked :	19.42	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
GEA2	1176	48.52	Busy :	33.33	Blocked :	18.14	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
BC4	0	100.00	Busy :	0.00	Blocked :	0.00	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
REMFASTV	570	59.34	Busy :	3.23	Blocked :	16.00	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
REMLIDV	569	55.27	Busy :	3.23	Blocked :	20.08	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
FILLV	567	46.33	Busy :	32.25	Blocked :	0.00	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
RELIDV	567	75.36	Busy :	3.21	Blocked :	0.00	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
RATTCHV	567	75.36	Busy :	3.21	Blocked :	0.00	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
INSPECT	974	49.28	Busy :	27.61	Blocked :	1.68	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
EXCWTR	93	77.95	Busy :	0.53	Blocked :	0.10	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
DECON	14	77.18	Busy :	1.39	Blocked :	0.00	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
BC5	974	91.87	Busy :	2.76	Blocked :	5.36	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
BC6A	423	77.23	Busy :	1.20	Blocked :	21.58	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
REMFASTA	423	57.27	Busy :	2.40	Blocked :	18.91	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
REMLIDA	423	54.26	Busy :	2.40	Blocked :	21.92	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
ATTACH	423	50.97	Busy :	1.20	Blocked :	26.40	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
FILLA	423	48.47	Busy :	30.10	Blocked :	0.00	Setup :	0.00
					Setup :	0.00	Cycle :	0.00
					Down :	0.00	Repair :	0.00
RELIDA	423	76.17	Busy :	2.40	Blocked :	0.00	Setup :	0.00
					Setup :	0.00	Cycle :	0.00

					Down	:	0.00	Repair	:	0.00
RATTCHA	423	76.17	Busy	: 2.40	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
BC7A	566	98.40	Busy	: 1.60	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
ENTRYP1	566	28.84	Busy	: 6.42	Blocked	:	43.31	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MIXATTP	566	76.97	Busy	: 1.60	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
FILLP1	566	70.81	Busy	: 7.76	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MIXP1	566	62.53	Busy	: 16.04	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
DISCONP1	566	76.97	Busy	: 1.60	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
GELPOLY1	566	62.27	Busy	: 16.04	Blocked	:	0.26	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
EXITP1	566	63.04	Busy	: 6.42	Blocked	:	9.11	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
BC7B	507	98.56	Busy	: 1.44	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
BC7C	393	98.89	Busy	: 1.11	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
BC7D	279	99.21	Busy	: 0.79	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
ENTRYP2	507	34.31	Busy	: 5.75	Blocked	:	38.51	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
ENTRYP3	393	44.26	Busy	: 4.46	Blocked	:	29.85	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
ENTRYP4	279	54.14	Busy	: 3.16	Blocked	:	21.27	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MIXATTP1	0	100.00	Busy	: 0.00	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MIXATTP2	507	77.13	Busy	: 1.44	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MIXATTP3	393	77.46	Busy	: 1.11	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MIXATTP4	279	77.78	Busy	: 0.79	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
FILLP2	507	71.62	Busy	: 6.95	Blocked	:	0.00	Setup	:	0.00

					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
FILLP3	393	73.22	Busy :	5.35	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
FILLP4	279	74.70	Busy :	3.87	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MIXP2	506	64.22	Busy :	14.35	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MIXP3	393	67.43	Busy :	11.14	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MIXP4	279	70.66	Busy :	7.91	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
DISCONP2	506	77.14	Busy :	1.43	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
DISCONP3	393	77.46	Busy :	1.11	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
DISCONP4	279	77.78	Busy :	0.79	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
GELPOLY2	506	64.23	Busy :	14.34	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
GELPOLY3	393	67.43	Busy :	11.14	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
GELPOLY4	279	70.66	Busy :	7.91	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
EXITP2	506	66.08	Busy :	5.74	Blocked	:	6.76	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
EXITP3	393	68.46	Busy :	4.46	Blocked	:	5.65	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
EXITP4	279	72.45	Busy :	3.16	Blocked	:	2.96	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
MERCEVAP	50	48.53	Busy :	29.76	Blocked	:	0.28	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
BC6V	574	85.98	Busy :	1.63	Blocked	:	12.39	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
UNLOADE2	328	76.03	Busy :	1.86	Blocked	:	0.68	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SORT4	328	63.60	Busy :	4.65	Blocked	:	10.32	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00
SHRED2E	32	77.66	Busy :	0.91	Blocked	:	0.00	Setup	:	0.00
					Setup	:	0.00	Cycle	:	0.00
					Down	:	0.00	Repair	:	0.00

9413227.0086

CONVEYOR STATISTICS REPORTED BY TOTAL SIMULATION TIME

Name	Now on	Total on	Av. Size	Av. Time	%Empty	%Move	%Block	%Queue	%Down
C1	5	361	3.9	385.91	13.73	0.27	0.00	86.02	0.00
C2	2	1419	1.8	45.46	8.00	0.06	90.63	1.31	0.00
C3	10	2820	9.5	118.93	0.19	0.02	0.00	99.79	0.00
C4	1	933	0.4	13.67	50.41	1.32	26.84	0.00	0.00
C5A	0	1937	0.0	0.58	96.83	0.66	2.52	0.00	0.00
C6	0	144	0.0	0.65	78.31	0.20	0.06	0.00	0.00
C7A	0	288	0.0	1.02	99.17	0.20	0.63	0.00	0.00
C8	2	573	0.4	24.23	78.52	0.20	17.82	3.45	0.00
C92	1	2810	1.0	12.50	0.41	0.48	99.11	0.00	0.00
C18	0	2720	0.3	3.66	87.94	3.43	1.43	7.21	0.00
RAISE1	1	931	0.3	12.45	52.98	2.61	22.98	0.00	0.00
RAISE2	1	929	0.4	14.13	49.50	2.61	26.47	0.00	0.00
CC4	4	1413	3.9	96.13	3.22	0.07	0.00	96.70	0.00
VC1	1	2690	0.3	4.15	68.37	22.87	8.76	0.00	0.00
CC1	4	1417	3.8	93.76	4.57	0.05	92.54	2.83	0.00
CC5	1	936	0.4	16.64	55.86	0.32	43.83	0.00	0.00
CC6	0	144	0.0	12.21	74.69	0.05	3.83	0.00	0.00
CC7	0	328	0.5	53.14	39.83	0.11	38.63	0.00	0.00
C19	0	328	0.4	44.21	45.63	0.46	32.48	0.00	0.00
C20A	0	582	0.0	1.35	97.78	0.20	2.03	0.00	0.00
C20B	0	582	0.0	1.47	76.15	0.20	2.22	0.00	0.00
C7B	0	288	0.0	2.14	98.25	0.20	1.55	0.00	0.00
C5B	0	1937	0.1	1.25	93.12	0.66	6.23	0.00	0.00
RAISE3	0	144	0.0	1.50	78.21	0.27	0.09	0.00	0.00
RAISE4	0	328	0.0	0.89	77.96	0.61	0.00	0.00	0.00
C40	0	2834	0.0	0.29	98.07	0.96	0.42	0.56	0.00
C42	1	2778	0.2	2.37	81.36	2.36	16.28	0.00	0.00
C43	0	2777	0.8	10.35	41.91	0.80	57.29	0.00	0.00
C70	1	974	0.3	11.71	76.75	0.47	9.15	13.64	0.00
C81	0	1138	0.0	0.57	98.16	1.61	0.23	0.00	0.00
C82	0	1608	0.1	2.19	90.03	2.28	7.69	0.00	0.00
C83	0	1176	0.1	3.90	86.99	1.67	11.35	0.00	0.00
C84	0	1568	0.2	3.78	83.21	2.22	14.57	0.00	0.00
C9	1	571	0.3	16.66	58.58	1.62	18.37	0.00	0.00
C10	0	567	0.0	0.44	78.10	0.32	0.06	0.10	0.00
C11	0	974	0.1	4.99	71.29	0.79	6.50	0.00	0.00
C13	0	974	0.1	2.81	73.10	2.76	2.71	0.00	0.00
C14	0	423	0.6	51.10	66.82	0.08	28.02	5.08	0.00
C15	0	423	0.4	29.54	51.19	1.20	26.18	0.00	0.00
C16	0	423	0.0	0.43	78.23	0.24	0.00	0.10	0.00
C91	0	2720	0.0	0.23	98.22	0.46	1.32	0.00	0.00
C93	2	2809	2.0	25.08	0.14	0.00	99.37	0.49	0.00
C90	0	2720	0.0	0.28	97.85	0.93	0.00	1.22	0.00
C83B	0	1175	0.1	4.11	86.32	1.67	12.02	0.00	0.00
C82B	0	1607	0.3	5.64	74.30	2.28	23.42	0.00	0.00
C84B	1	1568	0.2	3.52	84.29	2.22	13.50	0.00	0.00
C81B	0	1137	0.2	5.71	81.59	1.61	16.80	0.00	0.00
C43A	0	31	0.0	4.18	99.63	0.01	0.36	0.00	0.00

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VEHICLE STATISTICS REPORTED BY TOTAL SIMULATION TIME

Name	Distance	Loads	%Idle	%Demand	%Xfer	%Loaded	%Stop	%Block
FORK	474077.00	5200	55.62	10.41	4.32	10.19	0.00	0.00
						Off-Shift :		19.47
AGV1	857422.00	5614	71.53	13.52	2.01	12.95	0.00	0.00
						Off-Shift :		0.00
AGV2	3096139.00	10979	15.87	30.51	13.08	40.57	0.00	0.00
						Off-Shift :		0.00
TRCAR	53136.00	1409	2.87	0.76	95.61	0.77	0.00	0.00
						Off-Shift :		0.00
ASRS	707010.00	5612	67.89	12.10	1.24	18.78	0.00	0.00
						Off-Shift :		0.00

9112277.0008

Receiving Area Maximum Input Report Time: 4200.00

PART STATISTICS REPORTED BY ON-SHIFT TIME

Name	Number Entered	Number Shipped	Number Scrapped	Number Assembled	Number Rejected	W.I.P	Av. W.I.P	Av. Time
S1A	56	56	0	0	0	0	0.11	8.41
S1B	80	80	0	0	0	0	0.19	9.86
S1C	0	0	0	0	0	0	0.00	0.00
S1D	28	28	0	0	0	0	0.05	7.61
S2A	752	752	0	0	0	0	1.72	9.60
S2B	0	0	0	0	0	0	0.00	0.00
S2C	0	0	0	0	0	0	0.00	0.00
S2D	0	0	0	0	0	0	0.00	0.00
S3	144	144	0	0	0	0	0.33	9.49
S4	0	0	0	0	0	0	0.00	0.00
S5A	255	252	0	0	0	3	0.58	9.49
S5B	0	0	0	0	0	0	0.00	0.00
S5C	0	0	0	0	0	0	0.00	0.00
S5D	0	0	0	0	0	0	0.00	0.00
S6	124	124	0	0	0	0	0.28	9.42
S7	0	0	0	0	0	0	0.00	0.00
S8	0	0	0	0	0	0	0.00	0.00
EMPTYDRM	0	0	0	0	0	0	0.00	0.00
NEW	630	597	0	0	0	33	13.03	86.85
BOX	0	0	0	0	0	0	0.00	0.00
PALLET	645	0	360	0	0	285	142.35	926.96
DRUM	1440	0	0	1439	0	1	0.87	2.54
AGROUT	0	0	0	0	0	0	0.00	0.00
POLYMER	0	0	0	0	0	0	0.00	0.00
VGROUT	0	0	0	0	0	0	0.00	0.00
LLWFINAL	0	0	0	0	0	0	0.00	0.00

Maximum output = Total number of drums shipped = 1,436/10 days
(excluding new drums)
= 25,130/year

Size Reduction and Repack Area Maximum Input Report Time: 6300.00

PART STATISTICS — REPORTED BY ON-SHIFT TIME

Name	Number Entered	Number Shipped	Number Scrapped	Number Assembled	Number Rejected	W.I.P	Av. W.I.P	Av. Time
S1A	420	0	0	420	0	0	4.25	63.72
S1B	314	0	0	314	0	0	3.54	70.95
S1C	0	0	0	0	0	0	0.00	0.00
S1D	0	0	0	0	0	0	0.00	0.00
S2A	219	0	0	204	0	15	4.33	124.66
S2B	0	0	0	0	0	0	0.00	0.00
S2C	0	0	0	0	0	0	0.00	0.00
S2D	0	0	0	0	0	0	0.00	0.00
S3	0	0	0	0	0	0	0.00	0.00
S4	0	0	0	0	0	0	0.00	0.00
S5A	0	0	0	0	0	0	0.00	0.00
S5B	0	0	0	0	0	0	0.00	0.00
S5C	0	0	0	0	0	0	0.00	0.00
S5D	0	0	0	0	0	0	0.00	0.00
S6	0	0	0	0	0	0	0.00	0.00
S7	0	0	0	0	0	0	0.00	0.00
S8	0	0	0	0	0	0	0.00	0.00
EMPTYDRM	506	0	0	500	0	6	6.13	76.33
NEW	1002	0	0	988	0	14	13.43	84.42
BOX	0	0	0	0	0	0	0.00	0.00
PALLET	0	0	0	0	0	0	0.00	0.00
DRUM	413	0	0	413	0	0	0.00	0.00
AGROUT	0	0	0	0	0	0	0.00	0.00
POLYMER	938	938	0	0	0	0	0.02	0.12
VGROUT	50	50	0	0	0	0	0.00	0.12
LLWFINAL	0	0	0	0	0	0	0.00	0.00

Maximum output = Total number of drums shipped = 988/15 days

= 11,527/year

Special Waste and Repack Area Maximum Input Report Time: 6300.00

PART STATISTICS REPORTED BY ON-SHIFT TIME

Name	Number Entered	Number Shipped	Number Scrapped	Number Assembled	Number Rejected	W.I.P	Av. W.I.P	Av. Time
S1A	0	0	0	0	0	0	0.00	0.00
S1B	0	0	0	0	0	0	0.00	0.00
S1C	0	0	0	0	0	0	0.00	0.00
S1D	0	0	0	0	0	0	0.00	0.00
S2A	0	0	0	0	0	0	0.00	0.00
S2B	0	0	0	0	0	0	0.00	0.00
S2C	0	0	0	0	0	0	0.00	0.00
S2D	0	0	0	0	0	0	0.00	0.00
S3	0	0	0	0	0	0	0.00	0.00
S4	0	0	0	0	0	0	0.00	0.00
S5A	71	0	0	58	0	13	5.52	489.88
S5B	0	0	0	0	0	0	0.00	0.00
S5C	158	0	0	158	0	0	5.69	226.92
S5D	0	0	0	0	0	0	0.00	0.00
S6	0	0	0	0	0	0	0.00	0.00
S7	0	0	0	0	0	0	0.00	0.00
S8	0	0	0	0	0	0	0.00	0.00
EMPTYDRM	128	0	0	118	0	10	5.72	281.42
NEW	237	0	0	224	0	13	13.08	347.60
BOX	0	0	0	0	0	0	0.00	0.00
PALLET	0	0	0	0	0	0	0.00	0.00
DRUM	133	0	0	133	0	0	0.02	0.92
AGROUT	0	0	0	0	0	0	0.00	0.00
POLYMER	205	0	0	3	0	202	119.16	3662.0
VGROUT	19	0	0	1	0	18	10.70	3546.6
LLWFINAL	0	0	0	0	0	0	0.00	0.00

Maximum output = Total number of drums shipped = 224/15 days

= 2,613/year

NDA Area Maximum Input Report Time: 4200.00

PART STATISTICS REPORTED BY ON-SHIFT TIME

Name	Number Entered	Number Shipped	Number Scrapped	Number Assembled	Number Rejected	W.I.P	Av. W.I.P	Av. Time
S1A	0	0	0	0	0	0	0.00	0.00
S1B	0	0	0	0	0	0	0.00	0.00
S1C	0	0	0	0	0	0	0.00	0.00
S1D	0	0	0	0	0	0	0.00	0.00
S2A	0	0	0	0	0	0	0.00	0.00
S2B	0	0	0	0	0	0	0.00	0.00
S2C	0	0	0	0	0	0	0.00	0.00
S2D	0	0	0	0	0	0	0.00	0.00
S3	0	0	0	0	0	0	0.00	0.00
S4	0	0	0	0	0	0	0.00	0.00
S5A	0	0	0	0	0	0	0.00	0.00
S5B	0	0	0	0	0	0	0.00	0.00
S5C	0	0	0	0	0	0	0.00	0.00
S5D	0	0	0	0	0	0	0.00	0.00
S6	0	0	0	0	0	0	0.00	0.00
S7	0	0	0	0	0	0	0.00	0.00
S8	0	0	0	0	0	0	0.00	0.00
EMPTYDRM	0	0	0	0	0	0	0.00	0.00
NEW	0	0	0	0	0	0	0.00	0.00
BOX	0	0	0	0	0	0	0.00	0.00
PALLET	0	0	0	0	0	0	0.00	0.00
DRUM	0	0	0	0	0	0	0.00	0.00
AGROUT	350	348	0	0	0	2	2.17	26.04
POLYMER	350	348	0	0	0	2	2.15	25.78
VGROUT	0	0	0	0	0	0	0.00	0.00
LLWFINAL	0	0	0	0	0	0	0.00	0.00

Maximum output = Total number of drums shipped = 696/10 days

= 12,180/year

9413227.0092

Polymer Area Maximum Input Report Time: 4200.00

PART STATISTICS REPORTED BY TOTAL SIMULATION TIME

Name	Number Entered	Number Shipped	Number Scrapped	Number Assembled	Number Rejected	W.I.P	Av. W.I.P	Av. Time
S1A	0	0	0	0	0	0	0.00	0.00
S1B	0	0	0	0	0	0	0.00	0.00
S1C	0	0	0	0	0	0	0.00	0.00
S1D	0	0	0	0	0	0	0.00	0.00
S2A	0	0	0	0	0	0	0.00	0.00
S2B	0	0	0	0	0	0	0.00	0.00
S2C	0	0	0	0	0	0	0.00	0.00
S2D	0	0	0	0	0	0	0.00	0.00
S3	0	0	0	0	0	0	0.00	0.00
S4	0	0	0	0	0	0	0.00	0.00
S5A	0	0	0	0	0	0	0.00	0.00
S5B	0	0	0	0	0	0	0.00	0.00
S5C	0	0	0	0	0	0	0.00	0.00
S5D	0	0	0	0	0	0	0.00	0.00
S6	0	0	0	0	0	0	0.00	0.00
S7	0	0	0	0	0	0	0.00	0.00
S8	0	0	0	0	0	0	0.00	0.00
EMPTYDRM	0	0	0	0	0	0	0.00	0.00
NEW	0	0	0	0	0	0	0.00	0.00
BOX	0	0	0	0	0	0	0.00	0.00
PALLET	0	0	0	0	0	0	0.00	0.00
DRUM	356	0	0	352	0	4	3.30	38.98
AGROUT	0	0	0	0	0	0	0.00	0.00
POLYMER	356	0	0	352	0	4	3.85	45.44
VGROUT	0	0	0	0	0	0	0.00	0.00
LLWFINAL	352	352	0	0	0	0	0.24	2.87

Maximum output = Total number of drums shipped = 352/10 days

= 6,160/year

Grout Area Maximum Input Report Time:12600.00

PART STATISTICS REPORTED BY TOTAL SIMULATION TIME

Name	Number Entered	Number Shipped	Number Scrapped	Number Assembled	Number Rejected	W.I.P	Av. W.I.P	Av. Time
S1A	0	0	0	0	0	0	0.00	0.00
S1B	0	0	0	0	0	0	0.00	0.00
S1C	0	0	0	0	0	0	0.00	0.00
S1D	0	0	0	0	0	0	0.00	0.00
S2A	0	0	0	0	0	0	0.00	0.00
S2B	0	0	0	0	0	0	0.00	0.00
S2C	0	0	0	0	0	0	0.00	0.00
S2D	0	0	0	0	0	0	0.00	0.00
S3	0	0	0	0	0	0	0.00	0.00
S4	0	0	0	0	0	0	0.00	0.00
S5A	0	0	0	0	0	0	0.00	0.00
S5B	0	0	0	0	0	0	0.00	0.00
S5C	0	0	0	0	0	0	0.00	0.00
S5D	0	0	0	0	0	0	0.00	0.00
S6	0	0	0	0	0	0	0.00	0.00
S7	0	0	0	0	0	0	0.00	0.00
S8	0	0	0	0	0	0	0.00	0.00
EMPTYDRM	0	0	0	0	0	0	0.00	0.00
NEW	0	0	0	0	0	0	0.00	0.00
BOX	0	0	0	0	0	0	0.00	0.00
PALLET	0	0	0	0	0	0	0.00	0.00
DRUM	0	0	0	0	0	0	0.00	0.00
AGROUT	311	0	0	289	0	22	20.57	833.28
POLYMER	0	0	0	0	0	0	0.00	0.00
VGROUT	312	0	0	291	0	21	18.92	763.91
LLWFINAL	0	0	0	0	0	0	0.00	0.00

Maximum output = Number of AGROUT drums assembled = 289/30 days

= 1,686/year

+ Number of VGROUT drums assembled = 291/30 days

= 1,698/year

Shipping Area Maximum Input Report Time: 4200.00

PART STATISTICS REPORTED BY ON-SHIFT TIME

Name	Number Entered	Number Shipped	Number Scrapped	Number Assembled	Number Rejected	W.I.P	Av. W.I.P	Av. Time
S1A	0	0	0	0	0	0	0.00	0.00
S1B	0	0	0	0	0	0	0.00	0.00
S1C	0	0	0	0	0	0	0.00	0.00
S1D	0	0	0	0	0	0	0.00	0.00
S2A	0	0	0	0	0	0	0.00	0.00
S2B	0	0	0	0	0	0	0.00	0.00
S2C	0	0	0	0	0	0	0.00	0.00
S2D	0	0	0	0	0	0	0.00	0.00
S3	0	0	0	0	0	0	0.00	0.00
S4	0	0	0	0	0	0	0.00	0.00
S5A	0	0	0	0	0	0	0.00	0.00
S5B	0	0	0	0	0	0	0.00	0.00
S5C	0	0	0	0	0	0	0.00	0.00
S5D	0	0	0	0	0	0	0.00	0.00
S6	0	0	0	0	0	0	0.00	0.00
S7	0	0	0	0	0	0	0.00	0.00
S8	0	0	0	0	0	0	0.00	0.00
EMPTYDRM	0	0	0	0	0	0	0.00	0.00
NEW	0	0	0	0	0	0	0.00	0.00
BOX	0	0	0	0	0	0	0.00	0.00
PALLET	0	0	0	0	0	0	0.00	0.00
DRUM	0	0	0	0	0	0	0.00	0.00
AGROUT	0	0	0	0	0	0	0.00	0.00
POLYMER	0	0	0	0	0	0	0.00	0.00
VGROUT	0	0	0	0	0	0	0.00	0.00
LLWFINAL	706	173	0	519	0	14	15.21	90.50

Maximum output = Total number of pallets shipped x 4 = 692/10 days

= 12,110/year

APPENDIX J

PRELIMINARY SAFETY EVALUATION

9413227.0096

(BY WHC)

9413227.0087