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Volume I

Preliminary Design
for the

Waste Receiving And Processing Facility Module 1

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Preliminary Design Report

Prepared for
U.S. DEPARTMENT OF ENERGY
Richland Operations Office
Richland, Washington

Prepared by
UNITED ENGINEERS & CONSTRUCTORS
A Raytheon Company

Western Operations

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WRAP 1 TITLE I DESIGN REPORT

This Preliminary Design (Title I) Report is submitted to the Department of Energy, Richland Operations Office in accordance with the Statement of Work for Off-Site Architect-Engineer Services, dated 11 July 91.

3/19/92

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Project Manager
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Date

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ABBREVIATIONS AND ACRONYMS

ACD	Advanced Conceptual Design
ANSI	American National Standards Institute
C	Amplification Factor
A-E	Architect-Engineer
ARM	Area Radiation Monitoring
AGV	Automated Guided Vehicles
BNFL	British Nuclear Fuels Limited, Inc.
CCTV	Closed Circuit Television
CCTV	Closed Circuit Television System
CDR	Conceptual Design Report
CWBS	Construction Work Breakdown Structure
CH	Contact-Handled
CAM	Continuous Air Monitor
DMS	Data Management System
DOE-RL	Department of Energy Richland Operations Office
DBA	Design Basis Accidents
DCS	Distributed Control System
DOE	U.S. Department of Energy
DWDI	Double Wheel, Double Inlet
ECM	Energy Conservation Measures
EDS	Engineering Design Services
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EBR-II	Experimental Breeder Reactor II
FM	Factory Mutual
FRP	Fiberglass Reinforced Plywood
R_w	Force Reduction Factor
FDC	Functional Design Criteria
GEA	Gamma Energy Assay
GFE	Government Furnished Equipment
GTCC	Greater Than Class C
HDW-EIS	Hanford Defense Waste-Environmental Impact Statement
HSWA	Hazardous Solid Waste Amendments
HLW	High Level Waste
IES	Illuminating Engineering Society
I	Importance Factor
IEEE	Institute of Electrical and Electronic Engineers
IMT	Integrated Management Team
IMC	Intermediate Metal Conduit
KEH	Kaiser Engineers Hanford Company
LLW	Low-Level Waste
LLBG	Low-Level Waste Burial Ground
M&O	Management and Operating
MS	Military Specification
MCC	Motor Control Centers
NACE	National Association of Corrosion Engineers
NEMA	National Electrical Manufacturers Association

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ABBREVIATIONS AND ACRONYMS

NEC	National Electrical Code
NFPA	National Fire Protection Association
NDA	Non-Destructive Assay
NDE	Non-Destructive Examination
OS&Y	Outside Screw and Yoke
PAN	Passive-Active Neutron
PA	Performance Assessment
PCS	Plant Control System
PMS	Plant Management System
PCB	Polychlorinated Biphenyl
PSE	Preliminary Safety Evaluation
PCS	Process Control System
PDC	Project Design Criteria
RMW	Radioactive and Hazardous Mixed Waste
RTR	Real Time Radioscopy
ROD	Record of Decision
RAM	Reliability, Availability, Maintainability
RH	Remote Handled
RCRA	Resource Conservation Recovery Act
RWM	Restricted Waste Management
SC	Smear Counters
SWP	Special Work Permit
SWB	Standard Waste Boxes
SOW	Statement of Work
SDRD	Supplemental Design Requirements Document
TEC	Total Estimated Cost
TRUSAF	Transuranic Storage and Assay Facility
TRU	Transuranic
TRUPACT-2	Transuranic Package Transporter 2
TPA	Tri-Party Agreement
UL	Underwriters Laboratories
UBC	Uniform Building Code
UPS	Uninterruptible Power Supply
UE&C	United Engineers & Constructors
VAV	Variable Air Volume
VCR	Video Cassette Recorders
WDOE	Washington Department of Ecology
WIPP	Waste Isolation Pilot Plant
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing
WHC	Westinghouse Hanford Company

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1.0 INTRODUCTION

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1.0 INTRODUCTION

1.1 General

1. This Preliminary Design Report (Title I) for the Waste Receiving and Processing (WRAP) Module 1 facility is submitted to the Richland Operations office of the U.S. Department of Energy (DOE-RL) in response to contract DOE-AC06-91RL11946 Statement of Work, Revision 3A.

2. This Title I design report culminates the WRAP 1 preliminary design efforts performed by United Engineers & Constructors (UE&C), which encompassed a period of performance from 6 February 91 through 15 December 91. The Title I design was performed at UE&Cs Denver, Colorado offices.

3. The Title I design submitted specifies a WRAP 1 facility as illustrated in **Figure 1-1**, that achieves the stated DOE-RL functional requirements and is summarized by the following parameters:

Building Size	**51,300 square feet**
Building Type	**Pre-engineered Metal Building**
LLW/TRU Drum Throughput	**6,825 Drums per Year**
Facility Safety Classification	**Low Hazard**
Facility Total Estimated Cost Baseline	**$53.6 Million**
Facility Title I Estimated Cost	**$53.6 Million**

4. The Title I design submitted for the WRAP Module 1 Facility consists of the following volumes:

Volume I	**WRAP 1 Title I Design Report**
Volume II	**WRAP 1 Title I Drawings**
Volume III	**WRAP 1 Title I Outline Specifications**
Volume IV	**WRAP 1 Title I Project Cost Estimate**
Volume V	**WRAP 1 Title I Engineering Studies**
Volume VI	**WRAP 1 Title I Engineering Assessments**
Volume VII	**WRAP 1 Project Design Criteria**

5. **Volume I** provides a comprehensive narrative description of the proposed facility and process systems, the basis for each of the systems design, and the engineering assessments that were performed to support the technical basis of the Title I design. The intent of the system description presented is to provide DOE-RL/WHC an understanding of the facilities and equipment provided and the A/E's perspective on how these systems will operate.

6. **Volume II** provides the complete set of the Preliminary Design drawings. Once reviewed and approved these drawings will be baselined for the Title II design effort.

7. **Volume III** is a compilation of the outline specifications that will form the basis for development of the Title II materials and performance specifications. This volume contains abbreviated CSI outline specifications for non-equipment related construction material type items. For facility and process mechanical equipment items, data sheets are provided which specify the equipment overall design parameters.

8. **Volume IV** provides the Preliminary Design project cost estimate for the WRAP 1 facility. Included in this volume is the project construction schedule.

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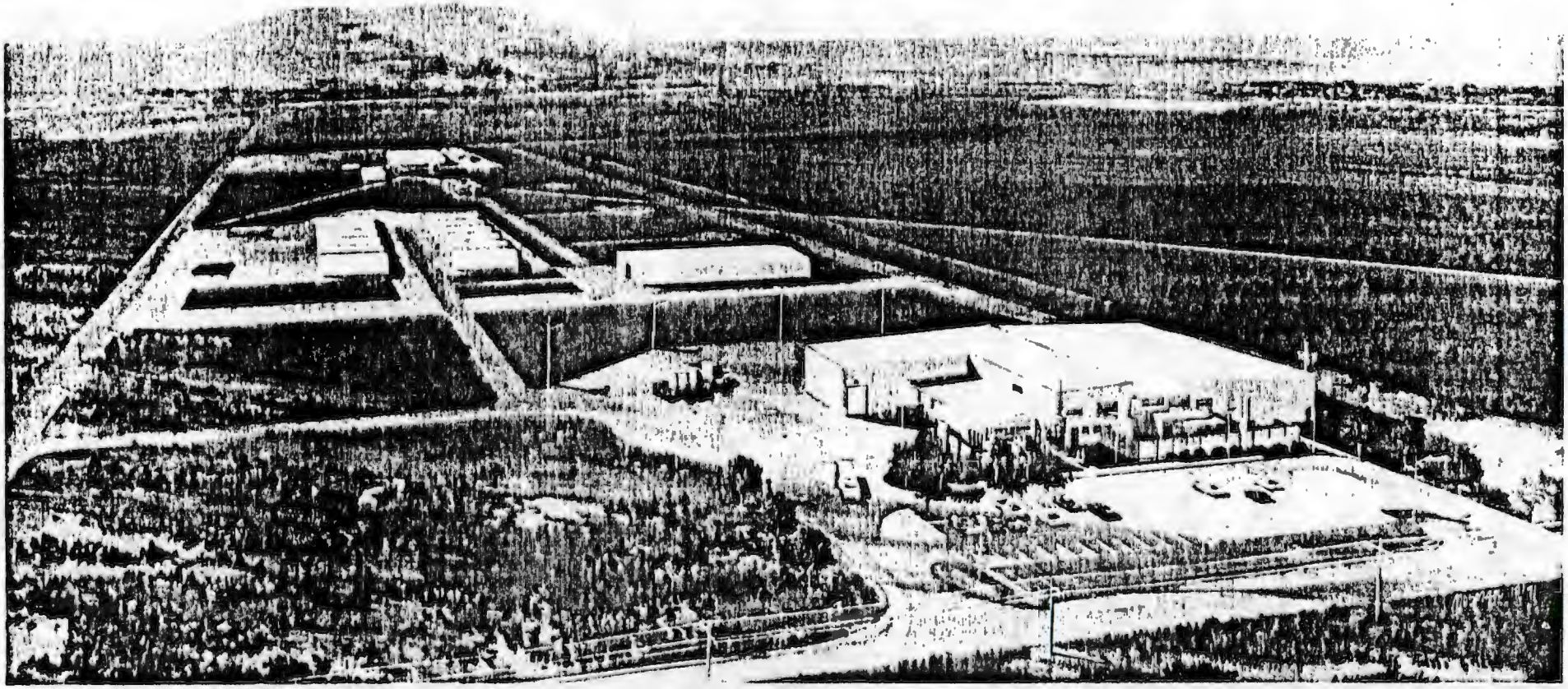

FIGURE 1-1

WRAP Module 1 Facility

9. **Volume V** contains the twenty (20) engineering studies that were performed at the onset of the project to resolve a number of technical issues identified during the WRAP 1 CDR phase.

10. **Volume VI** contains the detail engineering assessments performed on the Title I design. These include:

- Plant Throughput Modeling
- Shielding Assessment
- Criticality Assessment
- Reliability Analysis
- Energy Management Analysis
- Design Basis Fire Analysis
- Architectural Building Code Analysis

11. **Volume VII** is the Project Design Criteria document prepared by UE&C. It sets forth the A/E design basis for each system of the WRAP 1 facility, based upon the DOE-RL Functional Design Criteria, Revision 1 and the Supplemental Design Requirements Document, Revision 1.

1.2 Project Organization

1. The project is being performed by an Integrated Management Team under the direction of the Department of Energy Richland Operations office (DOE-RL). The Integrated Management Team consists of:

DOE-RL	**Project Management**
Westinghouse Hanford Company (WHC)	**Operations Contractor**
UE&C	**Architect-Engineer**
Kaiser Engineers Hanford (KEH)	**Construction Manager**

2. The Integrated Management Team (IMT) is an approach to project management which achieves excellence through coordinated participation of team members in accordance with the following fundamental principles:

- Assembly of a project team reflecting full spectrum of required expertise.
- Assignment of roles and responsibilities based on recognition of expertise.
- Emphasis on individual performance excellence by all team members.
- Elimination of duplication of effort.
- Focused and efficient checks and balances.
- Commitment to cooperative resolution of issues by all team members.
- Acceptance of objective performance measurement including how to show work quality indicators.
- Application of root cause analysis to support true corrective action and recurrence control.

3. The Integrated Management Team organization for WRAP is shown in **Figure 1-2.** The individual organization contractual responsibilities for procurement of goods and services is shown in **Figure 1-3.**

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FIGURE 1-2

WRAP Integrated Management Team Organization

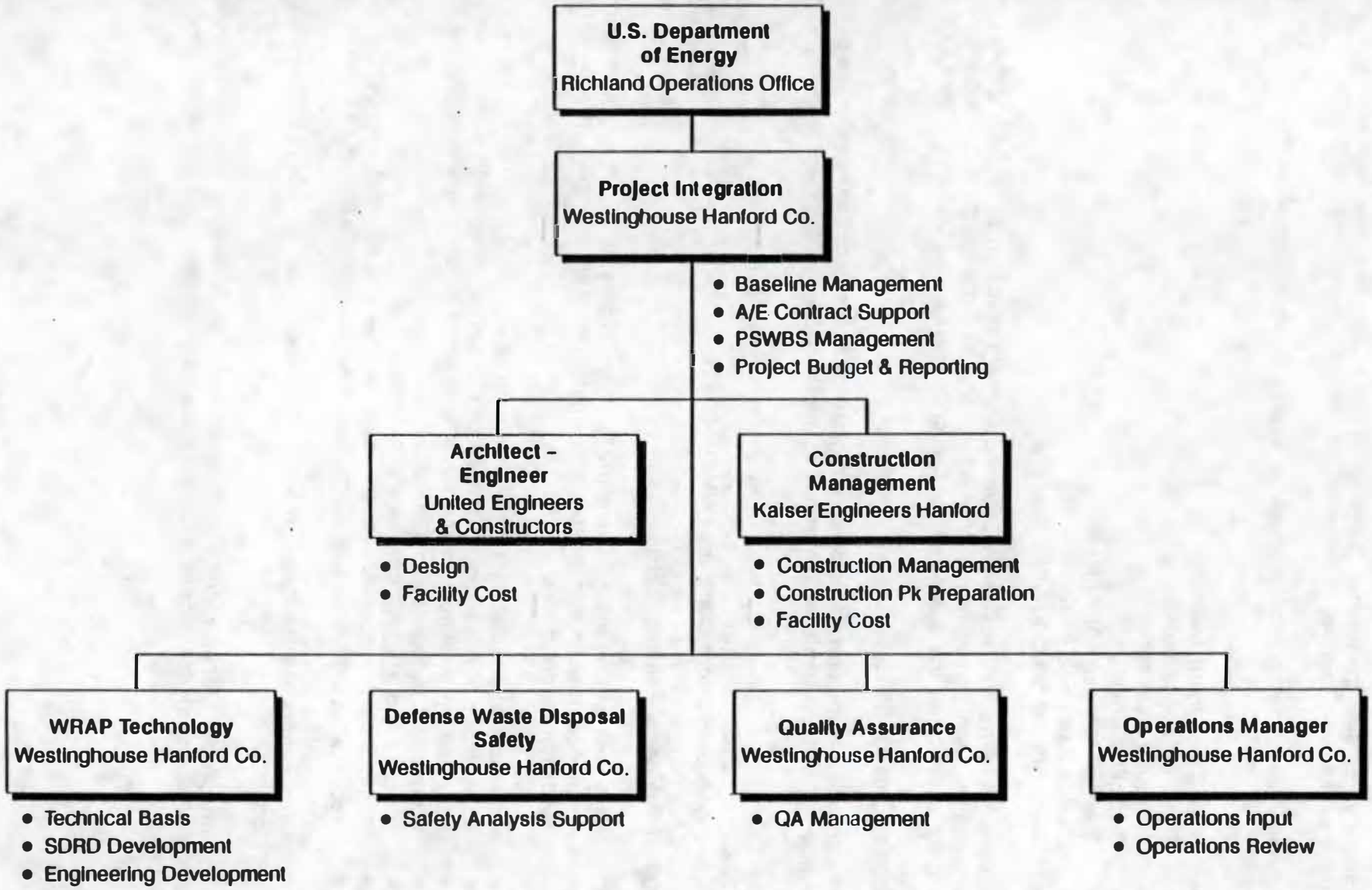
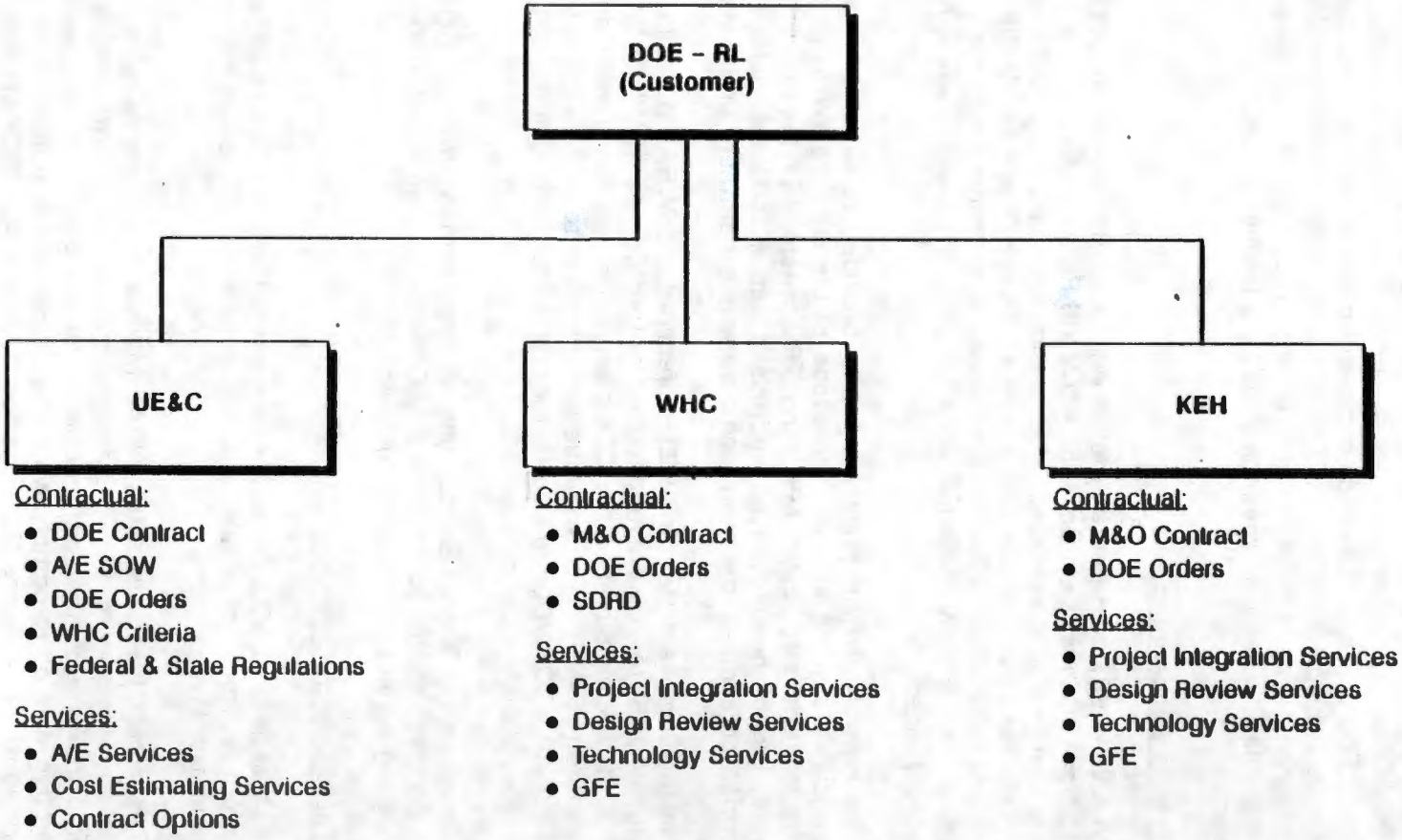


FIGURE 1-3

WRAP Contractual Relationship for Goods & Services Procurement



4. UE&C has executed the WRAP 1 preliminary design using an integrated design team consisting of UE&C, British Nuclear Fuels Limited, Inc. (BNFL) and Engineering Design Services (EDS). UE&C, as prime contractor to DOE-RL, has provided the overall project management and A/E design services for the project. BNFL has provided a cadre of senior solid waste management personnel from their United Kingdom operations, to perform the solid waste process design services. EDS is a small business engineering firm located in the State of Washington. They have provided the specialized TRUPACT solid waste shipping container design expertise to the project. The integrated project team has been located at UE&C's Denver, Colorado offices. A WHC project engineer has also been in residence at UE&C's Denver offices during the entire duration of the Title I design.

1.3 Project Background

1. In April 1988, the Hanford Defense Waste-Environmental Impact Statement (HDW-EIS) Record of Decision (ROD) was issued. The HDW-EIS ROD established the WRAP Facility as the Hanford facility that would treat solid TRU waste retrieved from storage and certify this waste as acceptable for emplacement in the Waste Isolation Pilot Plant (WIPP), located in New Mexico. By issuing the HDW-EIS ROD, DOE established a commitment to the public to construct the WRAP Facility at Hanford. Without the WRAP Facility, TRU waste would have to continue to be stored at Hanford indefinitely.

2. The Hanford WRAP Facility must be provided to satisfy the requirements and correct the deficiencies identified above. The scope of the Hanford WRAP Facility will eventually have to include treatment for LLW, MW, and TRU waste. By pursuing the WRAP facility in modular projects, urgent needs can be addressed earlier, and technology development work can be performed on some of the more complex waste treatment problems.

3. Kaiser Engineers Hanford (KEH) prepared the WRAP 1 facility Conceptual Design Report (Project W-026) for the Westinghouse Hanford Company (WHC). It was approved by DOE-RL in April 1989. Subsequent to the CDR completion, an Advanced Conceptual Design (ACD) effort was initiated by WHC/KEH to evaluate alternatives to resolve the technical uncertainties identified in the WRAP 1 CDR. Due to a curtailment of expense funding for this effort, the ACD activity was terminated shortly after it began.

4. Based upon a Brooks Bill competitive procurement process, DOE-RL selected and awarded a letter contract to United Engineers & Constructors on 6 February 1991, to provide Architect-Engineering services for the WRAP program.

1.4 Title I Design Objectives

1. As stated in UE&C's Project Management Plan, the Title I design development was governed by project technical, schedule, and cost objectives. These objectives were derived from the A/E Statement of Work.

2. **Technical Objectives** of the WRAP Module 1 Architect-Engineer (A-E) services is to provide design and engineering services for the purpose of constructing a WRAP Module 1 facility to provide characterization/certification for newly generated and retrieved solid contact handled radioactive wastes to comply with final disposal waste acceptance criteria as stipulated by the requirements of Resource Conservation Recovery Act (RCRA), Washington Administrative Code 173-303 and DOE Order 5820.2A Radioactive Waste Management. The principal design objectives are:

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a) Achieve technical adequacy.

b) Achieve optimum economy in operation and maintenance.

c) Assure that appropriate consideration is given to the expected period of use, sound construction practices, quality assurance requirements, and energy conservation requirements.

d) Assure compliance with DOE policies regarding nuclear safety, criticality safety, radiation safety, industrial safety, fire protection, and environmental protection.

3. **Schedule Objectives** of the WRAP A-E services are:

a) To achieve project scope within the conceptual schedule and compliance to DOE-RL and TPA milestones.

b) To develop a master milestone schedule which shows the time phasing and relationships of the different jobs to be done, indicating which can be done in parallel and which must be done in series, or where overlaps are possible.

c) To use the master milestone schedule as a basic management tool for monitoring progress.

4. **Cost Objectives** of the WRAP A-E services are:

a) Achieve project scope within conceptual schedule and budget.

b) Achieve minimum construction cost consistent with functional, programmatic, environmental, security, and safety requirements.

c) Implement proactive "Design to Cost" program for the duration of the WRAP facility design to support achievement of the project cost objectives.

1.5 Title I Scope

1. The WRAP 1 Title I design activities performed by UE&C has included performing optimization of the reference conceptual design, preparing the preliminary design media, and providing engineering support to WHC for the PSAR and RCRA Part B Permit Application.

2. The initial phase of the Title I effort consisted of performing a critical assessment of the reference conceptual design. This resulted in the identification of twenty engineering studies that were deemed necessary to be performed in order to advance the reference CDR sufficiently to provide a firm technical basis for the Title I design to proceed on. This optimization effort resolved all of the technical uncertainties that were identified during the CDR and also provided a cost basis for selection of the preferred engineering alternative, to assure the project TEC was not adversely impacted.

3. The production effort of the Title I design consisted of preparing design media (drawings and outline specifications) that would confirm the design concept and configuration of the facility and provide sufficient information to confirm the accuracy of the TEC and a solid basis for the detail engineering and design to proceed on. The intent was to produce drawings that specified the overall facility layout and equipment locations. The Title I drawings will be reviewed and approved as baseline documents to start the Title II phase for the facility. These drawings include only the following generic types:

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- Site Plans
- Process and Mechanical Flow Diagrams (Process, Utility, HVAC, Fire)
- Electrical One-Line Diagrams
- Computer System Block Diagrams
- Equipment Arrangement Drawings
- Equipment Plans & Elevations
- Instrumentation Arrangement Drawings (HP Monitoring, Safety Alarm, Communication)
- Building Interior Cross-Sections & Floor Plans
- Building Exterior Elevations
- Building Fire Zone Drawings
- Building Finish Schedules

4. UE&C's PSAR engineering support consisted of preparing chapters 4, 5, 6, and 7 for the Module 1 PSAR. It also included providing technical support to WHC in the areas of Design/PSAR interface and coordination, design criteria update and reviewing the PSAR draft once it is prepared by WHC.

5. The purpose of the Part B permit application is to obtain approval from the State Regulators for operating a treatment, storage, and disposal unit for dangerous waste. UE&C prepared Chapters 2.0 Facility Description and 4.0 Process Information for the Part B Permit. UE&C will also provide all the engineering reports and supporting documentation necessary to support the Part B Permit application.

1.6 Title I Achievement

1. Illustrated in **Figure 1-1** is a no-frills functional facility that developed upon first establishing the optimum layout of the solid waste process unit operations. Once these requirements were established using a program functional analysis approach to achieve them, the administrative and support areas were integrated into the floor plan layout that provides an optimum functional facility plan, ergonomically designed and material/personnel movement efficient.

2. The numerous technical issues that confronted the Title I design at the onset have been resolved and an overall enhancement of the reference conceptual design has resulted. The WRAP 1 design now reflects an essentially fully automated solid waste characterization plant utilizing the latest generation of computer technology for material movement and data acquisition applications.

3. Functional design typically equates to performance and cost effectiveness. These sought after features have been achieved in the WRAP 1 design. Based upon using a sophisticated manufacturing process simulation model, each step of the WRAP 1 solid waste characterization process was evaluated in terms of operational time and material articulation required to perform the task. This simulation integrated the entire process and evaluated the queuing/lag storage requirements over extended periods of time. This optimization established the equipment configuration and confirmed the plant can achieve the stated throughput of 6,825 drums per year.

4. Achievement of the Title I cost objective is demonstrated by the Title I cost estimate of $53.6 million for the WRAP 1 Facility. This estimate ties directly to the construction schedule prepared to reflect the Title I design.

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5. The $53.6 million cost estimate includes a 16.16 percent bottom line contingency to the estimated cost. This compares to the 20 percent contingency that the TEC carried at the beginning of Title I. This cost objective achievement is the direct result of the "Design-to-Cost" program that was implemented at the beginning of Title I. Adherence to the program during the entire Title I phase provided a basis to evaluate technical alternatives and the associated costs against the cost baseline of $53.6 million. A trend program was implemented to maintain a current status of the project TEC as the design matured.

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2.0 OVERVIEW

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2.0 OVERVIEW

2.1 Project Justification Background

1. Radioactively contaminated solid waste has been generated during routine defense materials production, research, and waste management activities at Hanford since it began operations in the early 1940s, and the regulations for treatment and disposal of these wastes have evolved along with the nuclear industry. Early regulations were concerned primarily with protecting the workers who were handling these wastes from the hazards associated with ionizing radiation emitted by the waste. As waste management knowledge, technology, and awareness evolved, the regulations became increasingly more detailed and began to emphasize protection of the environment, and stability of the waste form.

2. Per DOE Order regulations (DOE 1988b), radioactive solid waste is divided into Transuranic (TRU), which primarily includes low dose rate waste with long lived alpha emitting radioisotopes, High Level Waste (HLW), which primarily includes the high dose rate waste produced directly in fuel reprocessing that contains both transuranic and fission products, and Low Level Waste (LLW), which includes everything that is not TRU, HLW, spent nuclear fuel, or byproduct material.

3. Historically, only HLW was segregated for advanced treatment and disposal. In April 1970, the predecessor to the U.S. Department of Energy (DOE), the Atomic Energy Commission, issued Immediate Action Directive No. 0511-21, which directed Hanford (and other DOE sites) to begin temporarily storing all suspect TRU solid waste "in such a fashion that they can be readily retrievable as contamination-free packages within an interim period of 20 years." Initially, the definition of TRU included any waste with suspect alpha contamination. This definition was later (1972) changed to include only those wastes containing >10 nCi/gram alpha emitting isotopes with half-lives >20 years; and still later (1982) changed again to include only wastes with >100 nCi/gram of TRU radionuclides.

4. Prior to 1970, TRU wastes were not segregated and were buried at Hanford co-mingled with LLW. TRU wastes buried prior to 1970 are considered disposed and are not candidates for retrieval. Since 1970, it has been the policy of DOE that TRU wastes will be retrieved, treated (as required), certified, and transferred to the Waste Isolation Pilot Plant (WIPP) repository in New Mexico for permanent disposal. Because existing technology in the 1970s could not determine the concentration of TRU radionuclides at 10 or even 100 nCi/gram, any solid waste that was suspected to be TRU was placed in retrievable storage. As a result, it is anticipated that a large fraction of the waste placed in storage at Hanford as "suspect TRU" will actually be determined to be LLW after retrieval and assay. The most recent estimate [Anderson 1989] is that approximately 35$\%_{vol}$ of this suspect TRU waste will be determined to be LLW after retrieval. It is also known that some of the waste stored as suspect TRU has radioactive and hazardous mixed waste (RMW) components, in both the TRU and LLW fractions.

5. Prior to acceptance at WIPP, each TRU waste package must be certified by the shipper as being in compliance with the Waste Acceptance Criteria (WIPP-WAC) established for the WIPP. Certification means a signed statement that the waste package complies with all pertinent WIPP-WAC. Certification also includes all necessary elements of an auditable program designed to ensure and prove compliance with the WIPP-WAC. It is assumed that WIPP will accept properly characterized and treated TRU RMW for permanent disposal.

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6. The WIPP-WAC have been evolving since 1970; and even more restrictive requirements will be imposed by the evolving WIPP transportation system, the Transuranic Package Transporter 2 (TRUPACT-2). Still another change that has occurred since suspect CH TRU was placed in storage at Hanford is that the regulation governing the disposal of radioactive components in this waste, DOE Order 5820.2A (DOE 19886), now imposes more restrictive requirements on the disposal of LLW.

7. The impact of all of these changes will be that stored waste that may have complied with the applicable requirements at the time of emplacement may now not comply with (or cannot be proven to comply with) transportation and disposal requirements. Another important result of these changes is that Hanford currently has RMW (both TRU and LLW fractions) in storage configurations that do not meet the Resource Conservation Recovery Act (RCRA) Minimum Technical Requirements for hazardous waste storage.

8. Historically, low level RMW was disposed intermingled with LLW at Hanford using shallow land burial techniques since there was no requirement to characterize or segregate the hazardous components in radioactive waste. In 1979, DOE prohibited the burial disposal of liquid organic materials. Since that time, TRU and low level liquid organic waste have been packaged in drums and stored intermingled with CH TRU waste for later retrieval and treatment. In June 1987, DOE relinquished the byproduct exclusion for regulation of RMW, making the treatment, storage, and disposal of all RMW subject to regulation under the Resource Conservation and Recovery Act (RCRA), and the Hazardous Solid Waste Amendments (HSWA) which established the Land Disposal Restrictions.

9. All low level RMW at Hanford since that decision has been stored for later retrieval and treatment. Initially, low level RMW was stored in trenches similar to CH TRU storage; in 1987, Hanford began constructing a series of buildings for storing these wastes. All RMW stored in trenches and buildings at Hanford will be retrieved when permitted treatment and disposal facilities are available.

10. In 1988, DOE revised Radioactive Waste Management Order 5820.2A (DOE 1988b). This order established new criteria that requires each site to develop a specific Performance Assessment (PA) for LLW, and it is anticipated that the Hanford LLW PA, when completed, will identify specific radionuclides and activity concentrations that require more intensive management techniques (e.g. stabilization and advanced disposal configurations). DOE Order 5820.2A also requires that each LLW package be characterized, to identify treatment and disposal methodologies, and certified as meeting all transportation and disposal requirements.

11. Suspect CH TRU waste is stored at Hanford in the 224-T Building, in Burial Grounds in the 200 West and 200 East Areas; and in the 212-N and 212-P Buildings in the 200 North Area. As of January 1989, approximately 544,500 cubic feet of suspect TRU waste containing over 480,000 grams of transuranic radionuclides had been placed in storage at Hanford 200 Areas in over 38,700 containers (Anderson 1989). Retrieval of the containers in the 618-11 Burial Ground in the 600 Area (the 618-11 burial ground was formerly called the "Wye" burial ground and is located in the vicinity of WNP-2) will result in additional TRU waste from this operation.

12. In addition, to suspect TRU, containers of several other types of radioactive waste have been intermingled in storage with the suspect CH TRU waste. These other types include shielded remote handled (RH) waste, commercially generated Greater Than Class C (GTCC) LLW, classified DOE waste, irradiated fuel and hardware from the Experimental Breeder Reactor II (EBR-II), and LLW RMW such as containerized liquid organic waste.

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13. Suspect TRU and other waste types are stored in a variety of container types including 55-gallon, 30-gallon and 85-gallon steel drums, fiberboard boxes, steel boxes, plywood boxes, fiberglass reinforced plywood (FRP) boxes, concrete boxes, casks and others. Most of the containers in which suspect CH TRU is stored were intended to have a minimum expected life of 20 years, although there is little documentation concerning design life expectations for specific containers. At any rate, the storage of suspect CH TRU waste at Hanford began in May 1970, and it is therefore anticipated that many containers may be extensively deteriorated (it has been estimated that between 8% - 23% of stored waste containers may be breached now (Anderson 1989).

14. During 1986, Hanford began operating the Transuranic Storage and Assay Facility (TRUSAF) in the 224-T building. This facility included a passive-active neutron (PAN) assay system for 55-gallon drums, thereby providing Hanford with the ability to segregate the LLW fraction from suspect TRU drummed waste. Segregation of the LLW fraction from the suspect TRU waste drums has at least partially accounted for a dramatic lowering in the annual TRU waste generation rate.

2.2 Project Mission

1. The primary mission of the WRAP 1 Facility is to characterize and certify contact-handled (CH) waste in 55-gallon drums for disposal. Its secondary function is to certify CH waste in Standard Waste Boxes (SWBs) for disposal.

2. Alternatives for disposal of TRU wastes were considered as part of the final Environmental Impact Statement (EIS) for disposal of Hanford Defense HLW, TRU and Tank Wastes (DOE 1987). In April 1988, the Hanford Defense Waste-Environmental Impact Statement (HDW-EIS) Record of Decision (ROD) was issued (DOE 1988a), which contained the preferred plan for disposal of TRU waste.

3. The preferred plan consist of retrieving the waste and repackaging as necessary in the Waste Receiving and Processing (WRAP) facility to certify TRU waste for shipment to the Waste Isolation Pilot Plant (WIPP) in New Mexico. WIPP is a research and development facility designed to demonstrate the safe and environmentally acceptable disposal of TRU waste from National Defense programs. Retrieved waste found to be Low-Level Waste (LLW) after examination in the WRAP facility will be disposed of on the Hanford site in the low-level waste burial ground. The Hanford site TRU waste will be shipped to the WIPP for disposal between 1999 and 2013. Figure 2-1 shows schematically the Preferred Waste Management Plan for the disposal of TRU, LLW and nonradioactive hazardous waste. **Figures 2-2** and **2-3** show schematically the role of WRAP Facilities Module 1 and Module 2 in the treatment/ disposal of mixed solid waste.

4. In 1989, the Hanford Federal Facility Agreement and Consent Order, or Tri-Party Agreement, (TPA 1989) was signed by the U.S. Environmental Protection Agency (EPA), the State of Washington Department of Ecology (WDOE), and the U.S. DOE. This further reinforced DOE's commitment to build the WRAP facility at Hanford. The Tri-Party Agreement also specified WRAP as the Hanford facility that would provide necessary treatment for low level RMW in addition to TRU waste.

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FIGURE 2-1

Hanford Solid Waste Management 2000

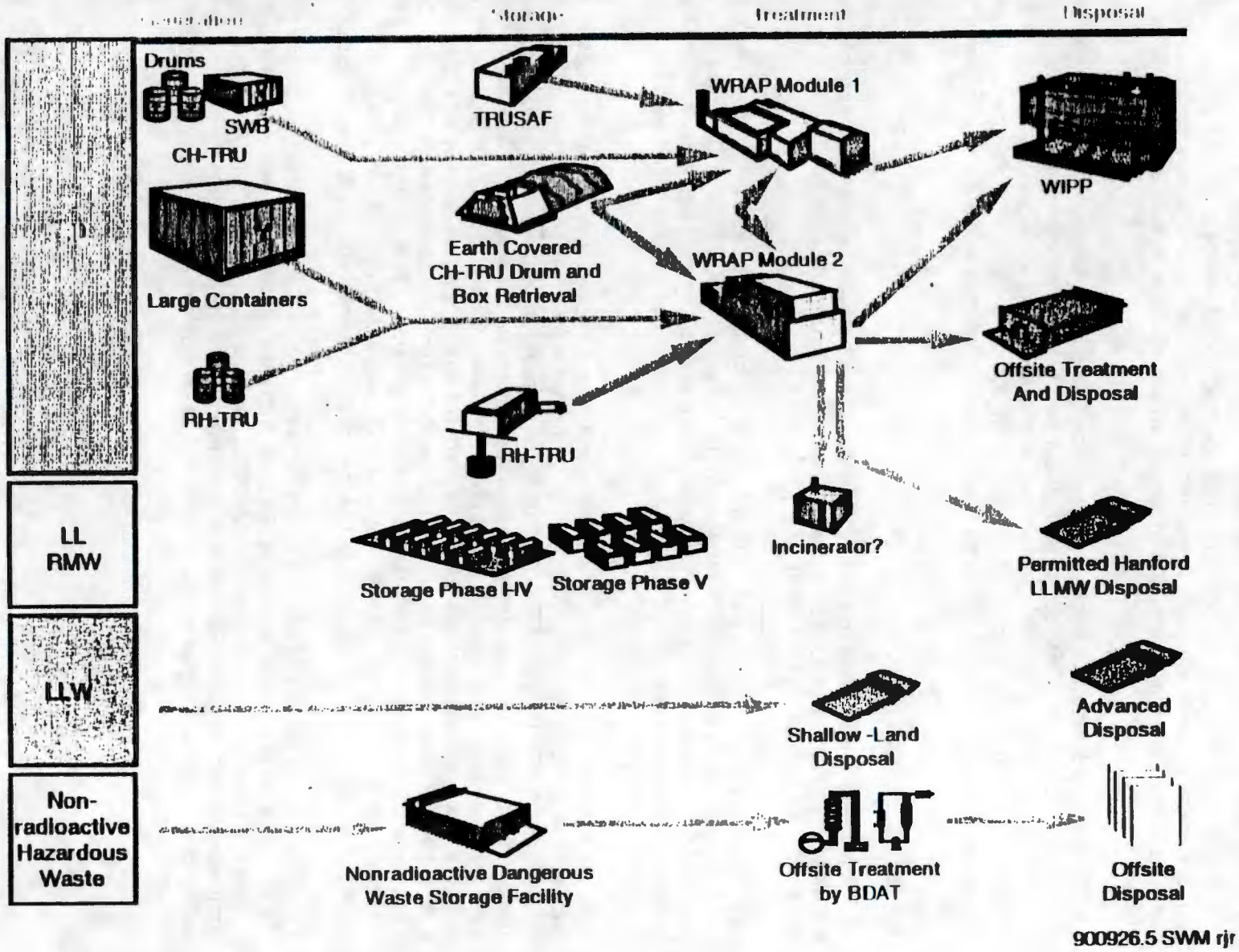

FIGURE 2-2

WRAP Module 1

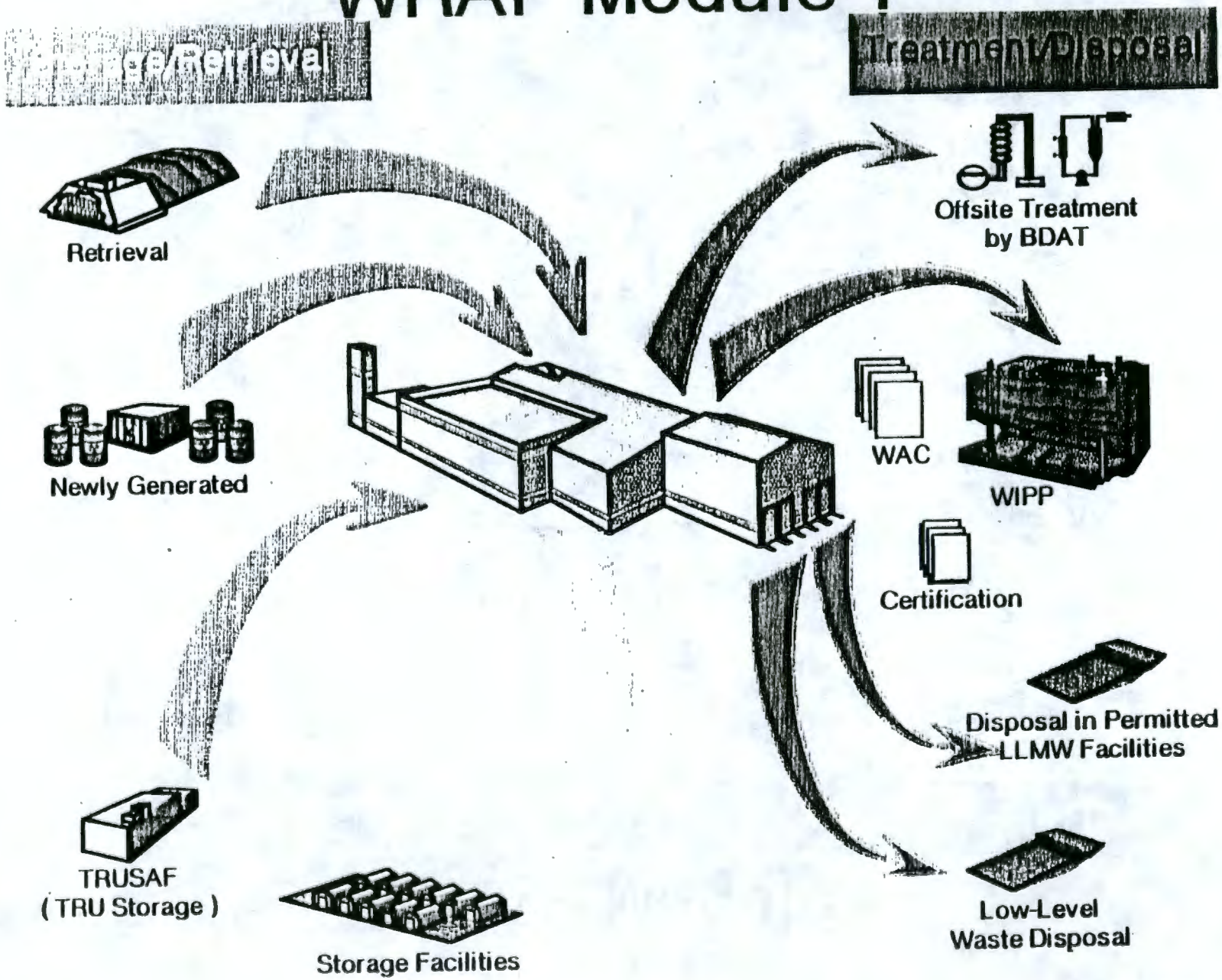

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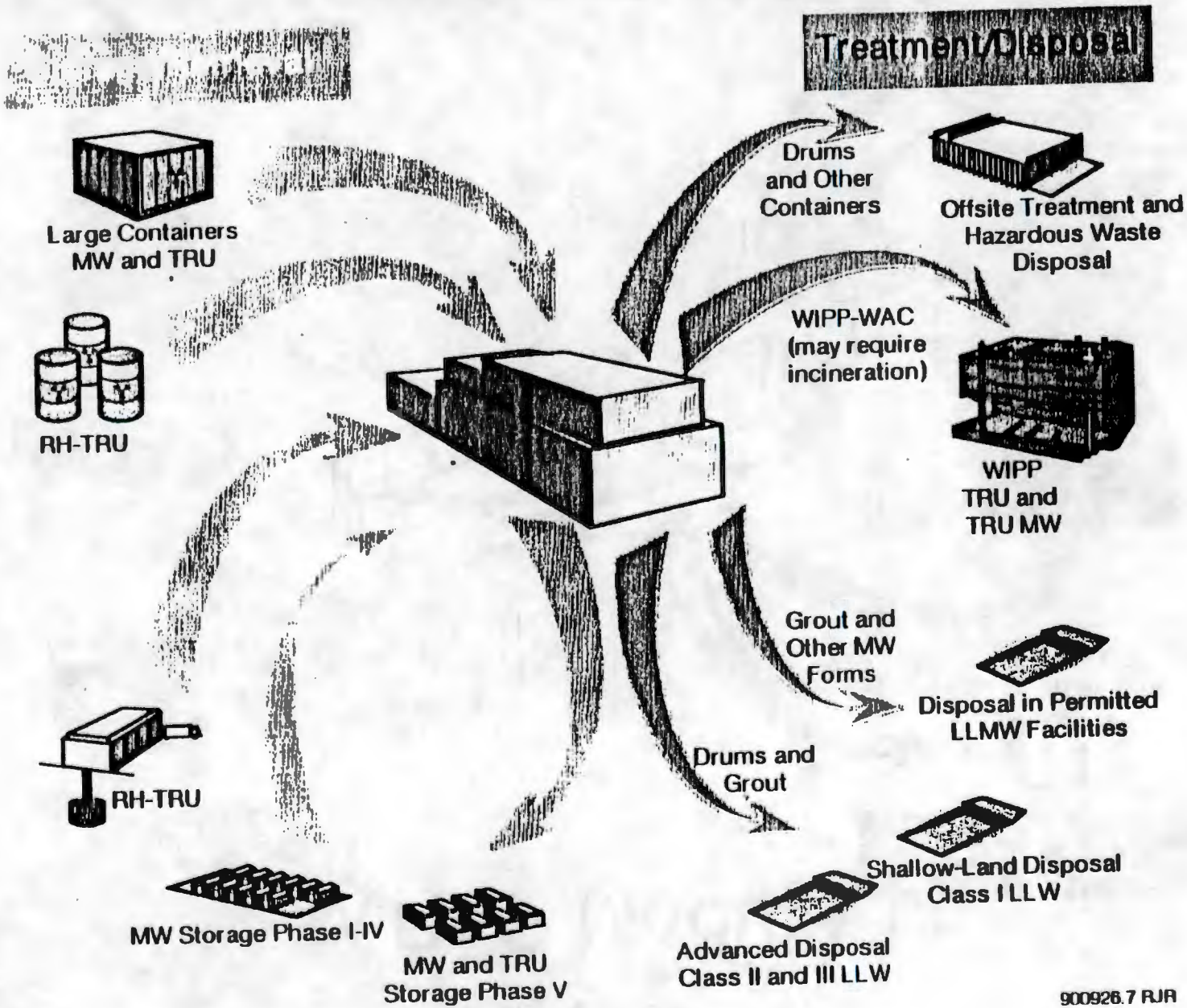
FIGURE 2-3

WRAP Module 2



5. Early in 1988, it became apparent that the WRAP facility would have to be accelerated as much as possible since continued deterioration of containers would unnecessarily increase the costs and personnel exposure required for retrieval, and because the continued storage of RMW in non-compliant configurations was unacceptable. It was also determined that the scope of the WRAP facility should be expanded to include other waste types besides the CH TRU included in the original WRAP scope. Waste identified for consideration for inclusion in the expanded scope of WRAP include:

- CH suspect TRU determined to be TRU (new & retrieved drums, boxes, and other containers), including TRU RMW.
- CH suspect TRU determined to be LLW (new & retrieved drums, boxes, and other containers).
- CH suspect TRU determined to be low level RMW (new & retrieved drums, boxes, and other containers).
- RH suspect TRU determined to be TRU (new & retrieved, in caissons, intermingled with CH containers, and in shielded containers).
- RH suspect TRU determined to be LLW (new & retrieved, in caissons, intermingled with CH containers, and in shielded containers).
- LLW (CH and RH).
- Low level RMW.
- Contaminated equipment.
- Suspect TRU boxes stored at certain other DOE sites.
- Secondary solids from Hanford Liquid Effluent Treatment Facilities.

6. In 1988, however, the expanded WRAP facility was not yet sufficiently defined to support the full scope as a Line Item project. Therefore, to accomplish the objective of accelerating WRAP as much as possible, it was proposed by the operating contractor (and agreed to by DOE-RL) that the WRAP should be split into at least two separate projects, called Module 1 and Module 2. This strategy had several advantages, including the fact that it permitted acceleration of those parts of WRAP that were well understood and used established technology, while allowing more time to better define other technologies and processes considered for inclusion in subsequent WRAP modules.

7. Of the total stored suspect TRU waste at Hanford, 55-gallon drums account for approximately 50% by volume, but 85% of the stored TRU activity. Because most of the TRU activity is in the drums and the vast majority of the stored drums have very low dose rates (almost 90% have surface dose rates less than 5mR/hr), making them comparatively easier to process, it was decided that Module 1 should concentrate primarily on contact handled drummed waste. In addition, Module 1 would provide limited handling and certification of newly generated CH TRU in boxes (because of their size, boxes are not amenable to opening in the same gloveboxes as drums, therefore, boxed TRU that could not be certified without opening will be stored for Module 2).

2.3 WRAP 1 Purpose

1. The WRAP Facility Module 1 will provide the capability for examination (including x-ray, visual, and contents sampling), treatment, repackaging, and certification of contact handled-transuranic waste in 55 gallon drums retrieved from storage as well as newly generated contact handled-low-level waste and contact handled-transuranic waste drums.

2. The WRAP Facility Module 1 will also provide examination (x-ray and visual only) and certification of previously treated contact handled-transuranic and contact handled-low-level waste in small boxes (maximum size is the standard waste box - 8'L x 5'W x 4'H), but the capabilities to open boxed waste will not be provided until a later WRAP module.

3. The WRAP Facility Module 1 will receive 6825 drums of contact-handled waste annually to be processed in 175 operating days/year, operating one (1) eight hour shift/operating day. Contact-handled wastes are comprised of retrieved wastes and newly generated wastes.

4. The WRAP Facility Module 1 throughput will consist of 2625 drums of retrieved wastes and 4200 drums of newly generated wastes. Both retrieved and newly generated wastes will be 50% Transuranic and 50% Low-Level Waste.

5. The WRAP Facility Module 1 will be designed to provide a useful operating life of at least 30 years, with a facility availability of 70% during a 250 work day year. Readily replaceable components will be used when a useful life of 30 years cannot reasonably be expected. The WRAP Facility Module 1 will be designed so that effluents from the process are environmentally acceptable and as low as reasonably achievable (ALARA) in quantity.

2.4 Facility Description

2.4.1 Site

1. The WRAP 1 facility will be located in Benton County, Washington, in the 200 west area of the Hanford site. This area has been designated by the U.S. Department of Energy as the Hanford Central Waste Complex.

2. The general location of waste management facilities at the Hanford site is depicted in **Figure 2-4**. Mixed waste, low-level waste and transuranic waste are received at the Central Waste Complex staging area. From the staging area, the waste packages are distributed either to the low-level waste burial ground (LLBG), to the Central Waste Complex, to the Transuranic Waste Storage and Assay Facility, or to the WRAP Module 1 Facility (when it becomes operational).

3. The WRAP 1 facility site layout is shown in **Figure 2-5**. New access roads from Dayton Avenue will be provided and utilities consisting of potable water and electrical power will be supplied via existing systems located adjacent to the site. A septic tank/leach field is planned for sanitary sewers discharges from the facility.

2.4.2 Facility

1. The WRAP 1 facility is housed in a single story metal building structure of about 51,300 square feet of floor space. **Figure 2-6** depicts the building exterior elevations. **Figure 2-7** is the facility floor plan.

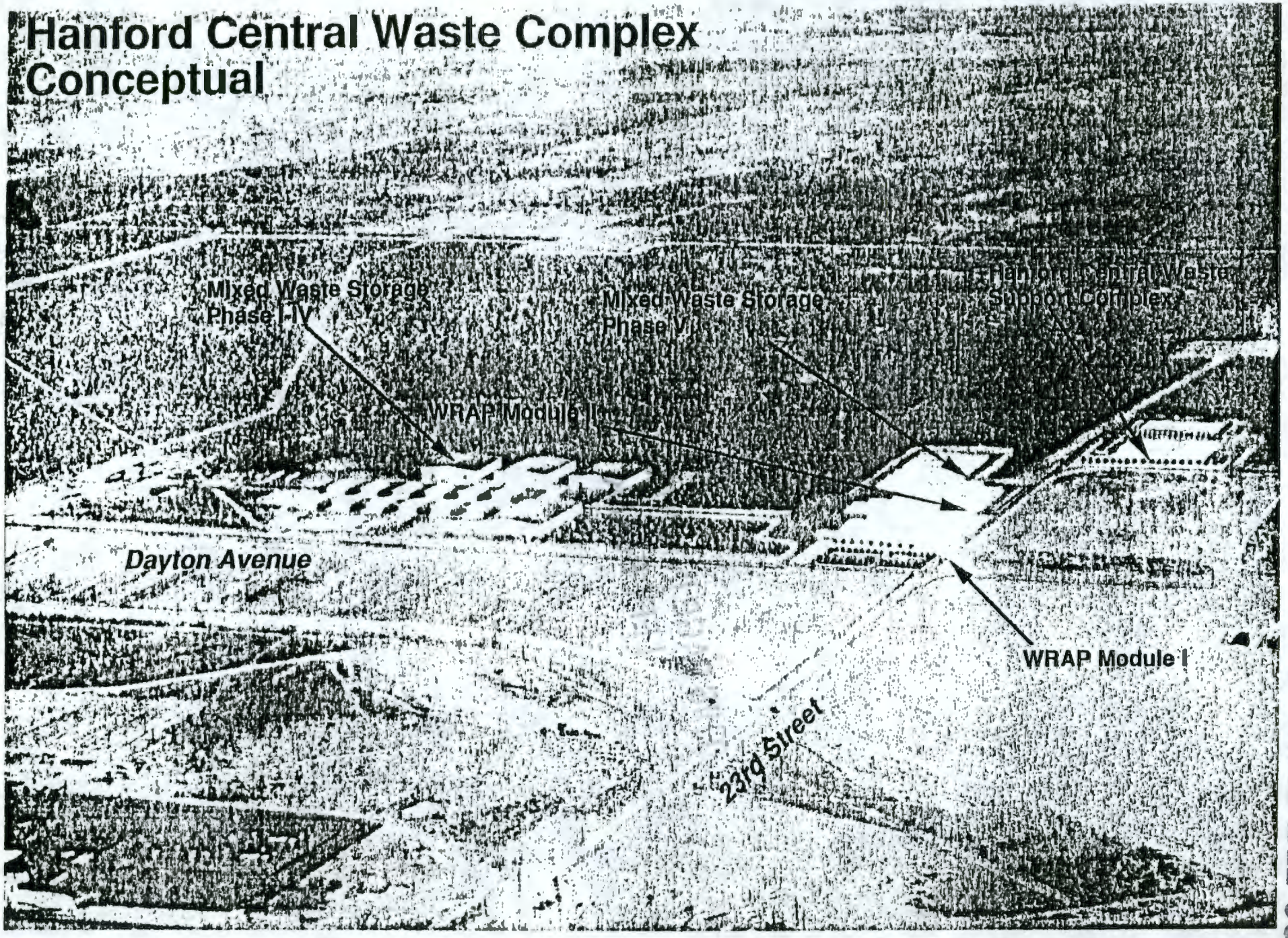


FIGURE 2-4

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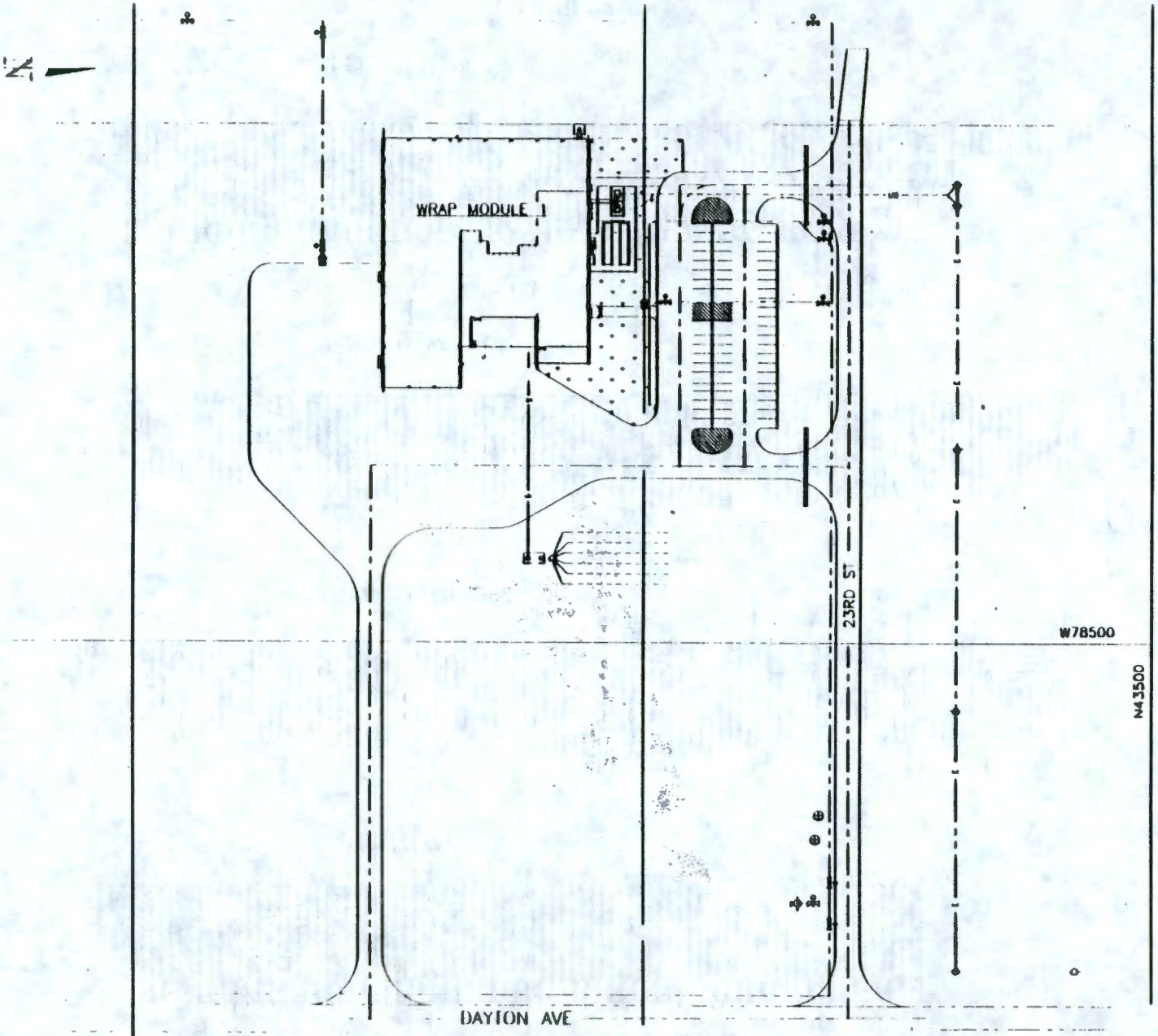


FIGURE 2-5

WRAP MODULE 1 - SITE PLAN

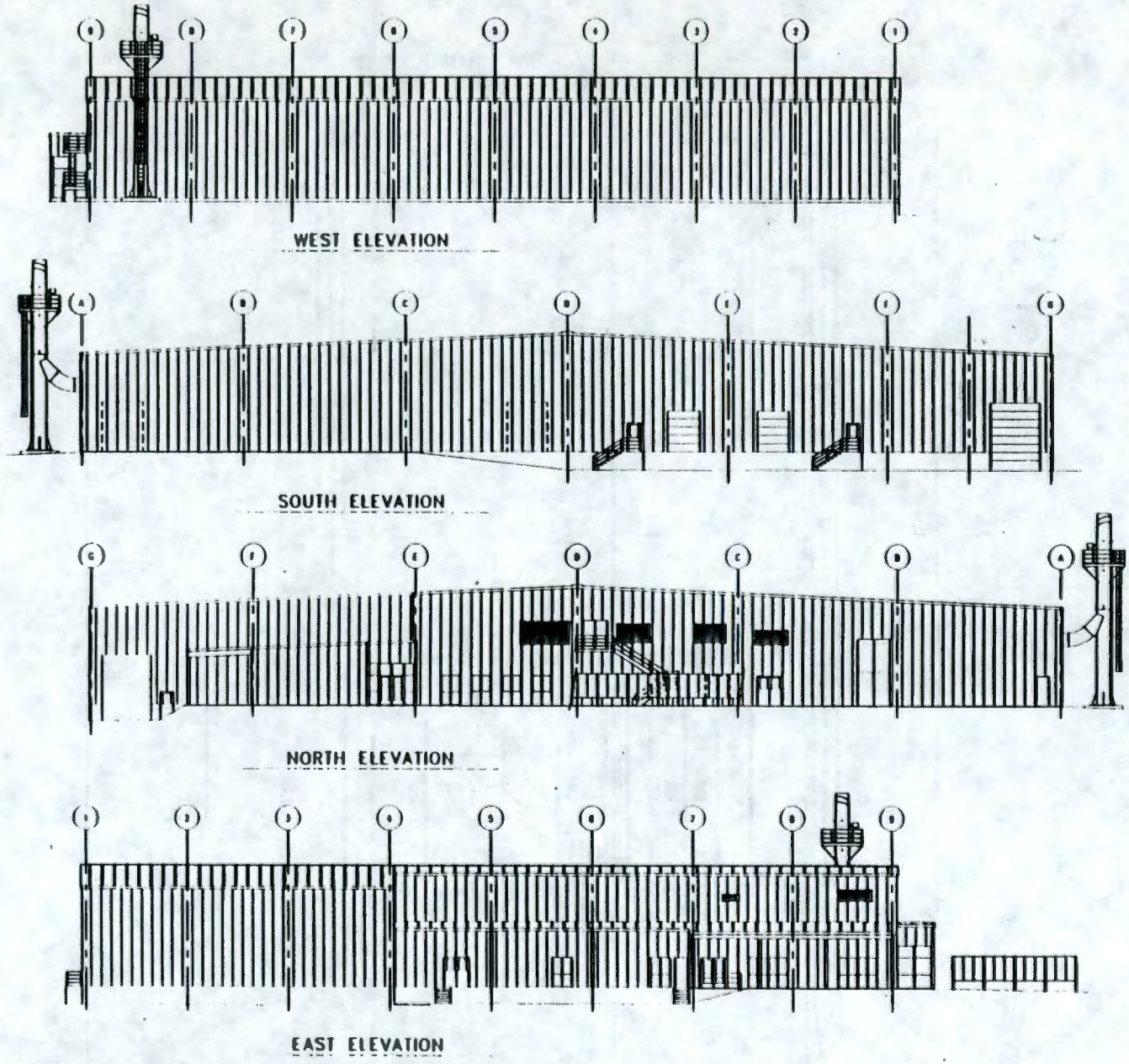
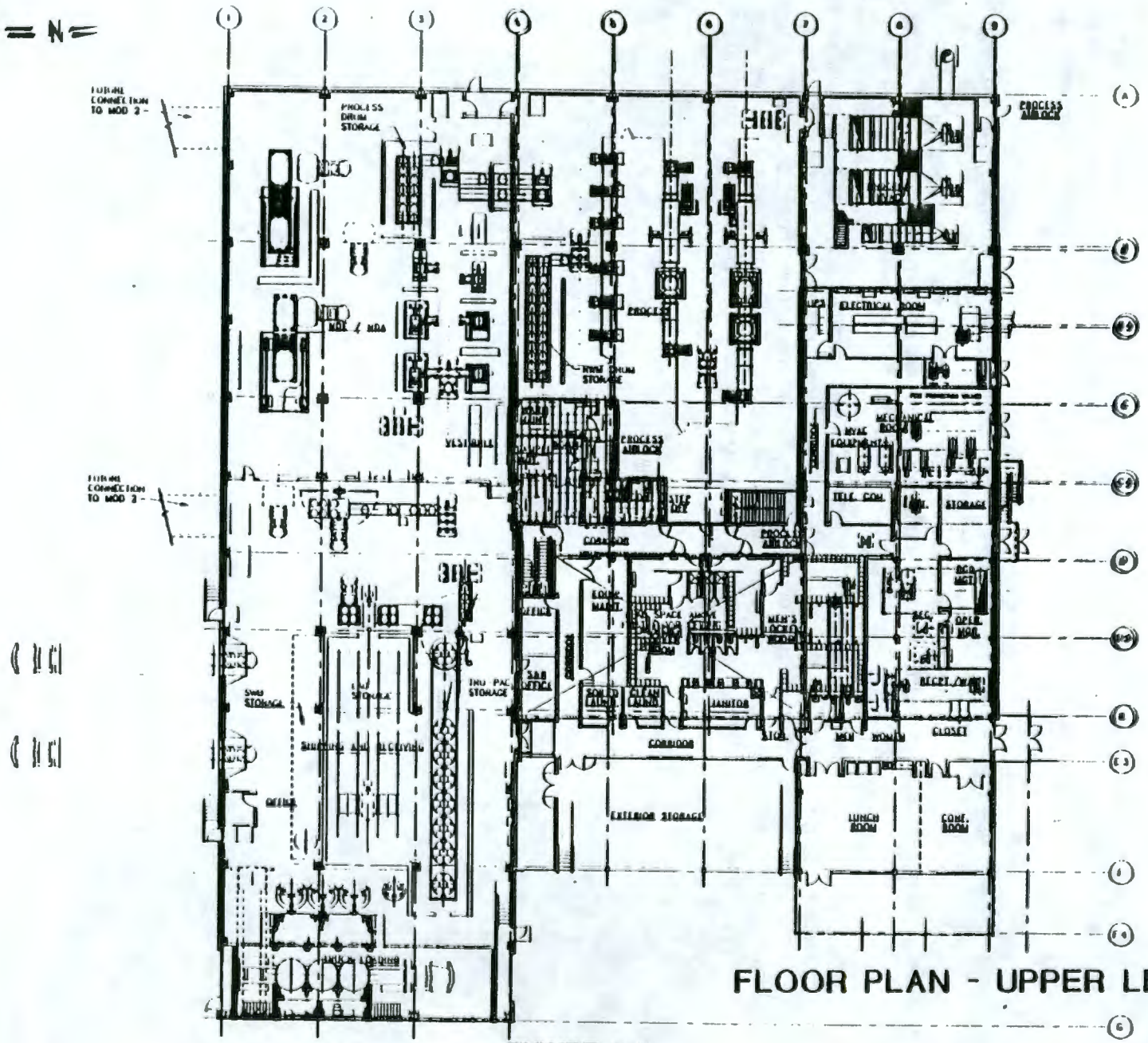


FIGURE 2-6

WRAP MODULE 1 - BUILDING ELEVATIONS



FLOOR PLAN - UPPER LEVEL

FIGURE 2-7

WRAP MODULE 1 - FLOOR PLAN - GROUND LEVEL

2. The WRAP 1 facility will have a reception area, waste receiving and shipping area, weigh station, nondestructive examination and nondestructive assay area, alpha confinement enclosures for opening and sorting drums, a restricted waste management area for waste treatment, and a sample management area.

3. The administrative area, and process/process support areas will be served by a zoned ventilation system. The administrative and reception areas will contain restrooms, change rooms, offices, office equipment and space necessary for administrative work and visitor control.

4. The process area consists of restricted waste management activities, sorting, volume reduction, and waste container load-out equipment. The process support area consists of nondestructive examination/nondestructive assay, shipping and waste receiving, instrumentation and control room, and associated support equipment.

5. Key design features of the facility include an automated drum stacker/retriever system in Shipping and Receiving, state-of-the-art NDE/NDA analytical equipment, alpha confinement glovebox suites that house the LLW, TRU and restricted waste management sorting/certification/volume reduction equipment, supercompaction of the LLW and TRU waste drums, and automated guided vehicles that service the NDE/NDA and waste process areas. Waste management data acquisition and supervisory control of the plant operations is provided by a distributed control computer system.

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3.0 METHOD OF PERFORMANCE

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3.0 METHOD OF PERFORMANCE

3.1 CWBS Organization

1. The WRAP 1 preliminary design is organized on a system basis. **Figure 3-1** identifies the Title I system using a CWBS format. The CWBS elements have formed the basic building block for design area identification and cost account reporting.

2. All CWBS elements represent physical systems or areas of the building, with the exception of Systems Engineering CWBS 1102. This CWBS element contained the engineering efforts associated with the engineering optimization studies, the radiological engineering activities, the reliability assessments, and the plant throughput modeling evaluation.

3. As a result of an engineering study evaluating decontamination requirements/methods for WRAP 1, it was determined that no wet decontamination systems, as proposed in the CDR, is required. Therefore, the Waste Decontamination CWBS 1108 has not been used.

3.2 Design Area Description

1. **CWBS 1105 Shipping & Receiving:** The Title I design scope for this area included the configuration development, equipment selection and area layout for the waste drums and Standard Waste Boxes (SWB) receipt, storage and shipment. The design of all equipment exclusive of building structure, concrete slab/equipment foundation, and utilities, is included in the scope of this area.

2. **CWBS 1106 NDE/NDA:** The Title I design scope for this area included the configuration development, equipment selection and area layout for the NDE/NDA equipment. UE&C scope for equipment specification included the drum NDE/NDA analytical equipment and the SWB box NDE analytical equipment. The Box NDA analytical equipment specification and design is designated as Government Furnished Equipment (GFE) and will be provided by WHC.

3. **CWBS 1107 Waste Process System:** The scope for this system included the configuration development, equipment selection and area layout for the Low Level Waste (LLW), Transuranic Waste (TRU) and Restricted Waste Management (RMW) waste process lines for the facility. The design scope included the process and mechanical flow diagram development, selection and design of alpha confinement enclosures, and the design of the internal process equipment and associated instrumentation.

4. **CWBS 1109 Internal Transportation:** The internal transportation design scope covered the development of the mechanical flow diagram, equipment selection and layout, for the drum/box conveyance system that interfaces with the Shipping & Receiving airlock and services the NDE/NDA and Waste Process areas.

5. **CWBS 1110 Building Systems:** The design scope consists of the site preparation and existing utilities inter-tie, the building foundation design, and the building structure and architectural layout.

6. **CWBS 1111 Ventilation:** Design scope consists of the preparation of the HVAC flow diagrams, equipment selection and layout for a three zone HVAC confinement system. Included in this effort was an optimization evaluation of the energy management features of the proposed ventilation system.

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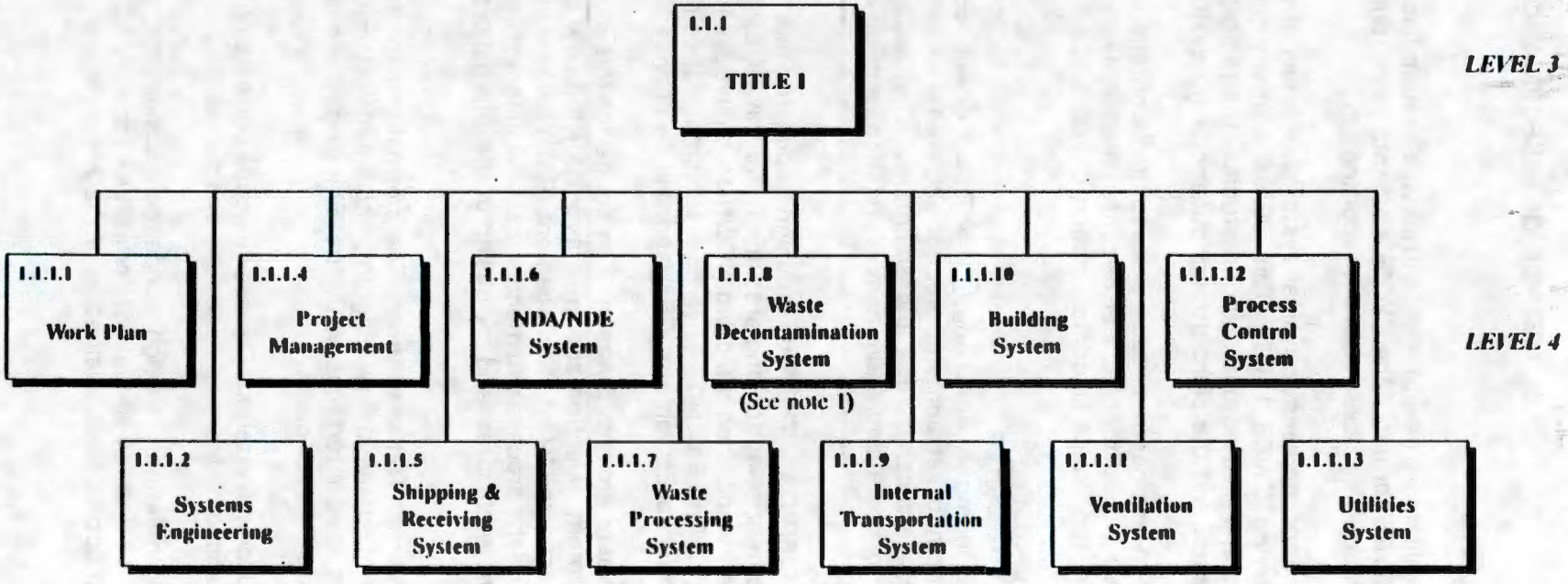
Figure 3-1

WRAP MODULE 1
TITLE I CWBS



Notes:

1 As a result of the engineering trade-off studies performed during Title I, this system was deleted from the project scope.

7. **CWBS 1112 Process Control System:** The scope of this system consists of the facility computer system specification for the data acquisition and process/building systems supervisory control requirements.

8. **CWBS 1113 Utilities System:** The utilities system design for Title I consists of the building water and compressed air systems, the facility fire protection system, and the electrical supply and distribution system for the facility.

3.3 Design Approach

3.3.1 General

1. The overall approach to the definitive design execution was to manage the technical and engineering effort required to transform the project objectives into drawings and specifications required to procure and construct an operational facility. This approach includes the planning and execution of technical tasks, the integration of engineering specialties, and the management of a totally integrated design effort to meet the cost, schedule, and technical objectives of the WRAP facility.

2. To accomplish this process, the work elements were divided into discrete tasks, by system in Title I. Each task has an identified Contract Work Breakdown Structure (CWBS) element, and an identified task manager, who is both a technical and a cost control manager for that task. Each task was further broken down by discrete elements, with identified deliverables for each element in each task, so that earned value for each task could be assessed on an objective basis. These elements were then scheduled, with start and completion dates, which were combined and logically integrated into an overall Critical Path Method (CPM) schedule (see **Figure 3-2**).

3. The design approach was driven by the systems engineering process, which analyzes mission needs and allocates these requirements to each system in WRAP in the form of system objectives and requirements, in sufficient detail for direct use as design criteria. Utilizing these requirements as a basis, the conceptual design was analyzed and optimized by the use of systems engineering tools including engineering (trade-off) studies, cost effectiveness analysis, and design to cost programs. The synthesized optimum design concept was developed into a Preliminary Design (Title I) baseline which was then reviewed to assure that the design criteria were met.

3.3.2 Project Design Criteria

1. Per DOE 4700.1, it is most important that the project design criteria provide a clean, concise, and accurate description of the design requirements without the need to provide an extensive list of other documents as part of the criteria or numerous cross-references to other documents. UE&C prepared a design oriented Project Design Criteria document based upon the FDC and SDRD criteria specified for the facility.

2. **Volume VII** is the WRAP 1 Project Design Criteria. The Project Design Criteria (PDC) is a comprehensive design document which defines the principal design requirements for the WRAP facility consistent with the design approach that has been adopted and in sufficient detail as to permit definition of, and allocation of requirements to systems which comprise the plant. These design requirements are presented for each major system of the WRAP as individual chapters of the PDC.

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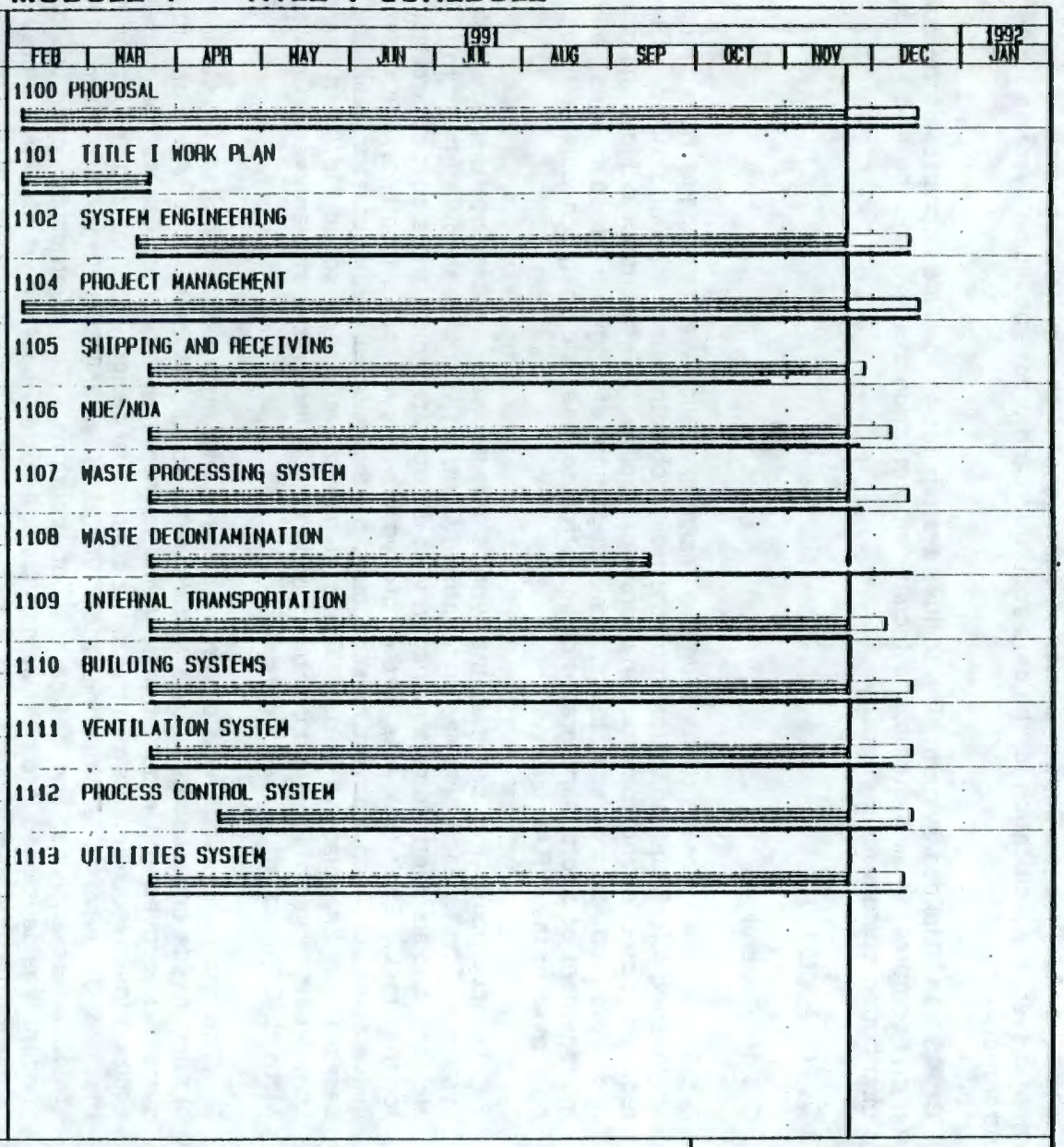
FIGURE 3-2

WRAP MODULE I - TITLE I SCHEDULE

TASK/AREA	EARLY START	EARLY FINISH
1100 PROPOSAL	6FEB91A	16DEC91
1101 TITLE I WORK PLAN	6FEB91A	22MAR91A
1102 SYSTEM ENGINEERING	18MAR91A	13DEC91
1104 PROJECT MANAGEMENT	6FEB91A	16DEC91
1105 SHIPPING AND RECEIVING	22MAR91A	27NOV91
1106 NDE/NDA	22MAR91A	6DEC91
1107 WASTE PROCESSING SYSTEM	22MAR91A	12DEC91
1108 WASTE DECONTAMINATION	22MAR91A	21NOV91
1109 INTERNAL TRANSPORTATION	22MAR91A	4DEC91
1110 BUILDING SYSTEMS	22MAR91A	13DEC91
1111 VENTILATION SYSTEM	22MAR91A	13DEC91
1112 PROCESS CONTROL SYSTEM	15APR91A	13DEC91
1113 UTILITIES SYSTEM	22MAR91A	10DEC91



[ ] Summary Bar/ Early Dates
[ ] Critical Designator
[ ] Progress Bar
Target Dates as of 28JUN91

Primavera Systems, Inc. 1984-1991

DEPARTMENT OF ENERGY
WASTE RECEIVING & PROCESSING
MASTER SUMMARY SCHEDULE

Sheet 1 of 1

Project Start : 6FEB91
Project Finish: 16DEC91

Data Date: 22NOV91
Plot Date: 30EC91

UNITED ENGINEERS & CONSTRUCTORS

Date	Revision	Checked	Approved

3. The design criteria defined in the PDC for each WRAP system is devised from the Functional (operational, maintenance, safety) requirements established for the facility as presented in the FDC and SDRD. The purpose of the PDC is to translate the project requirements to a consistent set of design criteria for each system which then provides the basis for the A/E to design the facility. Examples of which criteria is defined in this document includes applicable DOE orders, codes and standards; meteorological design criteria to base the site drawings analysis and design upon; gloveport configurations and standards to be used; and so on.

3.3.3 Design to Cost Program

1. A "Design to Cost" program was implemented on the Title I effort as illustrated in **Figure 3-3.** The program was comprised of the following elements:

- CDR estimate validation and baselining.
- CDR design assessment against FDC, SDRD, and PSE
- Performance of tradeoff studies and cost/benefit evaluations
- Implementation of cost reductions to meet TEC limitations
- Continuous cost baseline control.

2. Cost baseline control was maintained by the following steps and processes which were performed throughout the Title I design process:

a) Following CDR estimate validation and baselining, the cost estimate was issued to the task manager for each of the WRAP facility systems, for his control as the cost manager for that system.

b) Throughout the design evaluation, tradeoff studies and cost/benefit assessment, and cost reduction activities, each technical change proposed to the WRAP facility design was accompanied by a TEC impact assessment, which was documented in the form of a Trend if the cost impact is greater than established thresholds.

c) During the production phase of Preliminary Design, and during Detailed Design, as any change to the design baseline is identified, an assessment of the TEC impact is made before design change implementation, and these impacts are documented as part of the Change Request preparation, review, and approval process.

3.3.4 Systems Engineering & Design Integration

1. The systems engineering process utilized on the Title I effort was designed to develop the technical, cost, and schedule baseline during Preliminary Design, and to manage changes to each of the three elements of this baseline, once established, during preliminary and detailed design.

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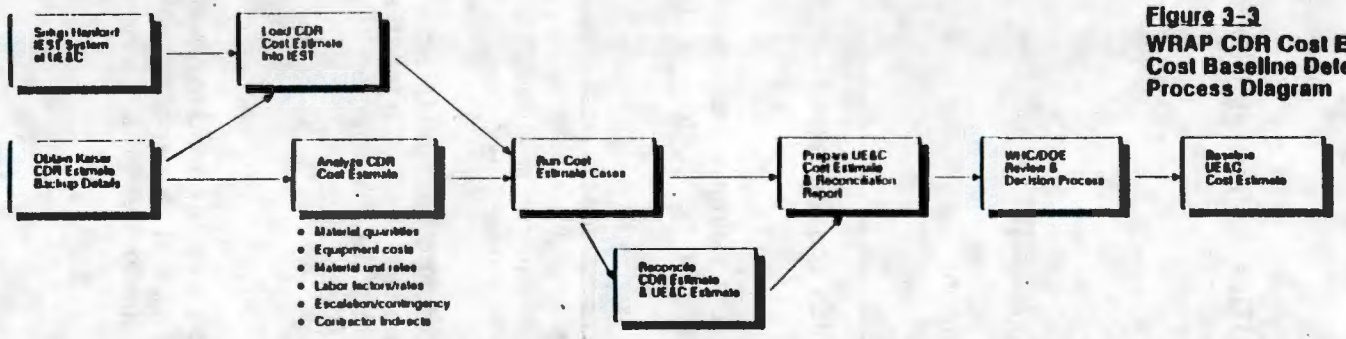
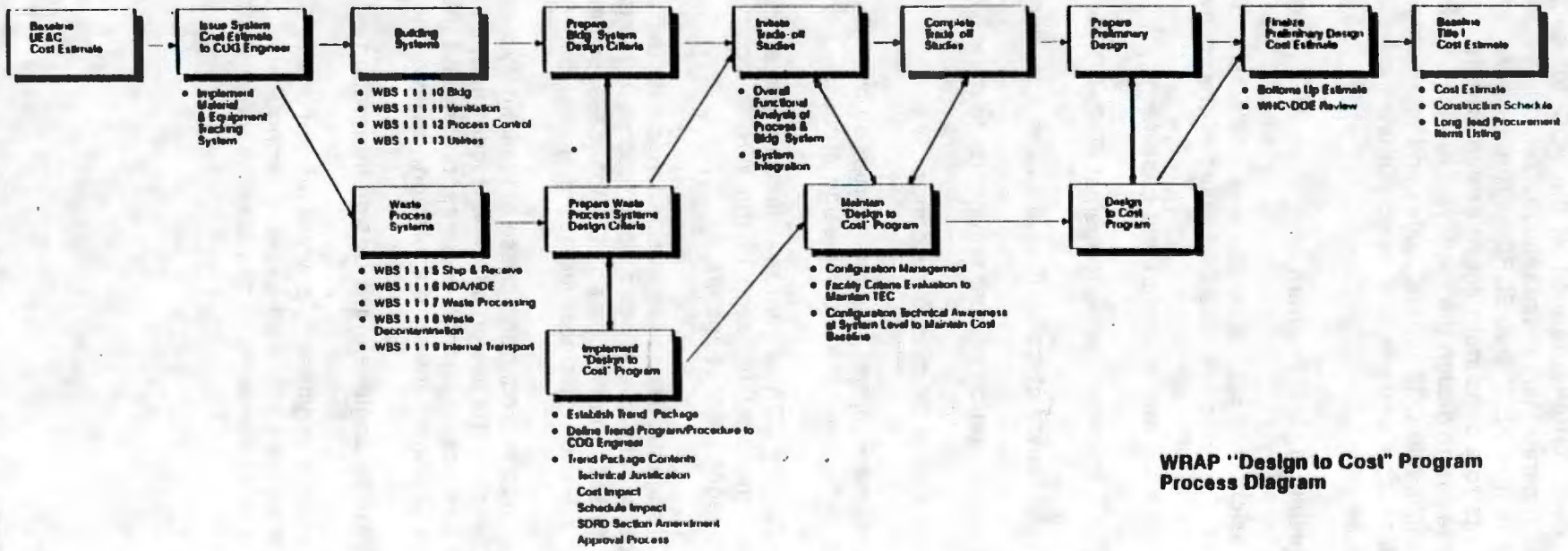


Figure 3-3
WRAP CDR Cost Estimate Evaluation & Cost Baseline Determination Process Diagram



WRAP "Design to Cost" Program Process Diagram

2. The Systems Engineering function for the WRAP definitive design is to provide integration of the technical, cost, schedule and performance requirements to ensure uniform development of design criteria and implementation of these criteria into appropriate design media. Systems Engineering assures that design interfaces between systems and interfaces between the WRAP facility design and the Hanford Site requirements are identified and controlled.

3. Systems Engineering was the lead group for project systems and functional requirements. This discipline provided the overall project control that assures the designs produced by the process and facilities group meet the defined goal of the WRAP mission.

4. Early Preliminary Design activities focused heavily on establishing the system and design interface documents scope and format that define the functional system requirements and interfaces for each appropriate engineering discipline. The system definition documents that define the interfaces consist primarily of mechanical flow diagrams, control system logic diagrams, and building background drawings, that define equipment location and operating envelope interfaces.

5. The primary mission of systems engineering during the Preliminary Design was:

- Integrate/coordinate the Project Design Criteria Development
- Establish the overall waste material flow configuration for the facility
- Confirm the overall Waste Process System performance compliance to project design criteria, with time and motion analysis and technology evaluation of the waste handling and certification process unit operations
- Define the boundaries and interfaces of the various systems required for the building and waste process systems.
- Perform Feasibility Evaluation and Cost Trade-off studies for system optimization.
- Function as the design integrator to ensure project design requirements are properly incorporated from a discipline level to a system level, and finally to the construction/procurement package level.

6. Systems Engineering considered the movement of the waste from the time it enters the site boundary until it leaves, assuring that all of the systems required to operate on the waste are evaluated and optimized. It also evaluated the entire plant configuration to ensure the systems were available and integrated to support and perform the required functions.

3.3.5 Engineering Studies

1. Engineering studies were performed to evaluate design alternatives to satisfy functional performance requirements contained in the Project Design Criteria, and to ensure that engineering decisions resulting from the review of alternatives were made only after considering their impact on system effectiveness and cost of acquisition and ownership.

2. Early in the Preliminary Design phase, a critical assessment was be made of the reference conceptual design to satisfy the functional and regulatory requirements for the facility, in a cost effective and constructable manner. Technical feasibility and cost trade-off evaluations were made beginning with the waste process systems and proceeding to the building systems (refer to **Section 6.0** for further details).

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3. During the work plan preparation phase technical interchange meetings were held with DOE-RL and WHC personnel. The focus of the meetings was to identify those areas of the Reference Conceptual Design that warrant further investigation/evaluation in order to advance the Reference Conceptual Design sufficiently to provide a firm technical basis for the WRAP Preliminary Design to proceed on. The technical issues/uncertainties that were addressed during Preliminary Design in the form of an engineering study, are identified in **Section 6.0**.

3.3.6 Performance & Procurement Design Packages

1. Performance outline specifications were prepared for the purchase of manufactured items such as equipment and electronic hardware, where the scope of work of the supplier includes the design, fabrication and assembly (or installation) of specialty items that are governed by national codes and standards. For such items, the performance specification will include a detailed narrative specifying the design criteria, materials of construction, codes and standards, scope of work, and quantitative performance requirements. It will also include the requirement that engineering calculations be submitted to the A/E for review and approval along with the detail fabrication drawings and other appropriate submittals. The key consideration in a performance specification is that the design is based upon recognized national engineering codes and standards, such as the NFPA for design and installation of fire sprinkler systems.

2. Procurement specifications were prepared for the purchase of manufactured items where the A/E, rather than the supplier, specifies the critical requirements for the design and manufacture of the item to be provided. For such items, the procurement specification will include a narrative specification that specifies the performance requirements, materials of construction, unique manufacturing requirements, design codes and industry standards to be applied, QA/QC requirements, preparation for shipment and warranty/guarantee. Specific data sheets may be included which specify the operating/design requirements for individual equipment items covered by the narrative specification (e.g. centrifugal pump data sheets). In addition to the narrative specification and data sheets, outline drawings may be included to define the space envelope for the item to be procured, as well as definition as to how the item is to be installed in the facility. Special considerations, such as operating panel location, utility tie-in locations, and foundation configuration may be specified on the drawings.

3. For special purpose equipment such as gloveboxes, a build-to-print approach is used. Beginning with general arrangement drawings, detail fabrication drawings will be developed. These include the assembly, subassembly and parts details. A procurement specification will be included that specifies the materials, codes, fabrication methods, and Quality Assurance requirements in accordance to NQA-1 criteria.

9 3 1 2 7 6 1 1 2 3 9

4.0 REFERENCES

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4.0 REFERENCES

The primary design reference for the WRAP 1 Title I design has been DOE Order6430.1A, General Design Criteria. In addition, the individual disciplines have used other reference material in the form of other primary DOE Orders, National Codes, and Hanford Standard Design Criteria as shown in the following table.

PRIMARY REFERENCE DOCUMENTS

	DOE	NATIONAL CODES	HANFORD
Architectural		UBC NFPA 101	
Electrical		NEC	SDC 7.2 SDC 7.4 SDC 7.5 SDC 7.7
Mechanical			
Process Control		ISA	
Civil			WSDOT
Structural		UBC AWS	SDC 4.1
HVAC		ASHRAE	SDC 5.1 WHC-CM-4-9, SEC. 4* WHC-CM-4-9
Process	5820.2A		
Piping			
Plumbing		UPC	
Fire Protection		NFPA	WHC-CM-4-3
ES&H	5820.2A 5480.11 WIPP-DOE-069 5400.1		WHC-CM-4-9 WHC-CM-7-5 WAC-173-303 WHC-CM-4-10 WHC-CM-4-11 WHC-EP-0063-2

*Not approved as yet, used for guidance only.

5.0 BASIS FOR DESIGN

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5.0 BASIS FOR DESIGN

5.1 Baseline Documents

1. WRAP 1 baseline documents which guided the technical development of the Title I design included:

a) **A/E Statement of Work (SOW) Revision 3A:** this DOE-RL contractual document specified the workscope, deliverables, schedule, method of performance and reference criteria for the Title I design preparation.

b) **Functional Design Criteria (FDC) Revision 1:** This DOE-RL technical criteria document specified the overall operational criteria for the facility. The document was a Revision 0 at the beginning of the design and advanced to Revision 1 as a result of preliminary design developments.

c) **Supplemental Design Requirements Document (SDRD) Revision 1:** This baseline criteria document prepared by WHC for DOE-RL augments the FDC by providing further definition of the process, operational safety, and facility requirements to the A/E for guidance in preparing the design. The document was at a very preliminary stage at the onset of Title I and was revised in concert with the results of the engineering studies that were performed to resolve the numerous technical issues that the project faced when Title I was initiated.

2. In addition to the A/E SOW and the FDC and SDRD technical baseline criteria, the Title I design was developed in compliance to the cost schedule baselines established during the project conceptual design phase. These included:

a) Cost Baseline; Total Estimated Cost (TEC) . . . . . $53.6 million

b) Schedule Baseline; Tri-Party Agreement (TPA)
Milestone for WRAP 1 Construction . . . . . March 1996

3. The tri-party agreement date specified for completion of the WRAP 1 construction is based upon the six (6) month schedule extension as requested by Change Request W026-005.

4. The Title I design submitted is based upon the technical, cost and schedule baselines specified above and changes contained in these latest revisions of the SOW, FDC and SDRD cited above have been incorporated into the Title I design as it progressed.

5. An additional document that has provided guidance to the facility design is the Preliminary Safety Evaluation Report Revision 0 for WRAP 1. The results of this DOE-RL approved evaluation established the facility as a radioactive solid waste "low hazard" classification. This determination resulted in significant modification to the WRAP 1 conceptual design which was based upon a moderate hazard facility.

5.2 A/E Design Basis

1. The technical baseline criteria noted above was reviewed in detail and the criteria was translated into engineering and design criteria by UE&C. The design criteria was compiled into a Project Design Criteria (PDC) document which was issued as Revision A at the commencement of Title I work. This document was then used by the A/E project team to prepare the engineering optimization studies required to resolve the numerous technical issues that existed at the inception of Title I.

2. This document was revised on completion of the Engineering Studies phase of the project and reissued as Revision B. Revision B reflected the current status of the facility during Preliminary Design and is contained in six sections. The main part of the document contains the major design criteria for each of the project systems (e.g. Shipping and Receiving, Process, HVAC, etc.). There then follow five discipline appendices which contain the more general engineering and design requirements pertaining to these disciplines.

3. This PDC document is **Volume VII** of the Title I submittal. On completion of the Title I review comment resolution process, the document will be updated as required and issued as Revision 0 for the Title II design.

5.3 Reference Conceptual Design

1. The WRAP 1 Conceptual Design Report (SD-W026-CDR-001 Revision 0) approved by DOE-RL, established a reference concept for the facility and a TEC of $52 million [due to a six (6) month schedule slip to the project definitive design start, the $52 million was escalated to a baseline TEC of $53.6 million).

2. This CDR was the reference conceptual design that UE&C used to initiate the Title I design. The conceptual design established the process configuration for the characterization, certification and repackaging of the contact handled LLW and TRU waste. It also identified several technical uncertainties that required further evaluation and resolution prior to the production of the Title I design media.

3. In addition to the WRAP 1 technical configuration established by the CDR, it established the funding limit authorized for the facility by the U.S. Government. UE&C implemented a "design to cost" program based on the CDR TEC for the Title I design. As a result of the "design to cost" program and technical ingenuity, the numerous technical issues facing the project have been resolved and the TEC baseline preserved.

4. As a result of completing some nineteen (19) engineering optimization studies (refer to **Volume V**) prior to the start of Title I design media production, significant modifications were made to the reference conceptual design prepared by Kaiser Engineer Hanford.

5. The major changes from the design presented in the CDR, to the current design, can be summarized as follows:

a) There are now no wet equipment decontamination facilities.

b) Supercompaction is to be utilized not only for LLW, but also for TRU waste.

c) The TRU waste processing glovebox line and the LLW processing glovebox line are now completely separate, and are separate from the Restricted Waste Management (RWM) gloveboxes.

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d) Remote manipulators are provided for all waste sorting/stabilization operations.

e) The number of shipping bays in the building has been reduced from two to one.

f) The internal transportation system for drums now utilizes Automated Guided Vehicles (AGVs).

g) The building is now classified as low hazard, which has resulted in the current design being of a pre-engineered, metal building structure.

h) The low hazard classification has also resulted in simplification of the ventilation system and in a reduction in the number of ventilation zones down to two. Further, the emergency diesel generator system has been eliminated.

i) The steam supply line to the building has been eliminated and steam heating replaced with hot water/electric heating.

5.4 Criteria Compliance Assessment

1. The WRAP Module 1 Preliminary Design has been reviewed for compliance with requirements as detailed in the Project Design Criteria (PDC) report. An exception reporting format has been adopted, and a compilation of areas of design which do not yet meet, or will not meet, the design requirements is tabulated in **Figure 5-1**. The majority of these non-compliances will be addressed and resolved during Title II Design.

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FIGURE 5-1
WRAP 1 TITLE I DESIGN
CRITERIA COMPLIANCE SUMMARY

POTENTIAL NON-COMPLIANCE	UE&C PDC REFERENCE	REASON/EXPLANATION	RESOLUTION
1. Lack of segregation of incompatible wastes during drum/box storage.	A.1.4,2,a,9 A.1.7,1	No special provisions have been incorporated into the design for segregating potentially incompatible drums of waste by means of a dike, berm, wall or other device apart from emplacement in lag storage in racks which prevent their commingling under normal operations. There is a concrete wall, however, separating lag stored drums from drums sitting outside of lag storage, but there are openings in the lag storage areas which are not bermed which will not prevent commingling of any liquid wastes (unlikely) under abnormal events.	Drums will be received into WRAP-1 banded to pallets from each point of origin. Each pallet will contain only drums from a single point of origin. Contents of potentially incompatible drums are segregated from each other by virtue of waste being contained in drums. Retrieved waste drums, whose contents may not be known, will be overpacked (and bagged in heavy plastic if their integrity is suspect) in new drums prior to receipt at WRAP 1. This should alleviate concerns of liquid spills after receipt and prior to processing. No liquids will be present in processed waste drums, returned to the Shipping & Receiving area.
2. Classification of personnel decontamination liquid collection tank undetermined.	A.1.15	A small tank is proposed for collection of spent water from the emergency decontamination shower; however, this tank has not yet been classified as a radioactive waste tank or a mixed waste tank.	Classification of this tank will occur during Title II design. This tank will only be filled if the emergency decontamination shower is used, and will then be sampled and taken away to be emptied without unnecessary delay.
3. ALARA requirements have not been satisfied.	A.2.2 A.2.7	WHC-CM-4-9, Section 8.0, subsection 2.0(2) requires that initial design effort should be directed to the lower radiation level of Table I (Shield Design Criteria); however, calculated dose points for Shipping and Receiving indicated that dose rates were achieved between the low and high ranges, and even above the high range in a few instances, rather than the low range. This is not ALARA. Radiation exposure from backscatter and air (and glovebox) scatter has not been addressed. Shielding on the gloveboxes may have to be increased and cover more area than present shielding configurations.	Further evaluations of dose rate and additional shielding requirements to meet ALARA will be resolved during Title II design.
4. Beta shielding requirements have not been determined.	A.2.6	No beta shielding has been specifically considered. It has been assumed that waste containers, glovebox walls and lead shielding should take care of any beta exposure; however, any waste out of containment should be considered a potential source of exposure to beta radiation. Low Z materials are primarily used for beta particle shielding.	Areas of the process which involve the handling of "raw" waste utilize remote manipulators and hence beta radiation is not a problem. The only routine operation involving hands through gloves is that of swiping incoming retrieved 55 gal drums for contamination check purposes, and as drums remain unopened at this stage, again there is no beta radiation problem. Thus, it is not proposed to provide any beta shielding. (See TC92013.007)
5. X-ray equipment classification has not yet been determined.	A.2.3,(RMI),6	Classification of the x-ray equipment installation system has not yet been performed as required by WHC-CM-4-10, Section 17, subsection 4.1.	Classification will be resolved during Title II design.
6. Battery room ventilation.	D.3.11,2,d	Positive separate ventilation is not provided for the battery room. This is needed only if H_2 is generated.	The UPS batteries are gel type and do not require H_2 gas ventilation. Resolved by WHC PDR comment No. 70-11.

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FIGURE 5-1 (CONTINUED)
WRAP 1 TITLE I DESIGN
CRITERIA COMPLIANCE SUMMARY

POTENTIAL NON-COMPLIANCE	UE&C PDC REFERENCE	REASON/EXPLANATION	RESOLUTION
7. External doors.		There are several doors that lead from the Shipping and Receiving area to ambient pressure outside. It is not determined at this time whether interlocks will be provided to prevent certain operations (ie., crane operations) when any door is opened. However, it is important that any accident (such as drum drop, forklift puncture of container, etc.) which leads to a radiological release within the shipping/receiving area be filtered through the HEPA filters. It is not clear that the normal pressure (-0.25 inches WG to ambient) can be maintained if doors are often open during operations.	This issue has already been satisfactorily resolved with WHC, with the resolution detailed in the HVAC Confinement Study.
8. Fire protection.	B.1	DOE Order 6430.1A requires that non-reactor nuclear facilities have the structural shell built to a fire resistance rating of minimum of 2 hours. In addition, 6430.1A requires a Design Basis Fire Analysis be performed.	This is required only if critical components, as defined by 6430.1A, are contained within the facility. WRAP 1 does not have any critical components. This issue has already been satisfactorily resolved with WHC.
9. Fire water supply.	B.9	DOE Order 6430.1A requires a dual source of fire water supply to a solid waste facility.	This issue has been satisfactorily resolved with WHC, and letter UDL0185.001 requests DOE approval. A second source of water supply will be provided by a separate Hanford project at a later date.
10. Fire loss, time out of service.	B.1	DOE Order 5480.7 addresses the requirement for a "vital" facility not to be shut down by fire for greater than 6 months. It is shown in the Preliminary Fire Protection design Analysis (**see Volume VI**) that a maximum credible fire in the waste process area could cause a shutdown of 9 months.	It has been agreed that while the WRAP 1 Facility is a significant part of the waste disposal program at Hanford, it is not in itself a vital facility or program. Therefore, potential delays of longer than 6 months caused by design basis fires are not judged to warrant application of "Higher Standard of Protection" features. UE&C letter (UDL0174.001) to DOE-RL has requested an extension of the 6 months. Also the fire protection analysis has been updated to support this.
11. Operating time per shift.	1.4	The SDRD gives the average operating time per shift as 5.5 hours, to take account of operators' break times, and clothing change times. Time and Motion analysis (see **Section 10.1**) shows that an operating shift time of 7 hours is required in the NDA/NDE area, to achieve the required throughput.	The NDA/NDE area will be operated remotely from the control room, and it is agreed that it is therefore reasonable to utilize a 7 hour operating shift time for this area. WHC formal concurrence is required, in response to the Time and Motion Study presented in **Volume VI**. SDRD Revision 1 includes the 7 hour shift.
12. Drum weight.		FDC Rev. 1 introduced the requirement for the facility to be able to handle a 3000 lb. drum. The design has proceeded on the previous (Rev. 0) basis of a 1000 lb drum weight limit.	Change Request CR-W026-008 has been approved by DOE limiting the drum weight to 1000 lb. (See also **Section 13.0** of this report for further details).

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6.0 ENGINEERING STUDIES

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6.0 ENGINEERING STUDIES

6.1 Scope and Objectives

1. The Preliminary Design phase of WRAP 1 commenced with the identification and execution of a number of Engineering Studies. These studies were identified primarily to resolve the uncertainties which existed at the completion of the WRAP 1 Conceptual Design Report.

2. Engineering studies were performed to evaluate design alternatives to satisfy functional performance requirements contained in the Project Design Criteria, and to ensure that engineering decisions resulting from the review of alternatives were made after considering the impact on system effectiveness and cost of acquisition and ownership.

3. In total, nineteen studies were identified as follows:

- CDR Technical Assessment
- Waste Processing System Functional Analysis Study
- Time and Motion Study
- CDR ALARA Assessment Study
- 83-Gallon Overpack Study
- Methods of Waste Entry Into Containment
- Waste Process System Layout and Configuration Study
- Drum and Box Lag Storage Study
- Glovebox Configuration Study
- Hardware For Waste Characterization Study
- Compaction Optimization Study
- Decontamination Methods Study
- Waste Minimization Study
- HVAC Confinement Study
- Building floor Space Functional Analysis Study
- Plant Automation Study
- Internal Transport Material Handling Study
- Bagless Transfer Study
- Plant Computer System Study

6.2 Technical Uncertainties Resolution

1. The technical uncertainties identified in the CDR. **Section 8** formed the primary basis for the scope of engineering studies required to be performed prior to the production of the Title I design media. The identification of these technical issues and how they were resolved in the Preliminary Design are delineated in **Figure 6-1**.

2. **Volume** V of this report presents the completed set of Engineering Studies, including an Executive Summary.

3. Additionally, the major changes from the CDR design which are now incorporated in the Title I Design were noted in **Section 5.3** above.

4. It has been concluded in **Volume** V that the completion of the Engineering Studies provided a sound basis for the Title I Design work which has now been competed and is presented in this report.

FIGURE 6-1
CDR TECHNICAL UNCERTAINTIES RESOLUTION SUMMARY

CDR TECHNICAL UNCERTAINTY	PRELIMINARY DESIGN RESOLUTION
PROCESS ENCLOSURES	
• Potential for cross-contamination between linked gloveboxes	TRU Waste Process Line, LLW Process Line, TRU RWM and LLW RWM are now separate gloveboxes.
• Glovebox sizes	Gloveboxes are modular units, and sizes have been optimized and standardized, where possible (reference Glovebox Configuration Study).
• Buffer storage, awaiting analysis results	The Hardware for Waste Characterization Study has recommended a separate storage area in the Process Cell for this propose. Time and Motion Assessment work has confirmed that the size of this storage is adequate.
• Shielding	The CDR ALARA Assessment Study and continuing Title 1 Shielding Assessment work have recommended suitable glovebox shielding. There is 1/2" lead in the full-time occupied operations areas.
• Materials handling/modernization within gloveboxes	The Plant Automation Study has recommended suitable equipment. Remote manipulators are included for operations in the Waste Sorting and RWM areas. All operations involving handling drums are automated.
DECONTAMINATION	
• Avoidance of generating secondary (mixed) wastes	The Decontamination Methods Study has shown that decontamination facilities are not required within the WRAP 1 facility.
• Alternative approaches for decontaminating large lead sheets	
CONVEYOR CONTROL	
• Development of complex conveyor system control logic	The Internal Transport Material Handling Study has recommended the use of Automated Guided Vehicles (AGVs) instead of conveyors. A standard manufactured system of AGVs, with its control system will be procured.
INSTRUMENTATION	
• Coordination of hardware and software between plant computer systems and NDA/NDE	The Plant Computers System Study has recommended a Distributed Control System (DCS). All Title I Design systems are compatible with this DCS.
AIRBORNE CONTAINMENT CONTROL	
• The ventilation requirements of both Shipping & Receiving and NDA/NDE require further assessment	The HVAC Confinement Study has taken account of the facility Preliminary Safety Evaluation, particular the reduction of building hazard classification to "low". The current HVAC design now has only two ventilation confinement zones and answers both concerns to the satisfaction of the WHC cognizant engineers.
• Requirement to have capability of 100% recirculation of Zone 2 during upset conditions	

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7.0 PROCESS SYSTEMS

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7.0 PROCESS SYSTEMS

7.1 Shipping & Receiving

7.1.1 Design Requirements

1. The Shipping & Receiving area contains facilities and equipment for the safe receipt, unloading, inspection and weighing of TRU and LLW waste containers consisting of 55 gallon drums, 83 gallon overpack drums, Standard Waste Boxes (SWB) and other waste boxes up to maximum size of 8'L x 5'W x 4'H.

2. The facility provides interim segregated storage areas for both incoming waste boxes and drums awaiting examination and outgoing shipping containers that are ready for shipment.

3. The Shipping & Receiving area provides equipment for the simultaneous packaging and loading of waste containers for shipment to WIPP, on-site LLW disposal or other on-site storage facilities.

4. It provides all the necessary equipment for the loading of TRUPACT 14-packs into TRUPACT 2 containers, for handling the TRUPACT 2 containers and lids, and for testing TRUPACT 2 containers.

5. Each incoming and outgoing vehicle and waste container will be visually and radiologically inspected for surface condition, radiation dose rate and removable contamination levels.

6. It provides equipment to generate and scan bar code labels on each waste container. The bar code label shall be attached on the top and sides of each waste container.

7. Equipment is provided to handle drums weighing up to 1,000 lbs. and boxes weighing up to 7,000 lbs.

7.1.2 Reference Drawings

Drawing Number	Drawing Title
H-2-87593	Piping & Equipment Legend and Symbols
H-2-87594	Shipping & Receiving Mechanical Flow Diagram
H-2-87595	Shipping & Receiving General Arrangement - Plan
H-2-87596	Shipping & Receiving General Arrangement - Section
H-2-87597	Shipping & Receiving General Arrangement - Section

7.1.3. Purpose and Scope

1. The Shipping & Receiving area is designed to ensure a compatible interface between the manually-operated, material off-loading and on-loading operations and the remotely-operated, automated material handling and internal transport operations.

2. The scope of the Title I design is to provide equipment for the facility that can take receipt of incoming waste packages, store incoming and outgoing waste containers, generate and label waste packages, inspect and weigh packages, and prepare waste containers for shipment.

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7.1.4 Feeds and Throughput

1. The Shipping & Receiving area houses the equipment required to receive 6,825 drums and 70 SWBs per year; this equates to approximately 20 drums twice a day and two boxes once per week. The drums arrive on trucks, containing five pallets, four drums to the pallet.

2. In the Shipping & Receiving area 6,825 drums per year are prepared for transfer to the NDA/NDE area. Shipping & Receiving receive 5,587 certified drums and 70 boxes from NDA/NDE per year. The facility prepares and ships 2,550 LLW/LLWMW drums to burial or storage on site, 3,037 TRU drums to WIPP, and 70 boxes per year.

7.1.5 Process Description

1. The Shipping & Receiving area contains equipment, such as fork trucks, powered conveyors, gravity conveyors, an overhead crane, jib cranes, and a storage/retrieval stacker for the handling of drums and pallets. The facility receives drums loaded on pallets and boxes at one of the truck docks. The pallets are removed from the truck with the Waste Box Forklift FT-05-01 or the Pallet Fork Truck FT-05-02. Boxes are taken off trucks by the Fork Truck FT-05-01. The facility receives repackaged TRU pallets back from the W-112 Storage Facility once the sample results are received for these drums. These pallets are moved by a fork truck directly to the TRUPACT pallet build out area. Upon receipt, drums and boxes are initially surveyed for radiation/contamination and their lading documents verified.

2. Pallets are then taken to the pallet stand. At the pallet stand the pallet is fully surveyed, bar code labels are attached to the drums, the bar code label is read, and the data concerning the drums is loaded into the Data Management System (DMS). The pallet is then picked up by the Pallet Storage/Retrieval Stacker CR-05-101, and placed into one of the 52 pallet locations. Each day a pick list will be generated by the DMS that designates which pallets should be prepared for transfer into the NDA/NDE area. The Pallet Storage/Retrieval Stacker picks up the pre-designated pallet and places it on the pallet stand. A fork truck picks up the pallet and transfers it to a location in front of the Drum Jib Crane Cr-05-102A.

3. The pallet straps are removed and the jib crane picks up a drum and places it on the Drum Infeed Conveyor, CV-05-101A. The conveyor sensors detect the drum and conveys it to the discharge end. At the discharge end, a photo sensor detects the drum and transfers it to the Drum Scale/Conveyor CV-05-103A, if the scale conveyor is empty. Sensors will detect the drum on the scale conveyor and the scale will weigh the drum. At this point, the bar code label is scanned to identify the drum for the DMS. The weight of the drum is shown on a L.E.D. display and the amount is recorded, allowing the operator to initiate, via pushbutton, the release of the drum from the scale conveyor to the second Accumulation Conveyor CV-05-101B. Conveyor interlocks will prevent the indexing of drums off of the scale conveyor if CV-05-101B is full. The drum is transferred to its discharge end and when the presence of an Automated Guided Vehicle (AGV) is noted, a handshake will occur and the drum will be conveyed onto the AGV.

4. Empty drums to be used in the Process area are transferred on a pallet from the exterior storage area to the Jib Crane, CR-05-102A. The empty drums are removed from the pallet and the jib crane places the drums on the Infeed Conveyor, CV-05-101A. The drums are transferred by conveyors CV-05-101A and CV-05-103A onto conveyor CV-05-101B for pickup by the AGV.

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5. Drums are returned to Shipping & Receiving by the NDA/NDE AGV as soon as they have been certified and processed. The AGV delivers the drum at the Drum Discharge Conveyor, CV-05-102. The bar code label on the drums is read and the drum is surveyed for contamination. The drum is transferred to the Drum Scale/Conveyor CV-05-103B. The drum is weighed and moved to the pallet area.

6. Certified TRU waste drums destined for WIPP are picked up by the Drum Jib Crane CR-05-102B and placed on the Pallet Stretch Wrapper SR-05-101. Once seven TRU drums are placed on the stretch wrapper, the drum 7-pack is stretch wrapped and a new slip sheet is placed on the top of the 7-pack. Seven additional TRU drums are assembled and stretched wrapped. The fourteen drums or 14-pack payload are moved to the TRUPACT Accumulation Conveyor CV-05-104. The 14-pack payload moves to the end of the conveyor or up to another 14-pack payload by the force of gravity.

7. The 14-pack payloads remain on the accumulating conveyor until a TRUPACT-2 truck arrives. When a TRUPACT-2 truck arrives, approximately twice a week, the 7-pack payload is loaded on a TRUPACT-2 truck by the TRUPACT Bridge Crane CR-05-103. The crane picks up the 14-packs, lifts it over the shielding wall and places it in a TRUPACT-2 cask. Three payloads can be loaded in one TRUPACT shipment. After the TRUPACT casks have been properly prepared for shipment and the necessary leak test has been performed the TRUPACT truck leaves the facility.

8. TRU and LLW waste drums are placed on a pallet located on the Pallet Transfer Car TR-05-101 by the Jib Crane CR-05-102B. Once four drums of TRU or LLW drums are loaded on pallet, the pallet is rebanded (if required) and moved by the transfer car to the Storage/Retrieval Stacker CR-05-101. The pallet is placed into lag storage by the storage/retrieval until a full shipment of pallets have been prepared for storage or burial. The pallet is removed from lag storage by the storage/retrieval, and a fork truck picks up the pallet and brings it to the dock for loading onto a truck.

9. The LLW pallets are loaded onto a truck for burial at the site. The pallets with repackaged TRU waste drums are sent to the W112 Storage Facility where they are stored until the sample results are received. Once the results are received, the TRU pallets are brought back to the Module 1 and taken by a fork truck to the Drum Scale/Conveyor, CV-05-103B. The drums are removed from the pallet by the jib crane and placed on the stretch wrapper so that drums can be configured into 14-packs.

10. LLMW, LLW Class III, >3 Clas III waste and other regulated wastes are palletized and sent to the W112 storage facility where they are stored pending treatment.

11. The Shipping and Receiving area has a number of automated systems that are controlled by the Plant Management Systems (PMS). The transfers and storage of pallets in the lag storage area are controlled by the storage/retrieval stacker's inventory control system. Operators control the movements and operations of drums and pallets at the weigh station area and the pallet area. The drum transfers from Shipping and Receiving to NDA/NDE is automated and is controlled by the PMS. The Shipping and Receiving area has a number of safety features built into its automatic system. Every conveyor is equipped with a rope switch which stops the live rollers when it is pulled.

12. The Shipping and Receiving area equipment requires electrical power, which is required for all the various motors, and fork truck battery charging station.

7.1.6 Design Features

1. The following paragraphs provide a summary description of the major equipment associated with the Shipping and Receiving area. Refer to Drawing H-2-87594 for location of the equipment in the process configuration.

2. **Pallet Storage/Retrieval CR-05-101:** The Pallet Storage and Retrieval system is fully automated for the transferring of pallets into and out of lag storage. The system includes a AS/RS stacker crane, storage racks, inventory control system and shuttle cars. The storage system is computer controlled and tracks the material from the moment the pallet arrives at the pallet stand for pick-up. When the pallet arrives at the storage retrieval system, the bar code labels on the drums are read and entered into the PMS. The AS/RS stacker crane picks up the pallet and transfers it to a location preselected by the inventory control system for future processing. The inventory control system records the information and the location of the pallet. When a pallet is requested for processing or shipping, the operator selects the desired pallet and the control system directs the stacker crane to the location of the pallet and brings it to the pallet stand or transfer car. The inventory control system includes a control panel with panel display, a function keypad, and bar code scanner. The AS/RS stacker crane has a lifting capacity of 4,400 pounds. The stacker crane has 3 separate motors for the lifting, horizontal traveling and shuttling of pallets. Each of these functions can be manually overridden (and hand cranked) in the event of breakdown to permit rapid recovery of the machine to its loading position, which also serves as the maintenance area. The storage racks are configured in two rows with 8 bays stacked three high and 2 bays stacked two high for a storage capacity of 52 pallets. The size of the individual storage rack is 56"W x 56"L x 42"H. Sufficient access space has been allowed around the storage racks to permit inspection of the stored waste when required.

3. **Drum Jib Crane CR-05-102A,B:** The drum jib cranes are used for placing drums on the infeed drum conveyor and drums on the transfer car for repalletizing drums or the stretch wrapper for building of TRUPACT 14-packs. The jib crane includes a top running span which can be rotated remotely through an electric drive, electric trolley and hoist, and drum gripper. The operation of the jib crane is controlled by a manual control pendant. Drums are manually placed in the drum gripper and lifted by the hoist for placement on the conveyor or pallet building areas. The jib crane hoist has a rated load capacity of 2,000 pounds. The hoist and trolley are powered by a 1 hp and 1/6 hp motors, respectively, and each have a speed of 30 feet per minute. The jib crane has a span of 11 feet and a rated capacity of 2,000 pounds.

4. **TRUPACT Bridge Crane CR-05-103:** The TRUPACT Bridge Crane transfers TRUPACT 14-pack payloads from the TRUPACT accumulation conveyor and Standard Waste Boxes (SWBs) to a TRUPACT-2 cask. The bridge crane is used for removing TRUPACT ICV and OCV cask lids and guide tubes and slip sheet from inside the cask. The bridge crane includes a top running double girder, electric trolley, hoist, and ACGLF fixture for loading 14-pack TRUPACTS or SWB's into the TRUPACT-2 cask. The operation of the bridge crane is controlled by a manual control pendant. The bridge crane hoist has a rated load capacity of 10,000 pounds and is equipped with a load cell attachment to prevent overloading the crane. The hoist and trolley are powered by a 5 hp and 1 ½ hp motors, respectively, and each have a speed of 30 feet per minute. The bridge crane has a span of 37 feet and a rated capacity of 5 tons.

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5. **Drum Infeed Conveyor CV-05-101A,B:** Chain driven live roller conveyor transfers drums to the Drum Scale Conveyor (CV-05-101A) and to the AGV (CV-05-101B). A drum is loaded onto conveyor CV-05101A are detected by sensors and convey to the discharge end. Photo sensors at the discharge end detect a drum and move the drum to the scale conveyor. Conveyor CV-05-101B and the AGV interface via a photo-eye control that is mounted on the conveyor to sense the presence of the AGV. When the conveyor senses the presence of an AGV a handshake will occur which starts the conveyor. The communication link between this conveyor and AGV will be controlled by the PMS. The overall length of the conveyor is 10 feet which is divided into four separate 30 inch accumulation zones. The overall width of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches with a 4½ center spacing. The rollers are driven by a 3/4 hp motor. The conveyor has a speed of 30 feet per minute.

6. **Drum Discharge Conveyor CV-05-102:** Chain driven live roller conveyor receives drums from the AGV and convey the drums to the Drum Scale Conveyor CV-05-103B. Conveyor CV-05-102 and the AGV interface via a photo-eye control that is mounted on the conveyor to sense the presence of the AGV. When the conveyor senses the presence of an AGV a handshake will occur which starts the conveyor. The communication link between this conveyor and AGV will be controlled by the PMS. The overall length of the conveyor is 10 feet which is divided into four separate 30 inch accumulation zones. The overall width of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches with a 4½ center spacing. The rollers are driven by a 3/4 hp motor. The conveyor has a speed of 35 feet per minute.

7. **TRUPACT Accumulation Conveyor CV-05-104:** Gravity flow conveyor transfers TRUPACT 14-pack payloads from the jib crane to the bridge crane pick-up point. The conveyor has elastomeric hysteresis wheels in a heavy gauge steel frame for controlled movements of loads. The conveyor has an overall length of 56 feet and an overall width of 7 feet. The gravity slope of the conveyor is 0.4 inches per foot. The rollers have a diameter of 3 inches and the distance between is 1 ½ inch. The conveyor has a load capacity of 7,000 pounds.

8. **Drum Scale/Conveyor CV-05-103A,B:** Chain driven live roller conveyor mounted on a floor scale. Conveyor CV-05-103A receives drums from conveyor CV-05-101A. After the drum is weighed, the drum is conveyed to conveyor CV-05-101B. The overall length of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches with a 4½ center spacing. The rollers are driven by a 3/4 hp motor. The conveyor has a speed of 35 feet per minute. The floor mounted scale has a 3' x 3' platform and a 2,000 pound capacity. The scale is equipped with a digital instrument controller and shows the weight of the drum on its L.E.D. display.

9. **Waste Box Fork Truck FT-05-101:** (H-2-87594) - The Waste Box Fork Truck unloads boxes and pallets from enclosed trailer vans and transport pallets to various workstations or boxes to the NDA/NDE area. The fork truck is a dual drive reach truck with a maximum capacity is 7,000 pounds. The fork truck is powered by a 24 volt, 1200 AMP hour industrial storage battery. The fork truck has an elevated fork height of 152 inches. The fork truck has a travel speed of 5.0 miles per hour unloaded and 4.5 miles per hour loaded.

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10. **Pallet Fork Truck FT-05-102:** The Pallet Fork Truck unloads pallets from enclosed trailer vans and transport pallets to various workstations. The fork truck is a counter balanced lift with a maximum capacity of 4,000 pounds. The fork truck is powered by a 36 volt, 1000 AMP hour industrial storage battery. The fork truck has an elevated fork height of 183 inches. The fork truck has a travel speed of 7.0 miles per hour unloaded and 6.5 miles per hour loaded.

11. **Pallet Stretch Wrapper SR-05-101:** The Pallet Stretch Wrapper is a custom designed high profile pallet stretch wrap system used to wrap the TRUPACT 14-packs. The system is designed to accommodate TRUPACT 14-packs stacked two high. The 14-packs will be built on a turntable integral to the stretch wrapper. The 14-packs will be stretch wrapped by the machine operated by an operator at the control panel. After the completion of the wrap cycle the 14-packs are discharged to the gravity TRUPACT accumulation conveyor. The stretch wrap system has a capacity of 10,000 pounds. The turntable is powered by a 1 hp variable speed drive system. The control panel contains controls for the turntable, the stretch wrapper and the film elevator and delivery system. The system has a production capacity of 20 to 30 loads per hour.

12. **Pallet Transfer Car TR-05-101:** The Pallet Transfer Car is a rail guided conveyor system. The transfer car travels on two floor mounted steel rails. The transfer car moves pallets from the pallet building station to the storage retrieval stacker. The transfer car is controlled by the storage and retrieval control system. The transfer car has a maximum capacity of 4,000 pounds and has a travel speed of 41 feet per minute.

7.1.7 Outline Specifications

1. Following is a listing of the mechanical equipment outline specifications and mechanical equipment for the Title I design. The outline specifications are included in **Volume III** under the Shipping & Receiving tab.

CSI No.	Title
14000	Conveying Systems
14400	Fork Trucks
14620	Pallet Storage/Retrieval

Tag No.	Equipment Name
CR-05-101	Pallet Storage/Retrieval
CR-05-102	Drum Jib Crane
CR-05-103	Trupact Bridge Crane
CV-05-101	Drum Infeed Conveyor
CV-05-102	Drum Discharge Conveyor
CV-05-103	Drum Scale/Conveyor
CV-05-104	TRUPACT Accumulation Conveyor
FT-05-101	Waste Box Fork Truck
FT-05-102	Pallet Fork Truck
SR-05-101	Pallet Stretch Wrapper
TR-05-101	Pallet Transfer Car

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7.2 NDE/NDA

7.2.1 Design Requirements

1. NDE/NDA equipment shall be designed in order to facilitate the following operations:

   a) LLW and TRU waste drums will undergo the following NDE unit operations:

      - Real Time Radioscopy (RTR)

   b) LLW and TRU waste drums will undergo the following NDA unit operations:

      - Passive/Active Neutron Interrogation (PAN)
      - Gamma Energy Assay (GEA)

   c) Waste Boxes will undergo the following unit operations:

      - Real Time Radioscopy (RTR)
      - Passive/Active Neutron Interrogation (PAN)
      - Gamma Energy Assay (GEA)

7.2.2 Reference Drawings

Drawing Number	Drawing Title
H-2-87614	Drum & Box NDE/NDA Equip. General Arrangement - Plan
H-2-87615	Box NDE/NDA Equipment General Arrangement - Sections
H-2-87616	Drum NDE/NDA Equipment General Arrangement - Sections
H-2-87618	Drum NDE/NDA Process Flow diagram
H-2-87620	Drum/Box NDE and Box NDA Mechanical Flow Diagram
H-2-87621	Drum NDA Mechanical Flow Diagram

7.2.3 Purpose and Scope

1. Box NDA equipment design is being performed by WHC who will provide UE&C the appropriate engineering data for integration of this equipment into the WRAP 1 design.

2. The primary function of Non Destructive Examination is to examine the physical contents of waste containers (both drums and boxes) entering and/or leaving the WRAP 1 facility in order to either acquire certification data of the containers in accordance with storage and shipping criteria and/or to provide "intelligence" of the contents for the purpose of container processing and nuclear assay measurements.

3. The primary function of Non Destructive Assay is to assay the drums and boxes entering and leaving the WRAP 1 facility in order either to determine the appropriate waste process route, to ensure appropriate treatment and control of the waste, or (with the help of process knowledge and/or sample analysis) to acquire certification data of the waste in accordance with storage, disposal and transport requirements. The principal documents which dictate these requirements are TRUPACT SAR, WIPP-WAC and WHC-EP-0063.

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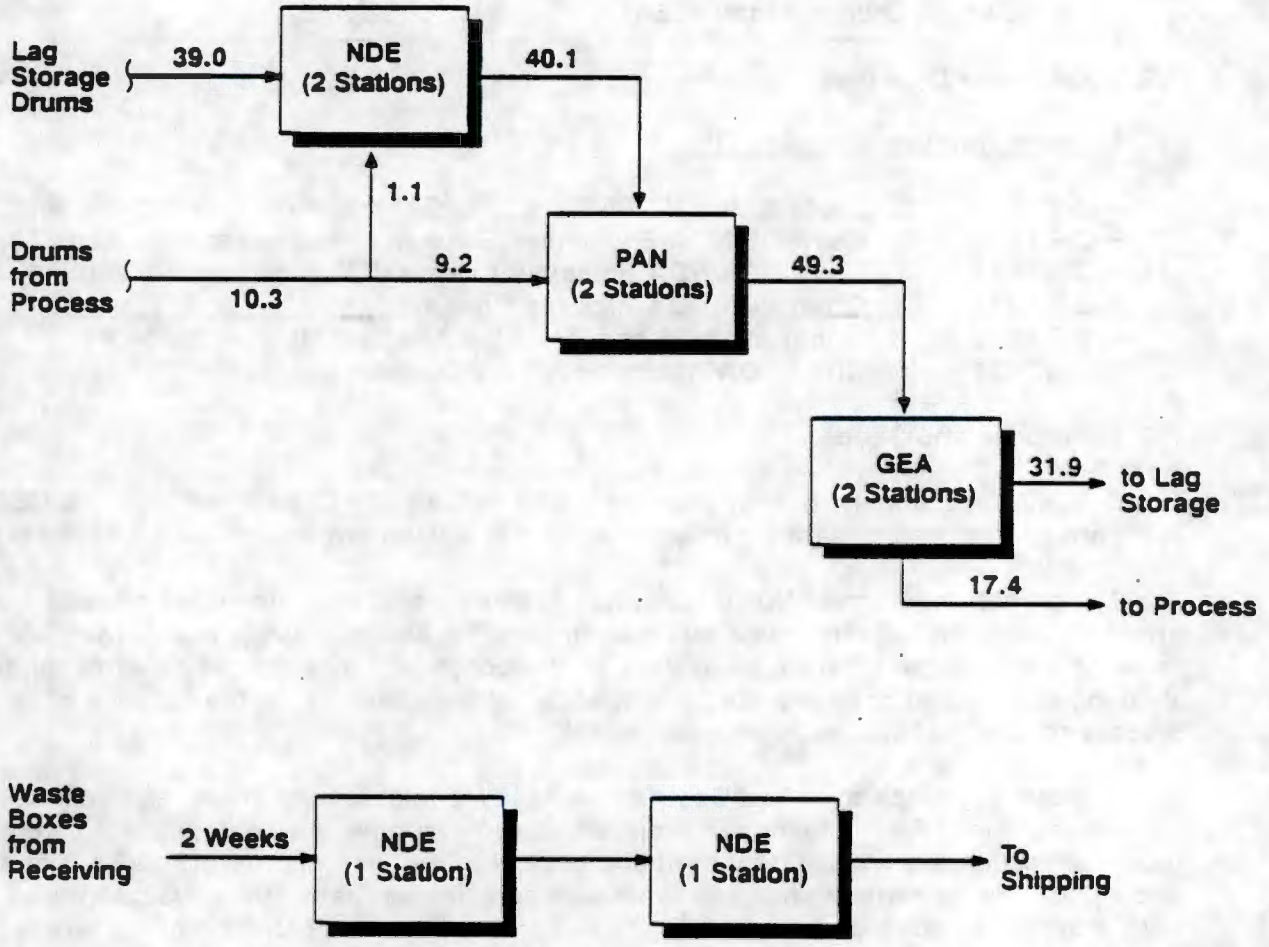
7.2.4 Feeds and Throughput

1. The feed to the NDE/NDA area consists of:

- Uncertified retrieved drums
- Uncertified newly generated drums
- Certified but unverified and uncertified newly generated drums
- Uncertified processed drums
- Uncertified standard waste boxes

2. The average throughput per day through the NDE/NDA area is 49.3 drums. However, every drum does not go through each component of the NDE/NDA area. The Process Flow schematic shown below, illustrates the required throughput through each NDE/NDA unit operation.



7.2.5 Technology Assessment

1. A primary objective of the NDE/NDA equipment design was to procure commercially demonstrated "off-the-shelf" analytical equipment based upon a performance specification approach. To determine the viability of this approach a technology assessment was performed to ascertain if the appropriate analytical equipment was commercially available and could achieve performance requirements of the WRAP 1 process. The confirmation of commercially available equipment requiring little or no research and development effort would allow the preparation of performance type specifications to be prepared for the procurement of this equipment. The full Technology Assessment is contained in **Engineering Assessments, Volume VI.**

2. In summary, the main findings of the Assessment were as follows:

<u>Drum NDA</u>

a) It was established that the functional requirements for drums in all streams would, in principal, be met by a combination of a passive/active neutron measuring instrument and a high resolution gamma measuring instrument which were interconnected by a data link in order to maximize the accuracy of the final measurement.

b) It was recommended that the functions of the segmented gamma scanner (SGS) and the fission and activation product monitor (FAP) be combined into one instrument.

c) The study established that instruments are available on the market that can be readily modified to meet the requirements of WRAP 1. The only qualification is that close attention must be placed on the performance specification to ensure the instrument integration software functional requirements are fully defined.

<u>Drum and Box NDE</u>

a) In the case of Drum NDE, it was generally concluded that previous applications by vendors precluded the need for any special development requirements.

b) In the case of Box NDE, it was concluded that there is some uncertainty about the ability of real time radioscopy (RTR) equipment to penetrate the full width of a box. RTR technology will only penetrate about 80 mm of steel equivalent. It was therefore recommended that some demonstration trails are performed and/or some investigation is carried out into the likely quantity of heavy absorbers present in boxes.

<u>Specific Findings</u>

a) The specific findings of the technology assessment are summarized in **Figure 7-1**.

7.2.6 Description of Processing Operations

1. The following paragraphs describe the equipment and unit operations of the NDE/NDA area. The description follows the process flow sequence that is presented in the NDE/NDA Mechanical Flow Diagram H-2-87620 and H-2-87621.

2. Design features describe the individual analytical equipment function and design details.

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FIGURE 7-1
NDE/NDA EQUIPMENT TECHNOLOGY ASSESSMENT SUMMARY

Measurement	Category	Comments/Qualifications
Drum NDA	2	a) Vendors have built equipment for assaying 55 gallon drums but some of WRAP-1 requirements are unique. e.g.: a) High throughput requirements b) Physics integration c) Automatic generation of reports in the format required for WIPP etc. d) 83 gallon drums (minor change) b) Software will need to be customer specific. Hardware may consist of a hybrid of previous designs.
Drum NDE	1-2	a) Vendors have designed systems for 55 gallon drums and demonstrated ability to see free liquids, etc. The modification to amend the designs for 83 gallon drums is minor. b) WHC Demonstration Plan should progress to endorse this conclusion with simulated waste 55 and 83 gallon drums. c) It is assumed that there are not substantial quantities of waste in excess of 80 mm steel equivalent along the drum diameter.
Box NDE	2-3	a) Vendors have designed systems for items as large as boxes. b) WHC Demonstration Plan should be amended to include some form of validation for simulated waste in a box. c) An uncertainty exists regarding the quantity of hard waste expected in boxes; WHC are asked to advise if materials greatly in excess of 80 mm steel equivalent are likely to be present along the minor diameter of the box.

Category definitions

1 - Off-the-shelf equipment exists that meets the measurement specification; no further development required.

2- Off-the-shelf or previously designed equipment exists that can be readily modified to meet the measurement specification.

3 - No off-the-shelf equipment exists but prototype equipment and development programs exist which meet or nearly meet the measurement specification.

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Drums

1. Each day, one of the two Transport/NDA control operators will select, from the control room console, a pick list of drums (from those in the lag storage) which require assaying. This list will be entered into the Plant Management System (PMS). The PMS will then integrate this information into its data base and take account of drums arising from the process area in order to establish the "next drum to be sent to NDE/NDA". Some order of priority will therefore need to be programmed into the PMS.

2. Drums requiring assaying from the lag storage will be transferred via the "Second Accumulation Conveyor" CV-05-101B where the drum's bar code is manually read; whereas drums requiring assaying from the process will arise at the drum carousel CV-09-102. Where the drum's bar code is automatically read before transfer to the Automated Guided Vehicle (AGV) GV-09-101. From this point, its location is automatically tracked throughout NDE/NDA by the PMS.

3. The PMS will have identified each type of drum, via its bar code label, enabling the PMS to determine each drum's first destination. As described on the Process Flow diagram H-2-87618, the first destination of drums is:

a)	Retrieved drums	: 100% to NDE
b)	Newly generated drums	: 100% to NDE
c)	Processed drums	: 10% to NDE 90% to PAN

4. For drums directed to the NDE, the PMS will determine availability and direct the AGV to the transfer conveyor of the appropriate NDE unit, CV-09-101A/B. Once this drum is in position on the transfer conveyor, the Plant Control System (PCS) will instruct the appropriate NDE PLC to open the NDE vault door, start up its conveyor, move the drum into position in the NDE equipment and close the NDE vault door.

5. At this point, the NDE operator in the control room will be prompted to push a hard-wired button on his console which will enable the X-ray generator and allow NDE operations to commence. During NDE operations, the full-time attention of the operator will be required. The drum and detector/generator assembly manipulators will be controlled **manually** using principally a joystick. The controls available will include up, down, rotate and transverse sideways (to the edge/tangent of the drum). In particular, the control system will have the capability to "jog" the drums in order to facilitate the identification of free liquids in the waste matrix. While the X-ray is running, the operator will have full control over a video recording device with audio recording capabilities to give a real-time image of the drum with commentary. The lighting in the NDE drum interpretation area of the control room shall be controllable.

6. On completion of NDE operations, in accordance with FDC paragraph 2.2.4, the NDE operator will input examination data onto the data base file of the drum. The data base file is stored on the Data Management System (DMS) computer. Additionally, one or two separate playback VCR's will be provided in the computer room to enable a control room operator to send recordings to the process enclosure operators.

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7. A WHC uncertainty currently exists as to whether this is adequate for the operator's needs and this is addressed in **Section 13.0** of this report. Pending resolution of this, consideration will be given to evaluating the technical feasibility and cost of providing a means of recording still NDE pictures onto a laser disc or equivalent. The objective of this is to store pictures onto a storage medium that will be instantly retrievable through the PMS Communication network from any terminal connected to it, e.g. the process operator in the glove box line.

8. On completion, the NDE operator will inform the PCS (via his keyboard) that the drum NDE is complete. This will initiate a sequence to open the NDE vault door, move the drum onto the transfer conveyor, call the AGV for pick up and move the drum to the Transfer Conveyor CV-09-101 C/D of an available PAN unit.

9. Prior to receiving drums at the Drum PAN station, a file on the drum will have been opened by the operator in Shipping and Receiving area and any history (process knowledge, characterization data, etc.) added to the file. In definitive design, the method of entering any additional information required by the NDA instruments will be investigated.

10. Drums arriving at the transfer conveyor will move on into the Drum PAN station in the same manner as at the NDE station (see above). If the PAN or GEA system requires more information prior to commencement of data acquisition (counting) or data processing, the Transport/NDA operator will be prompted for this information otherwise PAN operations will start.

11. On completion of PAN operations the drum will be automatically transferred to the next available GEA station in a similar manner to its transfer from NDE to PAN.

12. On completion of GEA operations the data gathered from both the PAN and the GEA systems will be combined, probably in the Data Management Computer, to obtain full certification data and to determine if the drum is classified TRU or LLW.

13. Certified Newly Generated drums, WRAP 2 drums, and Processed Drums will then be returned to Shipping and Receiving by the AGV. Retrieved drums as well as non-compliant Newly Generated, WRAP 2 and Newly Generated Drums requiring verification characterization will be transferred to the process buffer drum carousel by the AGV, or infrequently directly to the process airlock.

14. A PCS interlock will ensure that only drums classified as LLW and TRU will enter the LLW and TRU process lines respectively. The bar code number will be signalled from the DMS to each station of the NDE/NDA area in order to ensure the collected data is ascribed into the appropriate file.

Boxes

1. Boxes are transferred to the Box NDE unit by the Forklift Truck, FT-05-101, as described in **Section 7.1**. The bar code on the box will be read using the portable bar code reader and this will be signalled to the NDE operator in the control room in order to permit this number to be correlated against any NDE data entered on the PMS.

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2. Following a successful weigh on the Transfer Conveyor CV-09-105, the NDE operator in the control room will initiate a sequence to move the box into the Box NDE vault. The operations at the Box NDE station will then be similar to those described for Drum NDE above. However, a significant difference to drum NDE will be that, instead of rotating the box, the image intensifier/generator assemblies will be elevated through the height of the box.

3. Following completion of Box NDE a forklift truck will pick up the box and transfer it to the Box NDA station transfer conveyor. The bar code of the box is again read by the portable bar code reader and this number is then sent to the Box NDA computers. One of the transport / NDA controllers will then initiate Box NDA operations. Again, as with Drum NDA, if there is insufficient information available to start operations, the operator will be prompted for the missing information.

4. Half-way through Box NDA operations, the control room operator will be prompted through the PMS that the sequence to rotate the box has started. The control room operator will have the opportunity to view this operation via CCTV which will consist of retracting the box onto the turntable at the end of the unit, rotating it and returning it into the Box NDA unit. By viewing this on CCTV, the operator will be able to ensure that there are no misalignment problems. Additionally, if any part of the sequence fails, it is assumed that the GFE Box NDA equipment will annunciate this condition to control room operators through the PMS.

5. On completion of Box NDA operations, the control room operator will be prompted via the PMS to send for a fork lift driver to return the box to Shipping and Receiving.

7.2.7 Wastes and Effluents

1. The only potential waste or effluent arising out of NDE/NDA expected is the cooling oil from the NDE heat exchangers which may need replacing at some stage due to a malfunction or natural ageing.

7.2.8 Safety Instrumentation and Control

1. The Drum and Box NDE equipment will be required to meet federal and state statutory requirements. Additionally, the equipment must meet the requirements set out in document WHC-CM-4-10. Safety features specified in the above standards include, but are not limited to:

a) Monitoring by fail safe X-ray warning lamps

b) Redundant safety circuits for door interlocks

c) Fail safe door locking contact

d) Continuous internal diagnostic with automatic shutdown and fault display

e) Leakage radiation from vault less than 0.5 mR/hr

2. Control of all NDE functions will be carried out from the "NDE Operator Consoles #1 and #2, located above the area in the control room.

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3. NDA equipment will contain neutron generators in the PAN's and transmission sources in the GEA's. Shielding and access arrangements associated with these devices will be required to meet federal and state statutory requirements.

4. Control of all NDA functions will be carried out from the "Transport/NDA Consoles #1 and #2, located above the area in the control room.

7.2.9 Utility Services

1. The NDE/NDA equipment requires electrical power and potentially plant utility air. Electrical power is required for motors, High voltage (HV) generators, neutron generators and nucleonic processing equipment. The total anticipated load is 48 kVa at a single phase 120 volt and 10kVa three phase 120/208v.

2. Liquid nitrogen will be required on all GEA units to service the germanium detectors. It is proposed that the detector dewars will be filled by wheeling in a portable master dewar and manually filling the detector dewars as required (estimated to be twice per week).

3. Currently, vendors contacted have indicated a preference for electrically operated doors, lifting equipment etc. However, provision for air actuated equipment should be provided so as not to preclude other vendors.

7.2.10 Design Features

1. The NDE/NDA and related equipment will incorporate the following design features:

   a) Diagnostic hardware and software to detect and annunciate any equipment failures to the control room operators.

   b) Procedures and systems to verify the correct functioning of equipment:

   c) NDE systems will employ a standard drum or box containing an ASTM step wedge as described in ASTM F792.

   d) NDA systems will employ a "Verification Drum or Box" containing a mixture of known radioactive sources to periodically check the instrument performance.

   e) NDA systems will be capable of identifying significant changes in background radiation before and during the performance of assays.

   f) On leaving the NDE/NDA area, a check on the bar code label will be made in order to verify that the drum has been correctly tracked.

   g) GEA systems will employ standardization sources, to routinely check for "drift" in energy ranges being examined.

   h) Cryostats on GEA systems will employ level detectors to warn operators of low liquid nitrogen levels and (eventually) shutdown the GEA systems if the cryostats are not filled in order to protect capital equipment, and to ensure accuracy of results.

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i) Maintenance features and facilities will be provided at all parts of the measurement systems to enable the various components of the system to be maintainable by the appropriate craftsmen. Particular attention shall be given to access of equipment in highly shielded areas. For example, equipment in congested shielded areas could be mounted on a removable trolley. Processing electronic cabinets will be mounted away from areas of heavy traffic. Component parts for all measurement systems will be modular and interchangeable.

2. Drum Non-Destructive Examination ND-06-104 A/B: Two drum Real Time Radioscopy (RTR) stations will perform X-ray fluoroscopy examination of unopened containers for particulate material, free liquids, explosives, compressed gas containers, or other items requiring special processing. Drum RTR stations will examine 55-gallon drums or 83-gallon overpacks. Each will be equipped with shielding guillotine-type doors on the inlet to protect personnel in the NDA/NDE area from radiation emitted from the RTR equipment. The system consists of an X-ray generation unit and high-resolution imaging system, manipulation system, radiation-shielded enclosure, transport system, and control console. The enclosure is constructed of lead sheets laminated to steel panels. Once the drum is in position inside the enclosure, and the entrance door is closed, the X-ray set and the imaging chain pass over the drum in a synchronized movement. A system of CDRH-approved interlock switches and alarms prevents X-ray generation before the enclosure is completely sealed. The image intensifier can be manipulated along two axes, both up and down, and left to right. The scan and rotate axes feature variable speeds. The drum can also be rotated, so that the operator can properly align the drum with the imaging system. The movement variability and control in both the imaging system and the drum ensures optimum inspection results.

3. Box Non-Destructive Examination ND-06-106: One Box NDE system is provided that employs the same types of RTR technology as described for the drum NDE system.

4. Drum Passive/Active Neutron Interrogation ND-06-101 A/B: Two drum PAN assay stations will combine active and passive neutron counting methods to detect and measure the quantity of U, Pu, Np, Cm and Cf isotopes. These stations will determine low-level TRU activity of drums. The active neutron assay will provide the information used to sort and categorize the waste as either TRU (>100 nCi/g), LLW Category 3 (10-100 nCi/g) or LLW Category 1 (<10 nCi/g). The active portion of the PAN system utilizes a neutron generator to provide short (5-10 usec) bursts of thermal neutrons to "interrogate" the waste. The thermal neutrons induce fissions of fissile isotopes such as Pu-239 and Am-241, resulting in a burst of fission spectrum neutrons being emitted by each fissioning nucleus. The cadmium shielded detectors reject the thermal neutrons, but detect about 10% of all fission spectrum neutrons. A set of thermal flux monitors (one cadmium shielded the other bare) are also located in the assay chamber, and are used to determine the Absorption Index of the waste. The passive portion of the PAN system uses high-efficiency neutron detectors and coincidence counting techniques to quantify the number of time related neutrons being emitted by spontaneous fissioning isotopes such as Pu-240. This side of the counting equipment will be utilized for those drums which are determined by active neutron interrogation to be TRU waste, and will produce a "Pu-240 equivalent" value which can then be combined with the Pu isotopic ratio given by GEA, to give a total Pu content.

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5. Drum Gamma Energy Assay ND-06-102 A/B/C: The Gamma Energy Assay (GEA) system will be used to obtain isotopic information about the drums. The GEA system can be used to assay U-233, U-235 Pu isotopes, Np-237, Am-241, Am-243, and fission activation products. Assays are performed in segments along a waste package's vertical axis (typically 10-20 segments per drum). The energy ranges of interest are measured by the germanium detectors. At the same time, an external transmission source is selected to match the gamma ray energies being measured (e.g., Se-75 is typically used for Pu-239 assays), and is mounted on the opposite side of the drum from the high resolution germanium detectors. This external source is used to measure the gamma ray attenuation for each segment with the radioactive transmission source. This attenuation factor due to the hardwaste items contained in the drum can then be factored into the measurements being taken from the waste in the drum. Drums are rotated about their vertical axis and cycled through the required segment heights with computer-controlled electronic motors and precision mechanical turntable/elevator hardware.

7.2.11 Outline Specifications

1. Following is a listing of the outline specifications for the Title I design. The outline specifications are included in **Volume III** under the NDE/NDA tab.

CSI No.	Title
13531	Drum Non-Destructive Assay
13532	Drum & Box Non-Destructive Examination

7.3 Waste Process System

7.3.1 Design Requirements

1. The design requirements for the Waste Process System are detailed in the Project Design Criteria Document, in **Section 4.0**. The major design requirements are summarized as follows.

2. Segregation of processing of Low Level Waste (LLW), Transuranic Waste (TRU), Non-Compliant Waste (restricted waste) is required to avoid cross-contamination of the waste forms.

3. The LLW and TRU Waste Process Lines are required to be able to process a split of up to 75% of drums containing non-compliant items, and to allow simultaneous processing of the remaining 25% of drums, directly to the compactors.

4. Radiological worker safety is to be in accordance with relevant codes and standards, including DOE Order 5480.11, CM-4-9, CM-4-10 and ALARA principles (CM-4-11).

5. Alpha confinement is to be provided using high integrity enclosures with a negative pressure induced by the ventilation exhaust system, and discharging through at least two DOP testable-levels of HEPA filtration.

6. Capabilities are to be provided for remote manipulation of the waste sorting operations and for the restricted waste stabilization operations.

7. Design is to include provisions for maintenance through gloves, including provisions for modularization of equipment to facilitate contact maintenance and appropriate access and viewing capabilities.

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8. Waste processing, treatment, and certification is to be in compliance with WIPP-WAC, WHC-EP-0063 and WAC 173-303 for both TRU waste and for LLW.

9. Waste data acquisition and management capabilities are to be provided which meet NHC requirements, and all appropriate waste certification requirements.

10. Volume reduction equipment is to be provided, to optimize plant throughput, minimize operator exposure to ALARA, operability and maintainability, and life cycle disposal costs.

11. Appropriate equipment is to be provided to allow representative sampling of waste, in compliance with EPA SW 846 for characterization purposes.

12. The process gloveboxes are to be designed to facilitate cleaning and decontamination, including avoiding unnecessary ledges and crevices, use of smooth decontaminable surfaces, and provision of suitable access and viewing.

13. Fire prevention equipment is to be installed within the process gloveboxes in compliance with NFPA 17.

7.3.2 Reference Drawings

Drawing No.	Drawing Title
H-2-87625	PFD TRU PROCESS ENCLOSURE
H-2-87626	PFD LLW PROCESS ENCLOSURE
H-2-87627	PFD RWM PROCESS ENCLOSURE
H-2-87628	MFD TRU PROCESS ENTRY ENCLOSURE
H-2-87629	MFD TRU PROCESS SORTING/COMPACTION ENCLOSURE SHT. 1
H-2-87629	MFD TRU PROCESS SORTING/COMPACTION ENCLOSURE SHT. 2
H-2-87630	MFD TRU PROCESS EXIT ENCLOSURE
H-2-87631	MFD LLW PROCESS ENTRY ENCLOSURE
H-2-87632	MFD LLW PROCESS SORTING/COMPACTION/EXIT ENCLOSURE SHT. 1
H-2-87632	MFD LLW PROCESS SORTING/COMPACTION/EXIT ENCLOSURE SHT. 2
H-2-87632	MFD LLW PROCESS SORTING/COMPACTION/EXIT ENCLOSURE SHT. 3
H-2-87633	MFD RWM TRU PROCESS ENCLOSURE
H-2-87634	MFD RWM LLW PROCESS ENCLOSURE
H-2-87635	MAIN PROCESS FLOWSHEET SHT. 1
H-2-87635	MAIN PROCESS FLOWSHEET SHT. 2
H-2-87635	MAIN PROCESS FLOWSHEET SHT. 3
H-2-87637	WASTE PROCESS GLOVEBOX GENERAL ARRANGEMENT - PLAN
H-2-87638	WASTE PROCESS GLOVEBOX GENERAL ARRANGEMENT - ELEV (TRU & LLW)
H-2-87639	WASTE PROCESS GLOVEBOX GENERAL ARRANGEMENT - ELEV (RWM)
H-2-87640	TRU ENTRY GLOVEBOX GB-07-301
H-2-87641	TRU ENTRY GLOVEBOX GB-07-301
H-2-87642	TRU SORTING GLOVEBOX GB-07-302 SHT. 1
H-2-87642	TRU SORTING GLOVEBOX GB-07-302 SHT. 2
H-2-87642	TRU SORTING GLOVEBOX GB-07-302 SHT. 3
H-2-87644	TRU GIRTH COMPACTION GLOVEBOX GB-07-303 SHT. 1
H-2-87644	TRU GIRTH COMPACTION GLOVEBOX GB-07-303 SHT. 2
H-2-87645	TRU SUPERCOMPACTOR GLOVEBOX GB-07-304
H-2-87646	TRU EXIT GLOVEBOX GB-07-305
H-2-87647	TRU EXIT GLOVEBOX GB-07-305
H-2-87648	LLW ENTRY GLOVEBOX GB-07-101
H-2-87649	LLW ENTRY GLOVEBOX GB-07-101
H-2-87650	LLW SORTING GLOVEBOX GB-07-102 SHT. 1
H-2-87650	LLW SORTING GLOVEBOX GB-07-102 SHT. 2
H-2-87650	LLW SORTING GLOVEBOX GB-07-102 SHT. 3
H-2-87652	LLW SUPERCOMPACTOR GLOVEBOX GB-07-104
H-2-87653	LLW EXIT GLOVEBOX GB-07-105
H-2-87654	LLW EXIT GLOVEBOX GB-07-105

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8. Waste processing, treatment, and certification is to be in compliance with WIPP-WA WHC-EP-0063 and WAC 173-303 for both TRU waste and for LLW.

9. Waste data acquisition and management capabilities are to be provided which meet NHC requirements, and all appropriate waste certification requirements.

10. Volume reduction equipment is to be provided, to optimize plant throughput, minimize operator exposure to ALARA, operability and maintainability, and life cycle disposal costs.

11. Appropriate equipment is to be provided to allow representative sampling of waste, in compliance with EPA SW 846 for characterization purposes.

12. The process gloveboxes are to be designed to facilitate cleaning and decontamination, including avoiding unnecessary ledges and crevices, use of smooth decontaminable surfaces, and provision of suitable access and viewing.

13. Fire prevention equipment is to be installed within the process gloveboxes in compliance with NFPA 17.

7.3.2 Reference Drawings

Drawing No.	Drawing Title
H-2-87625	PFD TRU PROCESS ENCLOSURE
H-2-87626	PFD LLW PROCESS ENCLOSURE
H-2-87627	PFD RWM PROCESS ENCLOSURE
H-2-87628	MFD TRU PROCESS ENTRY ENCLOSURE
H-2-87629	MFD TRU PROCESS SORTING/COMPACTION ENCLOSURE SHT. 1
H-2-87629	MFD TRU PROCESS SORTING/COMPACTION ENCLOSURE SHT. 2
H-2-87630	MFD TRU PROCESS EXIT ENCLOSURE
H-2-87631	MFD LLW PROCESS ENTRY ENCLOSURE
H-2-87632	MFD LLW PROCESS SORTING/COMPACTION/EXIT ENCLOSURE SHT. 1
H-2-87632	MFD LLW PROCESS SORTING/COMPACTION/EXIT ENCLOSURE SHT. 2
H-2-87632	MFD LLW PROCESS SORTING/COMPACTION/EXIT ENCLOSURE SHT. 3
H-2-87633	MFD RWM TRU PROCESS ENCLOSURE
H-2-87634	MFD RWM LLW PROCESS ENCLOSURE
H-2-87635	MAIN PROCESS FLOWSHEET SHT. 1
H-2-87635	MAIN PROCESS FLOWSHEET SHT. 2
H-2-87635	MAIN PROCESS FLOWSHEET SHT. 3
H-2-87637	WASTE PROCESS GLOVEBOX GENERAL ARRANGEMENT - PLAN
H-2-87638	WASTE PROCESS GLOVEBOX GENERAL ARRANGEMENT - ELEV (TRU & LLW)
H-2-87639	WASTE PROCESS GLOVEBOX GENERAL ARRANGEMENT - ELEV (RWM)
H-2-87640	TRU ENTRY GLOVEBOX GB-07-301
H-2-87641	TRU ENTRY GLOVEBOX GB-07-301
H-2-87642	TRU SORTING GLOVEBOX GB-07-302 SHT. 1
H-2-87642	TRU SORTING GLOVEBOX GB-07-302 SHT. 2
H-2-87642	TRU SORTING GLOVEBOX GB-07-302 SHT. 3
H-2-87644	TRU GIRTH COMPACTION GLOVEBOX GB-07-303 SHT. 1
H-2-87644	TRU GIRTH COMPACTION GLOVEBOX GB-07-303 SHT. 2
H-2-87645	TRU SUPERCOMPACTOR GLOVEBOX GB-07-304
H-2-87646	TRU EXIT GLOVEBOX GB-07-305
H-2-87647	TRU EXIT GLOVEBOX GB-07-305
H-2-87648	LLW ENTRY GLOVEBOX GB-07-101
H-2-87649	LLW ENTRY GLOVEBOX GB-07-101
H-2-87650	LLW SORTING GLOVEBOX GB-07-102 SHT. 1
H-2-87650	LLW SORTING GLOVEBOX GB-07-102 SHT. 2
H-2-87650	LLW SORTING GLOVEBOX GB-07-102 SHT. 3
H-2-87652	LLW SUPERCOMPACTOR GLOVEBOX GB-07-104
H-2-87653	LLW EXIT GLOVEBOX GB-07-105
H-2-87654	LLW EXIT GLOVEBOX GB-07-105

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b) Supercompacted TRU and TRU mixed waste, loaded out into 55-gallon drums;

c) Treated restricted LLW and TRU waste, loaded out into 55-gallon drums.

7.3.6 Process Description

1. The process description presented herein covers the LLW waste process line, the TRU process line, the LLW Restricted waste process line and the TRU Restricted Waste process line. The description follows the 'left to right" flow of waste as shown on the following process flow diagrams (PFD).

- TRU Waste PFD H-2-87625
- LLW Waste PFD H-2-87626
- Restricted Waste PFD H-2-87627

2. The process narratives describe the anticipated operation of each waste line along with a description of the major equipment required to perform the operation. Detail description of the waste process equipment is provided in the following section under Design Features.

3. The LLW and TRU waste process lines for the sorting of non-compliant items and the Volume Reduction/packaging of compliant items are quite similar. This is also true for the processing of non-compliant items in the LLW and TRU Restricted Waste management glovebox lines. Therefore, a complete process description will be provided for the TRU sorting/volume reduction/packaging line and the TRU Restricted Waste Management (RWM) line. The areas of the LLW sorting/volume reduction/packaging line and the LLW RWM line which are different from the TRU lines will then be discussed.

TRU Waste Process Line

1. The TRU waste process line consists of various material handling equipment required to transfer/articulate 55-gallon drums through the alpha confinement process enclosure in order to sort, compact, sample, and produce certified repackaged TRU waste for shipment to WIPP.

2. The TRU waste process line involves the unit operations as shown in drawing H-2-87635 the Main Process Flowsheet. These will be individually described in the following paragraphs, beginning with a description of the glovebox, suites provided for alpha confinement and operator safety.

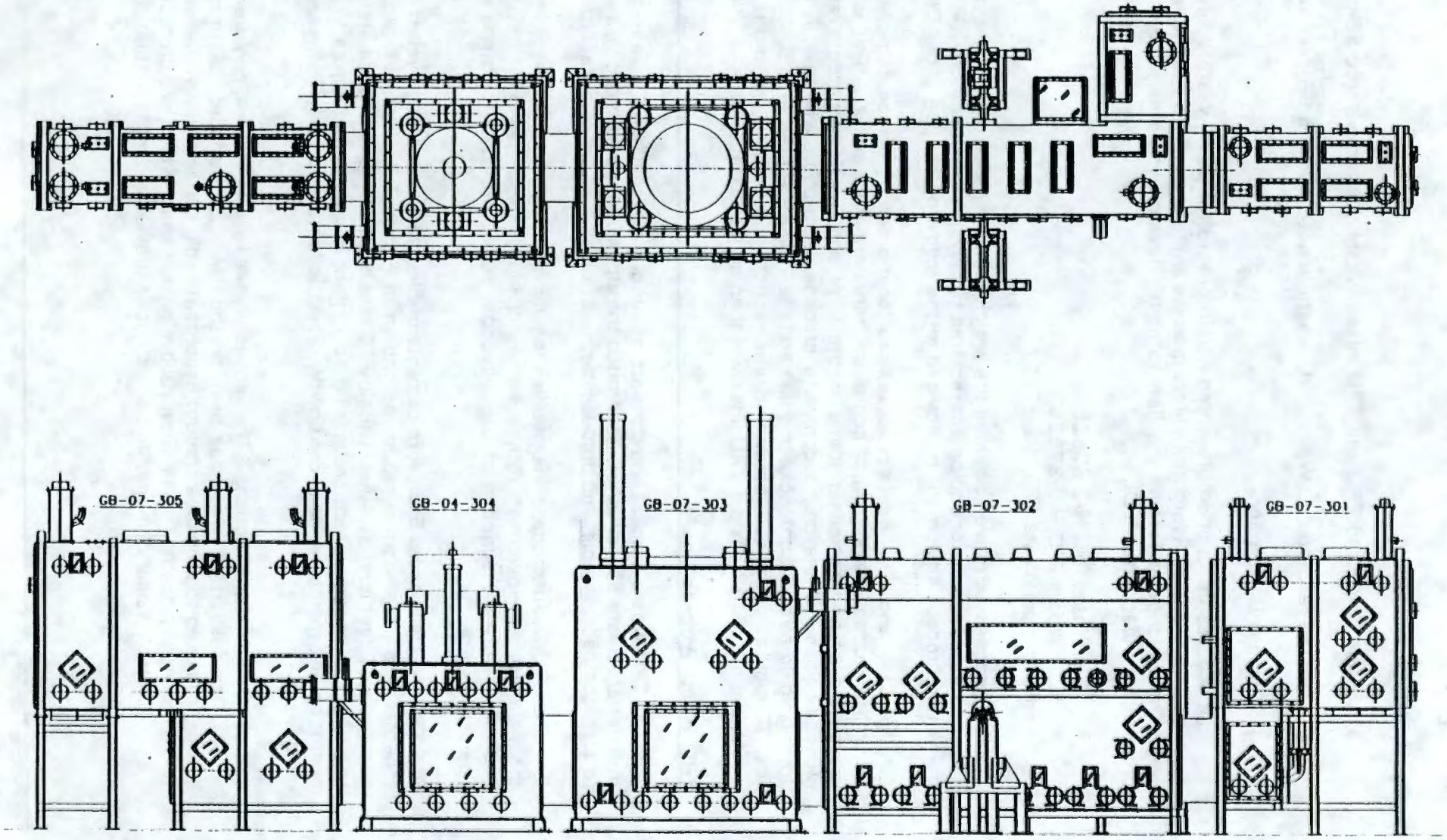
3. **TRU Waste Process Enclosure** consists of five stainless steel gloveboxes that are bolted together in a linear configuration, as shown in **Figure 7-2**. The overall glovebox suite is nominally 62 feet long by 4 feet wide by 12 feet high. The gloveboxes are custom designed to house the internal waste processing equipment in such a manner as to provide optimum operation and maintenance accessibility. Specific features of the TRU waste glovebox suite includes:

a) Overall Construction: The glovebox shell itself will be constructed of 7 gauge stainless steel which has been finished to a 2B standard. All internal corners are radiused to provide a smooth decontaminable surface. Individual gloveboxes will be flanged together using viton rubber gasket seals which are protected on the inside from physical damage, and so as not to provide a contamination trap.

9 3 1 2 7 1 1 2 7 0

FIGURE 7-2

TRU PROCESS LINE - GLOVEBOX EXTERNAL ARRANGEMENTS



b) Windows and Gloveports: Windows will be gasketed and bolted to the glovebox wall, in accordance with Hanford Plant Standards. They have been sized to provide appropriate viewing for operations and maintenance requirements, and range in size from approximately 6"x4" to approximately 42"x36". Gloveports will be of the Hanford Plant Standard type (8" diameter) and will be welded into the glovebox shell. These gloveports will accept the push-through design type gloves.

c) Shielding: In areas where full-time occupancy is envisaged, lead shielding has been attached to the external glovebox face. It will be sandwiched within steel sheets, to ensure that the lead itself does not become contaminated. Lead glass windows have also been incorporated in the design in these areas. The lead glass is protected on the inside of the glovebox window by toughened glass.

d) Lighting: Lighting is mainly provided through glovebox ceiling windows so that replacement of the light fitting takes place outside containment. In certain areas where this is not practical, pod lighting has been utilized, whereby the light tube is introduced into the glovebox within a protective glass sheath - again this means that the light fixtures can be changed outside of containment.

e) Feedthroughs: Pneumatic, hydraulic, electrical, and instrument services are fed through bulkhead-mounted standard penetrations in the glovebox ceilings or walls. Appropriate glands and couplings are utilized to ensure that alpha contamination cannot escape and connections can be readily maintained.

f) Operator Platforms: Where appropriate, operating access platforms are provided to ensure suitable ergonomic working positions can be achieved. Platforms will be both fixed and mobile, to suit applications. Platforms will conform with OSHA standards.

g) Operator Position. The operator at the sorting glovebox will generally stand in front of the box and operate the manipulators from a portable control console, that can traverse across the face of the glovebox.

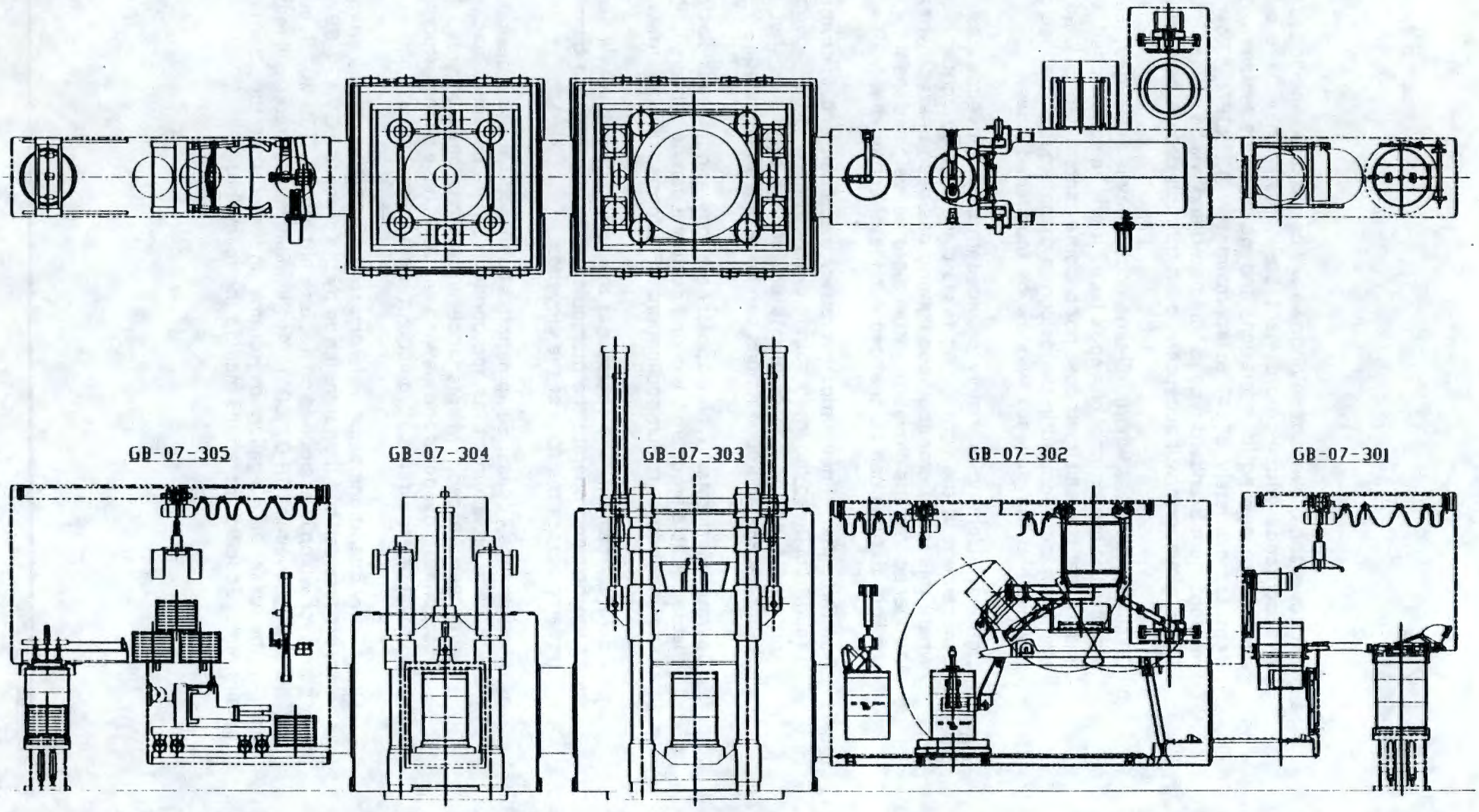
h) Maintenance Access: Equipment has been modularized in design to facilitate removal, repair and replacement, as appropriate. Where possible, quick release mechanisms have been utilized. Maintenance access has been provided through gloves, and appropriate gloveports and viewing windows have been positioned. Where infrequent removal of large items of equipment is envisaged, access panels have been provided.

4. **Drum Entry** operations begin (referring to **Figure 7-3**) by waste drums being brought into the waste process cell and then transferred by the process AGV, GV-09-201, onto a powered roller conveyor which is positioned on a scissor-lift table, LT-09-201G, below the opening into the TRU entry glovebox (GB-07-301). At this point, an operator will remove the lid clamping band in the case of 83-gallon overdrums in order that the drum lid is removable in containment. Specific operations include the following:

9 3 1 2 7 1 1 2 7 2

FIGURE 7-3

TRU PROCESS LINE - GLOVEBOX INTERNAL ARRANGEMENTS



a) 55-gallon waste drums (83-gallon overpacks) enter the TRU entry glovebox, GB-07-301, by elevating the drum by the scissor lift, LT-09-201G, to just below the drum entry port, DO-07-301. The drum entry port is opened and the drum proceeds into the enclosure by a few inches. In the case of 83-gallon overpack, the overpack drum lid is automatically attached to the drum entry port door and both are opened together.

b) The inner 55-gallon drum can then be grappled by the in-box one-ton capacity overhead hoist (CR-07-303A). Operator assistance, through gloves, will be required at this point to finally locate the pneumatically operated drum grab, DH-07-301, onto the inner drum, prior to lifting. For these retrieved drums, an external smear check will then be carried out by the operator, again through gloves, to ensure that there has been no loss of containment during storage or transfer of the overpack. It is anticipated that in the great majority of cases that there will have been no loss of containment, and hence it will be clear that the inside of the 83-gallon retrieval overpack is clean, and is therefore available to be returned to the Retrieval Project for re-use. For those small number of drums where loose contamination is found, the operator will need to manually clean or fix the contamination on both the outside of the 55-gallon drum, and on the inside of the 83-gallon overpack. A proportion of overpacks will be utilized for load-out of LLW, and those found to be contaminated will be utilized for this purpose . The entry port door can be closed again prior to removal of the outer drum.

c) The 55-gallon drum which has been lifted into the waste entry enclosure can then be traversed by the in-box hoist to a position above the sphincter entry system for TRU waste, DO-07-302. A key principle of the operation of the waste entry enclosures is that they remain essentially clean internally, and free from loose contamination. Hence there will need to be relatively frequent checking in this area, and manual cleaning when appropriate. Suitable gloveports and viewing windows have been provided in this glovebox for this purpose.

d) Drums can then be lowered through the sphincter entry system, into the process glovebox, GB-07-302. The sphincter entry system door is opened, and the drum entering is transferred to an upper hydraulically operated drum grab device (DH-07-302A) in the entry enclosure which can force the drum through the sphincter, as required. There is always a TRU waste drum held captive in the sphincter, and the drum in the upper grab is lowered initially at the same rate as the drum which is held in a similar lower grab (DH-07-302B, within the process glovebox) in the sphincter. The drives of both grabs will be linked to achieve the same rate of travel. At a height when the drum in the lower grab has not reached the bottom of its travel and the drum in the upper grab is now pushed into the sphincter, this top drum will be stopped, and the lower grab will continue, hence creating a gap of several inches between the two drums. The lower drum can then be transferred into the process glovebox, and the lower grab can now be elevated to support the drum currently in the sphincter. The upper grab can then release this drum, and the lower grab will lower this drum so that its top is just below the level of the top of the sphincter. The sphincter entry door can then be closed.

5. **Drum Opening and Waste Sorting** operations commence with the drum entering containment being pushed from the non-powered roller (CV-07-301A) by an electrically operated drum pusher cylinder (CY-07-310) onto the waiting drum transfer car (TC-07-301) which runs in the base of the box operations in this glovebox are then as follows:

9 3 1 2 7 1 1 2 7 4

a) The drum transfer car has a flat top base, has four small wheels, and is driven by a pneumatic peristaltic drive system. This device can be used to drive drums to the opening and tipping positions, in the case of drums containing non-compliant waste, or can be driven straight to the compactor loading point for compliant waste drums. Drums which have been identified at NDE as containing non-compliant waste will be moved by the drum transfer car to the drum opening station. Drums that are enclosed in a plastic overwrap will have the overwrap cut at this point. The top portion of the wrap will be held by one manipulator arm and cut using the twin reciprocating blade knife deployed by the other manipulator arm. The cut portion of the overwrap will be removed to the sorting table for subsequent packing into the open drum. Two slow-speed reciprocating saw units (RT-07-301A&B) are brought down onto the lid clamping band at diametrically opposed positions, and the clamp band is sawn through. The two pieces of the band are held during cutting and collected by remote manipulator arm units (EM-07-301) so that they can be returned to the drum later, as waste.

b) The drum lid can then be removed by a permanent magnet on the pneumatically operated lid removal fixture (RT-07-302). There is also a mechanism which can hydraulically shoot a punch device through the lid of the drum and can then lever off the lid should it prove to be stuck to the drum. This hydraulic punch is powered by hydraulic power unit HU-07-302. The lid is then held captive in the drum lid removal fixture, and the drum is moved to the tipping station. The drum tipper (DH-07-303) is hydraulically operated and can grip the drum approximately in its center area. The drum is rotated through approximately 135°, and the contents are transferred onto the sorting table. The tipper can be cycled several times if the waste does not slide from the drum, or the remote manipulator arms and in-box overhead hoist unit (CR-07-301B) can be utilized as equipped to assist in waste removal. The drum tipper is powered by hydraulic power unit HU-07-301.

c) In most cases, it is anticipated that a drum liner will be tipped from the drum, which contains packets of waste. The drum liner can be opened utilizing a twin-reciprocating blade cutting device, which is directed by operators utilizing hydraulic, remote waste sorting manipulator arms (EM-07-301) operated from a console adjacent to the glovebox. These are powered from hydraulic power unit HU-07-303. The individual waste packets are then available to an operator, to be removed as containing non-compliant items. In the TRU waste processing glovebox there is a packet X-ray unit (ND-07-301) located in a bulge in the back wall of the glovebox. TRU packets can be placed in a sliding tray within this unit (again using the manipulator arms), the pneumatically operated door (DO-07-303) can be closed and the item X-rayed so that the packet containing the non-compliant item can be identified. This item can then be bar-code labelled and placed into a divided tray unit which is lifted from and returned to the 55-gallon bagless transfer drum unit (DO-07-305), which is located in a second bulge in the back wall of the glovebox. A third in-box monorail hoist unit (CR-07-301E) is carried on a beam which runs perpendicular to the main glovebox line and is used to move the divided tray unit into and out of the bagless transfer drum. This bagless transfer drum of non-compliant items can be removed from containment and sent to Restricted Waste Management (RWM) for treatment utilizing a powered roller conveyor on a lift table (LT-07-201H) and the process AGV.

9 3 1 2 7 6 1 1 2 7 5

d) Once the waste sorting operation is complete, the remaining compliant waste can be tipped back into the original drum. This is achieved by moving the drum back towards the sphincter area slightly, to the waste receiving station, so that the lip of the waste sorting table (ST-07-301) is now hanging over the waiting drum. The top plate of the table can then be tipped by an electric actuator so that the waste is returned to the drum. The base plate of the sorting table is welded into the glovebox shell so that waste cannot drop below the table, into the base of the glovebox. The table base plate is also sloped to a catch pot in order to collect any free liquids which may be within the waste when tipped. Provisions are made in the design to allow clearing of the sorting table, to minimize the potential for co-mingling incompatible wastes, when appropriate.

e) TRU waste drums may also require opening to allow redistribution of the fissile material within an incoming drum in order to meet TRUPACT II fissile loading limits. In such cases the waste will be tipped onto the sorting table, and a proportion of it will be returned to the original drum. One or more new (empty drums) will be brought into the glovebox and the remainder of the waste distributed appropriately. There will need to be some in-box assay equipment at this point, to assist this operation and to monitor the movement of fissile material to and from RWM. This equipment is yet to be defined and is included as an area of uncertainty in **Section 13.0** of this report.

f) On being refilled with waste, the drum is returned on the transfer car to the lidding station, and the original lid is replaced onto the drum. The drum is then transferred to the lid fastening station and the lid is fixed in place by means of a remotely operated pneumatic drum lid fastener (RT-07-303).

6. **Waste Compaction and Sampling** are performed on waste drums entering the glovebox which do not require opening, and those drums which have been opened, refilled and re-lidded. Specific operations include the following:

a) The drum is transferred from the drum transfer car into the TRU girth-compaction process glovebox (GB-07-303) by a second drum transfer car. This second transfer car will be supplied integral with the compaction equipment and hence has no unique tag number. It takes the TRU waste drums first into the drum girth-compaction process. Here the drum is squeezed in a die by a hydraulic press (CM-07-301), and the drum diameter is reduced from 22.5" diameter to approximately 20" diameter.

b) The drum is then transferred by the transfer car into the Supercompactor (CM-07-302), which is a hydraulically operated press which can exert up to 2,000 tons force to compact the drums of waste. The supercompactor is enclosed within a separate glovebox, GB-07-304. A metal mold unit is brought down over the drum on entering the Supercompactor, and then a ram is pushed down inside the mold, compacting the waste drum. The ram and the mold then raise, allowing the compacted "hockey puck" of waste to be moved from the unit into the puck sample area. Pucks are then core sampled, to allow a waste characterization sample to be taken from the waste, and the puck is then transferred to the puck buffer storage area. Both compaction units are powered from the same hydraulic power unit, HU-07-304.

c) The waste puck is transferred to the TRU exit glovebox (GB-07-305) for sampling by the drum transfer car. The method for obtaining a sample requires further development work at this stage, but it is proposed that a hollow drill be utilized. The sample will be transferred to a small bagless transfer unit (DO-07-304A) for onward transmission to the analysis facilities on the Hanford site.

9 3 1 2 7 1 1 2 7 6

d) A total of three waste compacts will be held in the puck buffer storage area, and it will be possible to select from these pucks to optimize filling of the output drums from the standpoint of weight, fissile content, or physical fullness (i.e. height of waste). The waste pucks will be handled by a compacted drum lifter (DH-07-304) mounted from a fourth overhead monorail hoist (CR-07-301D) to move them into and out of the buffer storage area and into the load-out drums.

7. **Waste Load-Out** operations for TRU waste is in a 55-gallon drum which is compatible with TRUPACT 2 and WIPP requirements. Operations in this area include the following:

a) The waste puck is lowered through the output TRU drum exit port (DO-07-306), which is a bagless transfer system that is lidded by a BNFL "one-trip" double lid mechanism. With this system a second lid is fitted into the main lid of the drum once filling is complete, and swaged into position onto a seal. This drum can then be removed from containment and can be lidded with a second lid to cover any potential small "ring of contamination" on the seal, and hence provide a final containment barrier.

b) All loaded-out drums can then be transferred to the process AGV system via a powered roller conveyor on a drum lift table (LT-09-201J), to be routed via NDA/NDE and Shipping and Receiving for storage or disposal. It will be necessary initially to store such drums, awaiting the results from the analysis of the waste characterization, to allow appropriate certification of the waste prior to disposal.

9 3 1 2 7 6 1 1 2 7 7

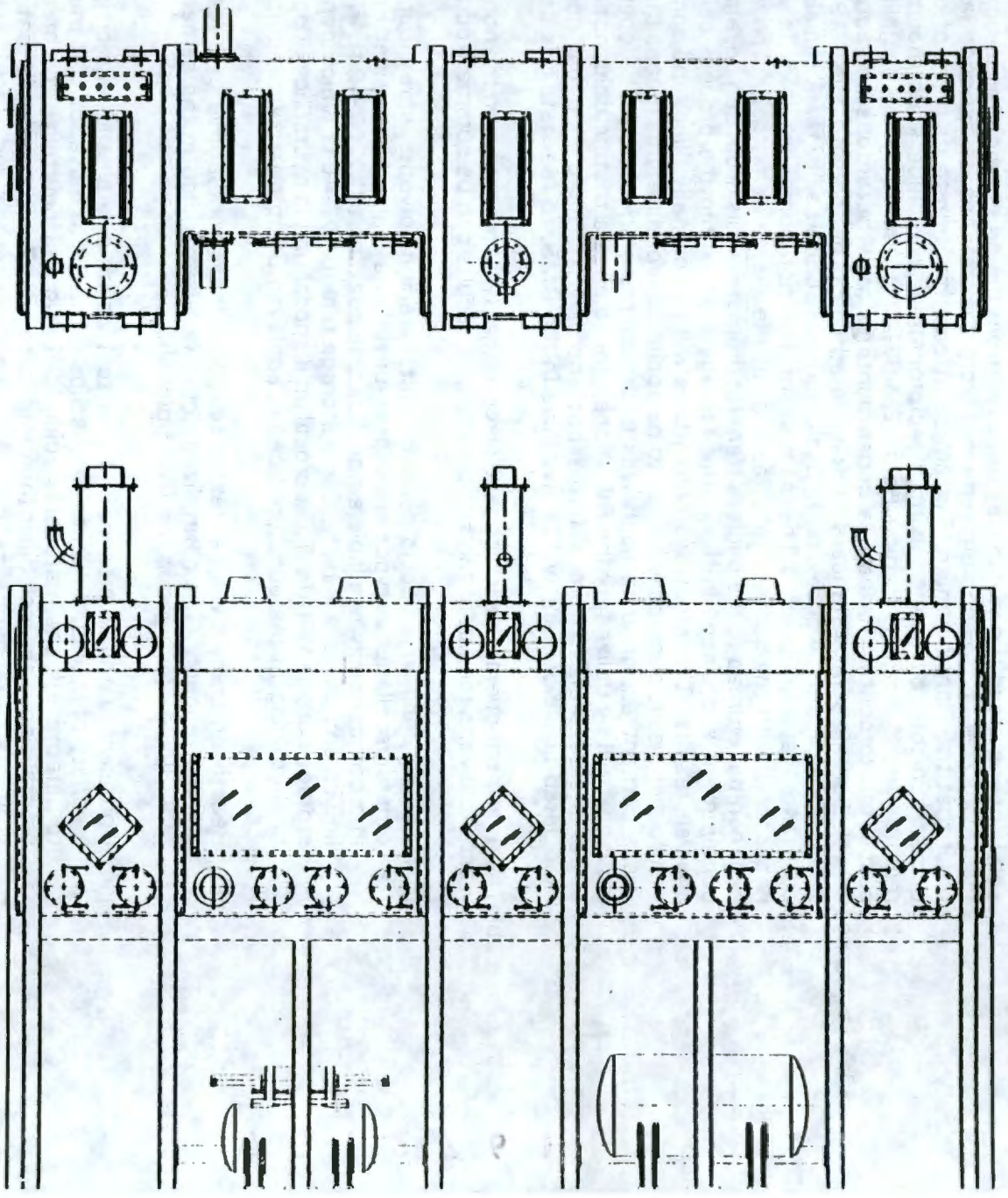
TRU Restricted Waste Management Line

1. **TRU Restricted Waste Management** (RWM) enclosure shown in **Figure 7-4**, consists of a single stainless steel glovebox which is approximately 20 feet long by 12 feet high by 5 feet 2 inches wide, at the widest points, down to 3 feet 6 inches at the narrowest (operating) points. The specific glovebox construction are very similar to those noted above in the description of the TRU waste process enclosure. The RWM glovebox has equipment for treating restricted waste to comply with the waste acceptance criteria as stated in the Hanford Site Radioactive Solid Waste Acceptance Criteria, WHC-EP-0063-2 and the TRU Waste Acceptance Criteria of the Waste Isolation Pilot Plant, WIPP/DOE-069. The treatment of the restricted waste is summarized below:

Non-Compliant Item	Treatment or Disposition
Aerosol Cans	Depressurize can, drain and collect liquids
Reactive Materials	Neutralize with liquid reagent
Chelating Compounds	Repackage and store until sufficient material is collected for packaging in a lab pack for storage and transfer to a waste acceptance area
Incompatible Materials	Segregate and package in separate containers
Corrosive Materials	pH tested, add appropriate reagent for neutralization
Pyrophorics	Remove from the WRAP facility
Gas Cylinders	Remove from the WRAP facility
HEPA Filters	Encapsulate
Liquids	Inorganic - Solidification Organic - Absorption
Mercury	Amalgamated and repackaged
Powders, Ashes, and Particulate Materials	Immobilize

FIGURE 7-4

TRU RESTRICTED WASTE MANAGEMENT GLOVEBOX - EXTERNALS



2. **TRU RWM Operations** will be carried out mainly remotely using locally controlled manipulators, as illustrated in **Figure 7-5**. This process enclosure is separated from the mair process enclosures to ensure that hazardous (chemical) operations are isolated from the main process. Items which are identified as non-compliant are transferred using 55-gallon bagless transfer drums to the TRU Restricted Waste Management Glovebox (GB-07-401) via the process AGV and a powered roller conveyor or a lift table. Specific operations include the following:

a) The bagless transfer drum is connected to the RWM drum entry/exit port (DO-07-401) and is opened, and the waste tray removed from the drum using the in-box overhead hoist (CR-07-401). Each item removed from the tray has its bar-code label read in order that the Plant computer System can trace this item to its drum of origin. The packet can then be opened using a reciprocating twin-blade knife mounted on the remote waste sorting manipulators (EM-07-401) and the non-compliant waste suspected to contain hazardous constituents or have hazardous characteristics are sampled at this point; (Standard sampling methods as defined in Table 3-19 of the Part B Permit Application will be used). Basic material compatibility tests can also be done on wastes at this point. The sample of the non-compliant item is labelled (if necessary) with the same number as that of the waste item itself. The waste item can then be returned to the bagless transfer drum, and this drum can be removed from containment and placed in the buffer storage area within the process cell, awaiting analysis results. These buffer stored drums will be optimally filled, and administrative controls on fissile content will need to be applied. In outline, this means that the total fissile content assigned to each waste packet transferred from the open and sort glovebox will be utilized by the RWM operator to ensure that he does not overfill the buffer stored drums, from a fissile content view. The packet bar code and its associated fissile content will be available in the DMS, to facilitate this control.

b) The treatment operations which take place in the RWM glovebox on the non-compliant waste following receipt of the sample analysis results can be summarized as follows:

(i) Aerosol cans which could contain paint, cleaning solvents, spray lubricants, and other miscellaneous types are depressurized and drained in a sealed environment in a commercially available aerosol can disposal unit (XX-07-401). The drained liquids and gases will be held in a storage tank (V-07-401) which can be sent to storage outside WRAP. The aerosol an disposal unit is hydraulically operated and final draining of the punctured can is achieved using a vacuum pump system.

(ii) Reactive materials will be treated to render them nonreactive by a reaction with a liquid reagent. The neutralized liquid will be handled in the same manner as other liquids received in the RWM glovebox.

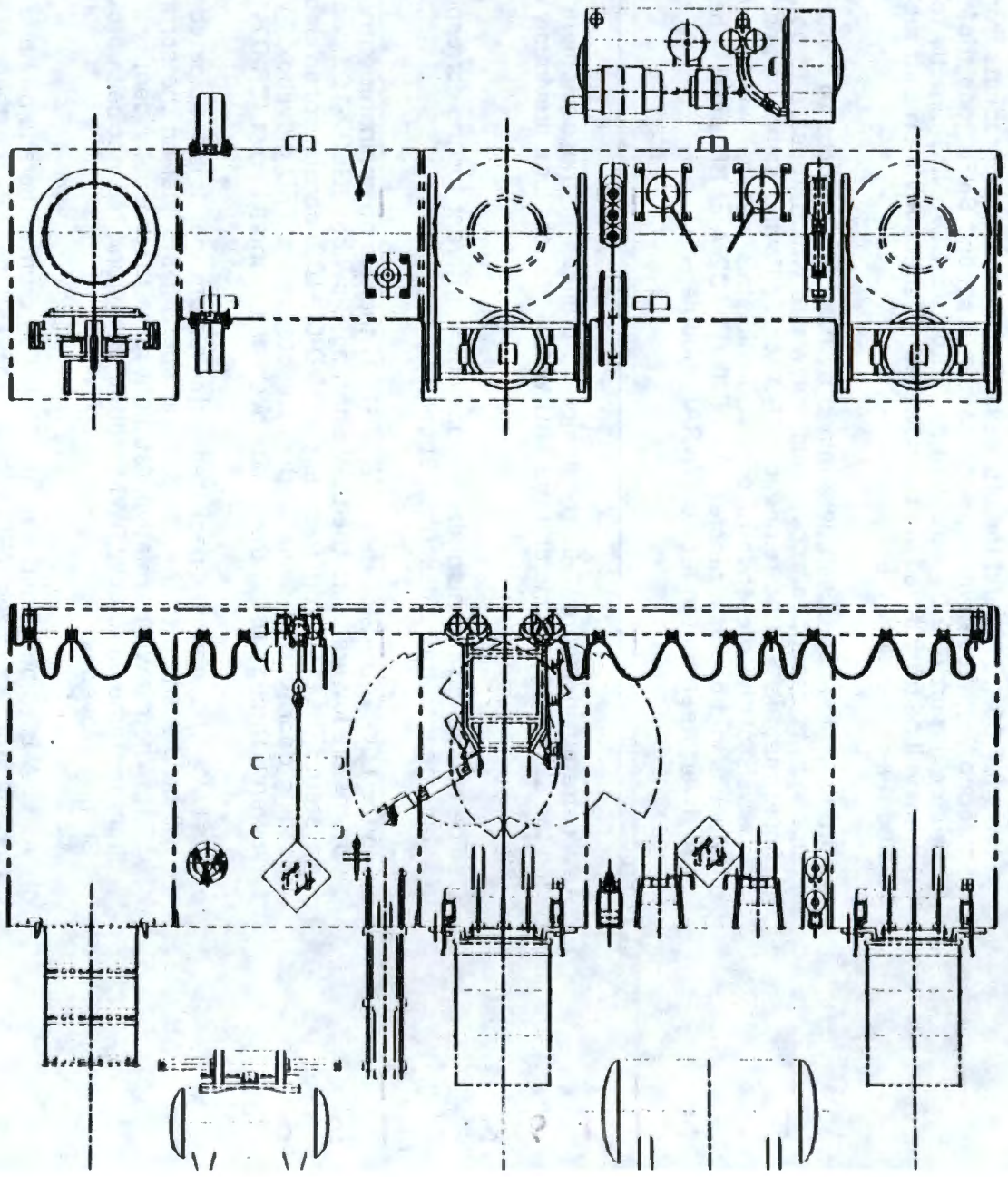
(iii) Corrosive materials present in 1 liter to 1 gallon size plastic jugs or jars include a variety of liquids, solids or semi-solids. The RWM glovebox has the capability to determine if the material is acidic or basic and neutralize the material. The neutralizing reagents adjust the pH level to near 7 without the formation of toxic products. After neutralization, the materials are transferred to liquid solidification, particulate immobilization or loaded out for storage awaiting treatment outside WRAP.

(iv) Liquids contained in plastic jars consist of variety of types such as hydraulic oils, drained aerosol can liquids, RCRA regulated organic liquids and incidental water collected from open drums. Organic liquids will be absorbed. Inorganic liquids will be neutralized if required and solidified by using cement additives. The liquids will be sealed in a container with a fixed paddle unit below the lid. These containers will then be rotated using a jar mill (XX-07-402), to allow mixing of the contents and will then be allowed to stand and cure.

9 3 1 2 7 5 1 1 2 7 9

FIGURE 7-5

TRU RESTRICTED WASTE MANAGEMENT GLOVEBOX - INTERNALS



(v) Particulate material not meeting the WIPP criteria will be immobilized with cement additives and sealed in a container. The container will be rotated using the jai mill to allow mixing of the contents and will then be allowed to stand and cure.

(vi) Spend HEPA filters will be immobilized using a fixative and will then be available for disposal as either TRU waste or TRU(M) waste.

c) The empty aerosol can from paragraph (i) above will be loaded out in a BNFL "one trip" bagless transfer drum via the RWM drum exit port (DO-07-402A) for return to the TRU processing enclosure to rejoin the main waste stream for compaction. The bagless transfer drum will be transferred via the powered roller conveyor on a lift table (LT-09-201E) and the process AGV. The treated products from paragraphs (ii) through (vi) above will be loaded out in a second BNFL "one trip" bagless transfer drum exit port (DO-07-402B) to be routed via NDA/NDE directly for disposal. This drum will be transferred via the powered roller conveyor on a lift table (LT-09-201D) and the process AGV.

d) Drums which have been determined by head gas analysis to contain VOC's will be opened, as described above, and the waste which appears to contain the organic liquid material will be removed to RWM. Following sampling and confirmation by analysis of the presence of organic liquid, this material will be removed from the process in a bagless transfer drum (DO-07-402 A or B), and will be sent to storage to await treatment in a future WRAP module.

LLW Process Line

1. As illustrated in **Figure 7-6**, the major differences in the equipment and operations between the LLW Process Line and the TRU Waste Process Line previously described are as follows:

a) The equipment tag numbers are obviously different for the corresponding pieces of equipment to those described above.

b) In the LLW Entry Glovebox (GB-07-101) there is no sphincter entry system. Waste drums are lowered into the LLW Shorting Glovebox (GB07-102) via a simple airlock system. The LLW drum transfer port (DO-07-102) consists of an electrically operated sliding door unit, in place of the sphincter in the TRU glovebox. Waste drums are lowered through using the in-box overhead monorail hoist (CR-07-101A).

c) As LLW is not normally packeted within a drum liner, it is anticipated that loose waste will be presented to the operator on opening the liner on the sorting table (ST-07-101). There it will be relatively straight forward to visually identify the non-compliant item for removal to LLW RWM, and an X-ray unit has not been provided in the LLW Sorting Glovebox.

d) As LLW is to be loaded out into 83-gallon drums, there is no need to utilize a girth compactor, as in the TRU Waste Process Line. Hence there are only four main gloveboxes in the LLW Process Line and the overall length is reduced to approximately 52 feet. The 83-gallon drum exit port (DO-07-106) is a simple double lidded system employing a permanent magnet which holds the lid captive on a pneumatic swinging door within the glovebox. On replacement of the lid on the filled drum, the operator will be required to manually attach and close the clamping band prior to movement by the process AGV. There will also be the capability (which will be further defined during Title II) to add material to the load-out drum to minimize void space within the drum.

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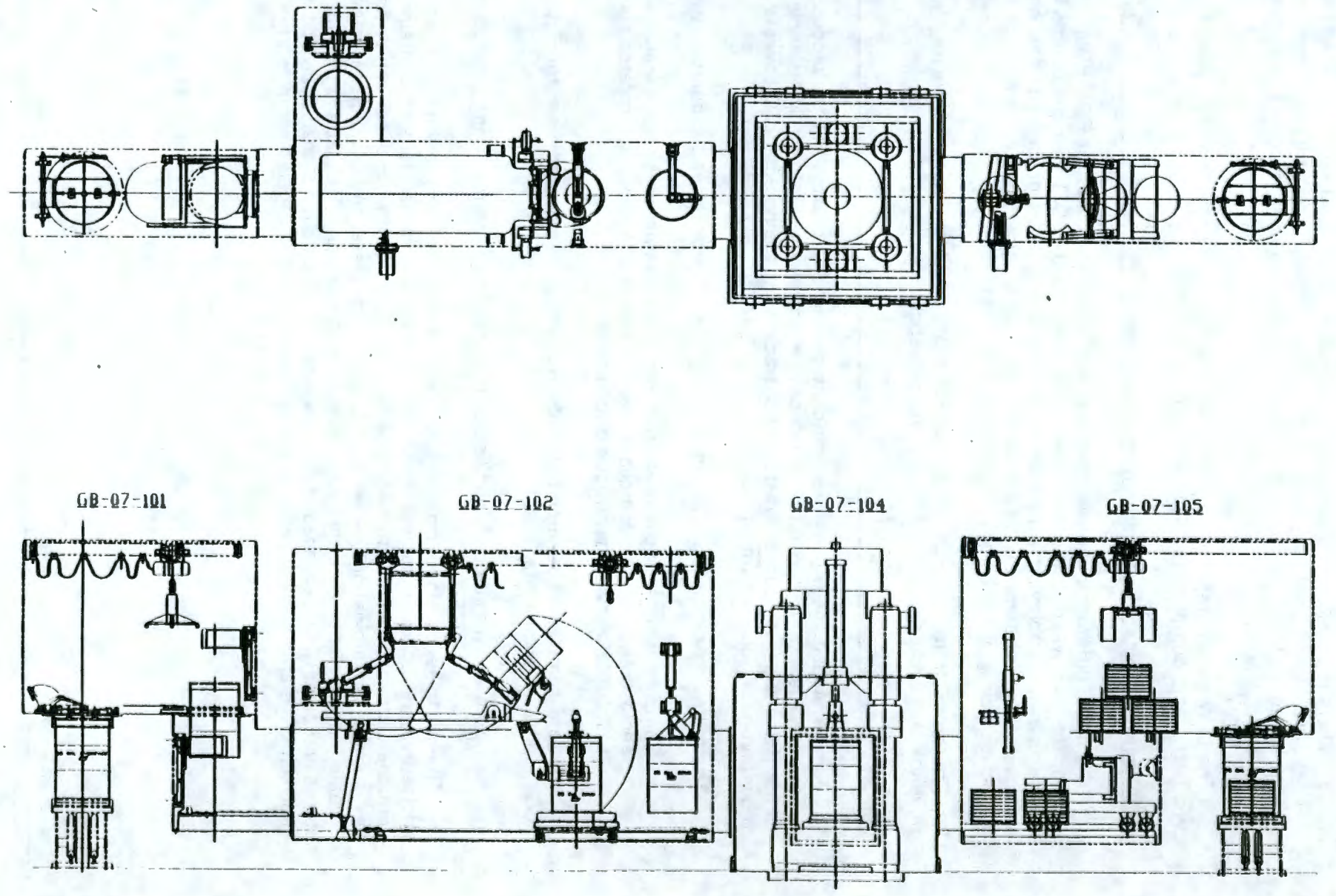
FIGURE 7-6
LLW PROCESS LINE - GLOVEBOX INTERNAL ARRANGEMENTS



e) There is to be additional shielding equivalent to 1/4" of lead on the external face of the LLW exit glovebox (GB-07-105). This shielding is primarily to protect the operator based at the LLW RWM glovebox from the shine from the LLW compact buffer storage area.

2. The LLW supercompactor is to be operated from the same hydraulic power unit as the two TRU waste compactors. This unit is HU-07-304.

LLW Restricted Waste Management Process Line

1. The major difference between the LLW RWM glovebox and the TRU RWM glovebox is that for the two waste exit ports (DO-07-202 and DO-07-203) a simple double lid bagless transfer system employing a permanent magnet to hold the drum lid to the port door is employed. This is deemed to be adequate from a radiological point of view, as this glovebox will not contain any significant quantities of TRU material.

2. Therefore, from a fabrication standpoint both the LLW Restricted Waste Management glovebox is a duplication of the TRU RWM glovebox.

Sample Management

1. **Sample Management** manages and controls samples obtained in the process area and dispositions the reports generated by the sample analysis laboratory. The samples are used for certifying supercompacted waste and characterizing the non-compliant waste suspected to contain hazardous constituents.

2. The following samples are obtained during normal process and support operations:

- Samples of non-compliant waste taken in the Restricted Waste Management (RWM) enclosures. The non-compliant waste consists of liquids, particulates and materials suspected of being hazardous or corrosive.
- Core samples of supercompacted TRU and LLW obtained from the TRU and LLW process enclosures.
- Miscellaneous samples from liquids that may be generated during process operations.

3. The samples obtained from the process area operations are transferred from the enclosures through the bagless transfer port into a bagless transfer container. These containers are manually transferred to a survey area so that the container can be analyzed for any surface contamination. After the survey is complete, the container is moved to the Sample Management office through a pass-through airlock. The sample management area stores, prepares and packages the containers for shipment to analytical laboratories for analysis. This area has the capability to refrigerate volatile organic samples at -4°C.

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4. Sample Management is responsible for controlling the samples and the results generated by the analysis lab. The control of samples begins at the process enclosures. The specific operations include the following:

a) When a sample is taken the sample is placed in a sample bottle that is pre-labeled with a bar code label. The bar code label on the jar is read by a reader and linked by the DMS to the sampled waste or supercompacted puck. The sample is placed in a transfer container and the container number is recorded in the DMS and linked with the other labels. Once the container arrives in the Sample Management office and is ready to be shipped the sample manager notes that a container is being transferred to the analysis lab by recording the number on the container in the DMS system.

b) After the sample has been analyzed, the results of the analytical test(s) are sent to the DMS via the WLAN. The sample manager analyzes the results and enters the appropriate method for treating the restricted waste into the DMS. The sample manager generates a listing for the restricted waste operator of the non-complaint packets that are ready for treating. The operator at the restricted waste enclosure selects items to be treated and the DMS relays the information through the control system for the AGV and to pick up the selected drum at the RW Storage Carousel. After the drum is brought into containment, the bar code label on the packet is read and the DMS displays the information about the waste and the type of treatment required for this item.

c) After the sample has been analyzed, the sample material is repackaged at the analysis lab into 55 gallon drums. This sample waste is returned to the Module 1 facility as newly generated waste and is processed by the facility as newly generated waste.

5. The Sample Management office is located adjacent to the main process area. The office contains the following equipment:

- Operator terminal and printer which is connected to the DMS through the WLAN.
- Bar code reader.
- Sample storage for bagless transfer containers and laboratory transfer packs.
- Refrigerated storage for volatile organic liquids.

6. The sample manager is responsible for preparing the containers used for treating the restricted waste. The containers are filled in an enclosed room located in the exterior storage area. The room will be equipped with the necessary analytical laboratory equipment, work area, and storage space for bulk materials. This room will have the necessary utilities, such as electrical, water, heating and ventilation to remove fine particles from the air (i.e. cement dust). After the containers are prepared, they are transferred to the sample management office to be stored or transferred through the pass-through airlock to the Restricted Waste Management area.

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7.3.7 Wastes and Effluents

1. All solid waste products generated during the processing of the wastes (e.g. glovebox HEPA filters, cleaning materials, gloves, tools for maintenance) will be dealt with as the waste itself, within the containment in which it arises. Large items which may arise as a result of maintenance activities will be either removed for treatment in future WRAP Modules or will be cut up in-situ for disposal.

2. Liquid effluents which arise from the drum at the waste sorting stage as the drum is tipped will be collected in one gallon polyethylene containers and will be transferred to RWM for sampling and treatment. The sorting table is sloped for collection of such liquids at the low point, and direction into collection bottles. A valve in the connection to the bottle allows quantities larger than the one gallon bottle capacity to be collected in several bottles. Any organic liquids which are found in the waste, or any contaminated hydraulic fluid will be sampled, contained in bottles, and removed from WRAP-1 to storage to await treatment in an appropriate future WRAP Module. Administrative controls will be employed to minimize the risk of mixing of incompatible liquids. Any liquid effluents which arise as a result of discharge of the building fire sprinkler system will be contained within the banded area within the building and will be pumped from a low point sump to a portable transfer container, there it will be sampled and will be directed to appropriate disposal facilities on the Hanford site.

3. Airborne effluents arising from the glovebox ventilation exhaust system will be routed via a glovebox filter into the HVAC system, as described in **Section 8.4** of this report. No provisions have been included for removal of hazardous constituents which may potentially be entrained in the glovebox extract. WHC has initiated a separate study on the potential impact of the Clean Air Act on the WRAP 1 facility, and hence this area is noted as an uncertainty in **Section 13.0** of this report.

7.3.8 Safety Instrumentation and Control

1. As is relatively standard practice for a complex computer controlled mechanical handling process, there will be all necessary software sequence links and interlocks to ensure individual pieces of equipment function within the prescribed computer-controlled operating envelopes and to allow appropriate progression of operations within the process (i.e., operation "B" will not be allowed to commence until operation "A" has successfully completed). The following controls and interlocks are highlighted as being of particular safety importance or as being related to novel items of equipment:

a) Drum entry: the sequencing of the outer enclosure door and the sphincter (or airlock) door will be interlocked so that only one will be open at any time. The sphincter will be closed before the outer door is allowed to be opened. Once the inner drum has been lifted clear into the enclosure, the outer door can be closed to allow the sphincter door to be opened.

b) TRU Sphincter: the two drum grab mechanisms (DH-07-302A&B) used to lower the drum through the sphincter will be interlocked so that there will always be a drum held in the sphincter.

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c) Sorting table: the remote manipulator arms must always be in the "park" position (proximity switch) to allow any movements of the drum tripper or the sorting table to take place. The table will not be allowed to tip unless the drum is in the correct position to receive the waste. The TRU packet X-ray will not be activated unless its door is closed and the RWM transfer drum "cake stand" must be located above the RWM transfer port so that it does not clash with the sorting table.

d) Glovebox ventilation: failure of the glovebox extract (indicated by loss of negative pressure in the glovebox) will automatically cut off any pneumatics which are piped into the glovebox.

e) Bagless transfer systems: Bagless transfer systems will be appropriately interlocked to prevent the container and lid being separated, away from the glovebox, and to prevent the glovebox door opening without any container present.

f) Gloveport operations: There is an infra-red beam down the front face of each glovebox. If this is broken by an operator putting his hands into a gloveport, then all moving machinery in the glovebox will stop.

g) The radiological instrumentation associated with the process glovebox is described in **Section 8.5**, and includes hard monitors, CAMs and criticality incident detection systems.

7.3.9 Services

1. Electrical: The process gloveboxes will be supplied with 110v and 480v. All electrical equipment within the gloveboxes will operate at 110v or 480v.

2. Compressed Air: The building compressed air main is stepped down from 90 psi to 80 psi for use in the gloveboxes. All pneumatic equipment utilizes 80 psi compressed air.

7.3.10 Design Features

This section contains a technical description highlighting the key design features of the primary equipment items that perform the waste process unit operations.

1. **Sphincter Entry System (DO-07-302)** is described as follows:

a) The sphincter entry system is based on the principle of providing a means for large items to enter containment while a controlled air leakage path is provided into the glovebox. At the same time a differential pressure between the inside of the glovebox and the process cell is maintained, and large items can be passed through the system to enter containment. The sphincter unit itself consists of three layers of overlapping rubber flaps which are supported on alternate layers of bristles which are formed in the section of a "bottle brush" type arrangement. The whole unit is housed within a cartridge arrangement such that when it becomes worn and loses its effectiveness, it can be "push through" changed. The old unit will be pushed through into the glovebox and can then be cut up and disposed of as waste. The sphincter is fitted with an external door which remains closed at all times other than when a drum is being transferred. This door effectively prevents any backflow of contamination in the event that the box ventilation system fails. It also blocks the flow of air <u>into</u> the sorting box. Therefore, a bypass pipe, fitted with a backflow preventer, connects the entry box to the sorting box to allow the inlet air to flow into that box.

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b) When the outer sphincter port door is opened, and the drums are being passed through the sphincter, sufficient air flow passes around the drum into the box to establish a flow velocity that will minimize back diffusion of airborne contamination. Once the drums have passed through and the sphincter is in a static state, with a drum held within the sphincter, then this door can be closed again. The combined resistance of the inlet filter, lid and sphincter should be such that the box operates at the required -0.7" w.g. In addition, the sphincter will be sized so that the drum enters under its own weight. To ensure that the sphincter meets WRAP specific needs, it is to be the subject of proof testing work to be performed by WHC, and is noted in **Section 13.0** of this report.

2. **Remote Manipulator Arms (EM-07-101, EM-07-202, EM-07-301 and EM-07-401)** are to be utilized in both open and sort areas, and in both RWM boxes and will be similar to the Schilling HV Series. These are 5 or 6 axis servo-hydraulic master/slave microprocessor controlled systems, specifically designed for use where manipulative tasks have to be undertaken in hostile environments or inaccessible areas. Control is achieved via a "joy stick" type compact master arm which fits in the palm of the operators' hand, permitting comfortable and fatigue-free operation. Specific technical details are as follows:

a) Motion is effected through hydraulic actuators that are hydraulic oil or water/glycol compatible. The standard capacity is 60 lb at full arm extension. They can be mounted to suit the specific glovebox functional requirement which in the case of WRAP 1 means fixed to an overhead rail system mounted in the glovebox roof.

b) It is envisioned that no special maintenance facilities are required for such manipulators. They are relatively robust under-utilized items of equipment that will be maintained in-situ in the glovebox. Hydraulic cylinders can be relatively simply removed and repaired or replaced.

c) Jaws and tools will be quickly changeable and will be located along the glovebox wall, close to where operations are carried out.

d) Manipulator hydraulic power units will be of 5-gallon reservoir capacity for the sorting areas and of 10-gallon reservoir capacity for the RWM areas and will generate up to 5,000 psi within the circuit.

3. **Drum De-lidding Station and Lid Fastener Station** are designed to perform several functions, namely:

- cutting of the drum clamp band to allow removal.
- removal of drum lid, including use of a lid punch device to remove a sticking lid.
- replacement of lid, following waste sorting, and fixing of lid onto drum.

While none of these operations utilizes prototype equipment, the specific uses, and combination together of these activities in two stations has involved relatively complex design consideration and is described as follows:

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a) The drum clamp band cutting operations will be undertaken using two slow-moving, reciprocating electric saw units (RT-07-101A&B for LLW and RT-07-301A&B for TRU) which are moved into position on the drum by pneumatic actuators. The two saw units are positioned 180° apart on the drum, and the remote manipulator arms are used to hold the two pieces of drum clamp band, which will result, and to place them on the sorting table. The saw units are lifted away from the drum, on completion of cutting operations, and are normally held against the sides of the glovebox where they can be accessed for Maintenance (e.g. to change saw blades).

b) The lid removal fixture (RT-07-102 for LLW and RT-07-302 for TRU) is lowered by a pneumatic actuator and has a permanent magnet built onto it to capture the lid. If the lid cannot be lifted from the drum utilizing the magnet along, then the hydraulic punch unit on the lid removal fixture is punched through the drum lid at a 45° angle. The arm can then lever the lid off through this punch, and lift the lid clear of the drum. The lid is then held captive on this fixture until the drum has been refilled with sorted waste and returned to this station for re-lidding. The lid is then replaced on the drum, and a small stroke pneumatic actuator is activated to push the lid off the permanent magnet. The drum can then be transferred by the transfer car to the drum lid fastener station.

c) The lid is then fixed in place using a pneumatically operated drum lid fastener (RT-07-103 or RT-07-303) which can access the top surface of the drum lid. The fastening will be fixed through the lid, and through the drum wall in several positions (probably four), in order to hold the lid in place for compaction. Development work has been proposed in this area to demonstrate that this method of fixing will be adequate to allow supercompaction of drums without lids coming off during the process, and this is noted in **Section 13.0** of this report.

4. <u>Compaction</u>: For the TRU waste processing line, the supercompactor is preceded by a girth compactor (CM-07-301) to reduce the diameter of the 55-gallon drum prior to supercompaction. This is so that the compacted "hockey puck" will fit into a 55-gallon drum for WIPP disposal. The details of the compactors are as follows:

a) The TRU drum is moved into the girth compactor (CM-07-301), and a typical type of compactor would have a series of eight open "fingers" which are lowered around the drum. Each of these fingers is locked into a tenon type slot, such that as a hydraulic ram is lowered down onto the top of the drum, the fingers are tapered inward at the base of the drum and locked around the drum. The tapered fingers are then drawn up the drum by a force of up to 1500 tons, and the drum diameter is reduced. Typically, the drum diameter will be reduced to approximately 20".

b) The supercompactors for both LLW and TRU waste (CM-07-102 and CM-07-302 respectively) will be very similar, except that the molds which surround the drum as it is compacted will be smaller in diameter for the TRU drums. The drum is pulled into the compactor, onto a platter, and the mold unit is lowered around the drum. The ram is then forced down inside the mold, and up to 2000 tons compaction force is applied. Typical resultant puck heights will vary, but are expected to average around 16".

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c) Supercompactors can typically achieve 15-20 drums per hour throughput rate. The duty of the supercompactors in WRAP 1 calls for up to 9 drums per day throughput. Routing of drums through the supercompactors gives throughput advantages, as it is much quicker to process a drum directly through compaction. Dose exposure savings and disposal cost savings also result from the use of the supercompactor. These issues are covered in more detail in the Compaction Optimization Study (see **Volume V**).

d) It is envisioned that both of the supercompactors and the girth compactor unit will be powered from one hydraulic power unit, HU-07-304. The hydraulic system will contain approximately 530 gallons of hydraulic pressure of 3000 psi. The system will have three basic circuits:

- the primary circuit, serving the hydraulic press ram, the mold, and providing the compaction force;
- the secondary circuit provides the force for operating the ancillary equipment including the loader and the unloader;
- the third circuit circulates oil through an oil-water heat exchanger.

e) The compaction presses will be of a 4-column vertically oriented design, with a single acting main cylinder built into the crown of the press. The crown will be directly mounted onto the four columns, forming a rigid construction capable of absorbing, internally, the compaction forces. The mold is guided by the four columns and is raised and lowered by two auxiliary cylinders located on either side of the press crown. This mold is fitted with hardened steel linings.

5. **Waste Coring System**: The compacted waste coring system consists of a high torque, low speed, drill unit, holding a hollow diamond drill, of approximately 1" inside diameter. This drill will be held in a quick-release collet chuck. The drill will be automatically advanced into the waste compact, to penetrate full depth. The drill is then automatically retracted, and an electrically powered "pick and place" robot arm removes the drill from the quick-release collet and moves it over to a small bagless transfer port which contains a drawer unit containing nine sample pots. A small punch is used to punch the sample from the drill, into one of the sample pots. The PCS will tie the identity of the sampled drum with the appropriate sample pot. Longer samples will be individually posted out into a bagless transfer container.

6. **Bagless Transfer Systems**: Four bagless transfer systems are to be utilized in WRAP 1, namely: the BNFL "one trip" drum; the 55-gallon Drath and Schrader system, the simple double lid system and the BNFL small purged port system. All systems operate on the "Standard" double lid principle. These systems are covered in detail in the Bagless Transfer Study (see **Volume V**) and can be described in summary as follows:

a) The BNFL "one trip" system utilizes a "paint can" type lid within the standard 55-gallon drum lid. This inner lid will be approximately 21-1/2" diameter and will be placed on a closed-cell soft neoprene seal on top of the drum lid (when the drum has been filled, and is ready for closure). Four hydraulically operated swaging fingers are activated within the lidding unit, which pull the inner lid down onto the seal, and fix it in place on the drum. The drum can then be removed from containment. This drum lidding system can only be used once, and will be utilized to finally close the TRU waste drum, ready for shipment to WIPP. The one-trip drum is to be sized specifically for WRAP 1 needs and is to be proof tested by WHC, as noted in **Section 13.0** of this report.

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b) The 55-gallon Drath and Schrader drum is a proprietary piece of equipment and will be used for transfers of materials between the processing enclosures and the RWM gloveboxes. The system is based on the "standard" double lid principle, and relies on several seals, between the drum and the glovebox, and between the port door and the drum lid.

c) The simple double lid system will be utilized for LLW only, and is used in two sizes. An 83-gallon drum size will be used in the LLW Process Line for load-out and a 55-gallon drum size unit will be used in the LLW RWM glovebox for load-out. In both cases, the principle of operation will remain the same in that the drum will be held in an opening in the glovebox and the port door to this opening will have a permanent magnet on its underside. The drum lid will hence be pulled onto a seal on the underside of the port door and both the port door and drum lid will be swung into the glovebox. On completion of filling of the drum, the lid will be replaced, using a pneumatic actuator to push the lid off the magnet and an operator will manually attach a clamp band.

d) The BNFL purged port system will be utilized as a 6.5" diameter unit, and although the double lid principle is used, it relies on a purged air gap around the port door and container lid, rather than on seals, and in this way, the "ring of contamination" is avoided.

7. **Aerosol Can Depressurization** utilizes a piece of proprietary equipment or similar which is used commercially for puncturing and draining aerosol cans. This equipment is called Evac Jr., and it can be incorporated within the RWM gloveboxes (XX-07-201 for LLW and XX-07-401 for TRU), and drains to tanks which are external to the gloveboxes (V-07-201 and V-07-401). The unit is powered hydraulically, and it merely crushes and hence ruptures the can in a sealed chamber. A vacuum can then be applied to the chamber to remove the bulk of the remaining contents of the crushed can, and the propellant gases and liquids from the cans are collected in the external tank. Operational controls will be applied to can depressurization operations, to ensure that non-compatible chemicals are not mixed within the receipt tank. Consideration will need to be given in Title II Design to the use of smaller, multiple collection vessels to facilitate control of mixing of non-compatibles.

7.3.11 Maintenance Provisions

1. Preliminary equipment design/specification has incorporated the requirements for maintenance in accordance with Section 11 of the Project Design Criteria.

In-Glovebox Equipment

2. All in-box equipment are configured for hands-on (via gloves) in-situ repair or disposal in accordance with the principals and details listed below. In relation to this listing **Table 7-1** identifies the principal design basis for maintenance that is applicable to individual major items of equipment contained in the gloveboxes.

a) **Minimized in-situ repair** requirements to reduce production down time and personnel radiation exposure. Generally, this means that equipment will be run until it fails then disposed of through the waste route in the process boxes, that is via 55 gallon drums.

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b) **Minimized routine maintenance** requirements to reduce production down time and personnel radiation exposure. This is achieved by using "sealed-for-life" bearings, obviating the use of elastomer gaiters or shrouds, obviating the use of gearboxes etc.

c) **Use of proven, low cost equipment** capable of many thousands of cycles before failure. For example the extensive use of suitably sized standard industrial pneumatic cylinders for moving/positioning drum lid removal/replacement devices, door systems etc. Note, pneumatic and hydraulic actuators typically have lives in excess of 10^5 cycles. Considering that the majority of in box equipment which is pneumatically or hydraulically actuated is only cycled on average 15 times daily, then it is expected that these devices will need replacing very infrequently.

d) **Maintainable equipment** located inside the process gloveboxes has, where possible, been configured in modules from readily available proprietary components. Modules have been sized, located and attached such that they can be accessed for in-situ repair or be easily removed from their working position for transfer to a position in the glovebox were they can be repaired or prepared for disposal. For example the Sorting Gloveboxes have a number of diverse equipment types in them with differing maintenance needs. Therefore, devices in these boxes have been designed such that they can be readily dismantled and moved to the sorting table where they can be repaired. This principal has also been followed in the Restricted Waste Management Gloveboxes. Modular equipment in these boxes will be transferred to either the sorting or sampling tables for repair.

e) Each glovebox is fitted with an electric hoist to assist in maintenance activities.

f) All equipment modules are fitted with lifting lugs to permit attachment to the in-box hoist.

g) All modules or replaceable components are attached using varying types of quick release devices which permit in most cases one handed manipulation. Extensive use has been made of such devices to prevent the need to use wrenches, screwdrivers or special tools in gloveboxes. For example the pneumatic cylinders that raise and lower the "One-Trip" Door Mechanism are located and attached using a combination of "T" slots and ball indent quick release pins, all pneumatic and hydraulic hoses are connected using quick release couplings etc.

h) Electrical switches and positioning devices are clamped in quick release "U" brackets to aid simple adjustment and replacement. Electrical devices are also fitted with the appropriate length of "flying" lead terminated in a plug for attachment to a mating socket installed in an electrical bulkhead.

i) Wiring in gloveboxes is looped through "pigtail" support and restraint attachments to give a tidy arrangement that aids tracing and replacement.

j) Post repair/replacement testing and validation is assumed to be via operability performance. The requisite controls (via the PCS) for carrying out these functions locally have been considered in the design of the control system. Typically the control system will be switchable between normal operational or automatic control and maintenance control to permit for example "push-to-run" control of motors, actuators etc.

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Table 7-1 Glovebox Equipment Design Basis for Maintenance

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
GB-07-101 LLW ENTRY GLOVEBOX					
CR-07-101A	1 Ton Chain Hoist w/Motor Driven Trolley. Remote Control, Speed: 16 fpm.	Festoon Motors Switches Bearings	Yes	Unit will be lowered to box floor for repair	No repairable components. Component disposal and replacement.
CV-07-101A,B	Capacity: 1,000 lbs., Gravity Roller Conveyor 7"BF x 4'-3"L, 3.5 Dia. x 6"L Rollers on 4" Centers	Roller/ Bearing Assy's	Yes	None	No repairable components. Component disposal and replacement.
CY-07-101	Capacity: 1,000 lbs., Electric Rodless Cylinder Stroke: 5'-6", Servo Motor Drive	Yes	-	None	Unit disposal and replacement. Vendor advises unit good for 10^5 cycles; gives min 20yr life.
DH-07-101	Capacity; 1,000 lbs., 55 Gal. Drums Spring Actuated, Pneumatic release	Cylinder Springs Bushes Switches	Yes	None	No repairable components. Component disposal and replacement.
DO-07-101	27"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	Cylinder Bushes Switches	Yes	None	No repairable components. Component disposal and replacement.
DO-07-102	27"dia Port, Electric powered sliding door	Actuator Guides Bushes Switches	Yes	None	No repairable components. Component disposal and replacement.
GB-07-102 LLW SORTING GLOVEBOX					
CR-07-101B,C	1 Ton Chain Hoist w/Motor Driven Trolley. Remote Control, Speed: 16 fpm.	Festoon Motors Switches Bearings	Yes	Unit will be lowered to sorting table for repair	No repairable components. Component disposal and replacement.
EM-07-101	60 lbs. Cap. Twin Arm Hydraulic Manipulator Overhead Carriage mounted w/Electric Drive (Unit Operated by: HU-07-201)	Yes	Yes	Arms will be lowered to sorting table for repair	Component disposal and replacement. Vendor indicates arm actuators need replacing yearly.
U-07-101	40 Gal. Reservoir, Hyd. Pump @ 2,300 psi (Unit Serves: DH-07-102)	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.

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Table 7-1 Glovebox Equipment Design Basis for Maintenance (continued)

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
ST-07-101	Capacity; 1,000 lbs., Electric powered tilting Sorting Table.	Yes	Yes	None	Component disposal and replacement. Uses actuators with min 10^5 cycle life and "sealed- for-life" bearings.
TC-07-101	Capacity; 1,000 lbs., Pneumatic powered, Rail guided	Yes	Yes	None	Component disposal and replacement. Uses Perastaltic drive with min 10^4 cycle life and "sealed- for-life" wheel bearings.
RT-07-101A,B	(2) Electric Saws, Pneumatically Positioned	Yes	Yes	Saws/positioners are easily detached for transfer to sorting table for repair. Saw blades changed in place.	Saw blades need frequent replacement, therefore quick attachment method used. Saw units and positioners should last many years at WRAP usage. Positioning actuators good for min 10^5 cycle life.
DH-07-102	Capacity; 1,000 lbs., 55 Gal. Drums Hydraulic Drum Dumper, 270 deg. rotation	No	Yes	Unit actuated external to glovebox to permit easy seal/bearing change and limit shock loading to glovebox fabric.	Hydraulic cylinder seals can be replaced in "Warm Maint" Room. Thru' wall drive uses cartridge seals which are replaced by insertion of new seal. Worn seal cartridge disposed of.
HU-07-102	2 Gal. Reservoir, Hyd. Pump @ 10,000 psi (Unit Serves: RT-07-102)	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.
RT-07-102	Hydraulic Punch, Pneumatically Raised/Lowered (Unit Operated by HU-07-102)	Yes	Yes	Drum lid removal unit is easily detached for transfer to the sorting table for repair.	No repairable components. Component disposal and replacement. Vendor indicates hydraulic cylinder will last 3 years at WRAP usage. Positioning actuator good for min 10^5 cycle life.
HU-07-103	6 Gal. Reservoir, Hyd. Pump @ 5,000 psi 2'W x 2'H x 3'L (Unit Serves: EM-07-101)	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.

Table 7-1 Glovebox Equipment Design Basis for Maintenance (continued)

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
RT-07-103	Pneumatic Nail Gun, Pneumatically Positioned	Yes	Yes	Drum lidding unit is easily detached for transfer to the sorting table for repair. Nails can be replenished with unit in operating position.	No repairable components. Component disposal and replacement. Vendor indicates nail gun will last 5 years at WRAP usage. Positioning actuator good for min 10^5 cycle life.
DO-07-104A	6.5"dia Port, Pneumatic powered Bagless Transfer System	No	Yes	Door seals will need changing approx every 5 yrs. This will be a greenhouse operation.	Pneumatic actuators have no repairable components and will be run until they fail. Actuators good for min 10^5 cycle life.
DO-07-105	24"dia Port, Pneumatic powered swing door Double Lidded System	No	Yes	Door seals will need changing approx every 5 yrs. This will be a greenhouse operation.	Pneumatic actuators have no repairable components and will be run until they fail. Actuators good for min 10^5 cycle life.
GB-07-103 LLW COMPACTOR GLOVEBOX					
CM-07-102	1,500-2,000 ton Hyd. Powered compactor, 55 gal. Drum capacity (Powered by HU-07-304)	No	Yes	Maintenance of the compactor will be a major endeavour that will require considerable greenhouse operations. However, the compactor is designed for minimal maint and will only require this level of maint perhaps once in the life of the plant.	"Frequently" renewable components, such as switches etc. can be accessed via gloves for adjustment, replacement and disposal. Secondary hydraulic cylinders ie. those that raise and lower the mold can be readily detached via gloves and "bagged-off" the containment for disposal. These cylinders may need to be changed twice in the life of the plant.
HU 07-304	Supercompactor Hydraulic Power Unit (Unit Serves: CM-07-102,301,302)	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.
GB-07-104 LLW EXIT GLOVEBOX					
XX-07-101	Pick & Place Robot 3 lb Payload	Yes	Yes	None	Simple electrically actuated unit. No repairable components. Component disposal and replacement.

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Table 7-1 Glovebox Equipment Design Basis for Maintenance (continued)

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
DO-07-104B	6.5"dia Port, Pneumatic powered Bagless Transfer System	No	Yes	Door seals will need changing approx every 5 yrs. This will be a greenhouse operation.	Pneumatic actuators have no repairable components and will be run until they fail. Actuators good for min 10^5 cycle life.
RT-07-104	Capacity: 1.125" dia. x 4"L, Electric core drilling unit	Yes	Yes	None	No repairable components. Component disposal and replacement.
CR-07-101D	1 Ton Chain Hoist w/Motor Driven Trolley. Remote Control, Speed: 16 fpm.	Festoon Motors Switches Bearings	Yes	Unit will be lowered to box floor for repair	No repairable components. Component disposal and replacement.
DH-07-103	Capacity; 1,000 lbs., 55 Gal. Drums Hydraulic Drum Clamp	Yes	Yes	None	No repairable components. Component disposal and replacement.
DO-07-106	27"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	Cylinder Bushes Switches	Yes	None	No repairable components. Component disposal and replacement.
GB-07-301 TRU ENTRY GLOVEBOX					
CR-07-301A	1 Ton Chain Hoist w/Motor Driven Trolley. Remote Control, Speed: 16 fpm.	Festoon Motors Switches Bearings	Yes	Unit will be lowered to box floor for repair	No repairable components. Component disposal and replacement.
CV-07-301A,B	Capacity: 1,000 lbs., Gravity Roller Conveyor 7"BF x 4'-3"L, 3.5 Dia. x 6"L Rollers on 4" Centers,	Roller/ Bearing Assy's	Yes	None	No repairable components. Component disposal and replacement.
CY-07-301	Capacity: 1,000 lbs., Electric Rodless Cylinder Stroke: 5'-6", Servo Motor Drive	Yes	-	None	Unit disposal and replacement. Vendor advises unit good for 10^5 cycles; gives min 20yr life.
DH-07-301	Capacity; 1,000 lbs., 55 Gal. Drums Spring Actuated, Pneumatic release	Cylinder Springs Bushes Switches	Yes	None	No repairable components. Component disposal and replacement.
DH-07-302A ,B	Capacity; 1,000 lbs., 55 Gal. Drum Grab Hydraulic Actuation.	Yes	Yes	None	No repairable components. Component disposal and replacement.

Table 7-1 Glovebox Equipment Design Basis for Maintenance (continued)

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
DO-07-301	27"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	Cylinder Bushes Switches	Yes	None	No repairable components. Component disposal and replacement.
DO-07-302	Sphincter Entry System With Electric powered sliding door	No	Yes	The sphincter seal arrangement will need to be replaced at least once a year. Special provisions for changing the seal have been incorporated into the units design.	The sliding door has no repairable components. Component disposal and replacement is the philosophy for this sub-unit.
HU-07-301	40 Gal. Reservoir, Hyd. Pump @ 2,300 psi	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.
GB-07-302 TRU SORTING GLOVEBOX					
CR-07-301B,C	1 Ton Chain Hoist w/Motor Driven Trolley. Remote Control, Speed: 16 fpm.	Festoon Motors Switches Bearings	Yes	Unit will be lowered to sorting table for repair	No repairable components. Component disposal and replacement.
EM-07-301	60 lbs. Cap. Twin Arm Hydraulic Manipulator Overhead Carriage mounted w/Electric Drive (Unit Operated by: HU-07-201)	Yes	Yes	Arms will be lowered to sorting table for repair	Component disposal and replacement. Vendor indicates arm actuators need replacing yearly.
HU-07-301	40 Gal. Reservoir, Hyd. Pump @ 2,300 psi (Unit Serves: DH-07-102)	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.
ST-07-301	Capacity; 1,000 lbs., Electric powered tilting Sorting Table.	Yes	Yes	None	Component disposal and replacement. Uses actuators with min 10^5 cycle life and "sealed- for-life" bearings.
TC-07-301	Capacity; 1,000 lbs., Pneumatic powered, Rail guided	Yes	Yes	None	Component disposal and replacement. Uses Peristaltic drive with min 10^4 cycle life and "sealed- for-life" wheel bearings.

Table 7-1 Glovebox Equipment Design Basis for Maintenance (continued)

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
RT-07-301A,B	(2) Electric Saws, Pneumatically Positioned	Yes	Yes	Saws/positioners are easily detached for transfer to sorting table for repair. Saw blades changed in place.	Saw blades need frequent replacement, therefore quick attachment method used. Saw units and positioners should last many years at WRAP usage. Positioning actuators good for min 10^5 cycle life.
DH-07-302	Capacity; 1,000 lbs., 55 Gal. Drums Hydraulic Drum Dumper, 270 deg. rotation	No	Yes	Unit actuated external to glovebox to permit easy seal/bearing change and limit shock loading to glovebox fabric.	Hydraulic cylinder seals can be replaced in "Warm Maint" Room. Thru' wall drive uses cartridge seals which are replaced by insertion of new seal. Worn seal cartridge disposed of.
HU-07-302	2 Gal. Reservoir, Hyd. Pump @ 10,000 psi (Unit Serves: RT-07-102)	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.
RT-07-302	Hydraulic Punch, Pneumatically Raised/Lowered (Unit Operated by HU-07-102)	Yes	Yes	Drum lid removal unit is easily detached for transfer to the sorting table for repair.	No repairable components. Component disposal and replacement. Vendor indicates hydraulic cylinder will last 3 years at WRAP usage. Positioning actuator good for min 10^5 cycle life.
HU-07-303	6 Gal. Reservoir, Hyd. Pump @ 5,000 psi 2'W x 2'H x 3'L (Unit Serves: EM-07-101)	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.
RT-07-303	Pneumatic Nail Gun, Pneumatically Positioned	Yes	Yes	Drum lidding unit is easily detached for transfer to the sorting table for repair. Nails can be replenished with unit in operating position.	No repairable components. Component disposal and replacement. Vendor indicates nail gun will last 5 years at WRAP usage. Positioning actuator good for min 10^5 cycle life.
DO-07-303	Pneumatically Actuated X-Ray Shield Door	Yes	Yes	None	No repairable components. Component disposal and replacement.

Table 7-1 Glovebox Equipment Design Basis for Maintenance (continued)

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
DO-07-304A	6.5"dia Port, Pneumatic powered Bagless Transfer System	No	Yes	Door seals will need changing approx every 5 yrs. This will be a greenhouse operation.	Pneumatic actuators have no repairable components and will be run until they fail. Actuators good for min 10^5 cycle life.
DO-07-305	24"dia Port, Pneumatic Powered Swing Door Double Lidded System	No	Yes	Door seals will need changing approx every 5 yrs. This will be a greenhouse operation.	Pneumatic actuators have no repairable components and will be run until they fail. Actuators good for min 10^5 cycle life.
ND-07-301	X-Ray Machine with Camera and Monitor	No	Yes	Electrical and electronic components can be removed for repair in the "Warm Maint" Room.	Fault finding will be carried out local to the machine. Components that cannot be repaired will be disposed of.
XX-07-302	Pneumatically Actuated Packet Tray	Yes	Yes	None	No repairable components. Component disposal and replacement.
GB-07-303 TRU GIRTH COMPACTOR GLOVEBOX					
CM-07-301	1,500-2,000 ton Hyd. Powered Girth Compactor, 55 gal. Drum capacity (Powered by HU-07-304)	No	Yes	Maintenance of the compactor will be a major endeavour that will require considerable greenhouse operations. However, the compactor is designed for minimal maint and will only require this level of maint perhaps once in the life of the plant.	"Frequently" renewable components, such as switches etc. can be accessed via gloves for adjustment, replacement and disposal. Secondary hydraulic cylinders ie. those that raise and lower the mold can be readily detached via gloves and "bagged-off" the containment for disposal. These cylinders may need to be changed twice in the life of the plant.
HU-07-304	Supercompactor Hydraulic Power Unit (Unit Serves: CM-07-102,301,302)	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.

Table 7-1 Glovebox Equipment Design Basis for Maintenance (continued)

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
GB-07-304 TRU SUPERCOMPACTOR GLOVEBOX					
CM-07-302	1,500-2,000 ton Hyd. Powered Supercompactor, 55 gal. Drum capacity (Powered by HU-07-304)	No	Yes	Maintenance of the compactor will be a major endeavour that will require considerable greenhouse operations. However, the compactor is designed for minimal maint and will only require this level of maint perhaps once in the life of the plant.	"Frequently" renewable components, such as switches etc. can be accessed via gloves for adjustment, replacement and disposal. Secondary hydraulic cylinders ie. those that raise and lower the mold can be readily detached via gloves and "bagged-off" the containment for disposal. These cylinders may need to be changed twice in the life of the plant.
HU-07-304	Supercompactor Hydraulic Power Unit (Unit Serves: CM-07-102,301,302)	No	Yes	Valves, pumps etc can be repaired in "Warm Maint" Room.	Note, powerpack located external to Glovebox.
GB-07-305 TRU EXIT GLOVEBOX					
XX-07-301	Pick & Place Robot 3 lb Payload	Yes	Yes	None	Simple electrically actuated unit. No repairable components. Component disposal and replacement.
DO-07-304B	6.5"dia Port, Pneumatic powered Bagless Transfer System	No	Yes	Door seals will need changing approx every 5 yrs. This will be a greenhouse operation.	Pneumatic actuators have no repairable components and will be run until they fail. Actuators good for min 10^5 cycle life.
RT-07-304	Capacity: 1.125" dia. x 4"L, Electric core drilling unit	Yes	Yes	None	No repairable components. Component disposal and replacement.
CR-07-301D	1 Ton Chain Hoist w/Motor Driven Trolley. Remote Control, Speed: 16 fpm.	Festoon Motors Switches Bearings	Yes	Unit will be lowered to box floor for repair	No repairable components. Component disposal and replacement.
DH-07-303	Capacity; 1,000 lbs., 55 Gal. Drums Hydraulic Drum Clamp	Yes	Yes	None	No repairable components. Component disposal and replacement.

Table 7-1 Glovebox Equipment Design Basis for Maintenance (continued)

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
DO-07-306	22" Dia. Port, Pneumatically Powered Sliding Door Double Lidded System Permanent Magnet Lid Handling System	Cylinders Bushes Seals Switches	Yes	None	No repairable components. Component disposal and replacement.
GB-07-201 AND GB-07-401 LLW & TRU RESTRICTED WASTE MANAGEMENT GLOVEBOXES					
CR-07-201 CR-07-401	1/2 Ton Chain Hoist w/Motor Driven Trolley. Remote control, Speed: 16 fpm	Festoon Motors Switches Bearings	Yes	Unit will be lowered to glovebox floor for repair	No repairable components. Component disposal and replacement.
DO-07-201 DO-07-401	24"dia Port, Pneumatic powered swing door Double Lidded System	No	Yes	Door seals will need changing approx every 5 yrs . This will be a greenhouse operation.	Pneumatic actuators have no repairable components and will be run until they fail. Actuators are good for min 10^5 cycle life.
EM-07-201 EM-07-401	60 lbs. Cap. Twin Arm Hydraulic Manipulator Overhead Carriage mounted w/Electric Drive (Unit Operated by: HU-07-201)	Yes	Yes	Arms will be lowered to box floor for repair.	Component disposal and replacement. Vendor indicates arm actuators need replacing yearly.
HU-07-201 HU-07-401	12 Gal. Reservoir, Hyd. Pump @ 5,000 psi (Units Serve: EM-07-201&401, respectively)	No	Yes	Valves, pumps etc. can be repaired in the "Warm Maint" Room.	Note, powerpack located external to Glovebox.
SC-07-201 SC-07-401	Capacity: 0-60 lbs. Dial indicator	Yes	Yes	None	No repairable components. Component disposal and replacement.
XX-07-201 XX-07-401	Hydraulic Powered, Aerosol Can Compaction, Vacuum pump	Yes	Yes	None	No repairable components. Component disposal and replacement.
DO-07-202	24"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	Actuator Bushes Switches	Yes	None	No repairable components. Component disposal and replacement.
DO-07-402	22" Dia. Port, Pneumatic Powered Sliding Door Double Lidded System	Actuator Bushes Switches	Yes	None	No repairable components. Component disposal and replacement.
XX-07-202 XX-07-402	Double Jar Roller, Electric powered	Yes	Yes	None	No repairable components. Component disposal and replacement.

Table 7-1 Glovebox Equipment Design Basis for Maintenance (continued)

PLANT ITEM NUMBER	MECHANICAL DESCRIPTION	DESIGN BASIS FOR MAINTENANCE			
		RUN TO FAIL	IN-SITU MAINTENANCE	SPECIAL MAINTENANCE PROVISION	REMARKS
DO-07-203	27"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	Actuator Bushes Switches	Yes	None	No repairable components. Component disposal and replacement.
DO-07-204 DO-07-404	6.5"dia Port, Pneumatic powered Bagless Transfer System	No	Yes	Door seals will need changing approx every 5 yrs. This will be a greenhouse operation.	Pneumatic actuators have no repairable components and will be run until they fail. Actuators good for min 10^5 cycle life.
DO-07-205 DO-07-405	Sphincter Port (consumables entry)	Yes	Yes	None	New seal cartridge is inserted from outside the glovebox. No repairable components. Component disposal and replacement.

Out of Glovebox Equipment

3. Equipment located external to the process gloveboxes are generally proprietary equipment requiring the usual level of industrial hands-on, in-situ repair or component replacement (e.g., conveyor roller drive chain replacement). Maintenance considerations include:

a) To assist in reducing personnel radiation exposure when undertaking equipment repair in the process area, a maintenance room has been provided (Room 108, Drawing H-2-88062). This room measuring 10 feet x 18 feet will allow small to medium sized components to be removed from the immediate vicinity of the gloveboxes for repair. The room has been sized to accommodate three workbenches each measuring 3 feet x 6 feet and is provided with a full range of services; power, compressed air etc.

b) It is assumed that each bench will be dedicated for use by either mechanical, electrical or instrument maintenance personnel. The room also has adequate space provision for tool storage and a small supply of consumables (eg. nuts/bolts, fuses, electrical switches etc.).

c) Typical equipment that is envisaged will be repaired in this room are pneumatic and hydraulic valves, electrical components from the AGV, electronic components from the x-ray machine etc.

7.3.12 Outline Specifications

1. Following is a listing of the mechanical equipment outline specifications and mechanical equipment for the Title I design. The outline specifications are included in Volume III under the Waste Process tab.

CSI No.	Title
11172	Waste Compactors
13100	General Process Equipment
13110	Glovebox Enclosures
14000	Conveying Systems

Tag No.	Equipment Name
CM-07-102	LLW Waste Super-Compactor
CM-07-301	Girth-Compactor
CM-07-302	Super-Compactor
CY-07-101	Drum Pusher Cylinder
CY-07-301	Drum Pusher Cylinder
DH-07-101	Drum Lifter
DH-07-102	Drum Tipper
DH-07-103	Compacted Drum Lifter
DH-07-301	Drum Lifter
DH-07-302	Drum Grab
DH-07-303	Drum Tipper
DH-07-304	Compacted Drum Lifter
DO-07-101	LLW Drum Entry Port
DO-07-102	LLW Drum Transfer Port
DO-07-104	Sample Transfer/Purge Port

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Tag No.	Equipment Name
DO-07-105	RW LLW Drum Exit Port
DO-07-106	LLW Drum Exit Port
DO-07-201	RWM LLW Drum Entry/Exit Port
DO-07-202	RWM LLW Drum Exit Port
DO-07-203	RWM Drum Exit Port
DO-07-204	Sample Transfer/Purge Port
DO-07-205	Consumable Entry Port
DO-07-301	TRU Drum Entry Port
DO-07-302	TRU Drum Transfer Port
DO-07-303	X-RAY Door
DO-07-304	Sample Transfer/Purge Port
DO-07-305	RWM TRU Drum Exit Port
DO-07-306	TRU Drum Exit Port
DO-07-401	RWM Drum Entry/Exit Port
DO-07-402	RWM Drum Exit Port
DO-07-403	RWM Drum Exit Port
DO-07-404	Sample Transfer Port
DO-07-405	Consumable Entry Port
EM-07-101	Waste Sorting Manipulator
EM-07-201	Waste Sorting Manipulator
EM-07-301	Waste Sorting Manipulator
EM-07-401	Waste Sorting Manipulator
GB-07-101	LLW Entry Glovebox
GB-07-102	LLW Sorting Glovebox
GB-07-104	LLW Super-Compactor Glovebox
GB-07-105	LLW Exit Glovebox
GB-07-201	Restricted Waste Glovebox
GB-07-301	TRU Entry Glovebox
GB-07-302	TRU Sorting Glovebox
GB-07-303	TRU Girth-Compactor Glovebox
GB-07-304	TRU Super-Compactor Glovebox
GB-07-305	TRU Exit Glovebox
GB-07-401	Restricted Waste Glovebox
HU-07-101	Drum Handler HPU
HU-07-102	Drum Lid Removal HPU
HU-07-103	Manipulator HPU
HU-07-201	Manipulator HPU
HU-07-301	Drum Handler HPU
HU-07-302	Drum Fixture HPU
HU-07-303	Manipulator HPU
HU-07-304	Compactor HPU
ND-07-301	X-Ray Machine
RT-07-101	Drum Clamp Band Saw
RT-07-102	Lid Removal Fixture
RT-07-103	Drum Lid Fastener
RT-07-104	Drum Puck Core Sampler
RT-07-301	Drum Clamp Band Saw
RT-07-302	Lid Removal Fixture
RT-07-303	Drum Lid Fastener
RT-07-304	Drum Puck Core Sampler

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Tag No.	Equipment Name
SC-07-201	Weigh Scale
SC-07-401	Weight Scale
ST-07-101	Waste Sorting Table
ST-07-301	Waste Sorting Table
TC-07-101	Drum Transfer Car
TC-07-301	Drum Transfer CAR
V-07-201	Primary Collection Receiver
V-07-401	Primary Collection Receiver
XX-07-101	Core Sample Robot
XX-07-201	Aerosol Can Disposal Unit
XX-07-202	Jar Mill
XX-07-301	Core Sample Robot
XX-07-302	X-Ray Packet Tray
XX-07-401	Aerosol Can Disposal Unit
XX-07-402	Jar Mill
CR-07-101	Glovebox Monorail Hoist
CR-07-201	Glovebox Monorail Hoist
CR-07-301	Glovebox Monorail Hoist
CR-07-401	Glovebox Monorail Hoist
CV-07-101	Drum Transfer Conveyor
CV-07-301	Drum Transfer Conveyor

7.4 Internal Transportation

7.4.1 Design Requirements

1. The internal transportation equipment must be able to manage the material flows as estimated in the FDC revision 1 without creating a bottleneck between workstations. The FDC estimated the material throughput of the facility to be 6,825 drums and 70 boxes annually.

2. The internal transportation system is to incorporate an automated design for transferring drums and boxes from one area to another in order to comply with ALARA requirements and achieve the facility throughput criteria.

3. Separate internal transportation equipment is to be used in both the NDA/NDE and process area to reduce the possibility of tracking contamination in either area.

4. The equipment must be selected to be able to handle the weight requirements of 1,000 pounds for drums and 7,000 pounds for boxes.

5. The equipment must be able to interface with the future WRAP Modules and the W-112 Storage Facility.

6. Lag storage is to be provided within the process areas to accumulate drums. This storage is provided within the process areas to allow for temporary interruptions in the material flow.

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7.4.2 Reference Drawings

Drawing Number	Drawing Title
H-2-87717	Mechanical Flow Diagram Internal Transport NDA/NDE
H-2-87718	Mechanical Flow Diagram Internal Transport Airlocks
H-2-87719	Mechanical Flow Diagram Internal Transport Waste Processing
H-2-87720	NDA/NDE & Process General Arrangement - Plan
H-2-87721	Internal Transport General Arrangement - Section
H-2-87722	Internal Transport General Arrangement - Section

7.4.3 Purpose and Scope

1. The purpose of the Title I design is to provide a totally integrated, automated integral handling system that provides for efficient transfer of drums and boxes throughout the facility.

2. The scope of the Title I design is to determine the most appropriate means for handling material between areas and select equipment that provides safe automated transport of waste between Shipping & Receiving, NDA/NDE and Waste Processing areas.

7.4.4 Feeds and Throughput

1. The NDA/NDE area receives material from the Shipping & Receiving and the Process areas. Shipping & Receiving transfers 6,825 drums annually to the NDA/NDE area. The Process area processes and transfers back to the NDA/NDE area 1,807 drums annually.

2. The number of drums transferred from NDA/NDE through the airlock to the Process area was estimated to be 3,045. The number of drums returning from the Process area to NDA/NDE is 1,807.

3. The TRU and LLW Process Enclosures each receive 1,522 drums annually. The process enclosures transfer 117 drums to the LLW Restricted Waste Enclosure and 109 drums to the TRU Restricted Waste Enclosure annually.

7.4.5 Process Descriptions

1. The internal transportation system services the NDE/NDA area, airlocks, and the waste process area. One Automated Guided Vehicle (AGV) is provided in the NDE/NDA area and one AGV in the waste process area.

2. The following paragraphs describe each area the internal transportation system services.

<u>Internal Transport - NDA/NDE</u>

1. The internal material transport system for drums in the NDA/NDE area consists of one AGV, GV-09-101, transfer conveyors at each NDE and NDA station, CV-09-101A through CV-09-101F, a drum carousel, CV-09-102, for the buffer storage area between NDA/NDE and process areas. The internal transport system for drums is automated and the AGV and the NDE/NDA equipment are controlled by a central computer. The internal transport system for boxes consists of a forklift truck, FT-05-101, and a transfer conveyor, CV-09-105, for boxes at the NDE station. The internal transport system for the NDA/NDE area is shown on the Mechanical Flow Diagram H-2-87717.

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2. The Automated Guided Vehicle (AGV) brings a drum from Shipping & Receiving into the NDA/NDE area. The AGV proceeds to the first available NDE station for retrieved and newly generated waste. At the station the AGV stops at the transfer conveyor and the AGV signal the transfer conveyor of its presence. Once the interface is established, if a drum is finished in the station, the transfer conveyor transfers the drum to the AGV. The AGV moves one position so that it can begin transferring the first drum to the transfer conveyor which transfers the drum into the station. The AGV takes the newly loaded drum to the next station or it moves to the a station that is requesting its services.

3. The AGV transfers the waste drums from NDE to PAN to GEA. After the drums have been assayed, the AGV will transfer the waste drums that require processing to the drum carousel or directly to the process airlock. The certified waste is transferred by the AGV to the Shipping & Receiving area. The Process area can request through the computer that the AGV pick up a pre-selected drum at the drum carousel and transfer it to the process airlock. Waste drums returning from the Process area transferred to the buffer storage until they can be reprocessed through the NDA/NDE area.

4. Boxes are transferred by the forklift truck, FT-05-101, from Shipping & Receiving and to the NDE transfer conveyor/scale, CV-09-105. The box is weighed on the conveyor by the scale which is an integral part of the conveyor. The box proceeds into the NDE station for examination. After NDE is complete, the forklift truck picks up the box and transfers it to the box NDA station. Once NDA is complete the box is transferred by the forklift back to Shipping & Receiving.

<u>Internal Transport - Airlocks</u>

1. The AGV, GV-09-101, transfers the waste drum from the NDA/NDE area to the transfer, CV-09-103B, for processing in the Process enclosures. The transfer conveyor moves the drum to its opposite end. The sensing device signals the airlock door to open and the retractable gravity conveyor is raised into position. At this point the drum is transferred to the airlock conveyor, CV-09-104B. Once the drum is on the airlock conveyor, the airlock door is signaled to close. The other door opens when the first door has closed. The drum is then moved to the transfer conveyor, CV-09-201B, in the Process area. The Process area AGV, GV-09-201, is signaled to pickup the drum at the conveyor. The drum is transferred to the AGV which takes the drum to the appropriate process enclosure.

2. After a drum has been processed, the Process area AGV transfers the drum to the transfer conveyor, CV-09-201A. The conveyor transfers the drum onto the airlock conveyor, CV-09-104A. After the airlock doors have completed closing and opening, the airlock conveyor moves the drum to the NDA/NDE transfer conveyor, CV-09-103A. The NDA/NDE area AGV is called and the conveyor transfers the drum to the AGV. The AGV returns the drum to buffer storage so that the drum can be processed into a NDA/NDE workstation.

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Internal Transport - Waste Processing

1. The Process AGV, GV-09-201, picks up a drum at the transfer conveyor, CV-09-201B and delivers the drum to either the TRU enclosure or the LLW enclosure drum lift table, LT-09-201G or LT-09-201K. The AGV transfers the drum to the lift table and proceeds onto its next requested destination. The lift table moves the drum to its opposite end, into position for raising the drum up into the waste entry portion of the waste processing enclosure. Once the inside drum has been removed from the overpack drum, the lift table is lowered and the drum is transferred to the other end of the lift table. The AGV picks up the empty overpack drum and takes it to either the exit end of the enclosure for load out or to the airlock conveyor for removal from the facility for use at the retrieval.

2. In the process enclosure, load-out drums are reloaded with compacted drums and the drums are removed from the enclosure by the lift table, LT-09-201J or LT-09-201M, and transferred to the AGV. The AGV transports the drum to the airlock conveyors for certification in the NDA/NDE area. Non-compliant items are removed from the process enclosure at lift table LT-09-201H or LT-09-201L and transferred to Restricted Waste management by the AGV.

3. The transfers between the enclosures and restricted waste management are accomplished by the AGV, the processing enclosure transfer lift tables, LT-09-201H or LT-09-201L, and the restricted waste management lift tables, LT-09-201C or LT-09-201F. The AGV picks up a special 55 gallon drum at the processing enclosure lift table and transfers it to the LLW or TRU Restricted Waste Management Enclosure lift table. After the processing is completed in the restricted waste enclosure, the AGV pick up drums at lift table LT-09-201B or LT-09-201E, for transferring to the processing enclosure, or lift table LT-09-201A or LT-09-201D, for transferring to the airlock conveyor, CV-09-201A.

4. The AGV transfers special 55 gallon drums containing material awaiting sampling results from lift table, LT-09-201C or LT-09-201F, to the restricted waste drum storage carousel, CV-09-202. After the sampling results are received, depending upon the results, drums are returned to the to the restricted waste enclosure or to the airlock conveyor for certification in the NDA/NDE area.

7.4.6 Safety Instrumentation and Control

1. The internal transport system is an automated system that is controlled by the PMS. The control of material in the NDA/NDE area is accomplished by the PMS. The PMS controls the transfers between the AGV and the transfer conveyors, transfers between the AGV and lift tables, the conveyors and doors at the airlocks, tracks the movement of drums and directs the movement of the AGV.

2. The control interface between an AGV and a conveyor is performed by a photo-eye control device mounted on the conveyor. The device senses the presence of the AGV, to initiate a handshake and start the conveyors. The transfers between the AGV and lift tables occur like the conveyors. The PMS system tracks drums by the bar code label on each drum. The PMS records the movement of each drum and determines the path of the drum based on the results from the previous station. The PMS directs the movement of the AGV based on the path previously established for the drums.

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3. The internal transport system has a number of safety features built into its automatic system. The AGVs are equipped with a detection system including a tactile bumper and several sensors to prevent contact with any object or person. Every conveyor is equipped with a rope switch which stops the live rollers when it is pulled. The airlock doors are interlocked so that only one door can be opened at one time to prevent a loss of containment.

7.4.7 Services

1. The internal transport equipment requires electrical power and plant utility air. Electrical power is required for all the 3/4 and 1½ hp motors, and 3.4 kW for the AGV battery recharger. Plant utility air is required for the air actuators at the airlock doors.

7.4.8 Design Features

1. The following paragraphs provide a summary description of the major equipment associated with the internal transportation system. Refer to Drawings H-2-87717, H-2-87718, and H-2-87719 for location of the equipment in the process configuration.

2. **NDA/NDE Drum Transfer Conveyor CV-09-101A through F (H-2-87717):** Chain driven live roller conveyor sections are used to convey drums off of the AGV. The conveyor has a reversible drive to allow both loading and unloading of drums off of and onto the AGV. The conveyor and AGV interface with each other via a photo-eye control that is mounted on the conveyor to sense the presence of the AGV. When the AGV is present a handshake will occur which starts the conveyor. The communication link between the conveyor and AGV will be controlled by the PMS. The overall length of the conveyor is 36 inches. The overall width of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches and a center to center spacing of 4½ inches. The rollers are driven by a 3/4 hp motor. The conveyor has a speed of 35 feet per minute.

3. **Drum Storage Carousel CV-09-102 (H-2-87717):** An accumulating roller conveyor system is used for the storage of 55 gallon drums weighing up to 1,000 pounds. The carousel system includes two sections with a length of 30 feet, one 10 foot section and chain operated pop-up 90° transfer sections. The 10 foot section has a bi-directional drive to allow both loading and unloading of drums off of and onto the AGV. The conveyor and AGV interface via a photo-eye control that is mounted on the conveyor to sense the presence of the AGV and a handshake will occur which starts the conveyor. The communication link between the conveyors will be controlled by the PMS. Drum locations are recorded and stored in the PMS. Tracking and retrieval of drums is assured by the use of bar code label reading equipment located at the storage entry/exit position. The two 30 foot sections are divided into 12 each 30 inches long accumulation zones. The overall width of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches and a center to center spacing of 4½ inches. The rollers are driven by a 1½ hp motor. The conveyor has a speed of 30 feet per minute.

4. **Box Conveyor/Scale CV-09-105 (H-2-87717):** Chain driven live roller conveyor mounted on a floor scale to convey boxes into the box NDE equipment. The conveyor is bi-directional so that the box can be moved into and out of the box NDE. The overall length of the conveyor is 10 feet and has a width of 67 inches between the frames. The rollers have a diameter of 3½ inches and the spacing between the rollers is 6 inches. The rollers are driven by a 3/4 hp motor. The conveyor has a speed of 15 feet per minute. The scale range is 6,000 to 8,000 lbs. and is equipped with a digital instrument controller and shows the weight of the box on its LED display.

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5. **Drum Transfer Conveyor CV-09-103A,B (H-2-87718):** Chain driven live roller conveyor sections used to convey drums off of and onto the AGV. The conveyor is equipped with reversible drives to provide redundancy to support facility maintenance operations. The conveyor and AGV interface via a photo-eye control that is mounted on the conveyor to sense the presence of the AGV and a handshake will occur which starts the conveyor. Other sensing units will be attached to the conveyor at the airlock doors so that the conveyor can sense the presence of the airlock door. The communication link between the conveyor and AGV will be controlled by the PMS. Pneumatically retractable gravity rollers will be included and activate when drums are conveying through the doorway. The overall length of the powered conveyor is 60 inches. The overall width of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches and a center to center spacing of 4½ inches. The rollers are driven by a 3/4 hp motor. The conveyor has a speed of 30 feet per minute. The gravity conveyor has a length of 26 inches.

6. **Drum Airlock Conveyor CV-09-104A,B (H-2-87718):** Chain driven live roller conveyor sections used to convey drums off of and onto the AGV. The conveyor is equipped with reversible drives to provide redundancy to support facility maintenance operations. The conveyor and AGV interface via a photo-eye control that is mounted on the conveyor to sense the presence of the AGV and a handshake will occur which starts the conveyor. Other sensing units will be attached to the conveyor at the airlock doors so that the conveyor can sense the presence of the airlock door. The communication link between the conveyor and AGV will be controlled by the PMS. Retractable air operated gravity rollers will be included and activate when drums are conveying through the doorway. The overall length of the powered conveyor is 60 inches. The overall width of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches and a center to center spacing of 4½ inches. The rollers are driven by a 3/4 hp motor. The conveyor has a speed of 30 feet per minute. The gravity conveyor has a length of 26 inches.

7. **Drum Transfer Conveyor CV-09-201A,B (H-2-87718):** Chain driven live roller conveyor sections used to convey drums off of and onto the AGV. The conveyor is equipped with reversible drives to provide redundancy to support facility maintenance operations. The conveyor and AGV interface via a photo-eye control that is mounted on the conveyor to sense the presence of the AGV and a handshake will occur which starts the conveyor. Other sensing units will be attached to the conveyor at the airlock doors so that the conveyor can sense the presence of the airlock door. The communication link between the conveyor and AGV will be controlled by the PMS. Pneumatically retractable gravity rollers will be included and activate when drums are conveying through the doorway. The overall length of the powered conveyor is 60 inches. The overall width of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches and a center to center spacing of 4½ inches. The rollers are driven by a 3/4 hp motor. The conveyor has a speed of 30 feet per minute. The gravity conveyor has a length of 26 inches.

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8. **Automatic Guided Vehicle GV-09-101 (H-2-87718):** An Automated Guided Vehicle (AGV) is a free-ranging self-guided vehicle. The AGV would be equipped with a dual roller deck top. The AGV has wireless guidance system and is equipped with an on-board computer for navigation. The wireless guidance is accomplished by using either a laser beam to read barcoded targets mounted on walls or guidance methods that utilize an advance encoder, inertial guidance update marker system and innovative navigation firmware. The wireless system allows the operator to change the path of the AGV by performing off-line reprogramming of the guide path. The on-board computers are linked with the main control computer using a FM radio signal. The AGV control computer is linked with the PMS so that the AGV can interface with the other internal transfer equipment. The AGV is powered by an electric drive motor that is capable of speeds of 2.2 miles per hour and powered by rechargeable batteries. The AGV can recover from mechanical failures by the use of on-board self diagnostics programs to identify the failure mode. The recovery is accomplished by changing computer control boards or by the use of an on-board pendant control for manual override and local control.

9. **Automatic Guided Vehicle GV-09-201 (H-2-87719):** See description for GV-09-101.

10. **RW Drum Storage Carousel CV-09-202 (H-2-87719):** An accumulating roller conveyor system used for the storage of 55 gallon drums weighing up to 1,000 pounds. The carousel system includes two sections with a length of 30 feet, one 10 foot section and chain operated pop-up 90° transfer sections. The 10 foot section has a bi-directional drive to allow both loading and unloading of drums off of and onto the AGV. The conveyor and AGV interface via a photo-eye control that is mounted on the conveyor to sense the presence of the AGV and a handshake will occur which starts the conveyor. The communication link between the conveyors will be controlled by the PMS. Drum locations are recorded and stored in the PMS. Tracking and retrieval of drums is assured by the use of bar code label reading equipment located at the storage entry/exit position. The two 30 foot sections are divided into 12 each 30 inches long accumulation zones. The overall width of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches and a center to center spacing of 4½ inches. The rollers are driven by a 1½ hp motor. The conveyor has a speed of 30 feet per minute.

11. **Drum Lift Table LT-09-201A through M (H-2-87719):** The drum lift table is a hydraulic scissors lift with a powered conveyor deck. The lift table has an overall length of 84 inches and an overall width of 36 inches with a width of 33 inches between the frames. The scissor lift has a capacity of 3,000 pounds with and end load capacity of 2,500 pounds. The scissor lift is raised and lowered by a 1½ hp remote mounted pump motor. The pump motor includes special integral directional valving. The vertical travel of the lift is controlled by limit switches. The powered roller deck is a chain driven live roller conveyor. The conveyor is a bi-directional drive to allow both loading and unloading of drums off of and onto the AGV. The roller deck has an overall length of 84 inches. The overall width of the conveyor is 36 inches with a width of 33 inches between the frames. The rollers have a diameter of 2½ inches and a center to center spacing of 6 inches. The rollers are driven by a 1/3 hp motor.

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7.4.9 Outline Specifications

1. Following is a listing of the mechanical equipment outline specifications and mechanical equipment for the Title I design. The outline specifications are included in Volume III under the Internal Transportation tab.

CSI No.	Title
14000	Conveying Systems
14460	Automatic Guided Vehicle

Tag No.	Equipment Name
CV-09-101	Drum NDE/NDA Transfer Conveyor
CV-09-102	Drum Storage Carousel
CV-09-103	Drum Transfer Conveyor
CV-09-104	Drum Airlock Conveyor
CV-09-105	Box Conveyor/Scale
CV-09-201	Drum Transfer Conveyor
CV-09-202	RW Drum Storage Carousel
GV-09-101	Automated Guided Vehicle
GV-09-201	Automated Guided Vehicle
LT-09-201	Drum Lift Table

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8.0 BUILDING SYSTEM

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8.0 BUILDING SYSTEM

8.1 Site Development

8.1.1 Existing Site Conditions

1. The WRAP 1 Facility is located in the 200 West area at the Hanford Central Waste Complex, approximately 700 to 800 feet northwest of the intersection of Dayton Avenue and 23rd Street. The area is generally characterized as a high desert (elevation 710') where sagebrush is the predominant flora. The site is relatively flat with an overall elevation difference of 14.0 feet across the site. Annual precipitation is estimated at 6-7 inches per year.

2. The site weather is characterized by large daily temperature swings, low relative humidity, and ambient temperature extremes ranging from -20°F to 115°F. Wind predominately blows from the west across the site, with gusts up to 70 mph. Refer to Hanford Plant Standards SDC 4.1 and SDC 5.1 for design conditions.

3. The surface of the site consists of generally loose and dry soils ranging in depth from approximately 2 feet to 15 feet. Underlying this layer is relatively well graded dense soils that range from approximately 3 feet to 7 feet thick. The third stratum consists of fine to medium sands that exist to a depth of approximately 250 feet where it then becomes more gravelly to a depth of about 400 feet where the basalt contact layer begins.

4. The ground water exists at a depth of approximately 310 feet below the site. No perched water exists in the vicinity of the site.

5. Surface soil conditions at the site have an estimated percolation rate of 5 minutes per inch and an estimated soil resistivity of 25,000 ohm/cm^3 at a depth of 2.5 feet. The site frost line is estimated at 2.5 feet below grade.

6. Existing utilities required to service the WRAP 1 Facility consist of potable water and electrical power. The existing potable water underground pipeline will be tapped into to supply both potable water and fire water to the facility. The 12 inch pipeline residual pressure at flowing condition is estimated at 80 psig. The existing pipeline is located along the north and west sides of the WRAP 1 site.

7. The proposed WRAP 1 Facility site location referenced to the Hanford Area coordinate grid, is N42745.00 and W78986.00 (referenced to the building control lines A and 1).

8.1.2 Design Requirements:

1. The general location of the WRAP 1 facility within the Hanford Central Waste Complex was determined during the WRAP 1 CDR sitings study. Further refinement was achieved during the Preliminary Design by locating the facility west of the CDR site. This placed the facility on a more level site and also enhanced the integration of future WRAP modules with WRAP 1.

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2. The specific location of the WRAP 1 building structure was determined based upon maintaining a minimum 800 meter radius from the nearest onsite "receptor" location to comply with the WRAP 1 facility low hazard classification release criteria requirements. The safety criteria that established the 800 meter radius is based upon the postulated design basis accident for the facility which resulted in a 4.5 Rem dose to the maximum exposed individual at 800 meters from the building. The nearest normally occupied building to the WRAP Module 1 whose occupants have not been trained in WRAP Module emergency preparedness is Building 231Z. This established the northeast corner of the WRAP 1 structure.

3. A dominant design criteria for development of the facility site plan was the accommodation of TRUPACT II semi-trailer type trucks that will transfer WIPP TRUPACT II casks to and from the facility. These type of vehicles require a paved road design and sufficient road radius and maneuvering area to allow efficient and safe operation of the vehicles.

4. To the maximum extent possible, utilities are routed underground from the existing utility system tie-in point to the facility.

5. The civil and structural design of the facility is based upon the geotechnical engineering design parameters specified in WHC correspondence 9155823 to UE&C. This specified a recommended soil compaction of 95 percent maximum density and a soil compression strength of 3,000 psf.

8.1.3 Reference Drawings

Drawing No.	Title
H-2-88030	WRAP Module 1, Civil Notes and Abbreviations
H-2-88031	WRAP Module 1, Layout and Utility Plan
H-2-88032	WRAP Module 1, Grading Plan
H-2-88033	WRAP Module 1, Grading Sections

8.1.4 Site Design

1. The parking area was sized for a total of 60 cars, including 4 spaces for handicapped personnel. Two roads were designed to provide an access route for trucks that is separated from the automobile and bus route to the facility. Paving limits were set to accommodate the turning movements of the TRUPACT II (65 foot long) tractor trailer.

2. Asphalt pavement was designed using a CBR of 10 for the compacted subgrade, 2000 trips per year of the design tractor - trailer weighing 80,000 pounds, and a design life of 20 years.

3. The floor elevation of the building was established at 715.0 feet to provide satisfactory horizontal and vertical relationships between the various areas of the building and to provide satisfactory drainage for the completed site. The elevation for the facility was established higher than that required to provide an earthwork balance, in order to attempt to achieve a reasonable interface with the future WRAP 2 facility to be constructed west of the WRAP 1 facility. It has been assumed that the necessary borrow material required to balance the earthwork may be obtained from the area in which the WRAP 2 facility will be located. maximum cut and fill slopes of 4 horizontal to 1 vertical have been utilized to minimize erosion.

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4. The sanitary sewage system was designed for one shift of 34 employees and 10 administrative employees plus 2 future shifts of 34 employees each. Sewage flows of 35 gallons per day and 15 gallons per day were utilized for shift workers and administrative personnel respectively. A soil percolation rate of 5 minutes, per inch was utilized to design the sewage leach field.

5. Drainage design for the culvert installations was based on a 25 year design storm event of 0.8 inches per hour. An average runoff coefficient of 0.6 was used in the design calculations to account of future development in the area west of the WRAP 1 facility.

8.1.5 Design Features

1. The WRAP 1 Building has been located with finished floor elevation at 715.0 feet. The high point of the existing site within the building area is approximately 717.0 feet and the low point elevation in the building area is approximately 710.0 feet. The building foundation will be supported mainly at or below existing grade. Structural fill will be required to bring grade to the proper elevation under floor slabs. The building area will be proof rolled with vibratory rollers to density the soils prior to foundation construction.

2. All road, maneuvering areas and parking lots will be paved with asphaltic concrete paving. There will be no concrete aprons or concrete curb and gutters required.

3. Drainage will be directed around the north and south sides of the facility. Drainage on the north side will flow through culverts under the east and west access roads to the parking lot. Drainage on the south side will be directed by a ditch on the south side of the truck maneuvering area until the ditch flow line meet the existing grade.

4. The septic tank and absorption field are located approximately 200 feet east of building from column line "F" along column line 6.

8.1.6 Outline Specifications:

1. Following is a listing of the civil outline specifications developed for the Title I design. The outline specifications are included in **Volume III** under the Building tab.

CSI No.	Title
02210	Grading
02221	Excavating, Backfilling & Compacting for Structure
02225	Excavating, Backfilling & compacting for Utilities
02430	Culverts
02511	Aggregate Base Course
02513	Asphaltic concrete Paving
02528	Concrete Curbs and Walks
02650	Underground Piped Utilities
02665	Water Systems
02730	Sanitary Sewage Systems
02740	Septic System
02935	Landscaping

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8.2 Architectural

8.2.1 Architectural Considerations

1. The WRAP 1 architectural design was developed around the process configuration requirements and the administrative requirements for the facility. The result is an architectural form that is tailored to the facility functions and provides an efficient ergonomic environment for personnel to function in.

2. WRAP 1 is a solid waste processing facility as defined by DOE Order 6430.1A, Section 1324. As such the facility is required to provide protection and containment for the Low Level Waste and TRU Waste processing activities that take place in the facility. The secondary confinement system must be designed to withstand design basis earthquake, fires, and other accidents that could result in the release of radioactive or hazardous materials outside of the site boundary for a "low hazard" classification facility.

3. Radiological safety considerations were an integral part of the architectural development of the building. These included the accommodation of the building structure and the zoned HVAC system to provide containment of radioactive material contamination and also provide operator radiation protection in areas of the facility where waste storage drums/boxes are stored in sufficient quantities. Concrete shield walls are provided in the Shipping and Receiving area and also in the Waste Process Lag storage areas.

4. Decontamination considerations for the facility consist of providing suitable surface coatings, minimization of sharp corners and other construction details in the floor that make surface decontamination difficult, routing of only those utilities to the waste process areas that are required for those areas, and provision of secondary containment curbs. The secondary containment curbing is provided for:

a) Shipping and Receiving

b) NDE/NDA

c) Process

d) Process HVAC

5. Personnel support services including locker/change rooms, toilet facilities, and lunch/conference room are provided for 34 operational personnel (24 males, 10 females) per shift, and locker facilities provided for two additional shifts. The administrative area provides space for the operating manager and 4 staff personnel. The WRAP 1 Facility is <u>not</u> intended for occupancy or use by handicapped personnel; however, provisions are made to accommodate the handicapped in the administrative space of the building.

6. Space allocation in regards to the routing of utilities and HVAC ductwork has been addressed by dedicating space envelopes within the process operational areas or in the ceiling plenum in other spaces as utility corridors. This provides for the use of common supports and minimizes interference during construction. Utilities routed above ceilings are accessed via portable ladder after removal of lay-in ceiling tiles.

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7. The development of the facility layout and floor plans was a result of the architectural program analysis performed, as documented in the "Building Floor Plan Functional Analysis", Revision A (see **Volume V**). Additionally, a life safety code analysis was conducted that determined the personnel entry/egress requirements and also contributed to the definition of "controlled area" criteria established for the facility which include:

a) The process and process HVAC spaces constitute the "controlled areas" of the facility. A single point, monitored entry and exit is provided to these spaces through the SWP change rooms, process air lock, and process step-off area.

b) All entry and egress of the "controlled areas" are protected by airlocks.

c) The layout of the facility does not permit the co-mingling of personnel in the controlled areas with other facility personnel except under emergency conditions after they have exited through alarmed emergency egress doors.

d) At least one emergency exit directly to the outside is provided from each area which contains waste materials, or in which an identified hazard exists.

8. Based upon the facility "Low Hazard Classification" and capital cost considerations, the building incorporates a pre-engineered metal building design. An architectural performance specification will be prepared that will provide all the requirements necessary to obtain a fixed price bid from a metal building vendor for a turn key design/build package.

9. The Shipping and Receiving area operational requirements established the overall building eave height of 24'-0". This height was set based upon the bridge crane hook height requirements to service the TRUPACT II shipping casks. The building eave height was maintained throughout the facility, with the exception of the entry area of the building, which was lowered to provide an architectural contrast. The 24 foot eave height in the process area will also facilitate the removal of the supercompactor ram(s) during major maintenance on the equipment.

10. The building floor elevation was established to take advantage of the site grade that slopes from north to south, to facilitate the 5 foot lower elevation required in the Shipping and Receiving area for the truck bays.

11. Located on the south face of the facility column line 1 is provision for the connection (two places) of a future transfer corridor between WRAP 1 and other future processing facilities.

12. The following sections describe the primary design requirements, facility description, and pertinent design features from an architectural design standpoint.

8.2.2 Design Requirements

1. The WRAP Module 1 Facility is classified as a Non-Reactor Nuclear, WHC Safety Class 3, Low Hazard Facility.

2. Specific requirements concerning the building system are stated in Section 6.0 of the UE&C Project Design Criteria document.

3. The following area classifications are required within the WRAP 1 facility. Refer to the Safety Analysis Plan Drawing H-2-88062 for specific locations.

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AREA	CODE REFERENCE	OCCUPANCY	SEPARATION	CONSTRUCTION TYPE
Administration	UBC CHP.7	B-2/A-3	–	UBC II-N
Ship & Receive	UBC CHP.9	H-7	UBC-1HR FR	UBC II-N
NDE/NDA	UBC CNP.9	H-7	UBC-1HR FR	UBC II-N
Waste Process	UBC CHP.9	H-7	DOE-2HR FR	UBC II-N
Process HVAC	UBC CHP.9	H-7	DOE-2HR FR	UBC II-N
Mechanical Room	UBC CHP.7	B-2 (ACCESSARY)	–	UBC II-N
Electrical Room	UBC CHP.7	B-2 (ACCESSARY)	–	UBC II-N
Control Room	UBC CHP.7	B-2	–	UBC II-N
HVAC Equipment	UBC CHP.7	B-2 (ACCESSARY)	–	UBC II-N

4. For more detail on the design criteria for the building, refer to "Building Code Evaluation", Engineering Assessments, **Volume VI**, of this report.

5. A summary of the space allocated to each area of the building is specified in **Figure 8-1**.

8.2.3 Reference Drawings

1. Title I Architectural Drawings include:

Drawing Number	Drawing Title
H-2-88062	Safety Analysis Plan
H-2-88063	Floor Plan Shipping and Receiving
H-2-88064	Floor Plan NDE/NDA
H-2-88065	Floor Plan Process Area
H-2-88066	Floor Plan Office/Locker Room Area
H-2-88067	Floor Plan Upper Level
H-2-88068	Roof Plan
H-2-88069	Building Elevations
H-2-88070	Building Sections
H-2-88071	Building Sections
H-2-88072	Building Finish Schedule

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FIGURE 8-1
WRAP 1 SPACE ALLOCATION SUMMARY
(NET SQUARE FEET)

AREA	ROOM NO.	TITLE	SQ. FT.
Administrative	123	Operations Manager	180
	122	Record Management	182
	125/126	Reception Area	1,055
	121	Admin./Storage	252
	120	RPT Office	156
	128/129	Lunch/Conference Room	1,331
	137/138	Admin. Toilets	91
		ADMINISTRATIVE SUBTOTAL	3,247
Personnel Support	148	Men's Locker Room	720
	150	Toilet	156
	149	Shower	140
	146/147	SWP Change	179
	140	Women's Locker Room	294
	141	Toilet	104
	142	Shower	150
	143/144	SWP Change	120
	134	Janitor Room	200
	136	Store Room	81
	132	Clean Laundry	100
	131	Soiled Laundry	100
		PERSONNEL SUPPORT SUBTOTAL	2,344
Waste Process	107	Waste Process	7,184
	112	Step-Off	–
	108	Warm Maintenance	171
	111	Decon Room	138
	109	Sample Management	171
		WASTE PROCESS SUBTOTAL	
NDE/NDA	104	NDE/NDA	7,424
		NDE/NDA SUBTOTAL	7,424
Shipping & Receiving	101	Shipping & Receiving	10,464
	100	Truck Loading	–
	102	S&R Office	160
		SHIPPING & RECEIVING SUBTOTAL	10,624
Exterior Storage (Covered)	–	–	2,117
		EXTERIOR STORAGE SUBTOTAL	2,117
Control/Computer Area	201	Control Room	721
	202	Computer Room	247
	103	Operations Supervisor Office	155
		CONTROL/COMPUTER AREA SUBTOTAL	1,123
Facility Support Areas	113	Process HVAC	2,525
	118	Mechanical Room	1,066
	203	HVAC Equipment	5,559
	116/115	Electrical Room/UPS	893
	119	Telecommunications	153
	139	Equipment Maintenance	385
		FACILITY SUPPORT SUBTOTAL	8,056
		TOTAL NET	45,124

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8.2.4 Facility Description

1. This section describes the architectural layout of the facility as shown on the architectural floor plan drawings H-2-88063 through H-2-88067.

2. **Administrative Area:**

   a) This area is located at the building entrance and functions to control entry to the facility. A reception counter and waiting area is located adjacent to the personnel traffic pattern.

   b) Offices for the Operations Manager, Record Management, and Radiation Protection Technicians are situated off the open office space for the 3-4 supporting staff (including the receptionist). An administrative support style room, toilets and coat closet serve this area.

   c) Adjacent to the main circulation path is the multi-function lunch, conference, and training room which is sized to accommodate 60 persons. This area is divisible into two spaces by a folding partition and is served by vending machines, unit kitchen, and storage closet and will be equipped for audio-visual presentations.

   d) This area represents the only area in the facility where provisions have been made to accommodate the handicapped.

3. **Personnel Support Area:**

   a) The change room facilities are located off the main circulation path to the operational areas.

   b) Change rooms are sized to accommodate 34 operations personnel (24 males and 10 females) per shift with lockers provided for two additional shifts. Toilet areas are sized to accommodate shift change.

   c) Shower facilities are provided for the exiting shift.

   d) Special Work Permit (SWP) dressing facilities are provided for approximately one-half of the operational personnel and entered from the locker rooms through airlocks. The SWP change areas will contain individual storage bins for the protective clothing.

   e) Service spaces for these facilities include janitors closet and storage room, and clean and soiled laundry store rooms.

4. **Shipping and Receiving Area**

   a) The Shipping and Receiving area occupies the Southeast corner of the facility and is entered off the main circulation corridor.

   b) The finish floor elevation of the area is 48 inches above the adjacent exterior grade to accommodate two dock height, waste unloading and loading stations, and a depressed, drive-through bay to serve the TRUPACT II container loading.

   c) The mechanized, lag and TRUPACT II storage equipment is located in the center of the area and surrounded by poured-in-place, reinforced concrete shield walls.

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d) A bridge crane serves the TRUPACT II drive-through bay, and two free-standing jib cranes constitute the fixed material handling equipment in the area.

e) The truck loading stations will be served by fork lifts and will be equipped with front mounted dock ramps and vehicle restraints.

f) A small office is provided adjacent to the loading stations to protect the platform data collection terminal. The Shipping and Receiving office is adjacent to and entered from the area.

g) Two vertical lift overhead doors facilitate the movement of waste into the NDE/NDA area. The Shipping and Receiving and NDE/NDA areas are surrounded by a 6 inch high containment curb poured integrally with the floor slab.

h) Provisions will be made by means of portal framing and removable wall panels to accommodate the connection of a future waste transfer corridor with these two areas.

5. **NDE/NDA Area:**

a) The NDE/NDA area is located in the Southwest of the facility and is entered from the personnel corridor and Shipping and Receiving area.

b) The area contains separate lines of equipment for the examination and assay of waste boxes and drums.

c) The area designated for the storage of drums awaiting transfer to the process area is surrounded by concrete shield walls.

d) Airlocks are constructed in the space to facilitate the transfer of drums via conveyors into the "controlled" process area, and to provide emergency personnel egress from the Process area.

6. **Waste Process Area:**

a) The Process area serves as "secondary containment" when waste drums are opened in the process gloveboxes located in the space.

b) Ingress and egress of the area is restricted to a single location through the "step-off" area and process airlock to the SWP change rooms.

c) Waste drums enter and leave the area through the airlock located in the NDE/NDA area. An additional airlock (non-personnel) is provided for the transfer of empty containers and immobilization materials into the Process area from the corridor leading to the covered exterior storage platform. This airlock is restricted to the transfer of hand trucks and protected with interlocked doors - each of which is controlled from outside the airlock.

d) The designated area used for temporary RWM drum storage, awaiting analysis results, is surrounded by concrete shield walls.

e) A "warm" maintenance room is provided for future potential limited disassembly, part replacement, and maintenance activities associated with the process equipment.

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f) A wall pass-through unit is provided between the Process area and the sample management room for the transfer of sample containers between the two spaces.

g) Access to the process HVAC equipment (exhaust) room is made through the Process area. The doors connecting these two spaces are sized to accommodate the installation and eventual decommissioning or replacement of the gloveboxes and equipment.

h) An integral, perimeter floor curb provides spill containment for the two areas.

i) An emergency personnel exit through an airlock protected by alarmed doors is provided directly to the outside.

7. **Process HVAC Area:**

a) The Process HVAC area is located adjacent to the Process area, and contains the exhaust fans and HEPA filtration equipment associated with the Process area.

b) An intermediate level platform is constructed in the space to facilitate change-out of the four tiered filter banks. This platform is framed of steel members and covered with galvanized steel grating.

c) An 8' x 16' door opening is provided in the exterior wall to facilitate installation and removal of large equipment during construction, periods of plant shutdown, and decommissioning.

d) An emergency personnel exit through an airlock protected by alarmed doors is provided directly to the outside.

8. **Control and Computer Area:**

a) The Control and Computer rooms are located on the upper level (second floor) of the facility. The central location permits direct observation of the Shipping and Receiving, NDE/NDA and Process areas. This vision windows in the walls of the control room are equipped with fire shutters to maintain separation requirements.

b) Access to the area is via two enclosed stair towers from the lower level corridor.

c) The space within the control room utilized for the dispatcher station is partitioned off with a window wall.

d) The Control and Computer rooms have an 18 inch high accessible floor system in order to facilitate running the data control cables. The under floor area is also utilized as the supply air plenum for these spaces.

e) The operation supervisor's office for the facility is located on the lower level immediately adjacent to stairway #1.

9. **Electrical and Mechanical Equipment Areas:**

a) The air handling, HVAC equipment for the facility is located on the upper level of the facility; separated from the operational areas (containing hazardous waste).

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b) All air duct penetrations in the walls between this area and the Process and Process HVAC areas are protected with 2 hour fire rated dampers.

d) Openings in the remainder of the interior walls and floor do not require protection as they separate the area from other support activities (e.g. electrical, mechanical, personnel support and administrative spaces).

e) The area is accessed via enclosed stair tower #2. A clear path is maintained through the area to a pair of doors in the exterior wall and an exterior, bracketed, platform to facilitate equipment move-in to this area and the control and computer rooms.

f) Emergency egress is also accommodated via the exterior platform and an exterior, steel stair.

g) A Mechanical room is located on the lower level, beneath the HVAC equipment, and contains the pumps associated with this equipment and the two chiller/tower unit located outside the building at this location. This space also contains plant air compressors, fire water entry, and hot water heater.

h) A pair of doors in the exterior wall allows for equipment access.

i) The Electrical room is located off the service corridor outside the operational areas on the lower level.

j) Incoming electrical power is brought to the room via overhead bus duct from transformers located on the site at this location.

k) The room is subdivided by a masonry partition wall to separate the UPS equipment.

l) A Telecommunication room is located adjacent to the Administrative area on the lower level to house this equipment.

m) An equipment maintenance shop is provided on the lower level for the storage of spare parts and limited facility equipment repair.

8.2.5 Design Features

1. **Exterior:** The building exterior skin is a "Metal Building System" consisting of preinsulated, prefinished metal, interlocking roof and wall sandwich panels. The thermal coefficient of the roof panels is U=0.047 (R=21.28) and wall panels is U=0.069 (R=14.49). The roof slope is a 1/12 pitch and specified as a standing seam design. Exterior panel finish shall be "20 year" Kynar paint in a color selected to match existing buildings at the HCWC (white with blue trim).

2. **Doors, windows and Glazing:** Steel doors and frame shall be enamel painted. Windows, entry doors and sidelight framing and louvers shall be clear anodized aluminum, glazing will be gray tinted insulated glass.

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3. **Interior Finishes.** The interior face of the exterior wall and roof panels will be exposed and the factory applied polyester enamel will constitute the wall and ceiling finish in the operational and facility support areas. The structural framing (columns, beams, girts, and purlins) will be exposed and painted with an acrylic resin based primer and enamel. The mechanical ductwork, piping, and electrical conduit servicing these areas will be exposed and painted with enamel. Floors and wall surfaces in toilet rooms and shower areas will receive ceramic tile.

4. **Floors:** The floor and interior wall finish within areas of the facility subject to possible contamination will receive a 100% epoxy, "decontaminable" coating. The remaining operational and facility support areas will have a hardener/sealer compound applied to the exposed concrete floor surfaces and an epoxy enamel applied to the wall surfaces. The finished flooring material in the personnel support spaces will be sheet vinyl or vinyl composition tile where appropriate. The floors in the administration and lunch/conference space will receive a commercial grade carpeting.

5. **Walls:** The interior of the exterior wall and partitions in the administrative and personnel support spaces are light gauge metal framing covered with finished gypsum board. The interior partitions in the administrative spaces will receive texture, primer, and a two-coat system of latex paint. The interior walls in the operational, facility support, and high use areas will be constructed of reinforced concrete masonry.

6. **Ceiling:** The suspended ceilings will be painted gypsum board in toilet rooms, janitor closets, and service areas; and exposed grid/lay-in acoustic tile in other finished areas.

7. Refer to the Finish Schedule, Drawing H-2-88072, for specific finish materials and their locations. Confirmation of the finish color scheme is to be developed during Title II design.

8.2.6 Outline Specifications

1. Following is a listing of the architectural outline specifications. The outline specifications prepared for Title I are included in **Volume III** under the Building tab.

CSI No.	Title
0400	Masonry
06000	Wood and Plastics
07000	Thermal and Moisture Protection
08000	Doors and Windows
09000	Finishes
10000	Specialties
11000	Equipment
12000	Furnishings

8.3 Structural

8.3.1 Structural Considerations:

1. The building enclosure for the WRAP Module 1 Facility will be a metal building of the beam-and-column type which are typically supplied by pre-engineered metal building manufacturers. The building will be purchased from a pre-engineered metal building manufacturer under a performance specification; however, there are features in the building which will require structural design that is not normally provided by a pre-engineered building

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2. **Building Structure** will support a six inch thick elevated concrete slab on metal deck for the control room, computer room and HVAC room floors. In addition a 5-ton bridge crane will be supported on building columns at the TRUPACT II truck loading area. Masonry walls which extend from the floor to the building roof framing or to the elevated slab support framing will be laterally supported by the building structure for differential internal pressures and seismic forces. A grating platform for access to the HEPA filter in the northwest corner of the building will be supported from the building's west wall framing, and an offset in roof height at the east loading dock will have to be investigated for snow drifting.

3. **Main Building Framing** will consist of hot rolled or fabricated structural shapes of straight or tapered design (manufacturer's option). Girts and purlins will consist of cold formed "C" and "Z" shapes with intermediate support provided by sagrods. Shop connections will be welded and field connections will be bolted to the greatest extent practicable. Column base plates will all be located at one elevation approximately one inch above the highest floor elevation (seven inches above process area floor). Vertical x-bracing will be used to brace the building against lateral loads, however, due to wall openings and other open area requirements, it is anticipated that lateral stability also will be provided by rigid portal frames. Roof bracing will consist of rod x-bracing to distribute forces in the plane of the roof to vertical bracing and portal frames.

4. **Building Foundation:** The building foundation will be a spread footing and grade beam design based on loads determined from the analysis of an assumed metal building framing system. The foundation system selected is most practical for the pre-engineered metal building. Other foundation types such as piles or piers with grade beams, slab integral with grade beams and a mat foundation were considered and determined to be less desirable or inappropriate for a pre-engineered metal building foundation. Specific considerations addressed in the foundation analysis included:

a) Pile and pier foundations are normally used to transfer building loads to lower soil stratas when the surface soils are not capable of supporting the building loads. The relatively light weight metal building loads can be supported by the upper soil stratum thus eliminating any need for deep foundations.

b) Supporting the building structure on a slab-on-grade foundation with exterior edges thickened to provide protection from frost heave was also considered to be inappropriate due to the characteristics of the soils which could cause slab cracking as a result of differential settlement. This type of foundation also would not allow the erection of the building to be started until all under floor utilities and services have been installed. The erection of the building over the slab-on-grade would also expose the slab to damage during building erection.

c) A mat foundation was also eliminated from consideration because it would be necessary to provide both a mat foundation, with suitable depth to allow utilities to be installed between it and the underside of the floor slab and the relatively thick floor slabs required for equipment support. The quantity of concrete and additional excavation required to install the mat foundation was considered to be excessive for a pre-engineered building foundation.

d) The spread footing foundation design will allow the building to be erected without the floor slab being in place thus allowing utility installation to be done more conveniently. The quantity of concrete and the difficulty of construction will be less than required for deep foundations or mat type foundation also.

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8.3.2 Design Requirements

1. The WRAP 1 facilities have been assigned a low hazard classification as defined in UCRL-15910. The building design will include the building dead load, and live loads from elevated slabs and roof, wind loads and seismic loads.

2. **Dead loads** consist of the weight of building components including beams, columns, horizontal bracing, vertical bracing, girts, purlins, roof panels, wall panels, elevated concrete slab, control room access flooring, and metal decking for elevated slabs.

3. The following values were determined for dead loads:

   a) Roof (including purlins, roof panels, bracing and insulation) . . . . . 4.0 psf

   b) Walls (including girts, wall panels, bracing and insulation) . . . . . 2.5 psf

   c) Access flooring for control room and computer room. . . . . 15.0 psf

   d) Elevated floor slab (including six inch concrete on one and a half inch by 18 gauge metal decking) . . . . . 82.0 psf

4. **Live loads** consist of snow loads including the affects of drifting on roof areas and uniformly distributed live loads over elevated slab areas. The following values were determined for use as live loads:

   a) Roof:

      - snow loads uniformly distributed . . . . . 20 psf
      - snow drift at dock roof at column . . . . . 60 psf
        line "E" diminishing linearly to zero 15'-0" east of column line "E"

   b) HVAC floor . . . . . 200 psf

   c) Control room and computer room floors . . . . . 150 psf

   d) Bridge crane . . . . . 5 tons

5. **Wind loads** were evaluated in accordance with ASCE 7-88, "minimum design loads for buildings and other structures" for winds perpendicular to each of the four main walls of the building. Wind loads were applied in one direction at a time considering pressures on the windward wall, leeward wall, side walls and roof simultaneously and in combination with internal pressures due to wind loads.

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6. The following parameters were used in the development of wind loads:

- Wind speed ..... 70 mph
- Importance factor 1.07
- Exposure C
- Tornado and missile loads ..... (None)

7. **Seismic loads** were calculated using the requirements of the Uniform Building Code (UBC), 1988 edition, UCRL-15910, and Hanford "Standard Arch-Civil Design Criteria Design Load for Facilities SDC-4.1". The Uniform Building Code requirements governed for seismic loading.

8. The following seismic criteria was used:

- UBC Seismic Zone 2B
- Z Factor 2.0
- Importance Factor (I) 1.25
- Amplification Factor (C) 2.75
- Force Reduction Factor (R_w) 6.0
  For ordinary moment resisting space frames

9. The **building base shear** calculated for the pre-engineered metal building based on the above criteria is V = 0.115W.

10. A **collateral load** of 5 psf was assumed to occur over the total area of the building roof and under elevated floors to account for electrical lighting and HVAC ductwork weights.

11. **Slab-On-Grade Loading** included the following design considerations:

a) Slabs-on-grade are designed for vehicle loads and equipment that will be supported on the floors.

b) Six inch thick floor slabs supporting masonry walls will be locally thickened to 12 inch thick. For walls spanning from floor to building roof or cantilevered approximately thirteen feet above the floor, as in the locker room area, the thickened slab will be 4'-0" wide and centered on the wall.

c) Vehicle wheel loads used for the NDE/NDA and shipping and receiving areas consist of wheel loads from the 4,000 lbs and 7,000 lbs. capacity fork trucks. Self-guided vehicle wheel loads were also considered. Maximum wheel loads were increased by thirty percent for impact.

d) Normal H_2O truck wheel loads were used to design the slab-on-grade for the truck loading area. Design charts from "Thickness Design For Concrete Pavement" by the Portland Cement Association were used to determine slab bending moments used for reinforcing design.

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8.3.3 Referenced Drawings

1. There are no structural drawings provided in the Title I Design submittal. The structural design is illustrated in the architectural cross-section drawings (H-2-88070 and 88071). The foundation design depicted in the building section drawings was developed based upon a detail structural analysis and associated calculations. The structural design is presented in the following calculations:

Calc. Set No.	Title
WM1-S1	Building Analysis
WM1-S2	Building Loads
WM1-S3	Second Floor Framing
WM1-S4	Building Foundation
WM1-S5	Ground Floor Slab
WM1-S6	Control Room Floor
WM1-S7	Ground Floor Area 7
WM1-S8	Ground Floor Area 9
WM1-S9	Stack Foundation
WM1-S10	Glovebox Analysis

8.3.4 Design Features

1. The building foundation will have spread footings at building column locations and wall footings at location where the foundation grade beams act as retaining walls. Where wall footings and column footings are adjacent to each other, concrete will be placed monolithically.

2. The perimeter grade beam will extend six inches above the ground floor slab concrete in the Shipping and Receiving, NDE/NDA, Process and Process HVAC areas to provide a containment curb. Ramps and interior door stoops will be placed with the ground floor slab at truck dock overhead doors and at personnel doors. Door thresholds will be at the top of the grade beam and curbs.

3. The top of grade beams not adjacent to the rooms listed above will be six inches above the adjacent floor slab also except that there will be a block-out at doors to allow thresholds to be at floor level.

4. The ground floor slabs in the Shipping and Receiving and Process areas have been designed to support walls, storage racks, gloveboxes and equipment loads imposed on them. Only the girth compactor and the two super compactors will have foundations independent of the floor slabs.

5. All footings on the building perimeter will be at least 2'-6" below grade but may be deeper when required for uplift or overturning resistance. Interior and exterior column footings will have at least six inches of compacted fill between the top and the bottom of the floor slab. Floor slabs will be placed on a minimum of six inches of compacted fill with a four mil polyethylene vapor barrier on top.

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6. Floor slabs will be approximately twelve inches thick in the Shipping and Receiving and Process areas and ten inches thick in the NDE/NDA and truck loading areas. All other floor slab thicknesses will be six inches. Floor slab loading will be refined in the Title II which may allow the slab thicknesses to be reduced. Floor slabs in the truck loading, Shipping and Receiving, NDE/NDA, Process and Process HVAC areas will have integrally cast, six inch by six inch, concrete curbs at all floor penetration locations and along exterior wall grade beams.

7. Floor slabs will be reinforced to prevent or limit cracking of the concrete. Six inch thick slab-on-grade will have one layer of reinforcing. Ten and twelve inch thick slabs will have two layers of reinforcing.

8. Shielding Walls will be constructed of normal weight concrete and have reinforcing placed vertically and horizontally in each face. Vertical reinforcing will extend into the floor slabs which will support the walls. If future design indicates that the shielding wall footings should be thicker than the floor slab, the floor slab will be thickened under the wall to provide the required footing for the wall.

8.3.5 Outline Specifications

1. Following is a listing of the structural outline specifications for the Title I design. The outline specifications are included in **Volume III** under the Building tab.

CSI No.	Title
3	CONCRETE
03100	Concrete Formwork
03200	Concrete Reinforcement
03300	Cost-In-Place Concrete
03600	Grout
5	METALS
05000	Metals
05060	Welding
05100	Structural Steel
05101	Stainless Steel and Fasteners

8.4 HVAC

8.4.1 Design Requirements

1. A primary function of the ventilation system for the WRAP 1 facility is the confinement of radioactive contamination (alpha emitting transuranic material) to within the enclosed waste process system. This design objective is achieved by an integrated design of primary and secondary confinement structures and the HVAC system. Primary structures in WRAP 1 are the waste process gloveboxes, with the building structure forming the secondary confinement barrier.

2. The principle responsibility of the confinement systems are to ensure the potential airborne contamination exposure levels to workers, the environment and offsite populations are below the prescribed limits as stipulated in the applicable DOE/DOE-RL orders and WHC operational criteria.

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3. The WRAP 1 HVAC system has multiple services. Primarily it serves as a confinement system by ensuring air flows at the proper velocities from areas with a lessor contamination potential to areas with a higher potential for contamination. A zoned approach is used based upon a cascade pressure differential principle. The differential flow conditions are achieved by establishing boundaries within the facility that allows for the maintenance of pressure zones that become progressively more negative from the outside environment to the interior of the waste process gloveboxes where the contamination source potential is greatest.

4. The HVAC system design must also maintain the appropriate environmental conditions within the facility. This includes temperature and humidity control for workers and equipment, as well as the appropriate ventilation air flows in accordance with regulatory and industry standards.

5. The overall design and performance criteria for the WRAP 1 HVAC system is specified in DOE Order 6430.1A. Based upon a detail review of the 6430.1A requirements and consideration of the facility "low hazard" classification, the three zone (i.e., confinement Zone 1, confinement Zone 2, non-confined areas) HVAC system design is in accordance with the following design requirements:

a) Confinement Zone I (process gloveboxes) and confinement Zone II (Process Room) exhaust ductwork and HEPA filter plenums will be designed to withstand a "low hazard" safety class facility seismic event.

b) The total HVAC system for the facility (all zones) will shutdown to a safe static condition in the event electrical power is interrupted or lost.

c) The Shipping and Receiving and the NDA/NDE areas are defined as interim storage areas in accordance with DOE 6430.1A (1324-6.1). The waste drums have inner plastic liners or are overpacked, and therefore the drum forms a secondary containment system. Based upon this, the ventilation system for these two areas are not considered confinement zones, therefore, they do not have a dedicated HEPA filtration system and a negative pressure is not maintained.

6. In accordance with DOE Order 6430.1A a energy conservation evaluation was made on the Title I HVAC system design. The evaluation goal is to determine the life cycle cost effectiveness of energy conservation options in order to select the optimum one(s) for incorporation into the design. An economizer cycle and a glycol run-around heat recovery system and a rotary wheel heat recovery system were selected and included in the design. **Section 10.7** provides further details on the energy conservation assessment.

7. Per the Functional Design Criteria established for the WRAP 1 facility, the overall plant must achieve an availability of 70% which equates to 175 operating days per year. The HVAC system has a significant influence on the achievement of this operation requirement. A Reliability, Availability, Maintainability (RAM) assessment has been made to validate the HVAC system (see **Section 10.5**) design configuration to meet this requirement.

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8.4.2 Reference Drawings

1. Reference Drawings include the following:

Drawing Number	Description
H-2-88153	HVAC Legend, Abbreviations, and General Notes
H-2-88154	HVAC Airflow Diagram, System Composite
H-2-88155	HVAC Zoning Plan
H-2-88156	HVAC Equipment Floor Plan
H-2-88157	HVAC Equipment Room Plans
H-2-88158	HVAC Airflow Diagram, Process Area, Supply
H-2-88159	HVAC Airflow Diagram, Process Area, Exhaust
H-2-88160	HVAC Airflow Diagram, Shipping, NDE/NDA Area
H-2-88161	HVAC Airflow Diagram, Computer and Control Rooms
H-2-88162	HVAC Airflow Diagram, Administration Area
H-2-88163	HVAC Chilled Water Flow Diagram, Chillers
H-2-88164	HVAC Chilled Water Flow Diagram, Chillers
H-2-88165	HVAC Equipment Sections

8.4.3 Confinement Zone Description

1. The Waste Receiving and Processing (WRAP) Facility 1 will provide the capability to examine, treat, and certify contact-handled transuranic waste, mixed waste, and CH low level waste. To ensure the safe processing of the waste materials, process operations will be accomplished in containment systems (e.g. gloveboxes with the associated confinement ventilation systems).

2. In accordance with DOE 6430.1A, Section 1324, the WRAP 1 facility is classified as a Radioactive Solid Waste Facility and as such is required to have primary and secondary confinement systems. The WRAP 1 primary confinement system, with respect to the waste process area, in the gloveboxes and the Zone I ventilation system. The secondary confinement system is the building structures and the Zone II ventilation system.

3. The Conceptual Design Report (CDR) proposed a confinement system that would meet the various plant operating requirements during the normal mode of operation and during postulated Design Basis Accidents (DBA). The facility was defined as a "Moderate Hazard" facility.

4. After the CDR was issued, the WRAP 1 Preliminary Safety Evaluation (PSE) was prepared with the result that the facility should be defined as a "Low Hazard" facility. This meant that the confinement systems in the facility had been over-specified in the CDR. It was determined that considerable cost savings would be realized if the confinement systems were to be designed to the less stringent requirements.

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5. The following paragraphs summarize the Primary (Zone 1) and Secondary (Zone 2) WRAP 1 confinement systems features as presented in the Title I design. To assist in understanding the interaction between the Zone 1 and Zone 2 systems, the reader should refer to the HVAC System composite drawing, **Figure 8-2.**

a) The primary confinement for the LLW, TRU and Restricted Waste operations consists of gloveboxes. It also includes the exhaust ventilation system from each process enclosure and through a HEPA filter at the glovebox/exhaust duct interface and two (2) stages of HEPA filters in the exhaust filter train. It also includes inlet HEPA filters and duct interface.

b) The primary confinement system equipment (exhaust duct, fans and filters) will be designed to maintain its structural integrity during and after operational and natural phenomena Design Basis Accident as prescribed in WHC 4.1 for a "low hazard" classification Radioactive Solid Waste facility. The structural integrity of the system will be maintained, however, in the event of an electrical power failure, the primary exhaust fans will shut down and the system will go to a static condition. This credible event has been evaluated in the WRAP 1 PSE and will be further evaluated in the PSAR, that demonstrates the radioactive whole body dose is within the allowable limits of less than 5 REM on-site and less than 0.5 REM off-site.

c) The primary confinement system materials of construction is all stainless steel construction for the process enclosures and exhaust ductwork. The primary HEPA filter trains are of a bulkhead floor mounted design. Each glovebox supply air inlet is equipped with a HEPA filter to prevent blowback or migration of contamination in the event of an air pressure excursion or electrical power failure.

d) The Secondary confinement system is comprised of the building structures surrounding the waste process area and the Zone 1 HVAC exhaust system equipment. It is ventilated and HEPA filtered by the Zone 2 HVAC system. This system provides the operating and maintenance areas surrounding the primary confinement system with air quantities in accordance with the prescribed levels specified in ERDA 76-21 for potential airborne contamination. Some air provided to the Zone 2 area becomes supply air to the process enclosures. The remaining supply air is exhausted through the process room exhaust filter train at a controlled rate to maintain the proper negative pressure.

e) The building structure surrounding the secondary confinement (Zone II) area consists of eight inch masonry block wall extended to the building roof. The roof forms the Zone II upper boundary. It consists of the pre-engineered metal roof. Under normal operating conditions, personnel access to the Zone II confinement areas is through a process airlock. The Zone II rooms are maintained negative relative to the non-zone areas of the building by 0.15 inches W.G. to ensure air flows from the non-zone areas through the process airlock and into the waste process and process HVAC areas. The process HVAC area is maintained at -0.10 inches W.G. in order to maintain airflows from the Process HVAC room to the glovebox areas.

f) **Negative pressure control** of the Zone I and Zone II process air is based upon maintaining a constant exhaust airflow from the Zone II and Zone I areas, and maintaining a negative pressure setpoint in each of the gloveboxes. Each glovebox negative pressure setpoint will be maintained by throttling the glovebox ventilation exhaust.

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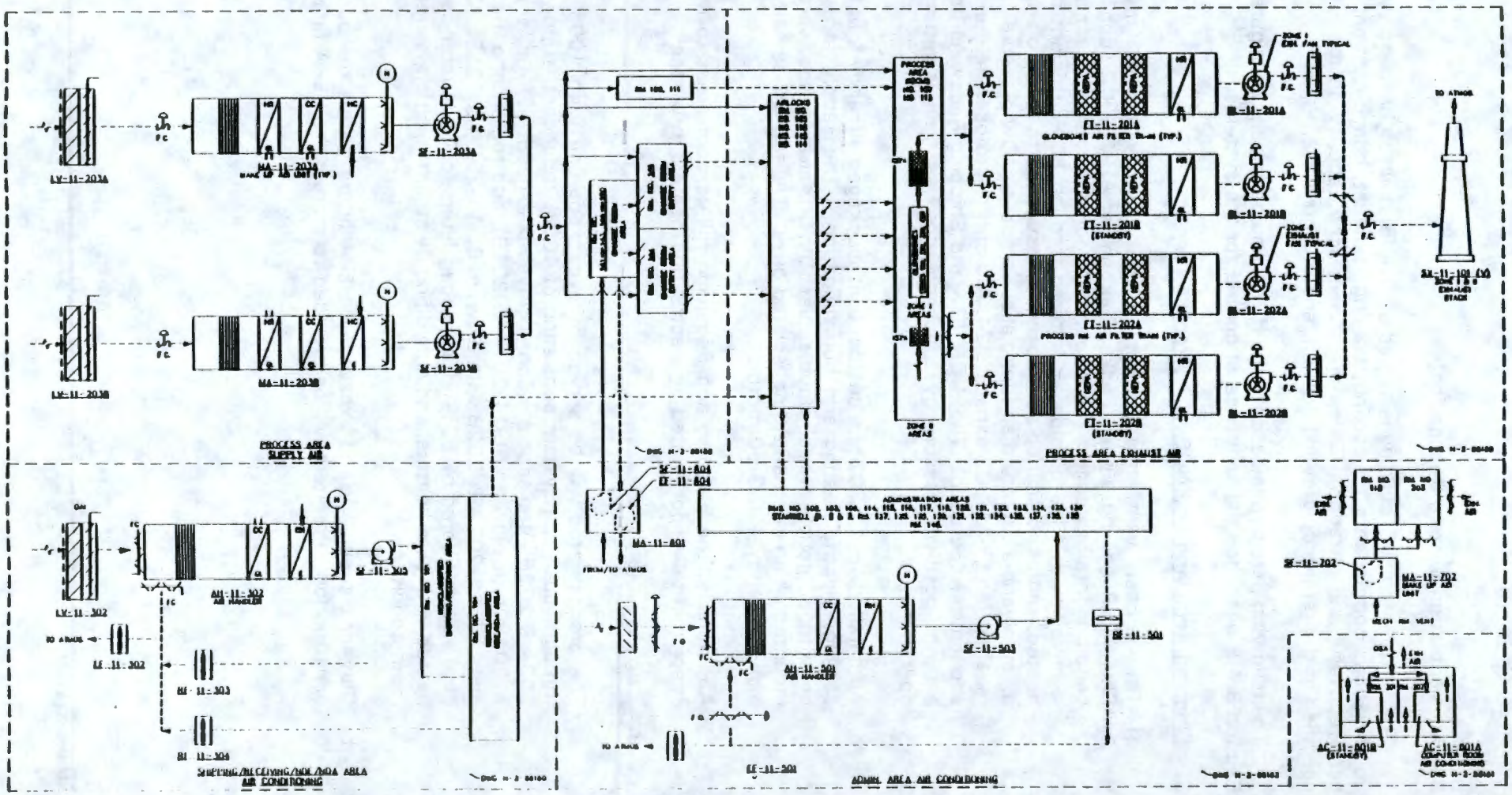

FIGURE 8-2

WRAP MODULE 1 - OVERALL HVAC FLOW DIAGRAM

8.4.4 Ventilation System Description

1. The WRAP Module 1 building is served by five (5) main air handling systems; each made up of various components for cooling, heating, exhaust, humidification, de-humidification, heat recovery, and filtration. These are shown schematically on the HVAC flow diagram specified in the reference drawing section, and in **Figure 8-2.**

2. The following paragraphs describe the HVAC equipment and configuration for each area. Section 8.4.5 describes the sequence of control for the systems.

3. Shipping/Receiving and NDE/NDA Areas:

   a) The largest ventilation system in the facility serves the NDE/NDA and Shipping/Receiving areas. Package airhandler AH-11-302 supplies 32,380 cfm of conditioned air through a round, seamed, galvanized steel, duct system. Return air is mixed with 11% outside air, filtered through 85% efficient bag filters, cooled, heated, and/or humidified as required, and supplied to the two areas. Each area has its own vane-axial return air fan to allow proper air flow pressure control. A common relief air fan EF-11-302 exhausts 24,000 cfm to atmosphere during smoke purge or economizer operation. The NDE/NDA and Shipping/Receiving areas will be held at a slight positive pressure by supplying more air than is returned during normal operations.

   b) Air handler AH-11-302 is a custom built, packaged airhandler, utilizing chilled water cooling, electric heating and humidification. The supply fan will be a Class II, centrifugal, double wheel, double inlet (DWDI), airfoil blade, vertical discharge fan mounted on an internal, spring isolated base. The fan will be belt driven by a 50 HP high-efficiency 480/3/60 motor.

   c) Additionally, the Shipping and Receiving roll-up door areas to the outside, will be supplementally spot heated by electric unit heaters in winter.

4. Process Areas

   a) The process area will be served by a package unit with 100% outside air, once through, push-pull system consisting of 100% redundant, supply air units (MA-11-203A & 203B), and separate Zone I glovebox exhaust HEPA filter units (FT-11-201A & 201B with blowers BL-11-201A & 201B), and room Zone II exhaust HEPA filter units (FT-11-202A & 202B with blowers BL-11-202A & 202B). Outside air (17000 cfm) will be filtered by 80% efficient bag filters, chilled water cooled or electrically heated with duct heaters, and humidified by steam injection, as required, to maintain room conditions.

   b) Glovebox supply air and exhaust air HEPA filters will be the push-through type of construction. Prefilters will be provided to protect the HEPA filters.

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c) The supply duct shall be round, welded, 16 gauge, black, carbon steel, epoxy-coated duct. Exhaust duct shall be round 14 gauge, welded, 304 stainless steel. Exhaust ducts shall be seismically supported. The exhaust air filter trains shall be bag-in, bag-out type with test sections upstream and downstream of the HEPA filters. Isolation valves, filter housings, test sections, heat recovery coil, and blowers will all be factory mounted on individual skids for the package filter train. Exhaust blowers will be Stainless Steel Class III construction, centrifugal fans, belt-driven, 45° upblast, and will terminate in a common 40"Ø breaching leading to the process exhaust stack.

d) A glycol, run-around, heat recovery system will be mounted in both the supply and exhaust units and will transfer heat from the exhaust air streams to the incoming outside air in the winter and conversely in the summer months, thus preheating or precooling the incoming air.

e) The supply units MA-11-203A & 203B (one operating, one standby) will utilize a Class I, 30"Ø, DWDI, airfoil, belt-driven, 30 HP, centrifugal fan with a horizontal intake flow and an upblast discharge.

5. Administration Areas:

a) The Administration areas will be served by a packaged air conditioning unit (AH-11-501) with plug-type supply air fans. Mixed air (approximately 20% outside air) will be filtered (30%, 2", cartridge prefilter and 90% bag final filter) and conditioned (chilled water, electric heat, and humidification) as required and delivered through commercial grade, galvanized ductwork, fabricated to SMACNA standards.

b) The lunch and conference rooms will have variable air volume (VAV) boxes to better handle peak occupancy loads.

c) When smoke is sensed in the return air duct, the system shall shut down per NFPA 90.

6. Change Rooms (SWP 144,146)/Locker Rooms/Airlock 145:

a) The Change Rooms, locker rooms and airlock 145 area shall be served by a packaged 100% outside air make-up unit (MA-11-601). Exhaust air from locker rooms shall exchange heat with the incoming 100% outside air in an air-to-air rotating wheel type heat exchanger (HR-11-601). The supply air shall be electrically heated or cooled (chilled water) as required to maintain locker room conditions. Final filtration shall be 80% bags with 2" throwaway 30% prefilters. Ductwork shall be commercial grade galvanized except for the exhaust branches from the shower areas, through the heat exchanger, which shall be commercial grade 304L stainless steel.

b) Electric heating coils will be utilized for heating 100% outside air. A constant speed supply fan with constant temperature discharge shall be utilized to control room temperature.

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7. Mechanical Rooms:

a) Packaged make up air unit MA-11-702 shall serve both the upper and lower mechanical spaces. 100% outside air will be used for summer cooling. Exhaust air from each room will be reduced in winter, with a variable speed supply fan to conserve heating energy. Exhaust fan EF-11-703 will serve the lower compressor room while exhaust fan EF-11-704 will exhaust the upper mechanical room.

8.4.5 HVAC Sequence of Operation

1. The WRAP Module 1 building is served by five (5) main air handling systems, each controlled by a local control panel, or remotely from the Control Room. Start/stop capability with adjustable setpoints may be controlled remotely from the Direct Digital Control System in the Control Room. Local control panels mounted in units are energized when units are started. CRTs in the Control Room will also allow monitoring of system run time, temperatures, humidities and airflow CFMs as applicable. Dampers and valves shall be pneumatically actuated. Control systems shall be electronic PID (proportional, integral, derivative), with 4-20 ma analog signals, and 0-24 volt start/stop signals.

2. The objective of the Process Control System (PCS) is to achieve positive control of particulate airflow from clean areas to potentially contaminated areas. Controls will be designed to fail safe to achieve this objective. If the Plant Control System (PCS) fails, the local control panels located on the airhandler will revert to the last setpoint and will continue to maintain airflow. Thus, all HVAC control will not be lost in the event of failure of the PCS systems.

3. Redundant air handlers and filter trains will be interlocked so that the standby unit will not be energized, and dampers and heating/cooling coils will go to the standby mode.

4. The following paragraphs describe the operation of each area HVAC system. The reader is referred to the respective area HVAC flow diagram as a supplement to the narrative provided.

5. The HVAC Air Flow Diagram, System Composite H-2-88154 depicts the overall HVAC system.

6. Shipping/Receiving and NDE/NDA Areas:

a) The Shipping/Receiving and NDE/NDA Areas are served by package airhandler AH-11-302 (32, 380 cfm), and supply fan SF-11-305, which is located inside the airhandler, zone return fans RF-11-303, and RF-11-304, and a ducted roof exhaust fan EF-11-302. These systems are controlled from a built in control panel.

b) Airhandler control panel is enabled via a local HAND/Off/AUTO control switch. After start up, "RUN" or "TROUBLE" will be indicated in the control room for both the supply and return fans status.

c) During start up, supply fan SF-11-305, return fans RF-11-303 and 304 will start, and the outside and return air dampers will open to the minimum outside air position. Airflow will be constant with 11% outside air.

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d) Room temperature will be maintained at setpoint by a local electronic PID (proportional, integral, digital) controller, two room temperature sensors and a modulating two-way valve. Upon a call for cooling the two-way chilled water valve will modulate open as required to maintain room temperature. Upon a call for heating the electric duct heater will energize in stages as required to maintain room temperature.

e) Room humidity will be maintained at no less than 30% RH by a local electronic controller. Upon a call for humidification, the humidifier system will add humidity to the discharge air. A high limit duct mounted humidistat set at approximately 80% will prevent flooding of the discharge air ductwork.

f) The economizer cycle will be activated via a local electronic controller when the outside air is less than 55°F (adjustable) and when there is a call for cooling. Then the outside air damper will open and the exhaust fan EF-H-302 will start. The outside air and return air dampers will modulate as necessary to maintain 55°F discharge air. The humidifier will add humidity as required to maintain room humidity.

7. <u>Process Air</u>:

a) The Process HVAC and Process Areas are served by 100% redundant package make up air units MA-11-203A&B (17,000 CFM each), and mounted within the package units are supply fans SF-11-203 A&B (SF-11-203B is standby).

b) The local make-up air units control panel is enabled remotely or via a local START/STOP control. A local AUTO switch will allow remote START/STOP capability from the Control Room. After start-up, "RUN or TROUBLE" will be indicated in the Control Room for the supply fan.

c) An interlock will permit start-up of the supply system only when the glovebox and selected room exhaust blower (BL-11-201 A&B) and (202 A&B) are running. This will preclude overpressurization of the process room. Another interlock located on the main supply air duct isolation butterfly valve will prevent startup of the supply fan if the valve is blocked or the supply duct is blocked. Additional sets of interlocks will de-energize and position the standby airhandler systems in the standby mode.

d) During start up, butterfly isolation valves on the inlet and outlet of the supply unit will open and supply fan SF-11-203 will start with the inlet vane in the minimum air position. A pitot array flow sensor in the discharge duct and a PID electronic controller will control the blower inlet pneumatic vane actuator in order to maintain flow setpoint (17,000 CFM adjustable). Flow setpoint is resettable from the Control Room PCS system, or from the local panel.

e) Process room air pressure sensors and the PCS digital system will reset the supply air setpoint as required to maintain room air pressure setpoint (0.15 IN WC differential pressure to surrounding rooms). The differential air pressure controller will control room pressure by automatically adjusting supply air flow, while the exhaust airflow is maintained constant. Process room pressures may be monitored on the Control Room CRT screens.

f) A local low flow indicator in the control panel will indicate airflow quantity in cfm and a flow alarm will indicate low flow on the Control Room CRT screens.

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g) The exhaust blowers shall run at a constant flow. Pitot array airflow sensors in the discharge air ducts and local PID electronic controllers will control the blower inlet vane pneumatic vane actuator in order to maintain resettable flow setpoints for BL-11-201A and BL-11-202A. When the air fillers load with particulate and cause a drop in airflow, the controllers will increase pressure to maintain constant airflow.

h) The glovebox pressure control system indicated on the glovebox drawings will maintain constant negative glovebox pressure. A glovebox pressure sensor and the local electronic PID controller will control a butterfly valve in the glovebox discharge duct as required to maintain glovebox pressure setpoint (-1.0 inch W.C.) relative to the room.

i) The room supply air conditioning control system will maintain constant discharge air temperature at 75°F (adjustable) and room humidity setpoint at 30% RH (adjustable). The temperature control system consists of a room humidity sensor and an electronic PID control system, and a two-way modulating chilled water valve at the cooling coil. Upon a call for cooling, the two-way valve will modulate open as required to maintain discharge air temperature. Upon a call for heating, the electric heating coil will energize in stages as required to maintain constant discharge air temperature.

j) Upon a call for dehumidification, the two-way chilled water coil valve will open fully and the electric reheat coil will energize in stages to maintain a constant discharge air temperature (55°F adjustable); upon a call for room heating, electric heaters will be energized and the discharge setpoint temperature will be increased as required to maintain discharge air temperature. Upon a call for humidification, the humidifier system will add moisture to the discharge air duct. A high limit duct humidistat control will limit maximum duct humidity to 80% to avoid water in the discharge duct.

k) A process heat recovery system (run-around heat recovery) will be controlled by a local control panel. When the outside air temperature is below 55°F or above 85°F (adjustable) the glycol recirculation pump will start. A self contained thermostatic three-way valve will automatically bypass glycol in order to prevent freezing of glycol and heat recovery coils.

8. <u>Administrative Areas</u>:

a) The Administrative Areas are served by package airhandler AH-11-501 (14,200 cfm) and supply fan SF-11-503, which is located inside the airhandler, axial return fan RF-11-501, and axial exhaust fan EF-11-501, both located in exhaust and return ductwork.

b) The local air airhandler control panel is enabled via a local HAND/OFF/AUTO control switch. Upon low fan differential pressure, "RUN" or "TROUBLE" will be indicated in the Control Room for the supply fan status. Likewise, low fan differential pressure and "RUN" status for the return and exhaust fans will be indicated in the Control Room.

c) During start-up, supply fan SF-11-503 will start via the local HOA switch. Likewise, the return fan SF-11-501 will start via the local START/STOP switch. The smoke exhaust fan EF-11-501 will not normally start, and the flow damper FV-646 will open, allowing approximately 20% outside air to be supplied to the space.

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d) Room temperature will be maintained by a local PID electronic controller, room temperature sensors, and a modulating two-way chilled water valve. Upon a call for cooling, the two-way chilled water valve will modulate open as required to maintain discharge air temperature at setpoint. Discharge air setpoint will be lowered by the controller as required to maintain room temperature.

e) Upon a call for heating, the electric duct heater will energize in stages as required to maintain room discharge air setpoint . Discharge air setpoint will be increased by a master PID controller as required to maintain room temperature setpoint.

f) Room humidity will be maintained at no less than 30% RH by a local PID electronic controller. Upon a call for humidification from the room humidity sensor, the humidifier system will add humidity to the discharge air. A duct mounted high limit humidistat set at approximately 80% will prevent flooding of the discharge air ductwork.

g) The economizer cycle will be activated when the outside air temperature is less than 55°F (adjustable), and when there is a call for cooling. When the economizer cycle is activated, the outside air damper will open and the exhaust fan EF-11-501 will start. "RUN" status for EF-11-501 will be annunciated in the Control Room. The return damper will shut and the outside supply damper will open, thus bringing a supply flow of cool air. During economizer operation, the chilled water valve will be shut off in order to conserve energy. The outside exhaust and return dampers will modulate as required to maintain 55°F discharge air temperature.

9. <u>Change Rooms (SWP 144, SWP 146)/Locker Rooms/Airlock 145</u>:

a) The change rooms, locker rooms and airlock 145 areas are served by a package make up air unit MA-11-601 (4000 cfm), with built in supply fan SF-11-604 and exhaust fan EF-11-604. This system is controlled from a local (built-in) control panel.

b) The local control panel is enabled via a local START/STOP controller. After start-up "RUN" will be indicated in the Control Room.

c) During start-up, the heat recovery wheel will start and run at a constant speed and will recover energy from the exhaust air from locker rooms. An automatic frost protection control system will stop the wheel as required to allow defrost.

d) An electronic PID discharge temperature control system will maintain discharge air at setpoint (75°F adjustable). Upon a call for cooling from the discharge air sensor, the controller, and a two-way control valve will modulate as required to maintain discharge air setpoint. Upon a call for heating, the electric heating coil will activate in stages as required to maintain discharge air setpoint. Humidity will be maintained at 30% (adjustable) by a local PID electronic controller. Upon a call for humidification, the electric humidifier system adds humidity to the discharge air. A duct mounted high limit humidistat set at approximately 80% will prevent flooding of the discharge air ductwork.

e) Air supplied to Change Rooms will be directed to process airlock 145 and then to process area by maintaining pressure differentials required to achieve flow of exhaust air into process area. This will assure that exhaust air from Change Rooms will be filtered via process air exhaust system.

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10. Mechanical Rooms:

a) The Upper and Lower Mechanical Rooms are served by a package airhandler MA-11-702, which provides heating and ventilation. A local electronic PID controller will be mounted in the unit. Supply fan SF-11-702, mounted in the unit will supply a variable airflow (from 2000 cfm to 11,200 cfm) via an electronic variable speed fan motor controller. Both Mechanical Rooms are served by separate exhaust fans. Fan EF-11-703 (5000 cfm) serves the lower Mechanical Room and EF-11-704 (5280 cfm) serves the Upper Mechanical Room.

b) The local airhandler controller panel is enabled via a local START/STOP switch. A "RUN" or "TROUBLE" status will be indicated in the Control Room for airhandler and exhaust fans.

c) Upon start-up, the supply fan will start at minimum speed and air flow, and the exhaust fans will not start. Backdraft dampers will allow flow of relief air. This is the energy conservation mode to preclude excess air flow and heating energy during winter operations.

d) Typically in the summertime season and upon a call for cooling from the high limit control and the room temperature sensor, the variable supply fan will increase airflow until the room setpoint (110°F maximum adjustable) is satisfied. The room requiring the most cooling will lead the call for cooling. When either of the Mechanical Rooms temperatures exceeds 95°F (adjustable), a local thermostatic switch shall start the exhaust fan located in that room.

e) Upon a call for heating,via the high limit controller and room thermostats, the electric heating coil shall be activated in stages as required to satisfy the coldest room at setpoint (55°F adjustable).

11. Computer and Control Rooms:

a) The Computer and Control Rooms are served by two 100% redundant self-contained, glycol cooled, electrically heated and humidified package computer room units. Room temperature and humidity will be closely controlled (72°F, 30-50% RH adjustable).

12. Chilled Water System:

a) The chilled water system consists of two skid mounted package chillers with attached closed circuit evaporative cooling towers (CH-11-101 A,B).

b) Capacity of each chillers is 50% of total design load. Reduced chiller capacity was selected to obtain lower initial cost and better part load efficiency, yet with sufficient backup capacity for the majority of the cooling season. This is compatible with the 70% minimum utilization required for the facility.

c) In addition to the package chiller/cooler units, the main glycol recirculation pumps (P-11-101-A,B) are used to recirculate chilled glycol to the air handler cooling coils. The main recirculation pumps are 100% redundant, and are controlled by a variable speed electronic controller in order to conserve energy during part load conditions.

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d) The chilled water piping is arranged in a primary-secondary loop such that when the system demand exceeds the lead chiller capacity, a flow reversal occurs in the bypass line, which actuates a flow switch. This in turn allows the lead lag control panel to turn on the lag chiller and its associated chiller feed pump, and its evaporative cooler.

e) To start the chiller, the HOA switch at the local chiller control panel is placed in the "Hand" position. Then the "Start" button is pushed. This allows the lead chiller feed pump to start. "Run" or "Trouble" is indicated in the Control Room.

f) The lead chiller then starts automatically, if sufficient flow pressure exists as indicated by the pressure differential flow switch in the chiller discharge pipe.

g) The lead evaporative cooler then starts automatically.

h) When the airhandler's chilled water load exceeds the capacity of the lead chiller, a flow switch will allow the lead lag panel to start the lag chiller pump, chiller and evaporative cooler similarly to the lead chiller starting sequence.

i) Chiller discharge temperature will be indicated in the Control Room. Likewise, system malfunction will be indicated by a "Trouble" indicator.

j) Interlocks will not allow chiller feed pump or chiller package operation unless the main chilled water recirculation pumps are running.

k) The main recirculation pumps are started at the "Start/Stop" button at the pump electronic speed control panel in the Mechanical Room. Pump "Trouble" or "Run", chiller selection ("Lead" or "Lag"), and pump discharge pressure are all indicated in the Control Room.

8.4.6 Safety Features

1. Safety features of the WRAP Module 1 facility include the following:

a) The Process Zone I enclosures will be confined by both supply and exhaust HEPA filters mounted on the gloveboxes in order to confine contamination during a total loss of power. Likewise Process Zone II rooms will be confined by two HEPA exhaust filters and a closable low leakage damper located in the supply duct.

b) The HVAC control systems will fail in the safe position. That is, the dampers and controls in Zone 1 and Zone 2 areas will fail in the position that will allow airflows and negative pressure to be maintained. Control systems will also be maintained by a hierarchy of control such that one single failure of the Central Control System (PCS) will not disable all of the HVAC systems. This will be accomplished by allowing HVAC systems to revert to local individual control if the PCS system fails. Local control panels will allow manual adjustment of setpoints.

c) The process HVAC systems are equipped with isolation dampers on the inlet and discharge of both the make-up air handlers and exhaust filter trains.

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d) HVAC HEPA (high efficiency particulate air) filters in the process exhaust filter plenums will be testable in place to verify efficiency of filters as a contamination barrier. Glovebox inlet and exhaust HEPA filters will be non-testable. Continuous air monitoring will be provided downstream of non-testable HEPA's, in the exhaust ductwork.

e) In the event the process air exhaust fan(s) shutdown, experience belt failure or other abnormal condition, the supply air fans will be interlocked to automatically shutdown. This precludes pressurization of the process area.

2. Sufficient redundancy has been provided in the equipment and control components to ensure a reliable and maintainable system.

8.4.7 Outline Specifications

1. Listing of the Title I outline HVAC specifications include the following. The outline specifications are included in **Volume III** under Tab HVAC.

CSI No.	Title
15050	Basic Mechanical Materials and Methods
15100	Valves and Special Hydronic Equipment
15140	Supports and Anchors
15160	Pumps
15250	Mechanical Insulation
15650	Refrigeration
15760	Liquid Heat Transfer
15781	Special Systems
15800	Air Distribution
15855	Air Handling Units
15860	Exhaust Fans
15883	HEPA Filter Housings

8.5 Process Control

8.5.1 Design Requirements

1. **Plant Management System:** A central processor based Plant Management System (PMS) shall be utilized to satisfy five basic objectives; (1) data acquisition, (2) data analysis, (3) process system control and surveillance (4) material transfer and inventory control, and (5) control and surveillance of building utilities (e.g. HVAC). The PMS is comprised of two sub-systems; the Plant Control System (PCS) and the Data Management System (DMS). The PCS provides the hardware and software functions for control and surveillance, while the DMS satisfies the data handling requirements. Central control and computer rooms shall be provided for remote control and surveillance of the plant as well as for entering and retrieving data. These rooms shall be environmentally controlled for temperature humidity and dust so as not to impact the operation of the PMS. Satellite stations shall be located at key areas of the facility where data can be manually or automatically entered into or obtained from the DMS and where the process may be controlled locally. The central and local control stations shall be provided with terminals and electronics suitably designed for the environment in which they must operate. Process instrumentation with graphic displays that mimic the process shall be used throughout WRAP 1 to operate and control each work station. The PMS shall have all the required hardware and software to perform the following:

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a) Accurately collect, display, store, and report all process and safety parameters in real time.

b) Display information in an orderly manner on video display terminals with color graphic features.

c) Provide a display console with a crucial process alarm selection and detection panel. This panel shall provide an audible and visual alarm calling attention to the display screen upon which the crucial parameter has been programmed to appear.

d) Generate all required permanent and backup records to include magnetic media and hard copies.

e) Generate all required shipping papers.

f) Provide personnel inventory control to aid in evacuation and emergency procedures.

g) Provide bar code reading.

h) Data reduction such as input averaging, parameter trend display, and data recording.

i) Compile and display approximate fissile content within all process enclosures, components and areas.

j) Track status of all incoming waste containers and contents as they are processed through the facility.

k) Identify location of all waste containers within the facility.

l) Store information on each incoming waste container.

m) Provide trend analysis on process parameters and other plant parameters (e.g. radiation levels) recorded by the PMS.

n) Interface with the Hanford and WIPP solid waste data bases and laboratory data management systems.

o) Provide for data transmission to 272-WA Facility.

p) Provide facility performance information such as numbers of containers of various waste types processed per shift, cumulative number of containers of various waste types processed, waste volume reduction factors, running fissile material inventories, radiation exposure per time, average and peak radiation levels of containers.

q) Store and transmit data required by the WIPP-WAC data reporting requirements on each container.

r) Permit overall management and control of plant operation from a central control room.

s) Provide regulatory closed loop control and sequential logic control.

t) Provide alarm processing, display, annunciation and printout capabilities.

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2. **Health Physics System:** All rooms and spaces within the facility which could potentially contain radioactive material will be continuously monitored for direct radiation (gamma/neutron) and airborne contamination (alpha/beta). The design shall provide:

a) Permanently installed monitors for air sampling, record sampling, dose rate and count rate.

b) Permanently installed effluent monitoring and sampling devices.

c) Self-survey stations equipped with hand, foot counters and body friskers.

d) Permanently installed area radiation monitoring and alarm equipment.

3. **Closed Circuit Television System:** The design shall provide a Closed Circuit Television System (CCTV) to assist in monitoring process operation especially the Non-destructive Examination (NDE) station. The CCTV system shall have the following features:

a) Provide remote monitoring of process operations and areas from the central control room and locally at the waste processing glove boxes. Monitors with switching circuitry shall be installed. The CCTV system shall provide video cassette recording with voice comment capabilities for the NDE operators.

b) All cameras shall be easily accessible for maintenance.

c) All cameras shall have multi-function capabilities including pan, tilt, and zoom. These features shall be controllable from remote panels mounted next to each monitor. All cameras shall be controllable from any control panel. The NDE operators' stations shall have priority of camera selection in the NDE area and NDE enclosures.

d) Cameras shall be provided in sufficient numbers to provide the operators visual access to the NDE/NDA area and the waste processing gloveboxes.

e) Monitors shall be provided at local control stations and in the central control room. Monitors shall be capable of selecting any camera.

f) The CCTV system shall be resistant to electrical system interferences.

g) The CCTV system shall have the capability to record from any camera. A title and time block feature shall be provided to identify the camera which is making the recording and the time and date of recording.

8.5.2 Reference Drawings

Drawing No.	Drawing Title
H-2-87740	Instrument & Control System Legend & Symbols
H-2-87741	Computer Room/Control Room General Arrangement
H-2-87742	Plant Management System Block Diagram/Control Room
H-2-87743	Plant Management System Block Diagram/Field
H-2-87744	Health Physics Instrumentation General Arrangement

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8.5.3 Plant Management System Description

1. **General:**

   a) The design scope for the process control systems at WRAP 1 encompasses a micro-processor based Plant Management System (PMS) consisting of two sub-systems; 1) the Data Management System (DMS) and 2) the Plant Control System (PCS).

   b) As part of the Plant Management System, the central micro-processor based Data Management System shall accurately collect, analyze, store and report waste container data and inventories. Additionally, a distributed architecture Plant Control System shall orchestrate the movement of waste containers among the various operating stations and monitor and control facility HVAC and utility systems.

   c) Operator consoles with graphic displays that mimic the process shall be used in a centrally located control room and at local work station. These consoles and work stations shall provide process and alarm status, and allow operators to control the process. The Control Room operator consoles shall have the capability for surveillance of plant status by means of CCTV monitors. Data entry and retrieval to/from the Data Management System shall be provided at the operator consoles and work stations.

2. **Plant Control System:**

   a) The PCS is based on a Distributed Control System (DCS) architecture. The PCS has local control units housed in four enclosures located on the plant floor to service the process and facilities areas as follows:

Controller	Area Served
CNR-12-101	Shipping/Receiving & NDE/NDA
CNR-12-102	LLW Process Enclosures
CNR-12-103	TRU Process Enclosures
CNR-12-104	HVAC/Utilities/Monitors

   b) Control of the Internal Transport System is distributed among the various area control units. This facilitates the interface between the transport system and the various enclosure. Radiation and Health Physics monitors are also distributed among the control units so that the shortest run of signal wiring from monitor to control unit will be achieved.

   c) Free standing cabinets are provided to house all electronic equipment such as controllers, communication network interface modules, multiplexers, power supplies, I/O modules and terminals. Racks and cabinets shall meet or exceed NEMA 4 requirements.

   d) Local control units provide continuous control and monitoring, independent of control room operator interfaces or communication network, by use of regulatory and sequential controllers. The local control units may consist of one or a combination of multi-loop regulatory and sequential controllers.

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e) The system is designed so that control functions are distributed on a modular basis to distribute risk. Control functioning shall not depend on a centrally based device or communication system.

f) The sequential controller is capable of implementing sequential control logic, interlock logic and discrete control functions without higher level support. The configuration of the system will allow either fully automatic operation or remote manual as controlled by operators located in the control room.

g) Programming will be by means of configuration in a logic flow charts manner using operator-oriented language. It will not require translation to either ladder logic or boolean algebra.

h) 24 to 28 volt dc power supplies for field transmitters and digital inputs shall have current output sufficient to power 4-20 milliamperes analog inputs and digital inputs as contained in the I/O list. Failed power supplies will have automatic switch over to a backup unit. Power supply failure contacts will be provided to indicate failure of either the primary or backup unit.

i) The distributed control system will be capable of handling the following input/output signals:

- 4-20 milliamperes Input
- 1-5 volts DC Input
- Field Contact State Input
- 3-Wire PNP Source/Sinking Transistor Input
- Digital Pulse Input
- Grounded/Ungrounded Thermocouple Input
- R.T.D Input
- Contact Output
- 120 VAC Output
- 4-20 milliamperes Output
- RS-232C Serial Link

j) All Digital I/O modules will contain optical isolating devices providing 1200 volts DC or more isolation from user wiring or other I/O modules.

k) Elements of the DCS are connected on a redundant, separately routed data highway compatible with linking to the Data Management System for a fully integrated Plant Management System.

3. **Data Management System:**

a) A separate stand alone computer system is provided to perform the functions of the Data Management System. The computer system is a multi-tasking, multi-user micro-computer based system.

b) The central processing unit is a micro-computer equivalent in capabilities to a Digital Equipment Corporation VAX series 4000 model 200 including disk, memory and ethernet interface capabilities. A minimum of 16 megabytes of RAM memory is provided.

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c) The internal hard disk is 1 gigabyte capacity. An internal cartridge tape drive is provided capable of storing data onto 95 megabyte, minimum, cartridges.

d) Terminals have 14 inch white monochrome graphics screen with a resolution of 800 pixels X 500 lines and standard English keyboard.

e) A terminal and printer connected to the DMS is provided in the following locations:

Location	Function
Computer Room	System Manager's Terminal.
Ship/Rec Office	Input manifest data and generate shipping papers and bar code label.
Sample Management Office	Input sample data from restricted waste management enclosure and retrieve sample results from laboratory.
TRUPACT Area	TRUPACT station terminal.

f) Communication with system peripherals will be by means of an internal local area network conforming to the IEEE 802.3 protocol.

g) Communications ports are provided to interface to the following systems.

- Plant Control System Communication Network.
- NDA Communication Network.
- Hanford Local Area Network via Fiber Optic Modem.

4. **Control Room Arrangement:**

a) The control room contains five operator consoles (see Figure 8-3) configured as follows;

- NDE Consoles 1 & 2
  - 1 section containing CCTV monitor w/control panel.
  - 1 section containing Color Graphic terminal w/keyboard.
  - 1 section containing NDE equipment electronics and VCR.
- Transport/NDA Cons. 1 & 2
  - 1 section containing CCTV monitor w/control panel.
  - 1 section containing Color Graphic terminal w/keyboard.
- Dispatcher Console — Same as Transport/NDA Consoles.

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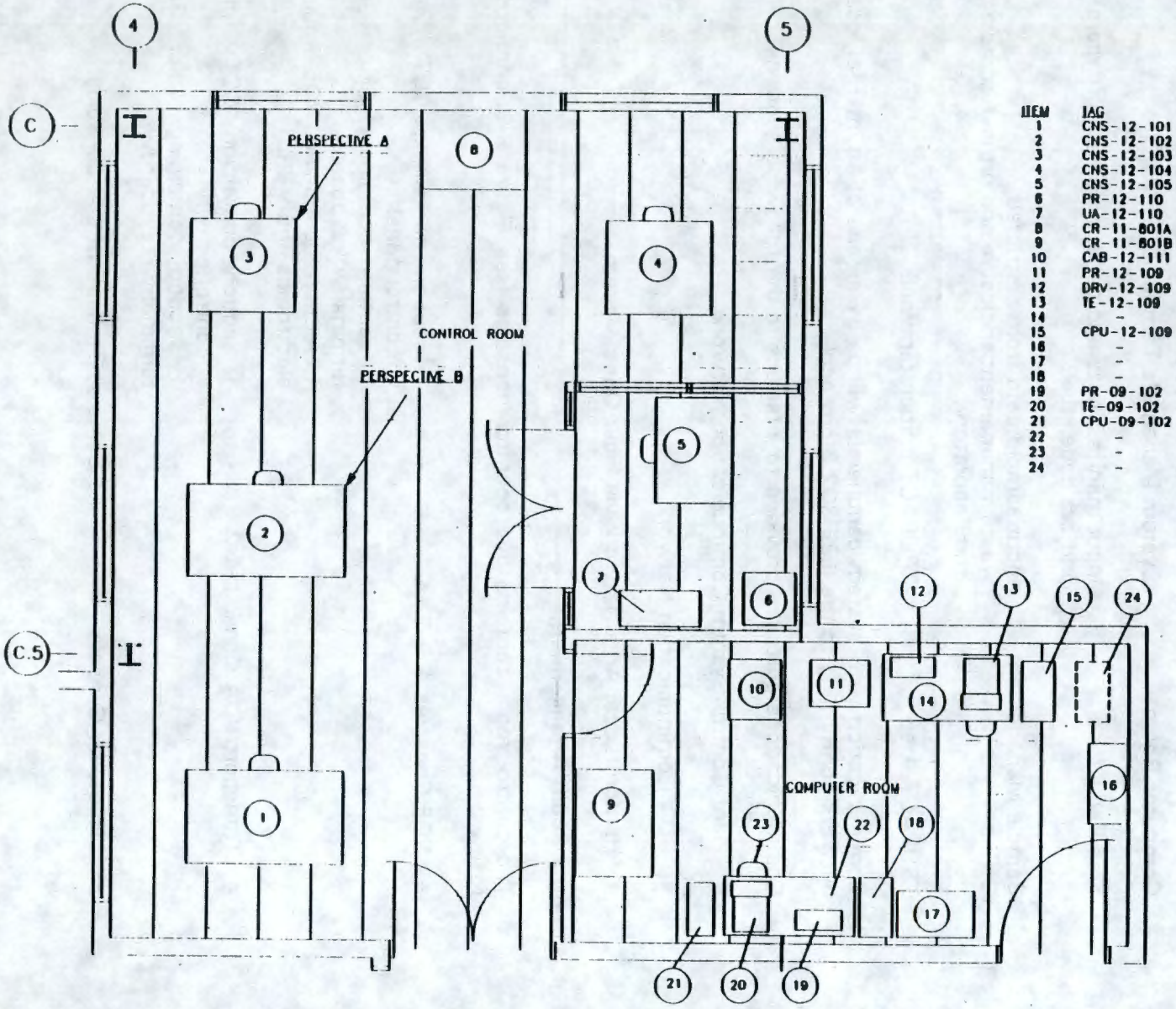

EQUIPMENT LIST

ITEM	TAG	DESCRIPTION
1	CNS-12-101	NDE Operator Console #1
2	CNS-12-102	NDE Operator Console #2
3	CNS-12-103	Transport/NDA Console #1
4	CNS-12-104	Transport/NDA Console #2
5	CNS-12-105	Dispatcher Console
6	PR-12-110	Plant Control System Printer
7	UA-12-110	Facility Alarm Annunciator
8	CR-11-801A	Computer/Control Room Air Cond. Unit
9	CR-11-801B	Computer/Control Room Air Cond Unit
10	CAB-12-111	CCTV Interface Cabinet
11	PR-12-109	Data Management System Printer
12	DRV-12-109	DMS External Disk Drive
13	TE-12-109	DMS Terminal & Keyboard
14	-	DMS Table
15	CPU-12-109	Data Management System CPU
16	-	Book Case
17	-	Disk Storage Cabinet
18	-	File Cabinet
19	PR-09-102	AGV Control System Printer
20	TE-09-102	AGV Control System Terminal & Keyboard
21	CPU-09-102	AGV Control System CPU
22	-	AGV Table
23	-	Operator Chair (typ. 7 ea.)
24	-	DMS Archive Disk Drive (as required)

FIGURE 8-3

WRAP MODULE 1 - CONTROL ROOM LAYOUT

b) Each console will be free standing and will be totally enclosed (except for required ventilation) with access doors at rear. The console will provide the cabinetry and table surfaces as required to mount the equipment specified.

c) Operator consoles will be designed in accordance with human factors guidelines given in Military Specification (MS) MIL-STD-1472D.

d) Operator interfaces with graphic displays that mimic the process are used to operate and control the plant. Data entry and retrieval to/from the Data Management System will be provided at the operator interfaces. Operator interfaces consist of a CRT monitor and keyboard assemblies complete with associate electronics package including micro-processor and memory, a power distribution assembly, and floppy/hard disk drives. A track-ball assembly will be provided for cursor control.

e) The two Transport/NDA consoles are located in the control room such that the operators will have visual access to the Process area. Transport/NDA console #1 will have additional visual access to the NDE/NDA area.

f) NDE console #1 is located with operator visual access to the NDE/NDA area. NDE console #2 is located with operator visual access to the Shipping/Receiving area.

g) A Dispatcher's console is provided in a glass-walled enclosure within the control room. The enclosure provides some measure of isolation of alarms and/or telephone conversation noise from the rest of the control room operators. An annunciator panel is provided for the Dispatcher to monitor crucial facilities alarms. An alarm and event printer is also provided within the enclosure to provide hard copy reports on a demand basis.

h) The control room will be provided with egg-crate diffusers on the over head lighting and dimmers to control glare reflected to the CRT terminals.

5. **Functional Description:**

<u>Receiving and Storage</u>

a) Each container will be visually and radiologically inspected, and its accompanying documentation inspected by an operator. Documentation will also be received electronically via the HLAN and available through the DMS. Each drum and box will have bar code identifiers on the sides and top. The radiological survey will be done manually.

b) All receiving operations will be done manually by an operator with the aid of a hand held bar code reader and a local work station with access to the Plant Management System. All information obtained from visual and radiological inspection and from the accompanying documentation will be input by the operator using the local work station. A terminal directly connected to the DMS will also be available in the Shipping/Receiving office for entering data.

c) Each box and drum will be identified via bar code reader, weighed, and the weight entered automatically into the Data Management System. Weigh information will be stored in pounds and kilograms.

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d) Container labels with measured weight and 14 digit identification number will be generated by a label printer and attached manually by the operator to each container.

Labeling and Shipping Station

a) The shipping area will ship boxes and drums to WIPP, on-site LLW disposal, and to storage facilities on a routine basis. Each container will be visually examined for damage and proper closure and radiologically surveyed. A local operator will have access to the Data Management System by means of a local work station. Accompanying documentation will be generated by the Data Management System via the Shipping/Receiving office terminal and printer which are connected directly to the DMS. Appropriate labels will be applied manually.

b) Each package will be uniquely identified by means of a label permanently attached in a conspicuous location. The package identification number (to be standardized), will be in medium to low density Code 39 bar code symbology and alphanumeric characters at least 1 inch high.

c) Waste packages containing hazardous materials will be identified with appropriate EPA/Ecology and Department of Transportation labels.

d) Waste packages containing free organic liquids will be labeled "LIQUID ORGANIC WASTE" and with the flash point on the materials in Deg F

Nondestructive Examination NDE Station

a) The PMS supports the following functions at the Nondestructive Examination Station:

- Track the location of all waste containers in the NDE area
- Provide capacity to examine up to 43 drums per shift and 2 boxes per week
- Provide X-ray images with video cassette recording and voice comment capability
- Allow direct input of examination data into PMS
- Incorporate automatic container inspection and handling techniques for loading, unloading and transport to Open/Sort, Compaction, and Shipping Stations where practical

b) The Nondestructive Examination (NDE) portion of Module 1 will utilize real time radioscopy (RTR) consisting of X-ray fluoroscopy to examine the contents of each drum and box. An operator in the control room will be able to remotely move the container into the RTR unit, and the unit will automatically identify the container by tracking its location in the NDE area through software programming. To ensure a complete scan, the drum RTR unit will be capable of rotating, raising, and lowering the drum and the box RTR unit will utilize a two dimension movable X-ray head. The operator can also increase or decrease the power to evaluate different waste items. Pertinent information (e.g. dense or non-compliant waste items identified) will be entered into the Data Management System by the operator. A video tape will be made of each container, and the operator can make voice comments onto the video tape. All operations at the NDE station are either automatic or remote manual from an operator console in the control room.

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Nondestructive Assay NDA Station

a) The PMS supports the following functions at the Nondestructive Assay Station.

- Track the location of all waste containers in the NDA area.
- Assay 55/83 gal drums with upper detection limit of 500 grams of fissile material
- Assay boxes up to 8'L x 5'W x 4'H in size with up to 1,000 grams of fissile material
- Neutron assay drums and boxes
- Gamma energy assay drums
- Determine whether waste is TRU or LLW
- Determine whether the LLW waste's category 1, 3 or greater than 3
- Provide the radioactive material content data required for WIPP-WAC or LLW certification for all outgoing waste packages
- Allow direct input of assay data into the PMS
- Incorporate automatic container handling techniques for loading, unloading, and transport to NDE, open/sort, compaction, and shipping station where practical

b) The nondestructive assay (NDA) portion of Module 1 will determine the radionuclide content of each container to the extent required to meet certification and shipping requirements. The NDA systems will also be used to identify containers that do not meet radiological requirements such as fissile material limits, and "flag" those containers on the Data Management System for opening/sorting to remove the non-compliant item(s). Those containers for which non-compliant conditions have not been detected by NDE or NDA may be routed to shipping as certifiable, if appropriate.

c) The NDA equipment will include passive-active neutron (PAN) systems, and Gamma Energy Assay (GEA) systems. Each NDA system will utilize weight, density, and radionuclide distribution data from the Data Management System and established algorithms to calculate necessary radionuclide information. Drums and boxes containing known waste matrices and radionuclide content will be used as standards for periodic recalibration of all NDA equipment.

d) An operator in the control room will be able to remotely move the containers into each of the NDA units, and the units will automatically identify the container as tracked by the software. The assays will be preformed automatically with necessary container movement control and computational algorithms provided by the control system. The operator will then enter the necessary certification information into the Data Management System and initiate routing of the container to the next station.

LLW/TRU Processing Enclosures

a) The PMS supports the following functions at the LLW/TRU Processing Stations:

- Identify waste package via bar code reader
- Utilize entry systems for waste loading
- Remotely open 55 and 83 gallon drums
- Remotely empty contents onto the sorting table
- Utilize remote sorting and repackaging techniques
- Retrieve waste container information from the computer data base
- Input waste material information into the computer data base

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- Compact waste containers
- Weigh all drums as they are being loaded
- Transfer waste to restricted waste management station or other stations

b) After entering the enclosures, non-compliant drums will be opened and tipped onto a sorting table and the inner plastic liner opened. All operations will be performed remotely with the aid of locally controlled manipulators.

c) The Processing Enclosure operators will enter descriptive information on waste materials into the Data Management System, and bar code labels will be manually applied to all samples transferred from the Processing Enclosures.

d) For drums that do not meet the fissile material criteria, the contents will be redistributed into one or more new drums. The sorting table will have a liquid collection system beneath. These drums with redistributed fissile material will be reassayed to ensure proper gram distribution. Collected liquids will be transferred to the Restricted Waste Management Enclosure.

e) All sorting and processing function performed in the Processing Enclosures will be remote by manipulators.

f) All drums will be weighed as they are being filled, and the final weight entered into the Data Management System. The operators will have local control for the sorting tables and compactors.

g) Operations in the LLW/TRU Enclosure may be monitored in the Control Room via CCTV.

<u>Restricted Waste Management Enclosures</u>

a) Operations at the Restricted Waste Management Enclosures will be performed by a local operator. The operator will be provided with a CRT monitor to retrieve processing information from the Data Management System.

b) Within the enclosure, the operator will also apply bar code labels to containers to be loaded out and will have use of a bar code reader to read the label and enter the information into the Data Management System.

<u>Sample Management Area</u>

a) Samples will be received in the Sample Management Area from the Process Enclosures and from the Restricted Waste Management Enclosures. A terminal and printer directly connected to the DMS will be available in the Sample Management Area to record information about the sample. The samples will then be sent to a laboratory for analysis.

b) Once the laboratory analysis is complete, the information will be retrieved through the Sample Management Area terminal via the HLAN. The sample information will be used to input information to the DMS about how to process (i.e., treat, ship, or store) the waste from which the sample was taken. This information will be stored in the DMS in a recipe form to be used by the Restricted Waste Management Enclosure operator to process the waste.

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Internal Transport System

a) Control of the Internal Transport System will be by means of a vendor supplied automated guided vehicle (AGV) control system interfaced to the PCS. The vendor supplied control system will supply the path information to an on-board processor which keeps the AGV on track. The task request will be made by the PCS through a network link to the AGV controller. Task requests include information which directs the AGV to proceed to a location, retrieve a load and take it to another location.

b) Task requests will be defined by the software code in the PCS based on Time and Motion studies detailing the most efficient route for containers through the process. The software will control container movement automatically. In the case where the automatic sequence must be altered, the operator in the control room may take remote manual control of task requests and direct the AGV to complete the necessary load movement. In manual override mode, AGV, and consequently drum movement, shall be tracked and recorded by the PCS.

HVAC System

a) The HVAC system will be controlled automatically by the Plant Control System. Graphic displays mimicking the HVAC system will be available in the central Control Room for operator monitoring and for remote manual override control. The Control Room operator will have the capability to start and stop the HVAC system and to change setpoints. Alarms and out-of-tolerance conditions will be annunciated in the Control Room.

Utility Systems

a) The Electrical system will not be under Plant Control System control. Power loss alarms and/or indications will be routed to the Plant Control System.

b) The Fire Detection System will be a stand alone system. Alarms and indications will be routed to the Plant Control System for monitoring by the Control Room operator. The fire control panel will be located in the main lobby. The fire alarm system will be tied into Hanford Fire Department via a RFAR box.

c) Air Systems will be operated locally through hard wired control panels. Alarms and indications will be routed to the Plant Control System for monitoring by the Control Room operator.

8.5.4 Health Physics System Description

1. Health Physics Systems include all equipment necessary to monitor and control alpha, beta, gamma, and neutron radiation for the WRAP Module 1 facility, external of the waste handling and processing operations. In this section, Title I design objectives for each Health Physics System is described. Requirements for uninterruptible power supply (UPS) support is also discussed.

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2. The majority of Health Physics Systems for WRAP Module 1 will be to Westinghouse Hanford Company (WHC) site standards or those already typically in use at WHC. For the purposes of this report, vendor names and models have been specified for each system, however, for applications where WHC site standards do not exist, the vendors and models listed only serve as a representative example for Title I design. For these systems, Title II design will consider equivalent systems from all qualified vendors for procurement.

3. Air Monitor Systems include those which detect the presence of radioactive particles (alpha and beta) in the air. Existence of these particles will be monitored in the stack, glovebox ventilation ducts, all rooms containing waste drums, and the Process HVAC room. These systems can measure contamination real-time, or collect a sample for analysis at a later date.

4. **Isokinetic Exhaust Stack Monitoring System** is provided at the ventilation exhaust stack to monitor plant emissions. Features of this system include:

a) A dual exhaust stack sampling system, consisting of an isokinetically controlled record sampler and an isokinetically controlled sampling system, is a regulatory requirement (40 CFR 60 & 61) and will be included in Title I design for WRAP Module 1.

b) The term "isokinetic" implies that representative stack air velocity be used to measure total air volume passing through the stack. This information is used to accurately calculate the concentration of contaminated particles being exhausted through the stack. This requires use of a "rake" type probe (multiple flow sensors) inserted into the stack.

c) The record sampler (RPMP-12-150) is a system which collects representative stack exhaust particulates on a paper filter. This filter is periodically removed, with the collected particulates measured for concentration of various contaminants using isokinetic air volume measurements in the calculation. This requires an independent "rake" type sampling probe inserted into the stack. This is not a real-time system.

d) The sampling system (APMP-12-151, ACAM-12-151, BPMP-12-152, BCAM-12-152) provides a real-time indication of radiation particle.concentration using isokinetic air volume measurements and in situ radiation detectors. This requires an independent "rake" type sampling probe be inserted into the stack for each type of radiation to be monitored. Both alpha and beta particulates will be monitored independently for WRAP Module 1.

e) The independent beta monitoring system is required due to the potential release of beta particles during handling and processing of waste containing mixed fission products. The alpha monitoring system is required due to the potential release of alpha particles during handling and processing of waste containing transuranic elements.

f) The WRAP Module 1 Title I Isokinetic Exhaust Stack Monitoring System consists of:

- A Kurz Instruments exhaust sampling assembly and triple automatic isokinetic sample probes, Model Kurz-EVA 4200D;

- A Kurz enclosure mounted exhaust isokinetic airflow controller, Model 4200;

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- A Kurz record filter assembly;
- Three Kurz flow controllers, Model 710;
- Three Kurz control valves, Model 730;
- Three Kurz sampler pumps, Model 251;
- An Eberline alpha continuous air monitor (CAM), Model ALPHA-5A;
- An Eberline beta continuous air monitor (CAM), Model AMS-3A;
- All mounted in a generic monitoring exhaust cabinet.

g) It is a regulatory requirement that the stack exhaust monitoring system remain functional during loss of building power. As a result, the stack monitoring system is supported by the Uninterruptable Power Supply (UPS) system for the building.

5. **Glovebox Ventilation Duct Continuous Air Monitoring (CAM) System:** The non-isokinetic, Glovebox Ventilation Duct CAM system (ACAM-12-102 and 104, APMP-12-102 and 104, BCAM-12-101 and 103, BPMP-12-101 and 103) will measure the concentration of alpha and beta particulates leaving each Process glovebox HEPA filter. This will aid building operators and Health Physics personnel in isolating and quantifying amounts of radioactive particulates bypassing glovebox filtering systems in the event of an operation problem. Alpha CAMs for each (4) glovebox ventilation duct system are provided. There are no requirements for emergency power to the ventilation monitoring systems. Each CAM system will consist of:

- An Eberline alpha air monitor, Model ALPHA-6 or beta air monitor, Model AMS-3A;
- An Eberline regulated air pump, Model RAP-1;
- A sample probe.

6. **Room Continuous Air Monitoring (CAM) Systems:** The Room CAM systems (ACAM-12-109 through 112 and 145, APMP-12-109 through 112 and 145, BCAM-12-113 through 116 and 144, BPMP-12-113 through 116 and 144) will measure the concentration of alpha and beta particulates in all rooms containing drums, the Process HVAC room, and around Process gloveboxes. Room CAMs will be strategically (near room exhaust walls) placed in each room containing waste drums and in the Process HVAC room, to allow representative sampling of room air for alpha and beta concentrations. The beta CAMs are required due to the potential release of beta particles during handling and processing of waste containing mixed fission products and a potential leak in the filter trains in the process HVAC room. The alpha monitoring system is required due to the potential release of alpha particles during handling and processing of waste containing transuranic elements. Room CAMs must remain functional during loss of building power. As a result, these systems must be supported by the UPS system for the building. The WRAP Module 1 Title I design consists of:

- Five Eberline alpha CAMs, Model ALPHA-5A;
- Five Eberline beta CAMs, Model AMS-3A;
- Ten Eberline regulated air pumps, Model RAP-1.

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7. **Operator Breathing Air Samplers:** Operator Breathing Air Samplers (OAS-12-138 through 141) will be strategically placed near process gloveboxes to sample air near frequently employed operator work stations. Filters collected from these samplers are periodically removed, with collected particulates analyzed for various contaminants. This requirement is identified in WHC-CM-4-9, Radiological Design Manual, Section 10.0, Rev 0, Sampling and Monitoring. The design includes 4 fixed air samplers consisting of an Eberline regulated air sampler, Model RAS-1. There are no requirements for emergency power to the Operator Breathing Air Sampling Systems.

8. **Radiation Monitoring Systems** are those which detect the presence of abnormal radiation levels in air. This includes systems to measure gamma rays as well as to detect criticality. These systems include both stationary and portable detectors.

9. **Area Radiation Monitoring (ARM) System:** Design (GMON-12-105 through 108) includes 2 ARMs in the Process room and 2 ARMs in the Shipping and Receiving room each strategically located near routinely occupied work stations. The ARMs must remain functional during loss of building power. As a result, this system must be supported by the UPS system for the building. Each system includes:

- An Eberline panel mount display, Model EC-8;
- An Eberline gamma detector, Model DA1-6.

10. **Criticality Monitoring System** (CDAM-12-137) will be required if it is determined that a credible incident may cause a criticality excursion. To date, this has not been determined, however, for WRAP Module 1 Title I design, criticality detectors will be shown installed in the Process room. The Criticality Monitoring System must remain functional during loss of building power. As a result, this system must be supported by the UPS system for the building. Design includes:

- Three Eberline, Model DA1-7C remote criticality detectors;
- An Eberline data acquisition module, Model DAM-4A. It will not include an independent control terminal since it's function can be provided by the Plant Management System (PMS). System alarm functions, however, will remain independent of the PMS.

11. **Portable Gamma Monitors** are necessary for monitoring gamma radiation levels during maintenance activities, during routine surveys, and prior to shipment and receipt of waste containers. The WRAP Module 1 Title I design will not include Portable Gamma Monitors. It is expected that Portable Gamma Monitors will be supplied by the Westinghouse Hanford Corporation (WHC) as required.

12. **Contamination Control Monitoring Systems** aid in restricting the spread of contamination both inside, and outside the facility. These monitors identify surface contamination and alert the operator or Health Physics technician as to the location and intensity of such contamination. They are typically used as part of the routine egress procedure from gloveboxes gloves and the Process and Shipping & Receiving rooms, and before entering and exiting the locker rooms. They will also be utilized in the entry enclosures of both Process gloveboxes to verify contamination levels inside overpack drums after delivery of a retrieved drum and before removal from the glovebox.

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13. **Fixed Friskers - Surface Contamination Monitors:** Fixed Friskers (SMON-12-120 through 134) or poppies consist of a fixed electronic counting device and a hand held "wand". They are used by operators and Health Physics personnel to detect contamination on the surfaces of skin, clothing, drums and equipment. The WRAP 1 Title I design identified 15 locations where the use of Fixed Friskers would be beneficial. There are no requirements for emergency power to the friskers. These areas include:

- 2 at each of the 4 process gloveboxes for monitoring hands and clothing immediately after hand removal from gloves;
- 2 at the exit of the Process room for monitoring the entire body for contamination before leaving the process area;
- 2 at the exit of the coveralls removal area, before entering the locker rooms;
- 1 at the exit of the Shipping and Receiving room;
- 2 inside the entry enclosures of both Process gloveboxes to verify contamination levels inside overpack drums after delivery of a retrieved drum and before removal from the glovebox.
- An Eberline radiation monitor, Model RM-20;
- An Eberline alpha scintillation probe, Model AC-3.

14. **Portable Friskers:** Portable Friskers are necessary for monitoring surface contamination levels during maintenance activities, during routine surveys, and prior to shipment and receipt of waste containers. Portable Friskers are identical to Fixed Friskers except that they are not secured and utilized in one particular area. The WRAP 1 Title I design will not include Portable Friskers. It is expected that Portable Friskers will be supplied by the Westinghouse Hanford Corporation (WHC) as required.

15. **Hand and Foot Monitors:** WRAP 1 Title I design (HFM-12-135 & 136) identified 2 locations where the use of Hand and Foot Monitors would be beneficial. These areas are the exits of the men's and women's locker rooms. These monitors detect surface contamination (both alpha and beta/gamma) on the hands and feet of personnel. An Eberline Hand and Foot Monitor, Model HFM-6 would be used for WRAP 1 design. There are no requirements for emergency power to the Hand and Foot Monitors.

16. **Smear Counters:** Smear Counters are desk top instruments (SC-12-142 and 143) used to detect radiation contamination (both alpha and beta/gamma) emitting from paper samples or paper filters. A sliding tray with a dish type depression allows entry of the paper sample or filter into the detector. Variable count times can be selected to measure contamination levels. Multiple tray units are available. WRAP 1 Title 1 design has identified the decontamination area of the Process room and the Shipping and Receiving room as the most appropriate locations for a Smear Counter. The Smear Counter identified for Title 1 design is the Eberline Model SAC-4, single tray scintillation alpha counter. There are no requirements for emergency power to the Smear Counters.

17. **Alarms/Annunciators:** Alarms, with appropriate annunciators, will be strategically placed throughout WRAP - 1 to aid in the suspected hazard indication.

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8.5.5 CCTV System Description

1. The Closed Circuit Television (CCTV) system for WRAP 1 has been designed with the process in mind. Therefore, the system will require additional hardware to accommodate CCTV for plant and perimeter security. The major components of the CCTV systems are as follows:

2. **Video Cameras:** Solid state monochrome (black & white) cameras with 6:1 zoom lenses provide good resolution and sensitivity for viewing process. The cameras are sealed in pressurized housing to protect camera from possibility of contamination. There are eight (8) video cameras in the plant. Their locations are as follows:

   a) 2ea. in the NDA/NDE area to view the movement of the Automated Guided Vehicle (AGV) in the area.

   b) 3ea. in the Low Level Waste process glove box to view the various functions not visible from the outside.

   c) 3ea. in the Trans-Uranic Process Glove Box to view the various functions not visible from the outside.

3. **Video Monitors:** There are seven (7) 14-inch monochrome (black and white) video monitors to view various plant process. Five (5) of the monitors are in the Control Room in the Operator Consoles. And, one monitor is in each of the two Process Glove Box operator stations.

4. **Video Matrix Switcher:** This is a microprocessor based unit capable of accepting 30 video inputs and switching them to any of the 20 video outputs. The video inputs come from the following sources:

   a) 8ea. Video Cameras

   b) 3ea. raw video signals from the box and drum NDE machines

   c) 2ea. NDE video with comments and data

   d) 4ea. Video Cassette Recorders

5. **Video Outputs** are configured as follows:

   a) 7ea. Monochrome video monitors

   b) 2ea. Output to video data generator for the NDE video

   c) 2ea. Video Cassette recorders

6. **Camera Control System:** This is a microprocessor based system to switch camera control. With the Video Matrix Switcher, this allows the operator to select video input and outputs and control pan, tilt, zoom, focus, and iris functions of the selected camera. There is one operator control panel associated with each of the seven (7) monitors.

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7. **Video Cassette Recorders:** There are two (2) Video Cassette Recorders (VCR) to playback the recording of the X-ray image of the drum contents taken by the NDE machines. This allows the process glove box operators to determine the best way to remove the contents from a drum.

8. **Figure 8-4** is a block diagram that provides a graphic representation of the CCTV system.

8.5.6 Outline Specifications

1. Following is a listing of the control system outline specifications for the Title I design. The outline specifications are included in **Volume III** under the Building tab.

CSI No.	Title
13401	Control and Instrumentation
13402	Control and Instrumentation for Packaged Equipment
13406	Bar Code Identification System
13407	Annunciator
13451	Health Physics
13452	Isokinetic Stack Effluent Monitoring System
13461	Plant Management System
13462	Plant Management System Software

8.6 Mechanical

8.6.1 Design Requirements

Plumbing System

1. All plumbing systems will be designed and installed in compliance with the 1991 edition of the Uniform Plumbing Code. Facilities for the physically handicapped will be in compliance with the American National Standards Institute A117.1, latest edition.

2. The plumbing system design is based upon an occupancy of 34 personnel working in the facility on a single shift basis.

Sanitary Drainage System

1. The system will be sized to supply the maximum peak requirements of 225 gpm with a minimum of 15 psi residual pressure at highest fixture.

2. The sanitary drainage system will comply with local health codes and the design is based upon a septic tank leach field system.

Compressed Air System

1. Compressed air for use throughout the facility will be provided by package air compressors consisting of one on-line unit and one standby unit. Two compressed services are required, an instrument air supply system to serve the pneumatic interrupt air operators in the facility and a plant air supply system to provide wet air to pneumatic equipment.

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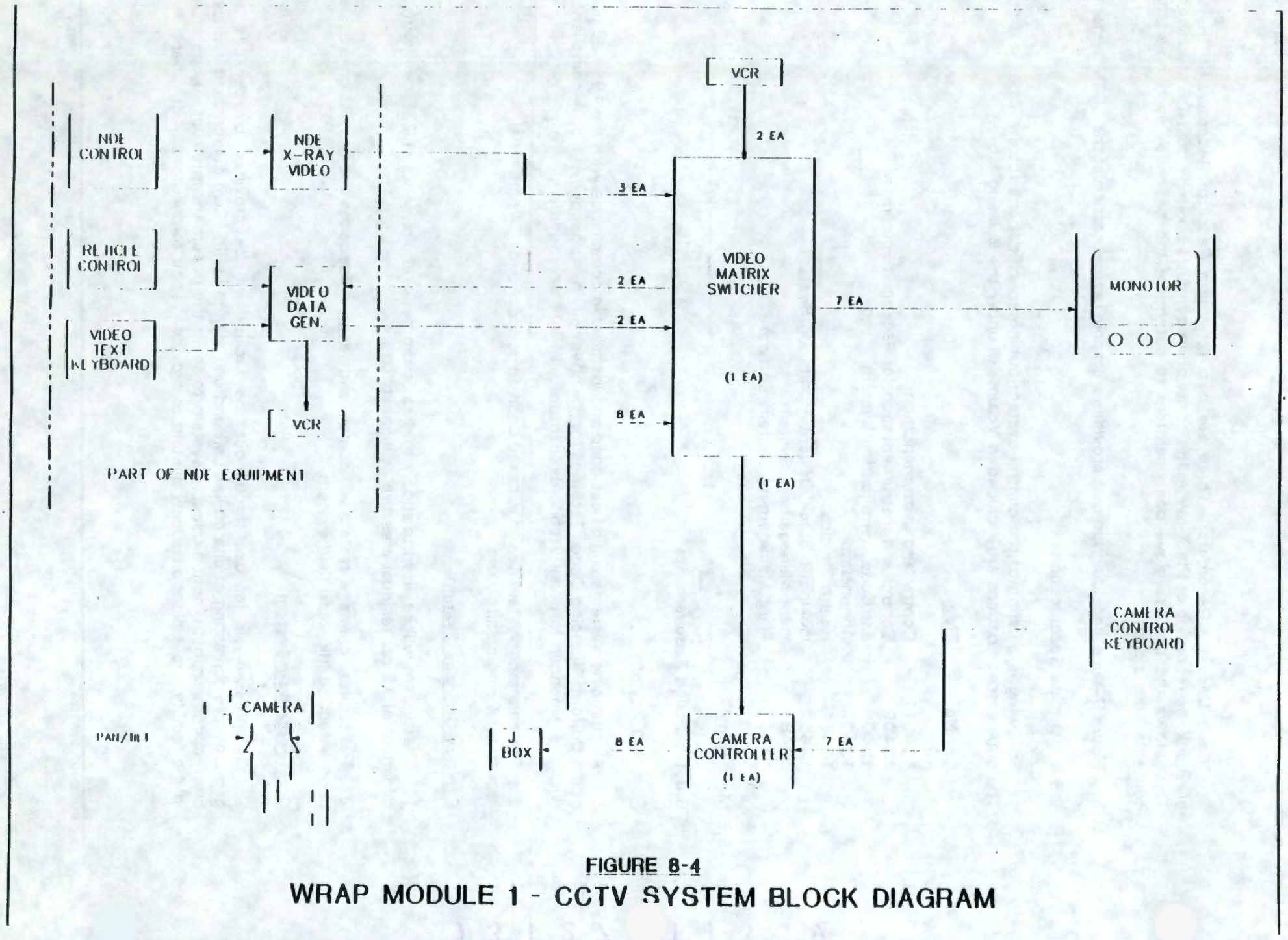

FIGURE 8-4

WRAP MODULE 1 - CCTV SYSTEM BLOCK DIAGRAM

2. The instrument air design requirements consists of providing -40°F dew point dry air at 90 psig to the users. The plant air design requirements consists of providing air direct from the compressor at a 1.25 grains per cubic foot moisture content and a delivery pressure of 80 psig.

3. Sizing of the plant and instrument air system equipment is based upon the requirements specified in **Figure 8-5.**

Fire Suppression System

1. Fire extinguishers, hose connections with water flow alarms and other fire protection and suppression systems will be located throughout the facility as required. A supervised fire alarm system will be provided with a centralized annunciator panel. Fire alarms will be arranged to notify the Hanford Fire Department of all fire alarm signals.

2. Automatic sprinklers used in areas presenting radiation or criticality risk will incorporate design features for handling contaminated water runoff and avoiding water induced criticality. Alternate fire suppression systems will be consider where criticality is a concern. Water sprinklers in radiation zones will be "on-off" type to minimize the generation of radioactive liquid waste.

3. Carbon Dioxide extinguishers will be provided in other areas (eg Control Room, and Electrical Equipment/UPS rooms) where water based or dry chemical extinguishers are not appropriate.

4. Glovebox fire extinguishment consists of dry chemical extinguisher system. Dry chemical bottles are mounted on the glovebox exterior and supply a nozzle system that flood the interior of the gloveboxes. The four (4) glovebox lines in the Waste Process Area will be protected with both manual dry chemical extinguishing systems and automatic local application dry chemical systems. This is in addition to the overhead wet pipe sprinkler system installed in the Waste Process Area. The dry chemical systems will be designed in accordance with NFPA 17. The glovebox fire suppression system design is in accordance with WHC-CM-4-3 Standard FP-5 and Guide FP-5. Each Glovebox is also equipped with an Incipient Fire Detection (IFD) in all areas.

5. Automatic local application dry chemical systems are provided in those areas of each glovebox where there is a potential of fire due to open waste being handled. Areas where no open waste occurs, will be equipped with IFD's for early alarm. In the LLW/TRU waste processing gloveboxes, the sorting table enclosure is protected with an automatic local application dry chemical system in the area above the sorting table. The RWM gloveboxes are protected by automatic local application dry chemical systems around the aerosol can compactor and evacuation systems, and in areas where waste is placed into other drums or containers. All glovebox enclosures are also equipped with multiple quick disconnect couplings allowing positioning of manually activated dry chemical extinguishers in the best position to extinguish fires. Exact nozzle and quick disconnect coupling locations, and areas of coverage will be determined in Title II design.

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FIGURE 8-5
PLANT AND INSTRUMENT AIR REQUIREMENTS SUMMARY

INSTRUMENT AIR				
Area	Total Estimated Requirements		Estimated % Maximum Usage	Requirements at Maximum Usage
	ACFM	PSIG		
HVAC Exh & 2nd Flr	20.0	90.0	20.0	4.0
Process Controls	80.0	90.0	50.0	40.0
			Total	44.0
			Sizing Basis	50.0
PLANT AIR				
Process	20.0	80.0	25.0	5.0
NDA/NDE	20.0	80.0	25.0	5.0
Material Transport	20.0	80.0	25.0	5.0
Utility Stations	20.0	80.0	25.0	5.0
			Total	20.0
			Sizing Basis	25.0

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Breathing Air

1. Breathing air will be supplied by portable racks.

8.6.2 Reference Drawings

Drawing Number	Drawing Title
H-2-88245	Water Piping Diagram
H-2-88246	Waste & Vent Piping Diagram
H-2-88225	Utility Flow Diagram Potable Water System
H-2-88226	Utility Flow Diagram Compressed Air System
H-2-88227	Utility Flow Diagram Compressed Air System
H-2-88298	Fire Protection Zone Plan
H-2-88299	Fire Protection Utility Flow Diagram

8.6.3 Plumbing

1. The plumbing system configuration is shown on plumbing isometrics H-2-88045 and 88046.

2. The sanitary drainage system serving the office area toilet rooms, shower and locker rooms, mechanical rooms and janitor's closet will flow by gravity (minimum velocity 2 fps) to a new 3,000 gallon septic tank and leaching field. The truck loading area will have a trench drain discharging through a 300-gallon sand and oil interceptor before entering the sanitary drainage system. Contaminated or potentially contaminated waste will not enter the sanitary system. All fixtures will be trapped and vented as required by the uniform plumbing code. Cleanouts will be provided at changes of direction and at 50 feet intervals for interior piping.

3. The building storm drainage system will consist of exterior gutters and downspouts. The downspouts will discharge to concrete splashblocks at grade.

4. Potable water will be supplied to the building by a separate three inch service line fed from an existing 12 inch, 120 psi water main. A water pressure regulating station at the service entry will reduce the maximum system pressure to 70 psi. The system will be sized to supply the maximum peak gpm requirement with a minimum of 30 psi residual pressure.

5. Reduced pressure backflow preventers will be provided where required to protect the potable water system from cross connection and contamination. All non-potable systems will be isolated from the potable supply.

6. Shut-off valves will be provided on branch lines and for groups of fixtures. Shock absorbers consisting of factory sealed pressurized compression chambers and stainless steel expansion bellows will be provided at quick closing valves. Stop valves will be provided at all fixtures.

7. Domestic hot water will be generated by an electric storage type water heater, 700-gallon storage capacity, 60 kW input. Hot water will be stored at 140°F. Showers will have individual thermostatic mixing valves. Hot water to hand washing lavatories will be supplied at 110°F. A hot water circulating pump will be used to provide continuous hot water to the most remote fixtures and equipment.

9 3 1 2 7 1 1 3 6 3

8. Plumbing fixtures will be white vitreous china. Waterclosets and urinals will be wall mounted and flush valve operated. Lavatories will have cold and hot water mixing faucets. Refrigerated drinking water coolers will be provided. Showers will be provided with 3 gpm shower heads. Combination emergency shower and eye washing units will be provided where needed. Personnel decontamination shower with contained drain will be provided.

9. A men's and women's toilet room with fixtures suitable for use by the physically handicapped will be provided near the office area.

8.6.4 Compressed Air System

1. The compressed air system configuration is shown on Drawings H-2-88226 and 88227. The compressed air system consists of two reciprocating air compressors with integral air receivers, and a dryer package consisting of a twin tower desiccant dryer, prefilter, and two afterfilters.

2. The plant and instrument air are supplied from one of the two-stage reciprocating air compressors, C-13-101A or C-13-101B, which operate on intermittent basis. The primary air compressor activates when the pressure drops below the set point of 125 psig. The secondary air compressor activates if the pressure drops below the set point of 100 psig. The plant utility air is distributed throughout the plant to the utility stations, process enclosure equipment and NDA/NDE equipment. The instrument air is dried by a desiccant dryer, DR-13-105 and the air is distributed throughout the facility to the instrument control equipment and HVAC control dampers.

8.6.5 Fire Suppression

1. The fire protection water system for the Module 1 facility is provided through a 6-inch cement lined ductile iron pipe branched off the 12-inch Sanitary Water line. The coordinates of the tie in point (TP 3) are N43184 and W78917. The 6-inch firewater line provides water for the four building fire areas and three fire hose stations. The Fire Protection utility flow diagram is shown on drawing H-2-88299.

2. A 6-inch post indicator valve is located on the fire water line. The 6-inch firewater line enters the building in the Mechanical Room and the pipe material is changed to carbon steel. A 6-inch backflow preventing device is provided on the line to prevent any firewater backflow into the sanitary water supply line. The firewater supply line has a pressure of 120 psia and does not require a firewater jockey pump. Three of the four fire areas have risers with valve stations and supply water to the area's sprinkler system. These three risers consist of one 2½-inch outside screw and yoke (OS&Y) valve with tamper switch, one 2½-inch alarm check valve and a 2½-inch hose connection.

3. The fourth area is a dry standpipe hose station which includes a riser with a 2½-inch manual deluge valve and 2½-inch OS&Y valve and supplies firewater for the Exterior Storage Area. The risers are located in the Mechanical room. The three fire hose stations are wet standpipes and include one 2½-inch OS&Y valve, one 2½-inch alarm check valve and a 2½-inch hose connection. The fire hose stations are located in the Process Airlocks, Rooms 106, 114 and 145. A siamese hose connection is available for a pumper truck and is located on the exterior wall of the Mechanical Room.

9 3 1 2 7 6 1 1 3 6 4

4. Two 6-inch lines are branched off the main 12-inch sanitary line and supply water to the building's two fire hydrants. The tie in points are located at coordinates N42685 and W79100 (TP 2) and N43184 and W78830 (TP 4).

8.6.6 Breathing Air System

1. Breathing air will be provided in four portable bottle racks, BA-13-111 through BA-13-114. These racks will be equipped with two high pressure air bottles with valves, regulators, and alarms. One bottle will be on-line at a time.

2. When the pressure drops to less than 500 psi, the other bottle will be valved on-line and the low pressure bottle will be replaced. This system is commonly used at other Hanford buildings. The four portable breathing air racks are shown on drawing H-2-88226.

8.6.7 Outline Specifications

1. Following is a listing of the mechanical equipment outline specifications and mechanical equipment for the Title I design. The outline specifications are included in Volume III under the Utilities tab.

CSI No.	Title
15000	General Mechanical

Tag No.	Equipment Name
BA-13-111	Portable Breathing Air
BA-13-112	Portable Breathing Air
BA-13-113	Portable Breathing Air
BA-13-114	Portable Breathing Air
C-13-101 A,B	Air Compressor
DR-13-105	Instrument Air Dryer
F-13-106	Instrument Air Prefilter
F-13-107	Instrument Air Prefilter
F-13-108	Instrument Air Afterfilter
V-13-103 A,B	Air Receiver

8.7 Electrical

8.7.1 Design Requirements

1. The electrical system for the WRAP 1 Facility is designed in accordance with the Functional Design Criteria, Revision 1, the Supplemental Design Requirements Document, Revision C, and the Project Design Criteria document.

2. The following is a general list of codes, standards, and guides which will be used in the design of the facility. A complete listing may be found in the Project Design Criteria.

- DOE Order 6530.1A General Design Criteria
- Hanford Plant Standard Design Criteria, 5/10/82
- American National Standards Institute (ANSI)
- Factory Mutual (FM) Approval Guide
- Institute of Electrical and Electronic Engineers (IEEE)

- Illuminating Engineering Society (IES) Handbook
- National Association of Corrosion Engineers (NACE) RP-01-69
- National Fire Protection Association (NFPA) 70, National Electrical Code, 1990
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code, ANSI C2
- Underwriters Laboratories (UL)

3. The major equipment loads for the facility that formed the basis for the electrical power requirements are listed in **Figure 8-6.**

4. Electrical design will be based on a nonhazardous National Electrical Code (NEC) classification. Electrical equipment located in the process area, Rooms 107, 108, 111, 112, and 113 will be NEMA 4.

5. All electrical equipment will be rated for operation at an elevation of 715 feet above sea level. Seismic disturbances will be provided for in the design of all electrical equipment (seismic Zone 2B) and its installation to ensure safety during seismic (earthquake) disturbances. Electrical equipment will not contain Polychlorinated Biphenyl (PCB). Special considerations will be applied to electrical devices and wiring subjected to radiation environments.

6. The estimated maximum electrical demand for the facility is 3100KVA. The load factor with two 2000KVA transformers is approximately 77%.

8.7.2 Reference Drawings

Drawing No.	Drawing Title
H-2-88318	Master One-Line Diagram
H-2-88319	One-Line Diagram Area 05 Shipping & Receiving
H-2-88320	One-Line Diagram Area 07 Process
H-2-88321	One-Line Diagram Area 09-100 NDA/NDE Internal Transport and Material Handling
H-2-88322	One-Line Diagram Area 09-200 Process Internal Transport and Material Handling
H-2-88323	One-Line Diagram Area 11 HVAC
H-2-88324	One-Line Diagram Area 11 HVAC

8.7.3 Primary Service

1. Three-phase primary service will be brought to the site from existing 13.8KV overhead line C8-L15. The line will be tapped at a pole near the northwest corner of 23rd Street and Dayton Avenue. A new overhead line will be extended west approximately 650 feet (3 spans) to two terminal poles on the north side of 23rd Street.

2. Two 13.8KV services will be extended under 23rd Street to two 2000KVA oil-filled transformers on the north side of the building.

9 3 1 2 7 6 1 1 3 6 6

FIGURE 8-6
MAJOR EQUIPMENT LOADS

TAG NO.	LOAD	HP	KW	VOLTS	PHASE	UNITS INSTALLED	UNITS OPERATING	PANEL NO.
CR-05-101	PALLET STORAGE/RETRIEVAL	10		460	3	1	1	MCC-05-101
CR-05-101	PALLET STORAGE/RETRIEVAL	3		460	3	1	1	MCC-05-101
CR-05-101	PALLET STORAGE/RETRIEVAL	1		460	3	1	1	MCC-05-101
TR-05-101	PALLET TRANSFER CAR	1		460	3	1	1	MCC-05-101
CR-05-102 A,B	DRUM JIB CRANE	1		460	3	2	2	MCC-05-101
CR-05-102 A,B	DRUM JIB CRANE	.5		460	3	2	2	MCC-05-101
CR-05-102 A,B	DRUM JIB CRANE	.5		460	3	2	2	MCC-05-101
CR-05-103	TRUPACT BRIDGE CRANE	30		460	3	1	1	MCC-05-101
CR-05-103	TRUPACT BRIDGE CRANE	5		460	3	1	1	MCC-05-101
CR-05-103	TRUPACT BRIDGE CRANE	2		460	3	1	1	MCC-05-101
CV-05-101 A,B	DRUM INFEED CONVEYOR	.75		460	3	2	2	MCC-05-101
CV-05-102	DRUM DISCHARGE CONVEYOR	.75		460	3	1	1	MCC-05-101
CV-05-103 A,B	DRUM SCALE CONVEYOR	.75		460	3	2	2	MCC-05-101
FT-05-101	WASTE BOX FORK TRUCK CHARGER	--	13	460	3	1	1	MCC-05-101
FT-05-102	PALLET FORK TRUCK CHARGER	--	10	460	3	1	1	MCC-05-101
SR-05-101	PALLET STRETCH WRAPPER	1		460	3	1	1	MCC-05-101
SR-05-101	PALLET STRETCH WRAPPER	1		460	3	1	1	MCC-05-101
SR-05-101	PALLET STRETCH WRAPPER	.5		460	3	1	1	MCC-05-101
ND-06-101 A,B	NDE/NDA DRUM PAN	--	5	120	1	2	2	PP-07-101
ND-06-102 A,B	NDE/NDA DRUM GEA	--	2	120	1	2	2	PP-07-101
ND-06-104 A,B	NDE/NDA DRUM NDE	--	11	120	1	2	2	PP-07-101
ND-06-105	NDE/NDA BOX NDE	--	10	120, 208	1	1	1	PP-07-101
GFE	NDE/NDA BOX NDA	--	12	208	3	1	1	PP-07-101
CR-07-101 A,B	GLOVEBOX MONORAIL HOIST	1.5		460	3	4	3	MCC-07-101
CR-07-101 A,B	GLOVEBOX MONORAIL (TROLLEY)	.5		460	3	4	3	MCC-07-101
EM-07-101	WASTE SORTING MANIPULATOR TROLLEY	1		460	3	1	1	MCC-07-101
HU-07-101	DRUM HANDLER HPU	30		460	3	1	1	MCC-07-101
HU-07-102	DE-HEAD CUTTER	10		460	3	1	1	MCC-07-101

FIGURE 8-6 (CONTINUED)
MAJOR EQUIPMENT LOADS

TAG NO.	LOAD	HP	KW	VOLTS	PHASE	UNITS INSTALLED	UNITS OPERATING	PANEL NO.
HU-07-103	DRUM FIXTURE HPU	10		460	3	1	1	MCC-07-101
HU-07-304	SUPER COMPACTOR PRIMARY PUMP	125		460	3	1	1	MCC-07-101
HU-07-304	SUPER COMPACTOR SECONDARY PUMP	20		460	3	1	1	MCC-07-101
HU-07-304	SUPER COMPACTOR HEAT EXCHANGER	7.5		460	3	1	1	MCC-07-101
HU-07-201	MANIPULATOR HPU	10		460	3	1	1	MCC-07-11
CR-07-201	OVERHEAD HOIST	1.5		460	3	1	1	MCC-07-101
CR-07-201	OVERHEAD HOIST (TROLLEY)	.5		460	3	1	1	MCC-07-101
XX-07-201	AEROSOL CAN DISPOSAL UNIT	20		460	3	1	1	MCC-07-101
EM-07-201	WASTE SORTING MANIPULATOR	1		460	3	1	1	MCC-07-101
CR-07-301 A-D	GLOVEBOX MONORAIL HOIST	1.5		460	3	1	1	MCC-07-101
CR-07-301 A-D	GLOVEBOX MONORAIL (TROLLEY)	.5		460	3	1	1	MCC-07-101
EM-07-301	WASTE SORTING MANIPULATOR TROLLEY	1		460	3	1	1	MCC-07-101
HU-07-301	DRUM HANDLER HPU	30		460	3	1	1	MCC-07-101
HU-07-302	DRUM FIXTURE HPU	10		460	3	1	1	MCC-07-101
HU-07-303	MANIPULATOR HPU	10		460	3	1	1	MCC-07-101
CR-07-401	OVERHEAD HOIST	1.5		460	3	1	1	MCC-07-101
CR-07-401	OVERHEAD HOIST TROLLEY	.5		460	3	1	1	MCC-07-101
XX-07-401	AEROSOL CAN DISPOSAL UNIT	20		460	3	1	1	MCC-07-101
EM-07-401	WASTE SORTING MANIPULATOR TROLLEY	1		480	3	1	1	MCC-07-101
CV-09-101 A-F	NDE/NDA TRANSFER CONVEYOR	.75		460	3	6	4	MCC-09-101
CV-09-102	DRUM STORAGE CAROUSEL	.75		460	3	1	1	MCC-09-101
CV-09-103 A,B	DRUM TRANSFER CAROUSEL	.75		460	3	2	2	MCC-09-101
CV-09-104 A,B	DRUM AIRLOCK CAROUSEL	.75		460	3	2	2	MCC-09-101
CV-09-105	BOX CONVEYOR/SCALE	.75		460	3	1	1	MCC-09-101
GV-09-101	AUTOMATED GUIDED VEHICLE CHARGER	--	.75	460	3	1	1	MCC-09-101
CV-09-201 A,B	DRUM TRANSFER CONVEYOR	.75		460	3	2	2	MCC-09-102
CV-09-202	RW DRUM STORAGE CAROUSEL	.75		460	3	1	1	MCC-09-102
LT-09-201 A-L	DRUM LIFT TABLE HYDRAULIC PUMP	1.5		460	3	12	7	MCC-09-102
LT-09-201 A-L	DRUM LIFT TABLE CONVEYOR	.5		460	3	12	7	MCC-09-102
GV-09-201	AUTOMATED GUIDED VEHICLE CHARGER	--		460	3	1	1	MCC-09-102

FIGURE 8-6 (CONTINUED)
MAJOR EQUIPMENT LOADS

TAG NO.	LOAD	HP	KW	VOLTS	PHASE	UNITS INSTALLED	UNITS OPERATING	PANEL NO.
CH-11-11 A	CHILLER	100		460	3	1	1	MCC-11-101
CT-11-101 A	COOLING TOWER FAN	15		460	3	1	1	MCC-11-101
P-11-101 A	CHILLED WATER PUMP	25		460	3	1	1	MCC-11-101
P-11-102 A	CHILLED WATER PUMP	20		460	3	1	1	MCC-11-101
P-11-103 A	CONDENSING WATER PUMP	20		460	3	1	1	MCC-11-101
P-11-104 A	HEAT RECOVERY PUMP	7.5		460	3	1	1	MCC-11-101
BL-11-201 A	GLOVEBOX BLOWER	15		460	3	1	1	MCC-11-101
C-13-101 A	INSTRUMENT AIR COMPRESSOR	25		460	3	1	1	MCC-11-101
BL-11-202 A	PROCESS ROOM BLOWER	50		460	3	1	1	MCC-11-101
SF-11-203 A	SUPPLY FAN	30		460	3	1	1	MCC-11-101
MA-11-203 A	MAKEUP AIR PACKAGE		365	460	3	1	1	MCC-11-101
CH-11-101 B	CHILLER	100		460	3	1	1	MCC-11-102
CT-11-101 B	COOLING TOWER FAN	15		460	3	1	1	MCC-11-102
BL-11-201 B	GLOVEBOX BLOWER	15		460	3	1	REDUNDANT	MCC-11-102
BL-11-202 B	PROCESS ROOM BLOWER	50		460	3	1	REDUNDANT	MCC-11-102
SF-11-203 B	SUPPLY FAN	30		460	3	1	REDUNDANT	MCC-11-102
MA-11-203 B	MAKEUP AIR PACKAGE		365	460	3	1	REDUNDANT	MCC-11-102
EF-11-302	SHIPPING/RECEIVING, NDE/NDA AREA EXHAUST FAN	3		460	3	1	1	MCC-11-102
EF-11-501	EXHAUST FAN ADMIN AREA	1		460	3	1	REDUNDANT	MCC-11-102
P-11-101 B	CHILLED WATER PUMP	25		460	3	1	REDUNDANT	MCC-11-102
P-11-102 B	CHILLED WATER PUMP	20		460	3	1	1	MCC-11-102
P-11-103 B	CONDENSING WATER PUMP	20		460	3	1	1	MCC-11-102
P-11-104 B	HEAT RECOVERY PUMP	7.5		460	3	1	REDUNDANT	MCC-11-102
C-13-101 B	INSTRUMENT AIR COMPRESSOR	25		460	3	1	REDUNDANT	MCC-11-102
AH-11-302	AIR HANDLING UNIT SHIPPING/RECG NDE/NDA ELECTRIC REHEAT COIL		107	460	3	1	1	MCC-11-103
SF-11-305	AHU-11-302 SUPPLY FAN	50		460	3	1	1	MCC-11-103
RF-11-303	RETURN AIR FAN	7.5		460	3	1	1	MCC-11-103
RF-11-304	RETURN AIR FAN	7.5		460	3	1	1	MCC-11-103
SF-11-503	AH-11-501 BLOWER	20		460	3	1	1	MCC-11-103

FIGURE 8-6 (CONTINUED)
MAJOR EQUIPMENT LOADS

TAG NO.	LOAD	HP	KW	VOLTS	PHASE	UNITS INSTALLED	UNITS OPERATING	PANEL NO.
AH-11-501	AIR HANDLING UNIT ELECT. REHEAT COIL		80	460	3	1	1	MCC-11-103
RF-11-501	RETURN AIR FAN ADMIN AREA	3		460	3	1	1	MCC-11-103
SF-11-604	MAKEUP AIR UNIT MA-11-601 CHANGE ROOM SUPPLY FAN	5		460	3	1	1	MCC-11-103
MA-11-601	MAKEUP AIR UNIT CHANGE ROOM ELECTRIC REHEAT COIL		75	460	3	1	1	MCC-11-103
EF-11-604	EXHAUST FAN	2		460	3	1	1	MCC-11-103
SF-11-702	SUPPLY FAN	10		460	3	1	1	MCC-11-103
MA-11-702	MAKEUP AIR UNIT ELECTRIC REHEAT COIL		225	460	3	1	1	MCC-11-103
EF-11-703	EXHAUST FAN	1.5		460	3	1	1	MCC-11-103
EF-11-704	MECHANICAL ROOM EXHAUST FAN	1		460	3	1	1	MCC-11-103

3. Two transformers and two services were chosen for the following reasons:

   a) Reduce the size of the service and accompanying fault current that would result from a single service.

   b) Provide a measure of redundancy for the HVAC system, and other loads.

4. It should be noted that this is not a fully redundant system. That is, the transformers are not sized so that either transformer alone can supply the entire building.

8.7.4 Building Service

1. The primary power is transformed to three-phase 480/277 volt solidly grounded wye at each transformer and enters the building via two overhead, 2500 amp bus ducts. The bus duct terminates at a line up of low voltage switchgear in electrical room 116.

2. The low voltage switchgear is arranged in a split bus configuration with a nonautomatic tie breaker. This allows paralleling the loads in the event a transformer or preceding feeder is lost, but prevents automatic paralleling of loads without first shedding loads to prevent overloading a transformer.

3. Metering will be provided on each incoming feeder, and will include three-phase volts, amps and watthours. In addition, each feeder will send a loss of power signal to the control room for power loss/recovery procedures.

4. No spare breakers will be provided.

8.7.5 Alternate Power

1. Alternate power in the form of emergency or standby engine generators will not be provided. However, see Portable Power Connection, Paragraph 12, this section.

8.7.6 Distribution

1. **Utilization Voltages:** Two voltage systems will be established in the plant. They include a 480Y/277 Volt, three phase; and 208Y/120 Volt, three phase, and 120 single phase.

2. Electrical loads will be assigned as follows:

   - Motors and loads larger than 1/2 HP 480V, three phase
   - Motors 1/2 HP and less 120V, single phase
   - Lighting 277V, single phase

3. 480V Motor Control Centers are provided on the following basis:

   a) Power will be distributed throughout the plant by seven Motor Control Centers (MCC).

   b) Four MMCs will be located in the electrical room and will serve the Process area (07); the Internal Transport and Material Handling equipment in the Process area (09-200); and first level HVAC equipment (11).

c) The remaining three MCCs will be located in, and will serve the Shipping and Receiving area (05); the Internal Transport and Material Handling equipment in the NDE/NDA area (09-100); and upper level HVAC equipment (11).

d) An effort will be made to keep electrical equipment out of the controlled (SWP) areas.

e) Non-motor 480V loads will be served by 480V panelboards located near the loads they serve.

4. **Lighting:** All lighting will be served by a 480Y/277V panelboard in the electrical room.

5. Power for miscellaneous loads and receptacles will be derived from 480-280Y/120V dry type transformers and panelboards located in the Electrical Room, or near the load they serve.

6. **Conductors and Raceways:**

a) All conductors will be copper.

b) Power, controls and instrumentation will be distributed via conduit in the administrative utility and non-process areas, and wireways with conduit dropouts in the process areas (05, 07, 09 and 11).

c) The process areas will use two separate wireway systems, one for power, and one for instrumentation and control.

d) No conduit will be permitted in the floor slab of the Process controlled (SWP) area (Room 107, 108, 111, 113). Under slab conduit will be permitted in all other areas of the plant.

e) Intermediate Metal Conduit (IMC) will be used in lieu of rigid metal conduit; Electrical Metal Tubing will be used indoors where not subject to damage; and concrete encased heavy duty PVC will be used for outdoor underground ducts.

8.7.7 Uninterruptible Power Supply (UPS)

1. A solid state UPS with static transfer switch and one hour gel cell sealed batteries will be provided.

2. The UPS will support the following loads:

- Data Management System
- Operator Consoles (3)
- Distributed Control Cabinets
- Criticality Alarms
- Radiation Monitors
- Stack Monitor Systems
- Emergency Evacuation Systems
- Fire Detection System
- Other (TBD)

9 3 1 2 7 6 1 1 3 7 2

8.7.8 Portable Power Connection

1. Portable engine generators up to 45 KW are available at Hanford, usually within one hour. In order to take advantage of this, a plug-in receptacle will be provided. The receptacle will be located outside, on the north wall near the electrical room.

2. It will be connected by manual transfer switch to panelboard SP-11-101. It will provide power for the UPS system, control and computer room lights, and egress lighting.

8.7.9 Lighting

1. Lighting levels will be per Hanford Standard SDC 7.5 as follows:

- Work Stations . . . . . 50 footcandles
- Work Areas . . . . . 30 footcandles
- Non-work Areas . . . . . 10 footcandles

2. **Interior Lighting:** In low ceiling areas, fixtures will be recessed or pendant, 277V fluorescent with local switching. In high bay areas, such as Shipping and Receiving, NDE/NDA, and Process, fixtures will be 277V high pressure sodium with local switching.

3. **Exterior Lighting:** The exterior of the building will be illuminated by a 175-watt, 277V low pressure sodium wallpack over each door. Area lighting will be provided for the parking lot and truck driveway/loading area.

4. **Emergency and Exit Lighting:** Emergency egress and exit lighting will be provided per the NFPA 101 Life Safety Code. Selected fluorescent fixtures will contain battery type ballasts. Nonfluorescent areas will have battery operated, recharging wall pack units. Exit lights will be electric with battery backup and automatic recharge.

5. **Glovebox Lighting:** Glovebox Lighting will be located primarily on the outside roof of the glovebox. The glovebox will have windows that the light fixtures will sit on. The type of fixtures will be determined during detail design.

8.7.10 Grounding

1. A grounding grid will be established for the building per NFPA 70 and IEEE 142. A separate ground wire will be provided for each power raceway. Raceways will not be used as ground paths. A single point ground system will be provided for instrument and control signal grounds. The overall grounding scheme is shown on **Figure 8-7**.

8.7.11 Lightning Protection

1. Lightning protection will be provided for the building. Protection will be designed per NFPA 78. Downcomers will be protected and will connect to the main ground grid.

8.7.12 Cathodic Protection

1. The need for cathodic protection of some 700 feet of underground water piping was studied. Due to the high soil resistivity, the anticipated corrosion activity is mild, and an impressed current system will provide the best protection.

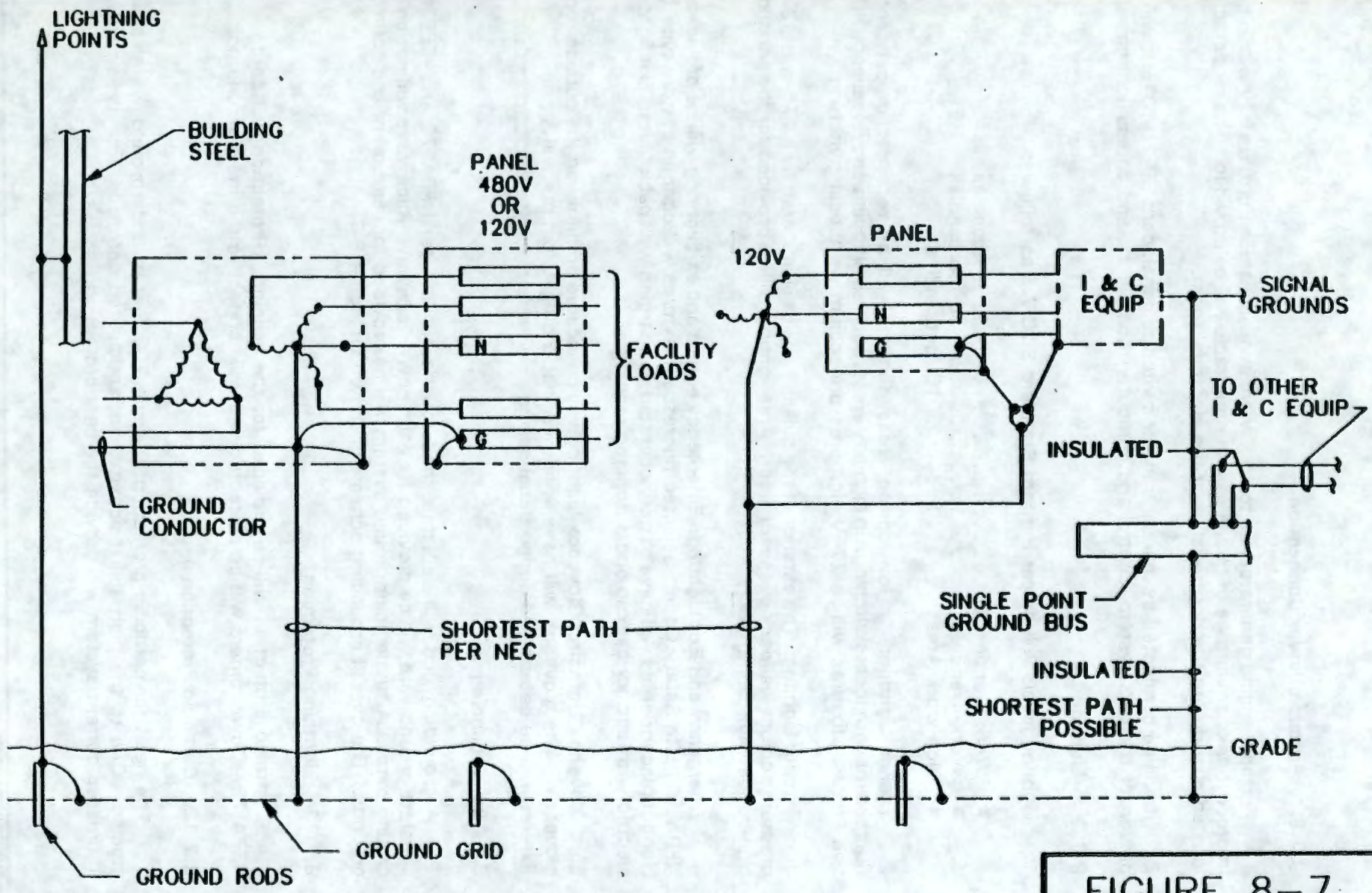

FIGURE 8-7

WRAP I GROUNDING

2. This conclusion may be influenced by the WRAP 2A project, and its requirements for cathodic protection. That is, WRAP 2A may require protection which may be combined with and justify protection for the WRAP 1 system.

3. Considering the small amount of piping involved, the inclusion of cathodic protection for the WRAP 1 project has been deferred until the requirements for WRAP 2A are better defined.

8.7.13 Communications

1. Communications will be provided based on criteria indicated in the FDC and the SDRD. Capabilities and interface requirements for systems specified are indicated as "TBD". Additional information is needed for specifics of design (Title II) complete project requirements.

2. **Telephone System:** Conduit, cable, junction boxes, wiring for 32 telephone outlets, type RJ-11 or RJ-45 and 14 LAN outlets will be provided. No end instruments are required.

3. **PA System:** Approximately seven speakers for low noise areas, nine for high noise areas, and PA system electronics. Conduit, wire, and junction boxes are included. Separate conduit system for 70V power and audio signals will be provided.

4. **Emergency Evacuation System:** Conduit, cable, junction boxes for sixteen speakers will be provided. A sound generator amplifier is provided. Interface requirements to site system are TBD and will be addressed in the Title II design. Telephone and LAN interfaces for work stations or office areas will be via power poles with appropriate telephone/LAN jacks as required. Interfaces with the CASS system and Hanford Fire Department need further definition and will be included as Title Design proceeds.

8.7.14 Spares

1. Transformers, motor control centers, and panelboards will have 25% spare capacity.

2. Motor control centers and panelboards will have a minimum of 10% spare compartments and breaker positions (spare only).

3. In addition, space is provided at each end of the main low voltage switchgear, and at least one end of each motor control center for the addition of future sections.

4. Underground concrete encased duct banks will be provided with one spare conduit. Per the NEC, all conduit fill will be sized to 40% of the conduit cross section. Trays and wire ways will be sized for 50% spare capacity.

8.7.15 Major Electrical Equipment

1. The major electrical equipment for the facility is listed in **Figure 8-8.**

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FIGURE 8-8
MAJOR ELECTRICAL EQUIPMENT

TAG NUMBER	DESCRIPTION
T-13-101	Power Transformer, 2000KVA, 3-Phase, 13.8 kV-480Y/277V.
T-13-102	Power Transformer, 2000KVA, 3-Phase, 13.8 kV-480Y/277V.
BD-13-101	Bus Duct, 2500A, 3-Phase, 3-Wire, 480V.
BD-13-102	Bus Duct, 2500A, 3-Phase, 3-Wire, 480V.
SG-13-101	Low Voltage Switchgear, 480V, 3200A, 3-Phase, 3-Wire.
MCC-05-101	Motor Control Center, 480V, 3-Phase, 3-Wire, 600A.
MCC-07-101	Motor Control Center, 480V, 3-Phase, 3-Wire, 800A.
MCC-09-101	Motor Control Center, 480V, 3-Phase, 3-Wire, 600A.
MCC-09-102	Motor Control Center, 480V, 3-Phase, 3-Wire, 600A.
MCC-11-101	Motor Control Center, 480V, 3-Phase, 3-Wire, 1200A.
MCC-11-102	Motor Control Center, 480V, 3-Phase, 3-Wire, 800A.
MCC-11-103	Motor Control Center, 480V, 3-Phase, 3-Wire, 1400A.
T-05-101	Transformer, Dry Type, 30KVA, 3-Phase, 480-208Y/120V.
T-07-101	Transformer, Dry Type, 150KVA, 3-Phase, 480-208Y/120V.
T-07-102	Transformer, Dry Type, 225KVA, 3-Phase, 480-480Y/277V.
T-09-101	Transformer, Dry Type, 30KVA, 3-Phase, 480-208Y/120V.
T-11-101	Transformer, Dry Type, 75KVA, 3-Phase, 480-208Y/120V.
T-11-103	Transformer, Dry Type, 30KVA, 3-Phase, 480-208Y/120V.
LP-05-101	Lighting Panel, 480/277V, 3-Phase, 3-Wire, 400A, 42 Circuit.
LP-07-101	Lighting Panel, 480/277V, 3-Phase, 4-Wire, 400A, 42 Circuit.
LP-09-101	Lighting Panel, 480/277V, 3-Phase, 3-Wire, 100A, 42 Circuit.
LP-11-101	Lighting Panel, 480/277V, 3-Phase, 3-Wire, 100A, 42 Circuit.
LP-11-102	Lighting Panel, 480/277V, 3-Phase, 3-Wire, 225A, 42 Circuit.
LP-11-103	Lighting Panel, 480/277V, 3-Phase, 3-Wire, 225A, 42 Circuit.
LP-11-104	Lighting Panel, 480/277V, 3-Phase, 3-Wire, 225A, 42 Circuit.
PP-05-101	Power Panel, 208/120V, 3-Phase, 4-Wire, 100A, 42 Circuit.
PP-07-101	Power Panel, 208/120V, 3-Phase, 4-Wire, 225A, 42 Circuit.
PP-07-102	Power Panel, 208/120V, 3-Phase, 4-Wire, 225A, 42 Circuit.
PP-09-101	Power Panel, 208/120V, 3-Phase, 4-Wire, 100A, 42 Circuit.
PP-11-101	Power Panel, 208/120V, 3-Phase, 4-Wire, 225A, 42 Circuit.
PP-11-102	Power Panel, 208/120V, 3-Phase, 4-Wire, 100A, 42 Circuit.
PP-11-103	Power Panel, 208/120V, 3-Phase, 4-Wire, 100A, 42 Circuit.
MTS-11-101	Manual Transfer Switch, 480V, 3-Pole, 100A.
SP-11-101	Power Panel, 480/277V, 3-Phase, 3-Wire, 100A, 42 Circuit.
UPS-11-101	Power Panel, 208/120V, 3-Phase, 4-Wire, 100A, 42 Circuit.
UPS	Uninterruptible Power Supply, 30KVA, 208Y/120V, 3-Phase.

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8.7.16 Outline Specifications

1. Following is a listing of the outline specifications for the Title I design. The outline specifications are included in **Volume III** under the Utilities tab.

CSI No.	Title
16050	Basic Electrical Materials and Methods
16110	Raceways
16120	Wire and Cables
16123	15KV Conductors
16141	Switches, Receptacles and Accessories
16252	Manual Transfer Equipment
16310	Aerial Power Distribution
16315	Low Voltage Substation
16450	Grounding
16462	Transformers - Dry Type
16470	Panelboards
16480	Motor Control Centers
16501	Lamps
16510	Lighting Fixtures
16610	Uninterruptible Power Supply System
16640	Cathodic Protection
16670	Lightning Protection Systems
16700	Emergency Audible Alarm Signals
16720	Fire Alarm and Smoke Detection Systems
16740	Voice and Data Systems
16750	Public Address System

8.8 General Plant Areas Maintenance Provisions

1. Equipment located in general process plant areas (eg. Shipping and Receiving) consists of proprietary equipment requiring the usual level of industrial hands-on, in-situ repair or component replacement.

2. To assist in reducing potential personnel radiation exposure when undertaking equipment repair in these areas, a maintenance room has been provided (room 139, Drawing H-2-88062). This room measuring 12 feet x 35 feet will allow small to medium sized components to be removed from the immediate vicinity of radiation areas for repair. The room will also provide general maintenance support for remaining plant areas of the building. The room has been sized to provide working space for each of the principal maintenance disciplines (mechanical, electrical and instrument) together with space to hold small quantities of spare parts.

3. It has been assumed that this room will be fitted with benches and a number of small power tools (pillar drill, bench grinder etc.) and services have been provided accordingly (eg. power, compressed air, instrument air etc.). Provision has not been included for repair of large items in this area, (eg. overhead crane hoist motor/gearbox assemblies etc.) nor has space/services for welding, machining, pipe bending or pipe/raw material storage been included in the room.

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9.0 DESIGN DOCUMENT LISTS

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9.0 DESIGN DOCUMENT LISTS

1. Included in this section are the following lists that identify the design media, and components for the WRAP 1 Facility.

2. The design document lists include the following:

- Title I Drawings List
- Title I Outline Specifications List
- Equipment List
- Specialty Item List
- Government Furnished Equipment List
- Long Lead Procurement List
- Plant Management Equipment List
- Radiological Instrumentation List
- Stack Effluent Analyzers List
- Closed Circuit Television List
- Bar Code Equipment List
- Instrument Index
- Instrument I/O List

3. The equipment safety class has been included on the mechanical equipment list, for each item of equipment (see **Section 9.3**). Most items are Safety Class 3, although a few are Safety Class 4. All electrical and instrument equipment items are similarly either Safety Class 3 or Safety Class 4. The Safety Equipment List will be incorporated in PSAR Chapter 4.

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9.1 Title I Drawing List:

9 3 1 2 7 1 1 3 8 0

Drawing No.	System No.	Title

WASTE PROCESS

H-2-87625	WP-1	PFD TRU Process Enclosure
H-2-87626	WP-2	PFD LLW Process Enclosure
H-2-87627	WP-3	PFD RWM Process Enclosure
H-2-87628	WP-4	MFD TRU Process Entry Enclosure
H-2-87629	WP-5	MFD TRU Process Sorting/Compaction Enclosure Sht. 1
H-2-87629	WP-5	MFD TRU Process Sorting/Compaction Enclosure Sht. 2
H-2-87630	WP-6	MFD TRU Process Exit Enclosure
H-2-87631	WP-7	MFD LLW Process Entry Enclosure
H-2-87632	WP-8	MFD LLW Process Sorting/Compaction/Exit Enclosure Sht. 1
H-2-87632	WP-8	MFD LLW Process Sorting/Compaction/Exit Enclosure Sht. 2
H-2-87632	WP-8	MFD LLW Process Sorting/Compaction/Exit Enclosure Sht. 3
H-2-87633	WP-9	MFD RWM TRU Process Enclosure
H-2-87634	WP-10	MFD RWM LLW Process Enclosure
H-2-87635	WP-11	Main Process Flowsheet Sht. 1
H-2-87635	WP-11	Main Process Flowsheet Sht. 2
H-2-87635	WP-11	Main Process Flowsheet Sht. 3
H-2-87637	WP-12	Waste Process Glovebox General Arrangement - Plan
H-2-87638	WP-13	Waste Process Glovebox General Arrangement - Elev (TRU & LLW)
H-2-87639	WP-14	Waste Process Glovebox General Arrangement - Elev (RWM)
H-2-87640	WP-15	TRU Entry Glovebox GB-07-301
H-2-87641	WP-16	TRU Entry Glovebox GB-07-301
H-2-87642	WP-17	TRU Sorting Glovebox GB-07-302 Sht. 1
H-2-87642	WP-17	TRU Sorting Glovebox GB-07-302 Sht. 2
H-2-87642	WP-17	TRU Sorting Glovebox GB-07-302 Sht. 3
H-2-87644	WP-19	TRU Girth Compaction Glovebox GB-07-303 Sht. 1
H-2-87644	WP-19	TRU Girth Compaction Glovebox GB-07-303 Sht. 2
H-2-87645	WP-20	TRU Supercompactor Glovebox GB-07-304
H-2-87646	WP-21	TRU Exit Glovebox GB-07-305 Sht. 1
H-2-87647	WP-22	TRU Exit Glovebox GB-07-305 Sht. 2
H-2-87648	WP-23	LLW Entry Glovebox GB-07-101
H-2-87649	WP-24	LLW Entry Glovebox GB-07-101
H-2-87650	WP-25	LLW Sorting Glovebox GB-07-102 Sht. 1
H-2-87650	WP-25	LLW Sorting Glovebox GB-07-102 Sht. 2
H-2-87650	WP-25	LLW Sorting Glovebox GB-07-102 Sht. 3
H-2-87652	WP-27	LLW Supercompactor Glovebox GB-07-104
H-2-87653	WP-28	LLW Exit Glovebox GB-07-105
H-2-87654	WP-29	LLW Exit Glovebox GB-07-105
H-2-87655	WP-30	LLW RWM Glovebox GB-07-201 Sht. 1
H-2-87655	WP-30	LLW RWM Glovebox GB-07-201 Sht. 2
H-2-87656	WP-31	TRU RWM Glovebox GB-07-401 Sht. 1
H-2-87656	WP-31	TRU RWM Glovebox GB-07-401 Sht. 2
H-2-87660	WP-32	TRU Entry Glovebox GB-07-301
H-2-87661	WP-33	TRU Sorting Glovebox GB-07-302
H-2-87662	WP-34	TRU Girth Compactor Glovebox GB-07-303 Sht. 1
H-2-87662	WP-34	TRU Girth Compactor Glovebox GB-07-303 Sht. 2
H-2-87663	WP-35	TRU Supercompactor Glovebox GB-07-304
H-2-87664	WP-36	TRU Exit Glovebox GB-07-305
H-2-87665	WP-37	LLW Entry Glovebox GB-07-101
H-2-87666	WP-38	LLW Sorting Glovebox GB-07-102

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Drawing No.	System No.	Title
WASTE PROCESS (continued)		
H-2-87667	WP-39	LLW Supercompactor GB-07-104
H-2-87668	WP-40	LLW Exit Glovebox GB-07-105
H-2-87669	WP-41	TRU RWM Glovebox GB-07-401
H-2-87670	WP-42	LLW RWM Glovebox GB-07-201
H-2-87671	WP-43	TRU/LLW Sorting Box Equip. Working Envelopes
SHIPPING & RECEIVING		
H-2-87593	M-1	Piping and Equipment Legend and Symbols
H-2-87594	M-2	Shipping & Receiving Mechanical Flow Diagram
H-2-87595	M-3	Shipping & Receiving General Arrangement - Plan
H-2-87596	M-4	Shipping & Receiving General Arrangement - Sections
H-2-87597	M-5	Shipping & Receiving General Arrangement - Sections
NDE/NDA		
H-2-87614	NDA-1	Drum & Box NDE/NDA Equip. General Arrangement - Plan
H-2-87615	NDA-2	Drum & Box NDE/NDA Equip. General Arrangement - Sections
H-2-87616	NDA-3	Drum & Box NDE/NDA Equip. General Arrangement - Sections
H-2-87618	NDA-5	Drum & Box NDE/NDA Process Flow Diagram
H-2-87620	NDA-7	Drum/Box NDE and Box NDA Mechanical Flow Diagram
H-2-87621	NDA-8	Drum NDA Mechanical Flow Diagram
INTERNAL TRANSPORTATION		
H-2-87717	IT-1	Mechanical Flow Diagram Internal Transport NDE/NDA
H-2-87718	IT-2	Mechanical Flow Diagram Internal Transport Airlocks
H-2-87719	IT-3	Mechanical Flow Diagram Internal Transport Waste Processing
H-2-87720	IT-4	Internal Transport General Arrangement - Plan
H-2-87721	IT-5	Internal Transport General Arrangement - Sections
H-2-87722	IT-6	Internal Transport General Arrangement - Sections
PROCESS CONTROL		
H-2-87740	I-1	Instrumentation Notes & Abbreviations
H-2-87741	I-2	Control Center General Arrangement
H-2-87742	I-3	DMS Block Diagram
H-2-87743	I-4	PCS Block Diagram
H-2-87744	I-5	HP Instrumentation General Arrangement
BUILDING (CIVIL)		
H-2-88030	C-1	Civil Notes & Abbreviations
H-2-88031	C-2	Layout and Utility Plan
H-2-88032	C-3	Grading Plan
H-2-88033	C-4	Grading Sections

9 3 1 2 7 6 1 1 3 8 2

Drawing No.	System No.	Title
BUILDING (ARCHITECTURAL)		
H-2-88061	A-1	Cover Sheet & Drawing Index
H-2-88062	A-2	Safety Analysis Plan
H-2-88063	A-3	Floor Plan Shipping and Receiving
H-2-88064	A-4	Floor Plan NDE/NDA
H-2-88065	A-5	Floor Plan Process Area
H-2-88066	A-6	Floor Plan Office/Locker Room Area
H-2-88067	A-7	Floor Plan Upper Level
H-2-88068	A-8	Roof Plan
H-2-88069	A-9	Building Elevations
H-2-88070	A-10	Building Sections
H-2-88071	A-11	Building Sections
H-2-88072	A-12	Building Finish Schedule
VENTILATION		
H-2-88153	H-1	HVAC Legend, Abbreviations & General Notes
H-2-88154	H-2	HVAC Airflow Diagram, System Composite
H-2-88155	H-3	HVAC Zoning Plan
H-2-88156	H-4	HVAC Equipment Floor Plan
H-2-88157	H-5	HVAC Equipment Room Plans
H-2-88158	H-6	HVAC Airflow Diagram, Process Area, Supply
H-2-88159	H-7	HVAC Airflow Diagram, Process Area, Exhaust
H-2-88160	H-8	HVAC Airflow Diagram, Shipping, NDE/NDA Area
H-2-88161	H-9	HVAC Airflow Diagram, Computer & Control Rooms
H-2-88162	H-10	HVAC Airflow Diagram, Administration Area
H-2-88163	H-11	HVAC Chilled Water Flow Diagram, Chillers
H-2-88164	H-12	HVAC Chilled Water Flow Diagram, Chillers
H-2-88165	H-13	HVAC Equipment Sections
UTILITIES (PROCESS)		
H-2-88225	U-1	Utility Flow Diagram Potable Water System
H-2-88226	U-2	Utility Flow Diagram Compressed Air System
H-2-88227	U-3	Utility Flow Diagram Compressed Air System
UTILITIES (PLUMBING)		
H-2-88245	PL-1	Water Piping Diagram
H-2-88246	PL-2	Waste & Vent Piping Diagram
UTILITIES (FIRE PROTECTION)		
H-2-88298	FP-2	Fire Protection Zone Plan
H-2-88299	FP-3	Fire Protection Utility Flow Diagram

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Drawing No.	System No.	Title

UTILITIES (ELECTRICAL)

H-2-88318	E-1	Master One Line Diagram
H-2-88319	E-2	One Line Diagram, Area 05 Shipping and Receiving
H-2-88320	E-3	One Line Diagram, Area 07 Process
H-2-88321	E-4	One Line Diagram, Area 09-100 NDE/NDA Internal Transport & Material Handling
H-2-88322	E-5	One Line Diagram, Area 09-200 Process Internal Transport & Material Handling
H-2-88323	E-6	One Line Diagram, Area 11 HVAC
H-2-88324	E-7	One Line Diagram, Area 11 HVAC

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9.2 Title I Outline Specifications List:

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OUTLINE SPECIFICATIONS LIST

SHIPPING AND RECEIVING
- Division 14 - Conveying Systems
  - 14000 Conveying Systems
  - 14400 Fork Trucks
  - 14620 Pallet Storage/Retrieval

NDE/NDA
- Division 13 - Special Construction
  - 13531 Drum Non-Destructive Assay
  - 13532 Drum and Box Non-Destructive Examination

WASTE PROCESS
- Division 11 - Equipment
  - 11172 Waste Compactors
- Division 13 - Special Construction
  - 13100 General Process Equipment
  - 13110 Glovebox Enclosures

INTERNAL TRANSPORTATION
- Division 14 - Conveying Systems
  - 14000 Conveying Systems
  - 14460 Automatic Guided Vehicles

BUILDING
- Division 2 - Grading
  - 02210 Grading
  - 02221 Excavating, Backfiling & Compacting for Structure
  - 02225 Excavating, Backfiling & Compacting for Utilities
  - 02430 Culverts
  - 02511 Aggregate Base Course
  - 02513 Asphaltic Concrete Paving
  - 02528 Concrete Curbs and Walks
  - 02650 Underground Piped Utilities
  - 02665 Water Systems
  - 02730 Sanitary Sewage Systems
  - 02740 Septic System
  - 02935 Landscaping
- Division 3 - Concrete
  - 03100 Concrete Formwork
  - 03200 Concrete Reinforcement
  - 03300 Cast-In-Place Concrete
  - 03600 Grout
- Division 4 - Masonry
  - 04000 Masonry

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OUTLINE SPECIFICATIONS LIST

Division 5 - Metals
- 05000 Metals
- 05060 Welding
- 05100 Structural Steel
- 05101 Stainless Steel and Fasteners

Division 6 - Wood and Plastics
- 06000 Wood and Plastics

Division 7 - Thermal and Moisture Protection
- 07000 Thermal and Moisture Protection

Division 8 - Doors and Windows
- 08000 Doors and Windows

Division 9 - Finishes
- 09000 Finishes

Division 10 - Specialties
- 10000 Specialties

Division 11 - Equipment
- 11000 Equipment

Division 12 - Furnishings
- 12000 Furnishings

Division 13 - Special Construction
- 13000 Special Construction

PROCESS CONTROL

Division 13 - Special Construction
- 13401 Control and Instrumentation
- 13402 Control and Instrumentation for Packaged Equipment
- 13406 Bar Code Identification System
- 13407 Annunciator
- 13451 Health Physics
- 13452 Isokinetic Stack Effluent Monitoring System
- 13461 Plant Management System
- 13462 Plant Management System Software

Division 16 - Electrical
- 16780 Closed Circuit Television System

9 3 1 2 7 6 1 1 3 8 7

OUTLINE SPECIFICATIONS LIST

UTILITIES

Division 15 - Mechanical

15000 General Mechanical
15050 Basic Mechanical Materials and Methods
15100 Valves
15140 Supports and Hangers
15160 Pumps
15240 Above Ground Piped Utilities
15250 Mechanical Insulation
15300 Fire Protection
15368 Carbon Dioxide Extinguishing
15370 Dry Chemical System
15375 Standpipe and Hose Systems
15400 Plumbing Systems
15450 Plumbing Fixtures and Equipment
15575 Stacks
15650 Refrigeration
15760 Liquid Heat Transfer
15781 Special Systems
15800 Air Distribution
15883 HEPA Filter Housings
15855 Air Handling Units

Division 16 - Electrical

16050 Basic Electrical Materials and Methods
16110 Raceways
16120 Wire and Cables
16123 15KV, Conductors
16141 Switches, Receptacles and Accessories
16252 Manual Transfer Equipment
16310 Aerial Power Distribution
16315 Low Voltage Substation
16450 Grounding
16462 Transformers - Dry Type
16470 Panelboards
16480 Motor Control Centers
16501 Lamps
16510 Lighting Fixtures
16610 Uninterruptible Power Supply System
16640 Cathodic Protection
16670 Lightning Profection System
16700 Emergency Audible Alarm Signals
16720 Fire Alarm and Smoke Detection System
16740 Voice and Data Systems
16750 Public Address System

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9.3 Equipment List:

9 3 1 2 7 1 1 3 8 9

MECHANICAL EQUIPMENT LIST

PROJECT: WRAP
CLIENT: DOE/WHC
PROJECT NO.: 6237001

AREA	DESCRIPTION	AREA	DESCRIPTION	AREA	DESCRIPTION
05	Shipping/Receiving	08	Waste Decon	11	Ventilation
06	NDE/NDA	09	Transport/Handling	12	Process Control
07	Waste Processing	10	Building	13	Utilities

BY: G. DURBIN
DATE: 12/16/91
REV: E

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	05	CR --05-101	1	PALLET STORAGE/ RETRIEVAL	(2) Racks (3)H x (9)L Storage Matrix, (1) Aisle (54)Pallets, Cap. 4,000 lbs./Pallet, 56"x56" Pallet Size Speed (fpm): Travel 207, Lift 33, Shuttle 66	H-2-87594
3	05	CR --05-102 A,B	2	DRUM JIB CRANE	1 Ton Capacity, Floor mounted, Pendant Control Speed (fpm): Hoist 30, Trolley 30, Rotate 10	H-2-87594
3	05	CR --05-103	1	TRUPACT BRIDGE CRANE	5 Ton Capacity, Overhead Bridge, Pendant Control Speed (fpm): Hoist 30, Trolley 30, Bridge 60 Span 37'-0"	H-2-87594
3	05	CV --05-101 A,B	2	DRUM INFEED CONVEYOR	Powered CDLR, 10'-0" long, 33" BF, Speed 30 fpm 2.5" Dia. on 4.5" Centers, (4) 30" Accum. Zones Cap. (lbs.): Unit Load 1,000, Dist. Load 4,000	H-2-87594
3	05	CV --05-102	1	DRUM DISCHARGE CONVEYOR	Powered CDLR, 10'-0" long, 33" BF, Speed 30 fpm 2.5" Dia. on 4.5" Centers, (4) 30" Accum. Zones Cap. (lbs.): Unit Load 1,000, Dist. Load 4,000	H-2-87594
3	05	CV --05-103 A,B	2	DRUM SCALE/CONVEYOR	Powered CDLR, 3'-0" long, 33" BF, Speed 30 fpm 2.5" Dia. on 4.5" Centers, W/ Load Cell Cap. (lbs.): Unit Load 1,000, Dist. Load 1,000	H-2-87594
3	05	CV --05-104	1	TRUPACT ACCUMULATION CONVEYOR	Gravity flow rack, Sloped 0.4" per ft. 3" Dia. roller on 1.5" centers, Hysteresis type Cap. (lbs.): Unit Load 7,000, Dist. Load 49,000	H-2-87594
3	05	FT --05-101	1	WASTE BOX FORK TRUCK	7,000 lbs. Cap. @ 30" Load Center, Electric 24v w/ Battery Charger Travel Speed: 5.0 mph unloaded, 4.5 mph loaded	H-2-87594

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	05	FT --05-102	1	PALLET FORK TRUCK	4,000 lbs. Cap. @ 24" Load Center, Electric 36v w/ Battery Charger Travel Speed: 7.0 mph unloaded, 6.5 mph loaded	H-2-87594
3	05	SR --05-101	1	PALLET STRETCH WRAPPER	7,000 lbs. Capacity, Speed 6 rpm Powered CDLR Roller Deck, Powered Turntable DC Motors controlled by vendor panel	H-2-87594
3	05	TR --05-101	1	PALLET TRANSFER CAR	Powered Rail Mounted Transfer Car, Speed 41 fpm Cap. (lbs.): Unit Load 4,000 (Supplied w/ CR-05-101)	H-2-87594
3	06	ND --06-101 A,B	2	DRUM PAN EQUIPMENT	6'-0"L X XX'-0"H X 10'-0"W Sliding Door, Conveyor System, Turntable Neutron Generator	H-2-87621
3	06	ND --06-102 A,B	2	DRUM GEA EQUIPMENT	6'-0"L X 8'-0"H X 8'-0"W Conveyor System, Turntable	H-2-87621
3	06	ND --06-104 A,B	2	DRUM NDE EQUIPMENT	6'-0"L X 8'-0"H X 8'-0"W Sliding Door, Conveyor System, Turntable X-Ray Generator	H-2-87620
3	06	ND --06-105	1	BOX NDE EQUIPMENT	22'-0"L X XX'-0"H X 13'-0"W Sliding Door, Conveyor System, X-Ray Generator	H-2-87620
3	07	CR --07-101 A-D	4	GLOVEBOX MONORAIL HOIST	1 Ton Chain Hoist w/Motor Driven Trolley. Remote control, Speed: 16 fpm	H-2-87631 H-2-87632
3	07	CM --07-102	1	LLW WASTE SUPER-COMPACTOR	1,500-2,000 ton Hyd. Powered compactor, 55 gal. Drum capacity (Powered by HU-07-304)	H-2-87632
3	07	CV --07-101 A,B	2	DRUM TRANSFER CONVEYOR	Capacity: 1,000 lbs., Gravity Roller Conveyor 7"BF x 4'-3"L, 3.5 Dia. x 6"L Rollers on 4" Centers,	H-2-87632

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	07	CY --07-101	1	DRUM PUSHER CYLINDER	Capacity: 1,000 lbs., Electric Rodless Cylinder Stroke: 5'-6", Servo Motor Drive	H-2-87631
3	07	DH --07-101	1	DRUM LIFTER	Capacity; 1,000 lbs., 55 Gal. Drums Spring Actuated, Pneumatic release	H-2-87631
3	07	DH --07-102	1	DRUM TIPPER	Capacity; 1,000 lbs., 55 Gal. Drums Hydraulic Drum Dumper, 270 deg. rotation	H-2-87632
3	07	DH --07-103	1	COMPACTED DRUM LIFTER	Capacity; 1,000 lbs., 55 Gal. Drums Pneumatic Drum Clamp	H-2-87632
3	07	DO --07-101	1	LLW DRUM ENTRY PORT	27"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	H-2-87631
3	07	DO --07-102	1	LLW DRUM TRANSFER PORT	27"dia Port, Electric powered sliding door	H-2-87631
3	07	DO --07-104 A,B	2	SAMPLE TRANSFER/PURGE PORT	6.5"dia Port, Pneumatic powered Bagless Transfer System	H-2-87632
3	07	DO --07-105	1	RW LLW DRUM EXIT PORT	24"dia Port, Pneumatic powered swing door Double Lidded System	H-2-87632
3	07	DO --07-106	1	LLW DRUM EXIT PORT	27"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	H-2-87632
3	07	EM --07-101	1	WASTE SORTING MANIPULATOR	60 lbs. Cap. Twin Arm Hydraulic Manipulator Overhead Carriage mounted w/Electric Drive (Unit Operated by: HU-07-103)	H-2-87632

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	07	GB --07-101	1	LLW ENTRY GLOVEBOX	12'-0"H X 10'-0"L X 3'-6"W Matl.: 304 SS, 7 Ga. Remotely Operated	H-2-87631
3	07	GB --07-102	1	LLW SORTING GLOVEBOX	12'-0"H X 15'-0"L X 4'-0"W Matl.: 304 SS, 7 Ga.	H-2-87632
3	07	GB --07-104	1	LLW SUPER-COMPACTOR GLOVEBOX	8'-0"H X 6'-6"L X 6'-0"W Matl.: 304 SS, 7 Ga.	H-2-87632
3	07	GB --07-105	1	LLW EXIT GLOVEBOX	12'-0"H X 15'-0"L X 3'-6"W Matl.: 304 SS, 7 Ga.	H-2-87632
3	07	HU --07-101	1	DRUM HANDLER HPU	40 Gal. Reservoir, Hyd. Pump @ 2,300 psi (Unit Serves: DH-07-102)	H-2-87632
3	07	HU --07-102	1	DRUM LID REMOVAL HPU	2 Gal. Reservoir, Hyd. Pump @ 10,000 psi (Unit Serves: RT-07-102)	H-2-87632
3	07	HU --07-103	1	MANIPULATOR HPU	6 Gal. Reservoir, Hyd. Pump @ 5,000 psi 2'W x 2'H x 3'L (Unit Serves: EM-07-101)	H-2-87632
3	07	RT --07-101 A,B	2	DRUM CLAMP BAND SAW	(2) Electric Saws, Pneumatically Positioned	H-2-87632
3	07	RT --07-102	1	LID REMOVAL FIXTURE	(1) Hydraulic Punch, Pneumatically Raised/Lowered (Unit Operated by: HU-07-102)	H-2-87632
3	07	RT --07-103	1	DRUM LID FASTENER	(1) Pneumatic Nail Gun, Pneumatically Positioned	H-2-87632

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	07	RT --07-104	1	DRUM PUCK CORE SAMPLER	Capacity: 1.125" dia. x 4"L, Electric core drill	H-2-87632
3	07	ST --07-101	1	WASTE SORTING TABLE	Capacity; 1,000 lbs., Electric powered tilt	H-2-87632
3	07	TC --07-101	1	DRUM TRANSFER CAR	Capacity; 1,000 lbs., Pneumatic powered, Rail guided	H-2-87632
3	07	XX --07-101	1	CORE SAMPLE ROBOT	Pick & Place Robot 3 lbs. Payload	H-2-87632
3	07	CR --07-201	1	GLOVEBOX MONORAIL HOIST	1/2 Ton Chain Hoist w/Motor Driven Trolley. Remote control, Speed: 16 fpm	H-2-87634
3	07	DO --07-201	1	RWM LLW DRUM ENTRY/EXIT PORT	24"dia Port, Pneumatic powered swing door Double Lidded System	H-2-87634
3	07	DO --07-202	1	RWM LLW DRUM EXIT PORT	24"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	H-2-87634
3	07	DO --07-203	1	RWM DRUM EXIT PORT	27"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	H-2-87634
3	07	DO --07-204 A,B	2	SAMPLE TRANSFER/PURGE PORT	6.5"dia Port, Pneumatic powered Bagless Transfer System	H-2-87634
3	07	DO --07-205	1	CONSUMABLE ENTRY PORT	Sphincter Port	H-2-87634

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	07	EM --07-201	1	WASTE SORTING MANIPULATOR	60 lbs. Cap. Twin Arm Hydraulic Manipulator Overhead Carriage mounted w/Electric Drive (Unit Operated by: HU-07-201)	H-2-87634
3	07	GB --07-201	1	RESTRICTED WASTE GLOVEBOX	6'-0"H X 19'-6"L X 7'-0"W Matl.: 304 SS, 7 Ga.	H-2-87634
3	07	HU --07-201	1	MANIPULATOR HPU	12 Gal. Reservoir, Hyd. Pump @ 5,000 psi (Unit Serves: EM-07-201,401)	H-2-87630
4	07	SC --07-201	1	WEIGH SCALE	Capacity: 0-60 lbs. Dial Indicator	H-2-87634
3	07	V --07-201	1	PRIMARY COLLECTION RECEIVER	100 Gal., ASME Sect. VIII Pressure Vessel Standard Propane Tank	H-2-87634
3	07	XX --07-201	1	AEROSOL CAN DISPOSAL UNIT	Hydraulic Powered, Aerosol Can Compaction, Vacuum pump	H-2-87634
4	07	XX --07-202	1	JAR MILL	Double Jar Roller, Electric powered	H-2-87634
3	07	CR --07-301 A-D	4	GLOVEBOX MONORAIL HOIST	1 Ton Chain Hoist w/Motor Driven Trolley. Remote control, Speed: 16 fpm	H-2-87628 H-2-87629 H-2-87630
3	07	CM --07-301	1	GIRTH-COMPACTOR	1,500-2,000 ton Hyd. Powered compactor, 55 gal. Drum capacity (Powered by HU-07-304)	H-2-87629
3	07	CM --07-302	1	SUPER-COMPACTOR	1,500-2,000 ton Hyd. Powered compactor, 55 gal. Drum capacity (Powered by HU-07-304)	H-2-87629

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	07	CV --07-301 A,B	2	DRUM TRANSFER CONVEYOR	Capacity: 1,000 lbs., Gravity Roller Conveyor 7"BF x 4'-3"L, 3.5 Dia. x 6"L Rollers on 4" Centers,	H-2-87628
3	07	CY --07-301	1	DRUM PUSHER CYLINDER	Capacity: 1,000 lbs., Electric Rodless Cylinder Stroke: 5'-6", Servo Motor Drive	H-2-87628
3	07	DH --07-301	1	DRUM LIFTER	Capacity; 1,000 lbs., 55 Gal. Drums Spring Actuated, Pneumatic release	H-2-87628
3	07	DH --07-302 A,B	2	DRUM GRAB	Capacity; 1,000 lbs., 55 Gal. Drums Hydraulic Drum Clamp	H-2-87628
3	07	DH --07-303	1	DRUM TIPPER	Capacity; 1,000 lbs., 55 Gal. Drums Hydraulic Drum Dumper, 270 deg. rotation	H-2-87629
3	07	DH --07-304	1	COMPACTED DRUM LIFTER	Capacity; 1,000 lbs., 55 Gal. Drums Hydraulic Drum Clamp	H-2-87630
3	07	DO --07-301	1	TRU DRUM ENTRY PORT	27"dia Port, Pneumatic powered swing door Simple Double Lidded System Permanent magnet Lid Handling System	H-2-87628
3	07	DO --07-302	1	TRU DRUM TRANSFER PORT	27"dia Port, Electric powered sliding door w/ Entry Sphincter	H-2-87628
3	07	DO --07-303	1	X-RAY DOOR	15"W x 30"L, Matl.: Stainless Steel Pneumatic Operated	H-2-87629
3	07	DO --07-304 A,B	2	SAMPLE TRANSFER/PURGE PORT	6.5"dia Port, Pneumatic powered Bagless Transfer System	H-2-87629 H-2-87630

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	07	DO --07-305	1	RWM TRU DRUM EXIT PORT	24"dia Port, Pneumatic powered swing door Double Lidded System	H-2-87629
3	07	DO --07-306	1	TRU DRUM EXIT PORT	22"Dia. Port, Pneumatic powered sliding door Double Lidded System Permanent magnet Lid Handling System	H-2-87630
3	07	EM --07-301	1	WASTE SORTING MANIPULATOR	60 lbs. Cap. Twin Arm Hydraulic Manipulator Overhead Carriage mounted w/Electric Drive (Unit Operated by: HU-07-303)	H-2-87629
3	07	GB --07-301	1	TRU ENTRY GLOVEBOX	12'-0"H X 10'-0"L X 3'-6"W Matl.: 304 SS, 7 Ga.	H-2-87628
3	07	GB --07-302	1	TRU SORTING GLOVEBOX	12'-0"H X 15'-0"L X 4'-0"W Matl.: 304 SS, 7 Ga.	H-2-87629
3	07	GB --07-303	1	TRU GIRTH-COMPACTOR GLOVEBOX	12'-0"H X 6'-0"L X 9'-6"W Matl.: 304 SS, 7 Ga.	H-2-87629
3	07	GB --07-304	1	TRU SUPER-COMPACTOR GLOVEBOX	8'-0"H X 6'-6"L X 6'-0"W Matl.: 304 SS, 7 Ga.	H-2-87629
3	07	GB --07-305	1	TRU EXIT GLOVEBOX	12'-0"H X 15'-0"L X 3'-6"W Matl.: 304 SS, 7 Ga.	H-2-87630
3	07	HU --07-301	1	DRUM LID REMOVAL HPU	40 Gal. Reservoir, Hyd. Pump @ 2,300 psi (Unit Serves: DH-07-302,303)	H-2-87629
3	07	HU --07-302	1	DRUM FIXTURE HPU	2 Gal. Reservoir, Hyd. Pump @ 10,000 psi (Unit Serves: RT-07-301)	H-2-87629

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	07	HU --07-303	1	MANIPULATOR HPU	6 Gal. Reservoir, Hyd. Pump @ 5,000 psi 2'W x 2'H x 3'L (Unit Serves: EM-07-301)	H-2-87629
3	07	HU --07-304	1	COMPACTOR HPU	Supercompactor Hydraulic Power Unit (Unit Serves: CM-07-102,301,302)	H-2-87629
3	07	ND --07-301	1	X-RAY MACHINE	Fluoroscope Unit w/ Camera & Monitor	H-2-87629
3	07	RT --07-301 A,B	2	DRUM CLAMP BAND SAW	(2) Electric Saws, Pneumatically Positioned	H-2-87629
3	07	RT --07-302	1	LID REMOVAL FIXTURE	(1) Hydraulic Punch, Pneumatically Raised/Lowered (Unit Operated by: HU-07-102)	H-2-87629
3	07	RT --07-303	1	DRUM LID FASTENER	(1) Pneumatic Nail Gun, Pneumatically Positioned	H-2-87629
3	07	RT --07-304	1	DRUM PUCK CORE SAMPLER	Capacity: 1.125" dia. x 4"L, Electric core drill	H-2-87630
3	07	ST --07-301	1	WASTE SORTING TABLE	Capacity; 1,000 lbs., Electric powered tilt	H-2-87629
3	07	TC --07-301	1	DRUM TRANSFER CAR	Capacity; 1,000 lbs., Pneumatic powered, Rail guided	H-2-87629
3	07	XX --07-301	1	CORE SAMPLE ROBOT	Pick & Place Robot 3 lbs. Payload	H-2-87629

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	07	XX --07-302	1	X-RAY PACKET TRAY		H-2-87629
3	07	CR --07-401	1	GLOVEBOX MONORAIL HOIST	1/2 Ton Chain Hoist w/Motor Driven Trolley. Remote control, Speed: 16 fpm	H-2-87633
3	07	DO --07-401	1	RWM DRUM ENTRY/EXIT PORT	24"dia Port, Pneumatic powered swing door Double Lidded System	H-2-87633
3	07	DO --07-402	1	RWM DRUM EXIT PORT	22"dia Port, Pneumatic powered sliding door Simple Double Lidded System Permanent magnet Lid Handling System	H-2-87633
3	07	DO --07-403	1	RWM DRUM EXIT PORT	22"dia Port, Pneumatic powered sliding door Simple Double Lidded System Permanent magnet Lid Handling System	H-2-87633
3	07	DO --07-404 A,B	2	SAMPLE TRANSFER PORT	6.5"dia Port, Pneumatic powered Bagless Transfer System	H-2-87633
3	07	DO --07-405	1	CONSUMABLE ENTRY PORT	Sphincter Port	H-2-87633
3	07	EM --07-401	1	WASTE SORTING MANIPULATOR	60 lbs. Cap. Twin Arm Hydraulic Manipulator Overhead Carriage mounted w/Electric Drive (Unit Operated by: HU-07-201)	H-2-87633
3	07	GB --07-401	1	RESTRICTED WASTE GLOVEBOX	6'-0"H X 19'-6"L X 7'-0"W Matl.: 304 SS, 7 Ga.	H-2-87633
4	07	SC --07-401	1	WEIGHT SCALE	Capacity: 0-60 lbs. Dial indicator	H-2-87633

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	07	V --07-401	1	PRIMARY COLLECTION RECEIVER	100 Gal., ASME Sect. VIII Pressure Vessel Standard Propane Tank	H-2-87633
3	07	XX --07-401	1	AEROSOL CAN DISPOSAL UNIT	Hydraulic Powered, Aerosol Can Compaction, Vacuum pump	H-2-87633
4	07	XX --07-402	1	JAR MILL	Double Jar Roller, Electric powered	H-2-87633
3	09	CV --09-101 A-F	6	DRUM NDE/NDA TRANSFER CONVEYOR	Powered CDLR, 3'-0" long, 33" BF, Speed 30 fpm 2.5" Dia. on 4.5" Centers, (1) 30" Accum. Zones Cap. (lbs.): Unit Load 1,000, Dist. Load 1,000	H-2-87717
3	09	CV --09-102	1	DRUM STORAGE CAROUSEL	Powered CDLR, 18'-0" long, 33" BF, Speed 30 fpm 2.5" Dia. on 4.5" Centers, (5) 30" Accum. Zones Cap. (lbs.): Unit Load 1,000, Dist. Load 12,000	H-2-87717
3	09	CV --09-103 A,B	2	DRUM TRANSFER CONVEYOR	Powered CDLR, 9'-0" long, 33" BF, Speed 30 fpm 2.5" Dia. on 4.5" Centers, (2) 30" Accum. Zones Cap. (lbs.): Unit Load 1,000, Dist. Load 2,000	H-2-87718
3	09	CV --09-104 A,B	2	DRUM AIRLOCK CONVEYOR	Powered CDLR, 5'-0" long, 33" BF, Speed 30 fpm 2.5" Dia. on 4.5" Centers, Cap. (lbs.): Unit Load 1,000, Dist. Load 1,000	H-2-87718
3	09	CV --09-105	1	BOX CONVEYOR/ SCALE	Powered CDLR, 10'-0" long, 68" BF, Speed 15 fpm 2.5" Dia. on 4.5" Centers, Cap. (lbs.): Unit Load 7,000, Dist. Load 7,000	H-2-87717
3	09	GV --09-101	1	AUTOMATED GUIDED VEHICLE	Electric powered, W/ Batt. Charger, Laser guided Dual roller decks, 2.5" Dia. on 4.5" Centers Cap. (lbs.): Unit Load 1,000, Dist. Load 2,000	H-2-87718
3	09	CV --09-201 A,B	2	DRUM TRANSFER CONVEYOR	Powered CDLR, 5'-0" long, 33" BF, Speed 30 fpm 2.5" Dia. on 4.5" Centers, (2) 30" Accum. Zones Cap. (lbs.): Unit Load 1,000, Dist. Load 4,000	H-2-87718

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	09	CV --09-202	1	RW DRUM STORAGE CAROUSEL	Powered CDLR, 33'-0" long, 33" BF, Speed 30 fpm 2.5" Dia. on 4.5" Centers, (11) 30" Accum. Zones Cap. (lbs.): Unit Load 1,000, Dist. Load 24,000	H-2-87719
3	09	GV --09-201	1	AUTOMATIC GUIDED VEHICLE	Electric powered, W/ Batt. Charger, Laser guided Dual roller decks, 2.5" Dia. on 4.5" Centers Cap. (lbs.): Unit Load 1,000, Dist. Load 2,000	H-2-87719
3	09	LT --09-201 A-M	12	DRUM LIFT TABLE	Powered CDLR, 5'-0" long, 33" BF, Speed 35 fpm 2.5" Dia. on 4.5" Centers, Hyd. Powered Lift Table Cap. (lbs.): Unit Load 1,000, Dist. Load 1,000	H-2-87719
3	11	AS --11-101	1	AIR SEPARATOR	16" Dia. X 36" L, Design Press.: 125 PSIG, Matl.: C.S., ASME Sect. VIII	H-2-88163
3	11	AS --11-104	1	AIR SEPARATOR	11" Dia. X 26" L, Design Press.: 125 PSIG, Matl.: C.S., ASME Sect. VIII	H-2-88163
3	11	CF --11-101	1	CHEMICAL FEED TANK	30 GAL., Design Press. 125 PSIG, Matl. Carbon Steel ASME Sect. VIII	H-2-88159
4	11	CH --11-101 A,B	2	AIR CHILLER	75 RTON, 400 GPM, 45% Glycol, Reciprocal Skid mounted w/ panel, mtr. starter and gages (Part of CT-07-101)	H-2-88163 H-2-88164
4	11	CT --11-101 A,B	2	COOLING TOWER	75 RTON @ 68 F WB, 150 GPM, 45% Glycol Wtr. Temp.: In/Out 100F/ 90F (2) Speed Fan, Control Panel w/ Mtr. Starters	H-2-88165
3	11	DP --11-101 A,B	2	DAMPER	1,700 ACFM, 0.05" D.P. W/ Pneumatic Actuator 60"W X 24"H, Matl.: 304L SS Parallel Blade, Isolation Damper	H-2-88158
3	11	DP --11-102 A,B,C	3	DAMPER	1,700 ACFM, 0.05" D.P. W/ Pneumatic Actuator 42"Dia., Matl.: 304L SS Butterfly Isolation Damper	H-2-88158

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	11	DP --11-103 A,B	2	DAMPER	1,460 ACFM, 0.05" D.P. W/ Pneumatic Actuator 12"Dia., Matl.: 304L SS Butterfly Control Damper	H-2-88159
3	11	DP --11-104 A,B	2	DAMPER	470 ACFM, 0.05" D.P. W/ Pneumatic Actuator 4"Dia., Matl.: 304L SS Butterfly Control Damper	H-2-88159
3	11	DP --11-105 A-D	4	DAMPER	3,500 ACFM, 0.05" D.P. W/ Pneumatic Actuator 18"Dia., Matl.: 304L SS Butterfly Control Damper	H-2-88159
3	11	DP --11-106 A-D	4	DAMPER	20,000 ACFM, 0.05" D.P. W/ Pneumatic Actuator 40"Dia., Matl.: 304L SS Butterfly Control Damper	H-2-88159
3	11	DP --11-107	1	DAMPER	14,200 ACFM, 0.05" D.P. W/ Pneumatic Actuator 96"W X 36"H, Matl.: C.S. Galv. Butterfly Isolation Damper	H-2-88162
3	11	ET --11-101	1	EXPANSION TANK	180 GAL., Design Press. 30 PSIG, Matl. Carbon Steel ASME Sect. VIII	H-2-88163
3	11	ET --11-104	1	EXPANSION TANK	30 GAL., Design Press. 30 PSIG, Matl. Carbon Steel ASME Sect. VIII	H-2-88159
3	11	FC --11-101 A-D	4	FLOW VALVE		H-2-88164
3	11	FC --11-102 A,B,C	3	FLOW VALVE		H-2-88164
3	11	FC --11-103	1	FLOW VALVE		H-2-88164

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	11	MV --11-101 A,B	2	DISCHARGE VALVE	Design Press.: 175 psi @ 300 F Matl.: Cast Iron	H-2-88163
3	11	MV --11-102 A,B	2	DISCHARGE VALVE	Design Press.: 175 psi @ 300 F Matl.: Cast Iron	H-2-88163
3	11	MV --11-103 A,B	2	DISCHARGE VALVE	Design Press.: 175 psi @ 300 F Matl.: Cast Iron	H-2-88163
3	11	MV --11-104	1	DISCHARGE VALVE	Design Press.: 175 psi @ 300 F Matl.: Cast Iron	H-2-88159
4	11	P --11-101 A,B	2	CHILLED WATER PUMPS	400 GPM, Disch Press. 34.7 PSIG, 45% Glycol ANSI Centrifugal, Horz. End Suction, Variable Speed Motor Control, 460V/3/60HZ	H-2-88156
4	11	P --11-102 A,B	2	CHILLED WATER PUMPS	200 GPM, Disch Press. 13.0 PSIG, 45% Glycol ANSI Centrifugal, Horz. End Suction, Constant Speed Motor Control, 460V/3/60HZ	H-2-88156
4	11	P --11-103 A,B	2	CONDENSING WATER PUMPS	150 GPM, Disch Press. 21.7 PSIG, 45% Glycol ANSI Centrifugal, Horz. End Suction, Constant Speed Motor, 460/3/60, (Part of CH-07-101)	H-2-88156
4	11	P --11-104	1	HEAT RECOVERY PUMP	180 GPM, Disch Press. 13.0 PSIG, 45% Glycol ANSI Centrifugal, Horz. End Suction, Constant Speed Motor Control, 460V/3/60HZ	H-2-88156
4	11	RC --11-101 A,B	2	HEAT RECOVERY COIL	150 MBH, 30 GPM, 45% Glycol Matl. Copper Tube, Copper Fins (Supplied w/FT-11-201)	H-2-88166
4	11	RC --11-102 A,B	2	HEAT RECOVERY COIL	700 MBH, 150 GPM, 45% Glycol Matl. Copper Tube, Copper Fins (Supplied w/FT-11-202)	H-2-88166

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
4	11	RC --11-103 A,B	2	HEAT RECOVERY COIL	850 MBH, 180 GPM, 45% Glycol Matl. Copper Tube, Copper Fins (Supplied w/MA-11-203)	H-2-88166
3	11	XS --11-101	1	EXHAUST AIR STACK	40" Dia. x 46'-0"H, 20,000 ACFM Matl.: Carbon Steel w/ 10 mil Epoxy Coating both sides	H-2-88159
3	11	BL --11-201 A,B	2	BLOWER	20,000 ACFM, Disch. Press.: -11 IN. SP, Variable Inlet Vanes, Constant speed drive w/ Control Panel, (Supplied w/ FT-11-201)	H-2-88159
3	11	BL --11-202 A,B	2	BLOWER	20,000 ACFM, Disch. Press.: -11 IN. SP, Variable Inlet Vanes, Constant speed drive w/ Control Panel, (Supplied w/ FT-11-202)	H-2-88159
3	11	FT --11-201 A,B	2	AIR FILTER TRAIN	3500 ACFM, Disch. Press.: -11.0 IN. SP, 150 MBH Heat Recovery Coil, HEPA Filter 2'Wx2'H Matl.: 10 Ga. SS, W/ Demister & Firescreeen	H-2-88159
3	11	FT --11-202 A,B	2	AIR FILTER TRAIN	20,000 ACFM, Disch. Press.: -9.0 IN. SP, 700 MBH Heat Recovery Coil, HEPA Filter 4'Wx4'H Matl.: 10 Ga. SS, W/ Demister & Firescreeen	H-2-88159
3	11	LV --11-203 A,B	2	WALL LOUVERS/DAMPER	17,000 CFM, 500 FPM	H-2-88156
3	11	MA --11-203 A,B	2	MAKE-UP AIR UNIT	17,000 CFM Constant Speed Fan, 1165 MBH Electric Heating Coil 365 KW, 460/3/60, w/ Control Panel, (Supplied w/ MA-11-203)	H-2-88158
3	11	SF --11-203 A,B	2	SUPPLY FAN	17,000 ACFM, Disch. Press.: 7 IN. SP, Variable Inlet Vanes, Constant speed drive w/ Control Panel	H-2-88156
3	11	AH --11-302	1	AIR HANDLING UNIT	32,380 ACFM, Disch. Press.: 6.0 IN. SP, Cooling Coil 130 GPM, 645 MBH Electric Reheat Coil 107 KW, w/ Control Panel	H-2-88160

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	11	EF --11-302	1	EXHAUST FAN	24,000 ACFM, Disch. Press.: 0.5 IN. SP, Vertical Upblast, W/ Backdraft Damper Axiel Vane, 460V/3/60	H-2-88160
4	11	EH --11-301 A,B	2	UNIT HEATER	5,000 ACFM, Electric Heat 30 KW 460V/3/60HZ	H-2-88156
4	11	EH --11-302 A,B	2	UNIT HEATER	8,000 ACFM, Electric Heat 50 KW 460V/3/60HZ	H-2-88156
3	11	LV --11-302	1	WALL LOUVERS	24,000 CFM @ 500 FPM	H-2-88156
3	11	RF --11-303	1	RETURN AIR FAN	20,000 ACFM, Disch. Press.: 0.5 IN. SP, Axiel Vane, 460V/3/60	H-2-88160
3	11	RF --11-304	1	RETURN AIR FAN	17,000 ACFM, Disch. Press.: 0.5 IN. SP, Axiel Vane, 460V/3/60	H-2-88160
3	11	RV --11-302	1	ROOF VENT	24,000 CFM, 500 FPM Air Exhaust	H-2-88160
3	11	SF --11-305	1	SUPPLY FAN	32,380 ACFM, Disch. Press.: 6.0 IN. SP, 460V/3/60HZ (Supplied w/AH-11-302)	H-2-88160
3	11	AH --11-501	1	AIR HANDLING UNIT	14,200 ACFM, Disch. Press.: 7.0 IN. SP, Cooling Coil 80 GPM Electric Reheat Coil 80 KW	H-2-88162
4	11	CB --11-501 A-T	17	CABINET HEATER	800 ACFM, 30 MBH 5 KW Electric Heater	H-2-88156

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	11	EF --11-501	1	EXHAUST FAN	14,200 ACFM, Disch. Press.: 0.5 IN. SP, Vertical Upblast, W/ Backdraft Damper, 460/3/60 (Supplied w/MA-11-601)	H-2-88162
3	11	EF --11-505	1	EXHAUST FAN	1,000 ACFM, Disch. Press.: 0.5 IN. SP, Horizontal, W/ Backdraft Damper 120V/3/60HZ	H-2-88162
3	11	EF --11-506	1	EXHAUST FAN	400 ACFM, Disch. Press.: 0.5 IN. SP, Ceiling mount 120V/3/60HZ	H-2-88162
3	11	LV --11-501	1	WALL LOUVERS	14,200 CFM @ 500 FPM	H-2-88162
3	11	LV --11-505	1	WALL LOUVERS	400 CFM @ 500 FPM	H-2-88156
3	11	RF --11-501	1	RETURN AIR FAN	14,200 ACFM, Disch. Press.: 0.5 IN. SP, 460V/3/60HZ	H-2-88162
3	11	RV --11-501	1	ROOF VENT	14,200 CFM, 500 FPM Air Exhaust	H-2-88162
3	11	RV --11-505	1	ROOF VENT	1,000 CFM, 500 FPM Air Exhaust	H-2-88162
3	11	SF --11-503	1	SUPPLY FAN	14,200 ACFM, Disch. Press.: 5.0 IN. SP, 460V/3/60HZ (Supplied w/AH-11-501)	H-2-88162
3	11	VA --11-501	1	VARIABLE AIR SUPPLY BOX	2,100 ACFM, Disch. Press.: 0.25 IN. SP, W/ 9.8 KW Electric Heater 460/3/60HZ	H-2-88156
3	11	VA --11-502	1	VARIABLE AIR SUPPLY BOX	1,200 ACFM, Disch. Press.: 0.25 IN. SP, W/ 5.6 KW Electric Heater 460/3/60HZ	H-2-88156

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	11	EF --11-604	1	EXHAUST FAN	4,000 ACFM, Disch. Press.: 1.0 IN. SP, Backward Inclined, 460/3/60 (Supplied w/MA-11-601)	H-2-88162
4	11	HR --11-601	1	HEAT RECOVERY UNIT	4,000 ACFM, 1" WC Delta P 100,000 BTUH, Air to Air Exchanger (Supplied w/MA-11-601)	H-2-88162
3	11	LV --11-601	1	WALL LOUVERS	3,500 CFM @ 500 FPM	H-2-88162
3	11	MA --11-601	1	MAKE-UP AIR UNIT	4,000 ACFM, Disch. Press.: 2.0 IN. SP, Electric Heating Coil 75 KW Constant Speed Fan	H-2-88162
3	11	RV --11-601	1	ROOF VENT	4,000 CFM, 500 FPM Air Exhaust	H-2-88162
3	11	SF --11-604	1	SUPPLY FAN	4,000 ACFM, Disch. Press.: 4.0 IN. SP, Backward Inclined, 460/3/60 (Supplied w/MA-11-601)	H-2-88162
3	11	EF --11-703	1	EXHAUST FAN	6,000 ACFM, Disch. Press.: 0.5 IN. SP, W/ Backdraft Damper & Birdscreen Thermostat Control, 120V/3/60HZ	H-2-88162
3	11	EF --11-704	1	EXHAUST FAN	5,000 ACFM, Disch. Press.: 0.5 IN. SP, W/ Backdraft Damper & Birdscreen Thermostat Control, 460V/3/60HZ	H-2-88162
3	11	LV --11-702	1	WALL LOUVERS	11,200 CFM @ 500 FPM	H-2-88162

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	11	MA --11-702	1	MAKE-UP AIR UNIT	11,200 ACFM, Disch. Press.: 1.0 IN. SP, Electric Heating Coil 767MBH, 225 KW w/ Variable Speed Fan	H-2-88162
3	11	RV --11-703	1	ROOF VENT	5,000 CFM, 500 FPM Air Exhaust	H-2-88162
3	11	RV --11-704	1	ROOF VENT	5,000 CFM, 500 FPM Air Exhaust	H-2-88162
3	11	SF --11-702	1	SUPPLY FAN	11,200 ACFM, Disch. Press.: 3.0 IN. SP, 460V/3/60HZ (Supplied w/MA-11-702)	H-2-88162
3	11	AC --11-801 A,B	2	COMPUTER ROOM ACU	4,000 ACFM, W/ Fan, 7.5 Ton 25 GPM Chilled Wtr. Coil, 460/3/60 Elect. Reheat Coil 15 KW, Elect. Humidifier 5 KW	H-2-88161
3	11	RV --11-801	1	ROOF VENT	800 CFM, 500 FPM Outside Air Intake	H-2-88161
3	13	BA --13-111 A-D	4	PORTABLE BREATHING AIR	(2) Breathing Air Cylinders 100 FT. of Hose and Masks	H-2-88226
3	13	C --13-101 A,B	2	AIR COMPRESSOR	85.2 ACFM, Air cooled, Aftercooler Design Press: 150 psi	H-2-88226
3	13	DR --13-105	1	INSTRUMENT AIR DRYER	Design Press.: 150 PSI, 101 SCFM Dessicant Dryer, Twin Tower	H-2-88226
3	13	F --13-106	1	INSTRUMENT AIR PREFILTER	5.0 Micron, Design Press: 150 PSIG Coalescing Prefilter (Included w/ DR-13-105)	H-2-88226

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
3	13	F --13-107	1	INSTRUMENT AIR AFTERFILTER	1.0 Micron, Design Press: 150 PSIG Particulate Afterfilter (Included w/ DR-13-105)	H-2-88226
3	13	F --13-108	1	INSTRUMENT AIR AFTERFILTER	0.5 Micron, Design Press: 150 PSIG Matl.	H-2-88226
3	13	V --13-103 A,B	2	AIR RECEIVER	Design Press: 150 psi, Matl.: C.S. (1) 240 Gal., 30'ID x 7'-0" (Included w/ C-13-101)	H-2-88226

9.4 Specialty Item List:

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SPECIALITY ITEM LIST

PROJECT: WRAP
CLIENT: DOE/WHC
PROJECT NO.: 6237001

AREA	DESCRIPTION	AREA	DESCRIPTION	AREA	DESCRIPTION
05	Shipping/Receiving	08	Waste Decon	11	Ventilation
06	NDE/NDA	09	Transport/Handling	12	Process Control
07	Waste Processing	10	Building	13	Utilities

BY: G. DURBIN
DATE: 12/16/91
REV: E

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
	05	SP --05-101 A,B	2	DRUM LIFTING FIXTURE	1,000lbs. Capacity (Use w/ CR-05-102A,B)	H-2-87594
	05	SP --05-102	1	FORK TRUCK BATTERY CHARGER	24 Volt, 1160 Amp Hr., 208/240/480V Supply (Supplied w/ FT-05-101)	H-2-87594
	05	SP --05-103	1	FORK TRUCK BATTERY CHARGER	36 Volt, 1050 Amp Hr., 208/240/480V Supply (Supplied w/ FT-05-102)	H-2-87594
	05	SP --05-121	1	HELIUM LEAK DETECTION	Trupact-II Leak Detection Equipment	H-2-87594
	05	SP --05-122	1	VACUUM PUMP	Trupact-II Vacuum Equipment	H-2-87594
	05	SP --05-123	1	ACG LIFT FIXTURE	Trupact-II Loading Fixture	H-2-87594
	05	SP --05-124	1	ACG LIFT FIXTURE STAND	Trupact-II Fixture Stand	H-2-87594
	05	SP --05-125 A,B,C	3	OCV LID STAND	Trupact-II Outer Lid Stand	H-2-87594

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
	05	SP --05-126 A,B,C	3	ICV LID STAND	Trupact-II Inner Lid Stand	H-2-87594
	05	SP --05-127	1	SWB's LIFT FIXTURE	Trupact-II SWB Lift Fixture Matl.: C.S.	H-2-87594
	07	SP --07-101	1	LLW PNEUMATIC CONTORL PANEL		H-2-87631
	07	SP --07-201	1	LLW RWM PNEUMATIC CONTORL PANEL		H-2-87631
	07	SP --07-203	1	WASTE GAS COLLECTION	100 GAL., 24" Dia. x 4'-4"L HIGH PRESSURE GAS CYLINDER	H-2-87633
	07	SP --07-205 A,B	2	NEUTRALIZATION CONTAINER	10" Dia. X 1'-0" L Matl.: S.S.,	H-2-87633
	07	SP --07-301	1	TRU PNEUMATIC CONTORL PANEL		H-2-87631
	07	SP --07-401	1	TRU RWM PNEUMATIC CONTORL PANEL		H-2-87631
	07	SP --07-403	1	WASTE GAS COLLECTION	100 GAL., 24" Dia. x 4'-4"L HIGH PRESSURE GAS CYLINDER	H-2-87633
	07	SP --07-405 A,B	2	NEUTRALIZATION CONTAINER	10" Dia. X 1'-0" L Matl.: S.S.,	H-2-87633

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
	09	SP --09-101 A,B	2	AGV BATTERY CHARGER	36 Volt, 1050 Amp Hr., 208/240/480V Supply (Supplied w/ GV-09-101,201)	H-2-87594
	09	SP --09-102	2	AGV COMPUTER SYSTEM	Micro VAX Computer, w/ Terminal, Printer, (Supplied w/ GV-09-101,201)	H-2-87594
	11	SP --11-101 A,B	2	SUCTION DIFFUSER	400 GPM, 1.5 psi	H-2-88163
	11	SP --11-102 A,B,C	3	SUCTION DIFFUSER	200 GPM, 1.5 psi	H-2-88159
	11	SP --11-103	1	MIXING VALVE	180 GPM, 1.0 psi Thermostatic Actuated	H-2-88157

9.5 Government Furnished Equipment List:

9 3 1 2 7 1 1 4 1 4

GFE EQUIPMENT LIST

PROJECT: WRAP
CLIENT: DOE/WHC
PROJECT NO.: 6237001

AREA	DESCRIPTION	AREA	DESCRIPTION	AREA	DESCRIPTION
05	Shipping/Receiving	08	Waste Decon	11	Ventilation
06	NDE/NDA	09	Transport/Handling	12	Process Control
07	Waste Processing	10	Building	13	Utilities

BY: G. DURBIN
DATE: 12/12/91
REV: A

SAFE CLASS	AREA	TAG NO.	QTY.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
	05	GFE --05-XXX A,B	2	PORTABLE FRISKER		H-2-87594
	05	GFE --05-XXX		STORAGE PALLETS	56" x 56" Storage Pallets	H-2-87594
	05	GFE --05-XXX		EMPTY WASTE DRUMS	55 Gal. Waste Drum	H-2-87594
	05	GFE --05-XXX		EMPTY WASTE DRUMS	83 Gal. Waste Drum	H-2-87594
	05	GFE --05-XXX		EMPTY WASTE DRUMS	55 Gal. Waste Drum Drath & Schrader Design w/ Cake Stand	H-2-87594
	05	GFE --05-XXX	1	ORGANIC SNIFFER	Drum Organic Sniffer	H-2-87594
	06	GFE --06-106	1	BOX NDA EQUIPMENT	30'L x 10'W x 12'H	H-2-87620
	07	GFE --07-XXX		PORTABLE TOOLING	Misc. Glovebox Tools	

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9.6 Long Lead Procurement List:

1. Long lead procurement items are defined as those items that must be procured prior to award of the construction contract in order to achieve key project completion milestones. No equipment items have been identified that meet this definition. However, to minimize risk to the project, the supercompaction equipment is recommended for early procurement based upon the following arguments.

2. UE&C is requesting DOE-RL to strongly consider an early procurement of the WRAP 1 supercompactor and girth compactor equipment. Our definition of early procurement for this equipment consists of a competitive bid procurement such that an award is made during the Title II design. This will provide some significant benefits to the project. It will allow a firm definition of the compaction equipment interfaces with the glovebox line to be established and confirmed with the successful vendor. It provides input from the successful vendor late in the Title II design that will allow a check to be performed and if required, appropriate adjustments made to the design package prior to the construction package procurement process.

3. UE&C's technical justification for the early procurement request includes the following factors:

a) **Equipment Importance:** The supercompactors and girth compactor represent a significant portion of the LLW/TRU waste process lines both from a unit operation and cost standpoint. Dependent upon the manufacturer selected to supply this equipment, the design could be significantly impacted if the equipment configuration deviates from the arrangement used in the detail design. Due to the uniqueness and limited availability of proven supercompaction/girth compaction equipment in the market place, the risk for a significant design impact to occur during a competitive procurement process is high.

b) **Demonstrated Technology:** The WRAP 1 design for the TRU waste process line integrates a unique equipment arrangement that reduces the 55 gallon drum diameter sufficiently to allow placement of the supercompacted puck inside a 55 gallon drum. There are a limited number of vendors world wide that can supply proven technology for this application. Based upon UE&C's WRAP 1 design research and BNF plc expertise in this application, proven and commercially demonstrated technology can be provided by two vendors (NGK, Fontjaigne) as identified in the Title I compaction study. The equipment supplied by these vendors is based upon an adaptation of standard metal forming equipment applications (girth compactor) which will provide the project a high confidence factor for success. Additionally, it is highly desirable that the same vendor that supplies the girth compactor, supplies the supercompactor. This provides for incorporation of a demonstrated supercompactor design in the girth compactor frame design, use of a common hydraulic supply system for the LLW/TRU compaction equipment, integration of the drum feed system for the two units, and spare part commonality.

c) **Design Team Continuity:** Due to the significance of the compaction equipment configuration on the design it is highly desirable to take advantage of the WRAP 1 design team expertise in participating in an early procurement process for this equipment during Title II. The ability to review the successful equipment vendor's submittals and integrate the selected equipment into the Title II design is invaluable in terms of minimizing design rework and associated costs during construction and Title III. Recommendation is made to include a technical WHC and UE&C/BNFL representative on the source selection based procurement.

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4. In summary, UE&C has ascertained that in the best interest of the WRAP 1 project, competitive procurement of the super/girth compactor equipment during Title II is highly recommended. This will substantially reduce the risk of cost impacts during construction, and considerably enhance the procurement process of obtaining commercially demonstrated technology at competitive prices. To accommodate any RCRA permit construction start restrictions and funding limitations, we would recommend the early procurement content be limited to having the successful vendor providing the equipment design only during Title II and releasing the vendor for fabrication after all DOE/Facility Permit hold dates for construction start have been achieved.

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9.7 Plant Management Equipment List:

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WRAP MODULE 1
PLANT MANAGEMENT EQUIPMENT LIST

BY: WLC
DATE: 05 DECEMBER 1991

AREA	TAG NO.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
12	CAB-12-111	CCTV INTERFACE CABINET	FREE STANDING ENCLOSURE W/CONTROLLERS MATRIX SWITCHER, VCR & ELECTRONICS	H-2-67742
12	CNR-12-101	SHIP/RCV/NDA/NDE CONTROLLER ENCLSR	NEMA 12 ENCLOSURE W/ DCS, I/O, POWER SUPPLY, FANS, TERMINALS, ETC.	H-2-67743
12	CNR-12-102	LLW PROCESSING CONTROLLER ENCLOSURE	NEMA 12 ENCLOSURE W/ DCS, I/O, POWER SUPPLY, FANS, TERMINALS, ETC.	H-2-67743
12	CNR-12-103	TRU PROCESSING CONTROLLER ENCLOSURE	NEMA 12 ENCLOSURE W/ DCS, I/O, POWER SUPPLY, FANS, TERMINALS, ETC.	H-2-67743
12	CNR-12-104	HVAC/UTIL/MONITORS CONTROLLER ENCL.	NEMA 12 ENCLOSURE W/ DCS, I/O, POWER SUPPLY, FANS, TERMINALS, ETC.	H-2-67743
12	CNS-12-101	NDE OPERATOR CONSOLE NO. 1	NEMA 4 CONTROL ROOM DESK TYPE CONSOLE W/ CRT, KEYBOARD, & ELECTRONICS - 3X WIDE	H-2-67742
12	CNS-12-102	NDE OPERATOR CONSOLE NO. 2	NEMA 4 CONTROL ROOM DESK TYPE CONSOLE W/ CRT, KEYBOARD, & ELECTRONICS - 3X WIDE	H-2-67742
12	CNS-12-103	TRANSPORT/ NDA CONSOLE NO. 1	NEMA 4 CONTROL ROOM DESK TYPE CONSOLE W/ CRT, KEYBOARD, & ELECTRONICS - 2X WIDE	H-2-67742
12	CNS-12-104	TRANSPORT/ NDA CONSOLE NO. 2	NEMA 4 CONTROL ROOM DESK TYPE CONSOLE W/ CRT, KEYBOARD, & ELECTRONICS - 2X WIDE	H-2-67742
12	CNS-12-105	DISPATCHER CONSOLE	NEMA 4 CONTROL ROOM DESK TYPE CONSOLE W/ CRT, KEYBOARD, & ELECTRONICS - 2X WIDE	H-2-67742
12	CPU-12-102	AGV SYSTEM CENTRAL PROCESSOR	COMPUTER W/ MEMORY,INTERNL DISK DRIVES, AND PERIPHERAL & NETWORK INTERFACE	H-2-67742
12	CPU-12-109	DATA MANGM'T SYSTEM CENTRAL PROCESSOR	COMPUTER W/ MEMORY,INTERNL DISK DRIVES, AND PERIPHERAL & NETWORK INTERFACE	H-2-67742
12	DRV-12-109	DATA MANGM'T SYSTEM EXTRNL DISK DRIVE	EXTERNAL BACKUP DISK DRIVE	H-2-67742
12	OIU-12-101	STACKER/RETRIEVER WORKSTATION	NEMA 4 INDUSTRIAL TERMINAL W/ CRT, KEYBOARD, & ELECTRONICS	H-2-67743
12	OIU-12-103	LLW PROCESSING WORKSTATION	NEMA 4 INDUSTRIAL TERMINAL W/ CRT, KEYBOARD, & ELECTRONICS	H-2-67743
12	OIU-12-104	TRU PROCESSING WORKSTATION	NEMA 4 INDUSTRIAL TERMINAL W/ CRT, KEYBOARD, & ELECTRONICS	H-2-67743
12	OIU-12-105	LLW RWM PROCESSING WORKSTATION	NEMA 4 INDUSTRIAL TERMINAL W/ CRT, KEYBOARD, & ELECTRONICS	H-2-67743
12	OIU-12-106	TRU RWM PROCESSING WORKSTATION	NEMA 4 INDUSTRIAL TERMINAL W/ CRT, KEYBOARD, & ELECTRONICS	H-2-67743
12	OIU-12-123	WEIGH/PALLETIZING WORKSTATION	NEMA 4 INDUSTRIAL TERMINAL W/ CRT, KEYBOARD, & ELECTRONICS	H-2-67743
12	PR-12-102	AUTO GUIDED VEHICLE SYSTEM PRINTER	WIDE CARRIAGE DOT MATRIX PRINTER	H-2-67742
12	PR-12-107	SAMPLE MANAGEMENT OFFICE PRINTER	WIDE CARRIAGE DOT MATRIX PRINTER	H-2-67743
12	PR-12-108	SHIP/RCV OFFICE PRINTER	WIDE CARRIAGE DOT MATRIX PRINTER	H-2-67743
12	PR-12-109	DATA MANAGEMENT SYSTEM PRINTER	WIDE CARRIAGE DOT MATRIX PRINTER	H-2-67742
12	PR-12-110	PLANT CONTROL SYSTEM PRINTER	WIDE CARRIAGE DOT MATRIX PRINTER	H-2-67742
12	TE-12-102	AUTO GUIDED VEHICLE SYSTEM TERMINAL	MONOCHROME CRT TERMINAL W/ KEYBOARD, & ELECTRONICS	H-2-67742
12	TE-12-107	SAMPLE MANAGEMENT OFFICE TERMINAL	MONOCHROME CRT TERMINAL W/ KEYBOARD, & ELECTRONICS	H-2-67743
12	TE-12-108	SHIP/RCV OFFICE TERMINAL	MONOCHROME CRT TERMINAL W/ KEYBOARD, & ELECTRONICS	H-2-67743
12	TE-12-109	DATA MANAGEMENT SYSTEM TERMINAL	MONOCHROME CRT TERMINAL W/ KEYBOARD, & ELECTRONICS	H-2-67742
12	TE-12-124	TRUPACT STATION TERMINAL	MONOCHROME CRT TERMINAL W/ KEYBOARD, & ELECTRONICS	H-2-67743
12	UA-12-110	FACILITIES ALARM ANNUNCIATOR	NEMA 12 SURFACE MOUNTED ANNUNCIATOR PANEL WINDOWS 4 HIGH BY 6 WIDE	H-2-67741

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9.8 Radiological Instrumentation List:

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WRAP MODULE 1
RADIOLOGICAL INSTRUMENTATION LIST

AREA	TAG NO.	QTY	NAME	MECHANICAL DESCRIPTION	REF. DWG.
12	BCAM-12-101	1	BETA VENTILATION DUCT MONITOR	OUTPUT: 1 ea 4-20mA, 2 ea relay, 1A, 120VAC POWER: 120 VAC, 0.3A SIZE: 15.50"(H) x 15.50"(D) x 25.00"(W)	H-2-87744
12	ACAM-12-102	1	ALPHA VENTILATION DUCT MONITOR	OUTPUT: 1 ea 4-20mA, 2 ea relay, 1A, 120VAC POWER: 120 VAC, 0.5A SIZE: 13.75"(H) x 12.50"(D) x 15.00"(W)	H-2-87744
12	BCAM-12-103	1	BETA VENTILATION DUCT MONITOR	OUTPUT: 1 ea 4-20mA, 2 ea relay, 1A, 120VAC POWER: 120 VAC, 0.3A SIZE: 15.50"(H) x 15.50"(D) x 25.00"(W)	H-2-87744
12	ACAM-12-104	1	ALPHA VENTILATION DUCT MONITOR	OUTPUT: 1 ea 4-20mA, 2 ea relay, 1A, 120VAC POWER: 120 VAC, 0.5A SIZE: 13.75"(H) x 12.50"(D) x 15.00"(W)	H-2-87744
12	GMON-12-105	1	ROOM GAMMA MONITOR	OUTPUT: 1 ea 4-2-mA, 3 ea relay, 1A, 120VAC POWER: 120VAC, 0.2A SIZE: 8.00"(H) x 13.20"(D) x 3.00"(W)	H-2-87744
12	GMON-12-106	1	ROOM GAMMA MONITOR	OUTPUT: 1 ea 4-2-mA, 3 ea relay, 1A, 120VAC POWER: 120VAC, 0.2A SIZE: 8.00"(H) x 13.20"(D) x 3.00"(W)	H-2-87744
12	GMON-12-107	1	ROOM GAMMA MONITOR	OUTPUT: 1 ea 4-2-mA, 3 ea relay, 1A, 120VAC POWER: 120VAC, 0.2A SIZE: 8.00"(H) x 13.20"(D) x 3.00"(W)	H-2-87744
12	GMON-12-108	1	ROOM GAMMA MONITOR	OUTPUT: 1 ea 4-2-mA, 3 ea relay, 1A, 120VAC POWER: 120VAC, 0.2A SIZE: 8.00"(H) x 13.20"(D) x 3.00"(W)	H-2-87744
12	ACAM-12-109	1	ROOM ALPHA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 2 ea relay, 1A, 120VAC POWER: 120 VAC, 0.5A SIZE: 13.75"(H) x 12.50"(D) x 15.00"(W)	H-2-87744
12	ACAM-12-110	1	ROOM ALPHA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 2 ea relay, 1A, 120VAC POWER: 120 VAC, 0.5A SIZE: 13.75"(H) x 12.50"(D) x 15.00"(W)	H-2-87744
12	ACAM-12-111	1	ROOM ALPHA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 2 ea relay, 1A, 120VAC POWER: 120 VAC, 0.5A SIZE: 13.75"(H) x 12.50"(D) x 15.00"(W)	H-2-87744
12	ACAM-12-112	1	ROOM ALPHA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 2 ea relay, 1A, 120VAC POWER: 120 VAC, 0.5A SIZE: 13.75"(H) x 12.50"(D) x 15.00"(W)	H-2-87744
12	BCAM-12-113	1	ROOM BETA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 3 ea relay, 1A, 120VAC POWER: 120 VAC, 0.3A SIZE: 15.50"(H) x 15.50"(D) x 25.00"(W)	H-2-87744
12	BCAM-12-114	1	ROOM BETA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 3 ea relay, 1A, 120VAC POWER: 120 VAC, 0.3A SIZE: 15.50"(H) x 15.50"(D) x 25.00"(W)	H-2-87744

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WRAP MODULE 1
RADIOLOGICAL INSTRUMENTATION LIST

AREA	TAG NO.	QTY	NAME	MECHANICAL DESCRIPTION	REF. DWG.
12	BCAM-12-115	1	ROOM BETA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 3 ea relay, 1A, 120VAC POWER: 120 VAC, 0.3A SIZE: 15.50"(H) x 15.50"(D) x 25.00"(W)	H-2-87744
12	BCAM-12-116	1	ROOM BETA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 3 ea relay, 1A, 120VAC POWER: 120 VAC, 0.3A SIZE: 15.50"(H) x 15.50"(D) x 25.00"(W)	H-2-87744
12	BCAM-12-144	1	ROOM BETA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 3 ea relay, 1A, 120VAC POWER: 120 VAC, 0.3A SIZE: 15.50"(H) x 15.50"(D) x 25.00"(W)	H-2-87744
12	ACAM-12-145	1	ROOM ALPHA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 3 ea relay, 1A, 120VAC POWER: 120 VAC, 0.5A SIZE: 13.75"(H) x 12.50"(D) x 15.00"(W)	H-2-87744
12	SMON-12-120	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-121	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-122	1	SURAFCE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-123	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-124	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-125	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-126	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-127	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-128	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-129	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744

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WRAP MODULE 1
RADIOLOGICAL INSTRUMENTATION LIST

AREA	TAG NO.	QTY	NAME	MECHANICAL DESCRIPTION	REF. DWG.
12	SMON-12-130	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-131	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-132	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-133	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	SMON-12-134	1	SURFACE CONTAMINATION MONITOR	OUTPUT: None POWER: 120 VAC, 0.1A SIZE: 5.50"(H) x 6.50(D) x 7.50"(W)	H-2-87744
12	HFM-12-135	1	HAND AND FOOT MONITOR	OUTPUT: None POWER: 120 VAC, 1.0A SIZE: 61.40"(H) x 42.10"(D) x 22.3"(W)	H-2-87744
12	HFM-12-136	1	HAND AND FOOT MONITOR	OUTPUT: None POWER: 120 VAC, 1.0A SIZE: 61.40"(H) x 42.10"(D) x 22.3"(W)	H-2-87744
12	CDAM-12-137	1	CRITICALITY DATA ACQ. MODULE	OUTPUT: 8 ea 4-20mA, 1 ea relay, 2A, 120VAC POWER: 120 VAC, 6.0A SIZE: 44.00"(H) x 16.00"(D) x 49.00"(W)	H-2-87744
12	OAS-12-138	1	OPERATOR AIR SAMPLER	OUTPUT: None POWER: 0.25 HP, 120 VAC, 5.0A SIZE: 11.00"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	OAS-12-139	1	OPERATOR AIR SAMPLER	OUTPUT: None POWER: 0.25 HP, 120 VAC, 5.0A SIZE: 11.00"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	OAS-12-140	1	OPERATOR AIR SAMPLER	OUTPUT: None POWER: 0.25 HP, 120 VAC, 5.0A SIZE: 11.00"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	OAS-12-141	1	OPERATOR AIR SAMPLER	OUTPUT: None POWER: 0.25 HP, 120 VAC, 5.0A SIZE: 11.00"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	SC-12-142	1	SMEAR (SAMPLE) COUNTERS	OUTPUTS: None POWER: 120 VAC, 0.25A SIZE: 11.50"(H) x 14.00"(D) x 6.00"(W)	H-2-87744
12	BPMP-12-101	1	BETA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744

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WRAP MODULE 1
RADIOLOGICAL INSTRUMENTATION LIST

AREA	TAG NO.	QTY	NAME	MECHANICAL DESCRIPTION	REF. DWG.
12	APMP-12-102	1	ALPHA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	BPMP-12-103	1	BETA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	APMP-12-104	1	ALPHA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	APMP-12-109	1	ALPHA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	APMP-12-110	1	ALPHA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	APMP-12-111	1	ALPHA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	APMP-12-112	1	ALPHA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	BPMP-12-113	1	BETA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	BPMP-12-114	1	BETA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	BPMP-12-115	1	BETA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	BPMP-12-116	1	BETA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	BPMP-12-144	1	BETA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	APMP-12-145	1	ALPHA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	SC-12-143	1	SMEAR (SAMPLE) COUNTERS	OUTPUT: None POWER: 0.25 HP, 120 VAC SIZE: 11.50"(H) x 14.00"(L) x 6.00"(W)	H-2-87744

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9.9 Stack Effluent Analyzers List:

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WRAP MODULE 1
STACK EFFLUENT ANALYZERS LIST

AREA	TAG NO.	QTY	NAME	MECHANICAL DESCRIPTION	REF. DWG.
12	RPMP-12-150	1	RECORD SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	APMP-12-151	1	ALPHA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	BPMP-12-152	1	BETA SAMPLE AIR PUMP	OUTPUT: None POWER: 0.25 HP, 120 VAC, 6.0A SIZE: 9.25"(H) x 17.75"(L) x 7.00"(W)	H-2-87744
12	ACAM-12-151	1	ALPHA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 2 ea relay, 1A, 120VAC POWER: 120 VAC, 0.5A SIZE: 13.75"(H) x 12.50"(D) x 15.00"(W)	H-2-87744
12	BCAM-12-152	1	BETA CONTINUOUS AIR MONITOR	OUTPUT: 1 ea 4-20mA, 3 ea relay, 1A, 120VAC POWER: 120 VAC, 0.3A SIZE: 15.50"(H) x 15.50"(D) x 25.00"(W)	H-2-87744
12	FCT-12-152	1	FLOW COMPUTER/ CONTROLLER	OUTPUT: 4 ea 4-20mA, 2 ea RS-232C, 4 ea relay, 2A, 120 VAC POWER: 120 VAC, ? SIZE: ?	H-2-87744

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9.10 Closed Circuit Television List:

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WRAP MODULE 1
CLOSED CIRCUIT TELEVSION
LIST

BY: WLC
12/02/91

AREA	TAG NO.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
09	TC-09-201	NDE/NDA AREA CAMERA NO. 1 W/ MOTORIZED ZOOM, PAN, TILT	120 VAC 35 W 115 VDC 102 VA MAX	H-2-87743
09	TC-09-202	NDE/NDA AREA CAMERA NO. 2 W/ MOTORIZED ZOOM, PAN, TILT	120 VAC 35 W 115 VDC 102 VA MAX	H-2-87743
07	TC-07-301	TRU WASTE GLOVE BOX CAMERA NO. 1 W/ MOTORIZED ZOOM, PAN, TILT	120 VAC 35 W 115 VDC 102 VA MAX	H-2-87743
07	TC-07-302	TRU WASTE GLOVE BOX CAMERA NO. 2 W/ MOTORIZED ZOOM, PAN, TILT	120 VAC 35 W 115 VDC 102 VA MAX	H-2-87743
07	TC-07-303	TRU WASTE GLOVE BOX CAMERA NO. 3 W/ MOTORIZED ZOOM, PAN, TILT	120 VAC 35 W 115 VDC 102 VA MAX	H-2-87743
07	TC-07-331	LLW GLOVE BOX CAMERA NO. 1 W/ MOTORIZED ZOOM, PAN, TILT	120 VAC 35 W 115 VDC 102 VA MAX	H-2-87743
07	TC-07-332	LLW GLOVE BOX CAMERA NO. 2 W/ MOTORIZED ZOOM, PAN, TILT	120 VAC 35 W 115 VDC 102 VA MAX	H-2-87743
07	TC-07-333	LLW GLOVE BOX CAMERA NO. 3 W/ MOTORIZED ZOOM, PAN, TILT	120 VAC 35 W 115 VDC 102 VA MAX	H-2-87743
12	TVM-12-101	VIDEO MATRIX SWITCHER 20 VIDEO IN / 10 VIDEO OUT	120 VAC 400 VA	H-2-87742
12	TVC-12-101	CAMERA CONTROLLER	120 VAC 250 W	H-2-87742
12	TCK-12-101	CAMERA CONTROL KEYBOARD NO. 1 (DISPATCHER'S CONSOLE)	120 VAC 20 W 3.5" H X 12.5" D X 19.0" W	H-2-87742
12	TCK-12-102	CAMERA CONTROL KEYBOARD NO. 2 (NDE CONSOLE NO. 1)	120 VAC 20 W 3.5" H X 12.5" D X 19.0" W	H-2-87742
12	TCK-12-103	CAMERA CONTROL KEYBOARD NO. 3 (NDE CONSOLE NO. 2)	120 VAC 20 W 3.5" H X 12.5" D X 19.0" W	H-2-87742
12	TCK-12-104	CAMERA CONTROL KEYBOARD NO. 4 (TRANSPORT CONSOLE NO. 1)	120 VAC 20 W 3.5" H X 12.5" D X 19.0" W	H-2-87742
12	TCK-12-105	CAMERA CONTROL KEYBOARD NO. 5 (TRANSPORT CONSOLE NO. 2)	120 VAC 20 W 3.5" H X 12.5" D X 19.0" W	H-2-87742
07	TCK-07-301	CAMERA CONTROL KEYBOARD NO. 6 (TRU WASTE GLOVE BOX OPERATOR CONSOLE)	120 VAC 20 W 3.5" H X 12.5" D X 19.0" W	H-2-87743
07	TCK-07-331	CAMERA CONTROL KEYBOARD NO. 7 (LLW GLOVE BOX OPERATOR CONSOLE)	120 VAC 20 W 3.5" H X 12.5" D X 19.0" W	H-2-87743
12	TM-12-101	MONITOR NO. 1 (DISPATCHER'S CONSOLE)	120 VAC 60 W 16" W X 12" H X 15" D	H-2-87742
12	TM-12-102	MONITOR NO. 2 (NDE CONSOLE NO. 1)	120 VAC 60 W 16" W X 12" H X 15" D	H-2-87742
12	TM-12-103	MONITOR NO. 3 (NDE CONSOLE NO. 2)	120 VAC 60 W 16" W X 12" H X 15" D	H-2-87742
12	TM-12-104	MONITOR NO. 4 (TRANSPORT CONOLSE NO. 1)	120 VAC 60 W 16" W X 12" H X 15" D	H-2-87742
12	TM-12-105	MONITOR NO. 5 (TRANSPORT CONSOLE NO. 2)	120 VAC 60 W 16" W X 12" H X 15" D	H-2-87742
07	TM-07-301	MONITOR NO. 6 (TRU WASTE GLOVE BOX OPERATOR CONSOLE)	120 VAC 60 W 16" W X 12" H X 15" D	H-2-87743

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WRAP MODULE 1
CLOSED CIRCUIT TELEVSION
LIST

BY: WLC
12/02/91

AREA	TAG NO.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
07	TM-07-331	MONITOR NO. 7 (LLW GLOVE BOX OPERATOR CONSOLE)	120 VAC 60 W 16" W X 12" H X 15" D	H-2-87743
12	VCR-12-101	VIDEO CASSETTE RECORDER NO. 1 W/ REAL TIME AND TIME-LAPSED RECORD AND PLAY BACK	120 VAC 50 W 18" W X 5" H X 13" D	H-2-87742 H-2-87742
12	VCR-12-102	VIDEO CASSETTE RECORDER NO. 2 W/ REAL TIME AND TIME-LAPSED RECORD AND PLAYBACK	120 VAC 50 W 18" W X 5" H X 13" D	

CCTVEQ.WK3

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9.11 Bar Code Equipment List:

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WRAP MODULE 1
BAR CODE EQUIPMENT LIST
12 DECEMBER 1991

AREA	TAG NO.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
12	BR-12-301	GB-07-301 TRU PROCESS GLOVE BOX ID: DRUMS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87628
12	BR-12-311	GB-07-307 TRU PROCESS GLOVE BOX ID: SAMPLES & BOTTLES	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 1A FIXED SCANNER	H-2-87629
12	BR-12-312	GB-07-307 TRU PROCESS GLOVE BOX ID: SAMPLE PIGS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87629
12	BR-12-331	GB-07-101 LLW PROCESS GLOVE BOX ID: DRUMS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87631
12	BR-12-341	GB-07-107 LLW PROCESS GLOVE BOX ID: SAMPLES & BOTTLES	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 1A FIXED SCANNER	H-2-87632
12	BR-12-342	GB-07-107 LLW PROCESS GLOVE BOX ID: SAMPLE PIGS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87632
12	BR-12-361	GB-07-401 TRU REST. WST. PROCESS GLOVE BOX ID: LIQUID CONTAINERS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 1A FIXED SCANNER	H-2-87633
12	BR-12-362	GB-07-401 TRU REST. WST. PROCESS GLOVE BOX ID: DRUMS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87633
12	BR-12-370	GB-07-401 TRU REST. WST. PROCESS GLOVE BOX ID: SAMPLE BOTTLES	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 1A FIXED SCANNER	H-2-87633
12	BR-12-381	GB-07-101 LLW REST. WST. PROCESS GLOVE BOX ID: LIQUID CONTAINERS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 1A FIXED SCANNER	H-2-87634
12	BR-12-382	GB-07-101 LLW REST. WST. PROCESS GLOVE BOX ID: DRUMS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87634
12	BR-12-390	GB-07-101 LLW REST. WST. PROCESS GLOVE BOX ID: SAMPLE BOTTLES	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 1A FIXED SCANNER	H-2-87634
12	BR-12-201	NDA/NDE CAROUSEL ID: DRUMS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 1A FIXED SCANNER	H-2-87717
12	BR-12-219	CV-09-105 BOX NDE ID: BOXES	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87718
12	BR-12-221	PROCESS CAROUSEL ID: DRUMS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 1A FIXED SCANNER	H-2-87719
12	BR-12-101	CR-05-101 PALLET STORAGE RETRIEVAL ID: DRUMS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87594

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WRAP MODULE 1
BAR CODE EQUIPMENT LIST
12 DECEMBER 1991

AREA	TAG NO.	NAME	MECHANICAL DESCRIPTION	REF. DWG.
12	BR-12-102	DS-05-101A RECEIVING DRUM SCALE CONVEYOR ID: DRUMS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87594
12	BR-12-103	DS-05-101B SHIPPING DRUM SCALE CONVEYOR ID: DRUMS	OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A HAND HELD SCANNER	H-2-87594
12	DC-12-101	SHIPPING/RECEIVING MULTI-DROP TERMINAL CONCENTRATER	INPUT: 1 ea. RS-485 OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A	
12	DC-12-301	PROCESS TRU GLOVE BOXES MULTI-DROP TERMINAL CONCENTRATER	INPUT: 1 ea. RS-485 OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A	
12	DC-12-331	PROCESS LLW GLOVE BOXES MULTI-DROP TERMINAL CONCENTRATER	INPUT: 1 ea. RS-485 OUTPUT: 1 ea. RS-232C POWER: 120 VAC 0.5A	
12	BP-12-120	SHIPPING/RECEIVING BAR CODE PRINTER	INPUT: 1ea RS-232C POWER: 120 VAC 3A 16.75"L X 10.5"W X 14.2"H	H-2-87594
12	BP-12-121	SHIPPING/RECEIVING BAR CODE PRINTER	INPUT: 1ea RS-232C POWER: 120 VAC 3A 16.75"L X 10.5"W X 14.2"H	H-2-87594

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9.12 Instrument Index:

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
05-HS	-103A	Ship/Recv Forklift Door O/C Sw.	H-2-87594
05-HS	-103B	Ship/Recv Forklift Door O/C Sw.	H-2-87594
05-HS	-104	Ship/Recv AGV Door H/O/A and O/C sw.	H-2-87594
05-HS	-106A	CV-05-101A Index Conveyor H/O/A Sw.	H-2-87594
05-HS	-106B	CV-05-101A Index Conveyor Start/Stop P.B.	H-2-87594
05-HS	-106C	CV-05-101A Index Conveyor Index Clutch H/O/A Sw.	H-2-87594
05-HS	-107A	DS-05-101A Weigh Conveyor H/O/A Sw.	H-2-87594
05-HS	-107B	DS-05-101A Weigh Conveyor Index P.B.	H-2-87594
05-HS	-108A	CV-05-101B Index Conveyor H/O/A Sw.	H-2-87594
05-HS	-108B	CV-05-101B Index Conveyor Index Clutch H/O/A Sw.	H-2-87594
05-HS	-109A	CV-05-102 Index Conveyor H/O/A Sw.	H-2-87594
05-HS	-109B	CV-05-102 Index Conveyor Start/Stop P.B.	H-2-87594
05-HS	-109C	CV-05-102 Index Conveyor Index Clutch H/O/A Sw.	H-2-87594
05-HS	-110A	DS-05-101B Weigh Conveyor H/O/A Sw.	H-2-87594
05-HS	-110B	DS-05-101B Weigh Conveyor Index Sw.	H-2-87594
05-WE	-107A	DS-05-101A Weigh Conveyor	H-2-87594
05-WE	-107B	DS-05-101A Weigh Conveyor	H-2-87594
05-WE	-110A	DS-05-101B Weigh Conveyor	H-2-87594
05-WE	-110B	DS-05-101B Weigh Conveyor	H-2-87594
05-WIR	-107	DS-05-101A Weigh Conveyor Weight Label Printer	H-2-87594
05-WIR	-110	DS-05-101B Weigh Conveyor Weight Label Printer	H-2-87594
05-WIT	-107	DS-05-101A Weigh Conveyor	H-2-87594
05-WIT	-110	DS-05-101B Weigh Conveyor	H-2-87594
05-XS	-106A	CV-05-101A Index Conveyor Rope Switch	H-2-87594

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
05-XS	-106B	CV-05-101A Index Conveyor Rope Switch	H-2-87594
05-XS	-107A	DS-05-101A Weigh Conveyor Rope Switch	H-2-87594
05-XS	-107B	DS-05-101A Weigh Conveyor Rope Switch	H-2-87594
05-XS	-108A	CV-05-101B Index Conveyor Rope Switch	H-2-87594
05-XS	-108B	CV-05-101B Index Conveyor Rope Switch	H-2-87594
05-XS	-109A	CV-05-102 Index Conveyor Rope Sw.	H-2-87594
05-XS	-109B	CV-05-102 Index Conveyor Rope Sw.	H-2-87594
05-XS	-110A	DS-05-101B Weigh Conveyor Rope Sw.	H-2-87594
05-ZEV	-106	CV-05-101A Index Conveyor Index Clutch	H-2-87594
05-ZEV	-108	CV-05-101B Index Conveyor Index Clutch	H-2-87594
05-ZEV	-109	CV-05-102 Index Conveyor Index Clutch	H-2-87594
05-ZS	-105	Ship/Recv AGV Door Cleared Photoeye	H-2-87594
05-ZS	-106	CV-05-101A Index Conveyor End Position P.E.	H-2-87594
05-ZS	-107	DS-05-101A Weigh Conveyor Loade P.E.	H-2-87594
05-ZS	-108A	CV-05-101B Index Conveyor Conveyor Full P.E.	H-2-87594
05-ZS	-108B	CV-05-101B Index Conveyor Loaded P.E.	H-2-87594
05-ZS	-109A	CV-05-102 Index Conveyor Conveyor Full P.E.	H-2-87594
05-ZS	-109B	CV-05-102 Index Conveyor Conveyor Loaded P.E.	H-2-87594
05-ZS	-110A	DS-05-101B Weigh Conveyor Loaded P.E.	H-2-87594
05-ZS	-110B	DS-05-101B Weigh Conveyor Overrun P.E.	H-2-87594
05-ZSC	-104	Ship/Recv AGV Door	H-2-87594
05-ZSO	-104	Ship/Recv AGV Door	H-2-87594
07-CAM	-322	GB-07-309 Exit Glove Box Exit Air Duct	H-2-87630
07-CAM	-352	GB-07-103 Exit Glove Box Air Outlet Duct	H-2-87632

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
07-CAM	-372	GB-07-401 TRU Rest. G. B. Air Outlet Duct	H-2-87633
07-CAM	-392	GB-07-401 LLW RWM Glove Box Air Outlet Du	H-2-87634
07-FI	-321	GB-07-309 Exit Glove Box HEPA Filter	H-2-87630
07-FI	-351	GB-07-103 Drum Exit Glove Box Air Outlet	H-2-87632
07-FI	-371	GB-07-401 TRU Rest. Glove Box Air Outlet	H-2-87633
07-FI	-391	GB-07-401 LLW RWM Glove Box Air Outlet HE	H-2-87634
07-FSL	-321	GB-07-309 Exit Glove Box HEPA Filter	H-2-87630
07-FSL	-351	GB-07-103 Drum Exit Glove Box Air Outlet	H-2-87632
07-FSL	-371	GB-07-401 TRU Rest. Glove Box Air Outlet	H-2-87633
07-FSL	-391	GB-07-401 LLW RWM Glove Box Air Outlet HE	H-2-87634
07-FT	-321	GB-07-309 Exit Glove Box HEPA Filter	H-2-87630
07-FT	-351	GB-07-103 Drum Exit Glove Box Air Outlet	H-2-87632
07-FT	-371	GB-07-401 TRU Rest. Glove Box Air Outlet	H-2-87633
07-FT	-391	GB-07-401 LLW RWM Glove Box Air Outlet HE	H-2-87634
07-NY	-301	GB-07-307 Compart Glove Box Bar Code Scanner	H-2-87629
07-NY	-311	GB-07-307 Compact Glove Box Bar Code Scanner	H-2-87629
07-NY	-312	GB-07-307 Compact Glove Box Bar Code Scanner	H-2-87629
07-NY	-321	GB-07-101 Drum Entry Glove Box Bar Code Scanner	H-2-87631
07-NY	-341	GB-07-103 Drum Open Glove Box Bar Code Scanner	H-2-87632
07-NY	-361	GB-07-401 TRU Rest. Glove Box Bar Code Scanner	H-2-87633
07-NY	-362	GB-07-401 TRU Rest. Glove Box Bar Code Scanner	H-2-87633
07-NY	-370	GB-07-401 TRU Rest. Glove Box Bar Code Scanner (sample bottles)	H-2-87633
07-NY	-381	GB-07-401 LLW RWM Glove Box Bar Code Scanner	H-2-87634
07-NY	-382	GB-07-401 LLW RWM Glove Box Bar Code Scanner	H-2-87634

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
07-NY	-390	GB-07-401 LLW RWM Glove Box Bar Code Scanner	H-2-87634
07-PDA	-303	GB-07-301 Airlock Glove Box	H-2-87628
07-PDA	-313	GB-07-307 Compart Glove Box	H-2-87629
07-PDA	-323	GB-07-309 Exit Glove Box	H-2-87630
07-PDA	-333	GB-07-101 Drum Entry Glove Box	H-2-87631
07-PDA	-341	GB-07-103 Drum Open Glove Box Air Inlet H	H-2-87632
07-PDA	-353	GB-07-103 Exit Glove Box	H-2-87632
07-PDA	-373	GB-07-401 TRU Rest. Glove Box	H-2-87633
07-PDA	-393	GB-07-401 LLW RWM Glove Box	H-2-87634
07-PDI	-301	GB-07-301 Airlock Glove Box	H-2-87628
07-PDI	-311	GB-07-303 Drum Open Glove Box	H-2-87629
07-PDI	-321	GB-07-309 Exit Glove Box HEPA Filter	H-2-87630
07-PDI	-331	GB-07-101 Drum Entry Glove Box	H-2-87631
07-PDI	-351	GB-07-103 Drum Exit Glove Box Air Outlet	H-2-87632
07-PDI	-361	GB-07-401 TRU Rest. Glove Box Air Inlet H	H-2-87633
07-PDI	-371	GB-07-401 TRU Rest. Glove Box Air Outlet	H-2-87633
07-PDI	-381	GB-07-401 LLW RWM Glove Box Air Inlet HEP	H-2-87634
07-PDI	-390A	CY-07-201 LLW RWM Glove Box Inert Gas	H-2-87634
07-PDI	-390B	CY-07-201 LLW RWM Glove Box Inert Gas	H-2-87634
07-PDI	-391	GB-07-401 LLW RWM Glove Box Air Outlet HE	H-2-87634
07-PDIC	-322	GB-07-309 Exit Glove Box Exit Air Damper	H-2-87630
07-PDIC	-352	GB-07-103 Exit Glove Box Air Outlet Dampe	H-2-87632
07-PDIC	-372	GB-07-401 TRU Rest. G. B. Air Outlet Damp	H-2-87633
07-PDIC	-392	GB-07-401 LLW RWM Glove Box Air Outlet Da	H-2-87634

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TAG NUMBER	SERVICE REMARKS	FLOWSHEET
07-PDISL -303	GB-07-301 Airlock Glove Box	H-2-87628
07-PDISL -313	GB-07-307 Compart Glove Box	H-2-87629
07-PDISL -321	GB-07-307 Compart Glove Box	H-2-87629
07-PDISL -323	GB-07-309 Exit Glove Box	H-2-87630
07-PDISL -333	GB-07-101 Drum Entry Glove Box	H-2-87631
07-PDISL -353	GB-07-103 Exit Glove Box	H-2-87632
07-PDISL -373	GB-07-401 TRU Rest. Glove Box	H-2-87633
07-PDT -301	GB-07-301 Airlock Glove Box	H-2-87628
07-PDT -311	GB-07-303 Drum Open Glove Box	H-2-87629
07-PDT -321	GB-07-309 Exit Glove Box HEPA Filter	H-2-87630
07-PDT -322	GB-07-309 Exit Glove Box	H-2-87630
07-PDT -331	GB-07-101 Drum Entry Glove Box	H-2-87631
07-PDT -341	GB-07-103 Drum Open Glove Box Air Inlet H	H-2-87632
07-PDT -351	GB-07-103 Drum Exit Glove Box Air Outlet	H-2-87632
07-PDT -352	GB-07-103 Exit Glove Box Air Outlet Dampe	H-2-87632
07-PDT -361	GB-07-401 TRU Rest. Glove Box Air Inlet H	H-2-87633
07-PDT -371	GB-07-401 TRU Rest. Glove Box Air Outlet	H-2-87633
07-PDT -372	GB-07-401 TRU Rest. G. B. Air Outlet Damp	H-2-87633
07-PDT -381	GB-07-401 LLW RWM Glove Box Air Inlet HEP	H-2-87634
07-PDT -391	GB-07-401 LLW RWM Glove Box Air Outlet HE	H-2-87634
07-PDT -392	GB-07-401 LLW RWM Glove Box Air Outlet Da	H-2-87634
07-PDT -393	GB-07-401 LLW RWM Glove Box	H-2-87634
07-PDV -321	GB-07-309 Exit Glove Box Exit Air Damper	H-2-87630
07-PDV -352	GB-07-103 Exit Glove Box Air Outlet Dampe	H-2-87632

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
07-PDV	-372	GB-07-401 TRU Rest. G. B. Air Outlet Damp	H-2-87633
07-PDV	-392	GB-07-401 LLW RWM Glove Box Air Outlet Da	H-2-87634
07-PDY	-322	GB-07-309 Exit Glove Box Exit Air Damper	H-2-87630
07-PDY	-352	GB-07-103 Exit Glove Box Air Outlet Dampe	H-2-87632
07-PDY	-372	GB-07-401 TRU Rest. G. B. Air Outlet Damp	H-2-87633
07-PDY	-392	GB-07-401 LLW RWM Glove Box Air Outlet Da	H-2-87634
09-FEV	-217	NDA/NDE Airlock Inlet Door 1	H-2-87718
09-FEV	-218	NDA/NDE Airlock Outlet Door 1	H-2-87718
09-FEV	-251	NDA/NDE Airlock Inlet Door 2	H-2-87718
09-FEV	-252	NDA/NDE Airlock Outlet Door 2	H-2-87718
09-HS	-201A	CV-09-101A Drum NDE Conv F/R P.B.	H-2-87717
09-HS	-201B	CV-09-101A Drum NDE Conv H/O/A Sw.	H-2-87717
09-HS	-202A	CV-09-101B Drum NDE Conv F/R P.B.	H-2-87717
09-HS	-202B	CV-09-101B Drum NDE Conv H/O/A Sw.	H-2-87717
09-HS	-203A	CV-09-101C Drum PAN Conv F/R P.B.	H-2-87717
09-HS	-203B	CV-09-101C Drum PAN Conv H/O/A Sw.	H-2-87717
09-HS	-204A	CV-09-101D Drum PAN Conv F/R P.B.	H-2-87717
09-HS	-204B	CV-09-101D Drum PAN Conv H/O/A Sw.	H-2-87717
09-HS	-205A	CV-09-101E Drum SGS Conv F/R P.B.	H-2-87717
09-HS	-205B	CV-09-101E Drum SGS Conv H/O/A Sw.	H-2-87717
09-HS	-206A	CV-09-101F Drum FAP Conv F/R P.B.	H-2-87717
09-HS	-206B	CV-09-101F Drum FAP Conv H/O/A Sw.	H-2-87717
09-HS	-211A	CV-09-103A NDA/NDE Airlock Inlet Conv F/R P.B.	H-2-87718
09-HS	-211B	CV-09-103A NDA/NDE Airlock Inlet Conv H/O/A Sw.	H-2-87718

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-HS	-212A	CV-09-103B NDA/NDE Airlock Inlet Conv F/R P.B.	H-2-87718
09-HS	-212B	CV-09-103B NDA/NDE Airlock Inlet Conv H/O/A Sw.	H-2-87718
09-HS	-213A	CV-09-104A NDA/NDE Airlock Conv F/R P.B.	H-2-87718
09-HS	-213B	CV-09-104A NDA/NDE Airlock Conv H/O/A Sw.	H-2-87718
09-HS	-214A	CV-09-104B NDA/NDE Airlock Conv F/R P.B.	H-2-87718
09-HS	-214B	CV-09-104B NDA/NDE Airlock Conv H/O/A Sw.	H-2-87718
09-HS	-215A	CV-09-201A NDA/NDE Airlock Outlet Conv F/R P.B.	H-2-87718
09-HS	-215B	CV-09-201A NDA/NDE Airlock Outlet Conv H/O/A/ Sw.	H-2-87718
09-HS	-216A	CV-09-201B NDA/NDE Airlock Outlet Conv F/R P.B.	H-2-87718
09-HS	-216B	CV-09-201B NDA/NDE Airlock Outlet Conv H/O/A Sw.	H-2-87718
09-HS	-217A	NDA/NDE Airlock Inlet Door 1 O/C P.B.	H-2-87718
09-HS	-217B	NDA/NDE Airlock Inlet Door 1 H/O/A Sw.	H-2-87718
09-HS	-218A	NDA/NDE Airlock Outlet Door 1 O/C P.B.	H-2-87718
09-HS	-218B	NDA/NDE Airlock Outlet Door 1 H/O/A Sw.	H-2-87718
09-HS	-219	CV-09-105 Box NDA/NDE Conv F/R P.B.	H-2-87718
09-HS	-221A	LT-09-201A RWM LLW Lift Table F/R P.B.	H-2-87719
09-HS	-221B	LT-09-201A RWM LLW Lift Table H/O/A Sw.	H-2-87719
09-HS	-222A	LT-09-201A RWM LLW Lift Table Up/Down P.B.	H-2-87719
09-HS	-222C	LT-09-201A RWM LLW Lift Table Hyd. Power S/S Sw.	H-2-87719
09-HS	-223A	LT-09-201B Lift Table F/R P.B.	H-2-87719
09-HS	-223B	LT-09-201B Lift Table H/O/A Sw.	H-2-87719
09-HS	-224A	LT-09-201B Lift Table Up/Down P.B.	H-2-87719
09-HS	-224C	LT-09-201B Lift Table Hyd. Power Pack S/S Sw	H-2-87719
09-HS	-225A	LT-09-201C Lift Table F/R P.B.	H-2-87719

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-HS	-225B	LT-09-201C Lift Table H/O/A Sw.	H-2-87719
09-HS	-226A	LT-09-201C Lift Table Up/Down P.B.	H-2-87719
09-HS	-226C	LT-09-201C Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-227A	LT-09-201D Lift Table F/R P.B.	H-2-87719
09-HS	-227B	LT-09-201D Lift Table H/O/A Sw.	H-2-87719
09-HS	-228A	LT-09-201D Lift Table Up/Down P.B.	H-2-87719
09-HS	-228C	LT-09-201D Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-229A	LT-09-201E Lift Table F/R P.B.	H-2-87719
09-HS	-229B	LT-09-201E Lift Table H/O/A Sw.	H-2-87719
09-HS	-230A	LT-09-201E Lift Table Up/Down P.B.	H-2-87719
09-HS	-230C	LT-09-201E Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-231A	LT-09-201F Lift Table F/R P.B.	H-2-87719
09-HS	-231B	LT-09-201F Lift Table H/O/A Sw.	H-2-87719
09-HS	-232A	LT-09-201F Lift Table Up/Down P.B.	H-2-87719
09-HS	-232C	LT-09-201F Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-233A	LT-09-201G Lift Table F/R P.B.	H-2-87719
09-HS	-233B	LT-09-201G Lift Table H/O/A Sw.	H-2-87719
09-HS	-234A	LT-09-201G Lift Table Up/Down P.B.	H-2-87719
09-HS	-234C	LT-09-201G Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-235A	LT-09-201H Lift Table F/R P.B.	H-2-87719
09-HS	-235B	LT-09-201H Lift Table H/O/A Sw.	H-2-87719
09-HS	-236A	LT-09-201H Lift Table Up/Down P.B.	H-2-87719
09-HS	-236C	LT-09-201H Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-237A	LT-09-201J Lift Table F/R P.B.	H-2-87719

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-HS	-237B	LT-09-201J Lift Table H/O/A Sw.	H-2-87719
09-HS	-238A	LT-09-201J Lift Table Up/Down P.B.	H-2-87719
09-HS	-238C	LT-09-201J Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-239A	LT-09-201K Lift Table F/R P.B.	H-2-87719
09-HS	-239B	LT-09-201K Lift Table H/O/A Sw.	H-2-87719
09-HS	-240A	LT-09-201K Lift Table Up/Down P.B.	H-2-87719
09-HS	-240C	LT-09-201K Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-241A	LT-09-201L Lift Table F/R P.B.	H-2-87719
09-HS	-241B	LT-09-201L Lift Table H/O/A Sw.	H-2-87719
09-HS	-242A	LT-09-201L Lift Table Up/Down P.B.	H-2-87719
09-HS	-242C	LT-09-201L Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-243A	LT-09-201M Lift Table F/R P.B.	H-2-87719
09-HS	-243B	LT-09-201M Lift Table H/O/A Sw.	H-2-87719
09-HS	-244A	LT-09-201M Lift Table Up/Down P.B.	H-2-87719
09-HS	-244C	LT-09-201M Lift Table Hyd. Power Pack S/S Sw.	H-2-87719
09-HS	-251A	NDA/NDE Airlock Inlet Door 2 O/C P.B.	H-2-87718
09-HS	-251B	NDA/NDE Airlock Inlet Door 2 H/O/A Sw.	H-2-87718
09-HS	-252A	NDA/NDE Airlock Outlet Door 2 O/C P.B.	H-2-87718
09-HS	-252B	NDA/NDE Airlock Outlet Door 2 H/O/A Sw.	H-2-87718
09-NY	-201	NDA/NDE Carousel Bar Code Scanner	H-2-87717
09-NY	-219	CV-09-105 Box NDA/NDE Conv Bar Code Scanner	H-2-87718
09-NY	-221	Process Area Carousel Bar Code Scanner	H-2-87719
09-PAL	-222	LT-09-201A RWM LLW Lift Table Hyd. Power	H-2-87719
09-PAL	-224	LT-09-201B Lift Table Hyd. Power Pack	H-2-87719

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-PAL	-226	LT-09-201C Lift Table Hyd. Power Pack	H-2-87719
09-PAL	-228	LT-09-201D Lift Table Hyd. Power Pack	H-2-87719
09-PAL	-230	LT-09-201E Lift Table Hyd. Power Pack	H-2-87719
09-PAL	-232	LT-09-201F Lift Table Hyd. Power Pack	H-2-87719
09-PAL	-234	LT-09-201G Lift Table Hyd. Power Pack	H-2-87719
09-PAL	-236	LT-09-201H Lift Table Hyd. Power Pack	H-2-87719
09-PAL	-238	LT-09-201J Lift Table Hyd. Power Pack	H-2-87719
09-PAL	-240	LT-09-201K Lift Table Hyd. Power Pack	H-2-87719
09-PAL	-242	LT-09-201L Lift Table Hyd. Power Pack	H-2-87719
09-PAL	-244	LT-09-201M Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-222	LT-09-201A RWM LLW Lift Table Hyd. Power	H-2-87719
09-PSL	-224	LT-09-201B Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-226	LT-09-201C Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-228	LT-09-201D Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-230	LT-09-201E Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-232	LT-09-201F Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-234	LT-09-201G Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-236	LT-09-201H Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-238	LT-09-201J Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-240	LT-09-201K Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-242	LT-09-201L Lift Table Hyd. Power Pack	H-2-87719
09-PSL	-244	LT-09-201M Lift Table Hyd. Power Pack	H-2-87719
09-SSL	-201	CV-09-101A Drum NDE Conv	H-2-87717
09-SSL	-202	CV-09-101B Drum NDE Conv	H-2-87717

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-SSL	-203	CV-09-101C Drum PAN Conv	H-2-87717
09-SSL	-204	CV-09-101D Drum PAN Conv	H-2-87717
09-SSL	-205	CV-09-101E Drum SGS Conv	H-2-87717
09-SSL	-206	CV-09-101F Drum FAP Conv	H-2-87717
09-SSL	-211	CV-09-103A NDA/NDE Airlock Inlet Conv Speed Sw.	H-2-87718
09-SSL	-212	CV-09-103B NDA/NDE Airlock Inlet Conv Speed Sw.	H-2-87718
09-SSL	-213	CV-09-104A NDA/NDE Airlock Conv Speed Sw.	H-2-87718
09-SSL	-214	CV-09-104B NDA/NDE Airlock Conv Speed Sw.	H-2-87718
09-SSL	-215	CV-09-201A NDA/NDE Airlock Outlet Conv Speed Sw.	H-2-87718
09-SSL	-216	CV-09-201B NDA/NDE Airlock Outlet Conv Speed Sw.	H-2-87718
09-SSL	-221	LT-09-201A RWM LLW Lift Table	H-2-87719
09-SSL	-223	LT-09-201B Lift Table	H-2-87719
09-SSL	-225	LT-09-201C Lift Table	H-2-87719
09-SSL	-227	LT-09-201D Lift Table	H-2-87719
09-SSL	-229	LT-09-201E Lift Table	H-2-87719
09-SSL	-231	LT-09-201F Lift Table	H-2-87719
09-SSL	-233	LT-09-201G Lift Table	H-2-87719
09-SSL	-235	LT-09-201H Lift Table	H-2-87719
09-SSL	-237	LT-09-201J Lift Table	H-2-87719
09-SSL	-239	LT-09-201K Lift Table	H-2-87719
09-SSL	-241	LT-09-201L Lift Table	H-2-87719
09-SSL	-243	LT-09-201M Lift Table	H-2-87719
09-WE	-219A	CV-09-105 Box NDA/NDE Conv	H-2-87718
09-WE	-219B	CV-09-105 Box NDA/NDE Conv	H-2-87718

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-WIR	-219	CV-09-105 Box NDA/NDE Conv Weight Printer	H-2-87718
09-WIT	-219	CV-09-105 Box NDA/NDE Conv	H-2-87718
09-XL	-222C	LT-09-201A RWM LLW Lift Table Hyd. Power Running	H-2-87719
09-XL	-224	LT-09-201B Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-226	LT-09-201C Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-228	LT-09-201D Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-230	LT-09-201E Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-232	LT-09-201F Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-234	LT-09-201G Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-236	LT-09-201H Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-238	LT-09-201J Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-240	LT-09-201K Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-242	LT-09-201L Lift Table Hyd. Power Pack Running	H-2-87719
09-XL	-244	LT-09-201M Lift Table Hyd. Power Pack Running	H-2-87719
09-XS	-201A	CV-09-101A Drum NDE Conv Rope Sw.	H-2-87717
09-XS	-201B	CV-09-101A Drum NDE Conv Rope Sw.	H-2-87717
09-XS	-202A	CV-09-101B Drum NDE Conv Rope Sw.	H-2-87717
09-XS	-202B	CV-09-101B Drum NDE Conv Rope Sw.	H-2-87717
09-XS	-203A	CV-09-101C Drum PAN Conv Rope Sw.	H-2-87717
09-XS	-203B	CV-09-101C Drum PAN Conv Rope Sw.	H-2-87717
09-XS	-204A	CV-09-101D Drum PAN Conv Rope Sw.	H-2-87717
09-XS	-204B	CV-09-101D Drum PAN Conv Rope Sw.	H-2-87717
09-XS	-205A	CV-09-101E Drum SGS Conv Rope Sw.	H-2-87717
09-XS	-205B	CV-09-101E Drum SGS Conv Rope Sw.	H-2-87717

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-XS	-206A	CV-09-101F Drum FAP Conv Rope Sw.	H-2-87717
09-XS	-206B	CV-09-101F Drum FAP Conv Rope Sw.	H-2-87717
09-XS	-211A	CV-09-103A NDA/NDE Airlock Inlet Conv Rope Sw.	H-2-87718
09-XS	-211B	CV-09-103A NDA/NDE Airlock Inlet Conv Rope Sw.	H-2-87718
09-XS	-212A	CV-09-103B NDA/NDE Airlock Inlet Conv Rope Sw.	H-2-87718
09-XS	-212B	CV-09-103B NDA/NDE Airlock Inlet Conv Rope Sw.	H-2-87718
09-XS	-213A	CV-09-104A NDA/NDE Airlock Conv Rope Sw.	H-2-87718
09-XS	-213B	CV-09-104A NDA/NDE Airlock Conv Rope Sw.	H-2-87718
09-XS	-214A	CV-09-104B NDA/NDE Airlock Conv Rope Sw.	H-2-87718
09-XS	-214B	CV-09-104B NDA/NDE Airlock Conv Rope Sw.	H-2-87718
09-XS	-215A	CV-09-201A NDA/NDE Airlock Outlet Conv Rope Sw.	H-2-87718
09-XS	-215B	CV-09-201A NDA/NDE Airlock Outlet Conv Rope Sw.	H-2-87718
09-XS	-216A	CV-09-201B NDA/NDE Airlock Outlet Conv Rope Sw.	H-2-87718
09-XS	-216B	CV-09-201B NDA/NDE Airlock Outlet Conv Rope Sw.	H-2-87718
09-XS	-219A	CV-09-105 Box NDA/NDE Conv Rope Sw.	H-2-87718
09-XS	-219B	CV-09-105 Box NDA/NDE Conv Rope Sw.	H-2-87718
09-XS	-221A	LT-09-201A RWM LLW Lift Table Rope Sw.	H-2-87719
09-XS	-221B	LT-09-201A RWM LLW Lift Table Rope Sw.	H-2-87719
09-XS	-223A	LT-09-201B Lift Table Rope Sw.	H-2-87719
09-XS	-223B	LT-09-201B Lift Table Rope Sw.	H-2-87719
09-XS	-225A	LT-09-201C Lift Table Rope Sw.	H-2-87719
09-XS	-225B	LT-09-201C Lift Table Rope Sw.	H-2-87719
09-XS	-227A	LT-09-201D Lift Table Rope Sw.	H-2-87719
09-XS	-227B	LT-09-201D Lift Table Rope Sw.	H-2-87719

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-XS	-229A	LT-09-201E Lift Table Rope Sw.	H-2-87719
09-XS	-229B	LT-09-201E Lift Table Rope Sw.	H-2-87719
09-XS	-231A	LT-09-201F Lift Table Rope Sw.	H-2-87719
09-XS	-231B	LT-09-201F Lift Table Rope Sw.	H-2-87719
09-XS	-233A	LT-09-201G Lift Table Rope Sw.	H-2-87719
09-XS	-233B	LT-09-201G Lift Table Rope Sw.	H-2-87719
09-XS	-235A	LT-09-201H Lift Table Rope Sw.	H-2-87719
09-XS	-235B	LT-09-201H Lift Table Rope Sw.	H-2-87719
09-XS	-237A	LT-09-201J Lift Table Rope Sw.	H-2-87719
09-XS	-237B	LT-09-201J Lift Table Rope Sw.	H-2-87719
09-XS	-239A	LT-09-201K Lift Table Rope Sw.	H-2-87719
09-XS	-239B	LT-09-201K Lift Table Rope Sw.	H-2-87719
09-XS	-241A	LT-09-201L Lift Table Rope Sw.	H-2-87719
09-XS	-241B	LT-09-201L Lift Table Rope Sw.	H-2-87719
09-XS	-243A	LT-09-201M Lift Table Rope Sw.	H-2-87719
09-XS	-243B	LT-09-201M Lift Table Rope Sw.	H-2-87719
09-XY	-201A	CV-09-101A Drum NDE Conv Motor Run Forward	H-2-87717
09-XY	-201B	CV-09-101A Drum NDE Conv Motor Run Reverse	H-2-87717
09-XY	-202A	CV-09-101B Drum NDE Conv Motor Run Forward	H-2-87717
09-XY	-202B	CV-09-101B Drum NDE Conv Motor Run Reverse	H-2-87717
09-XY	-203A	CV-09-101C Drum PAN Conv Motor Run Forward	H-2-87717
09-XY	-203B	CV-09-101C Drum PAN Conv Motor Run Reverse	H-2-87717
09-XY	-204A	CV-09-101D Drum PAN Conv Motor Run Forward	H-2-87717
09-XY	-204B	CV-09-101D Drum PAN Conv Motor Run Reverse	H-2-87717

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-XY	-205A	CV-09-101E Drum SGS Conv Motor Run Forward	H-2-87717
09-XY	-205B	CV-09-101E Drum SGS Conv Motor Run Reverse	H-2-87717
09-XY	-206A	CV-09-101F Drum FAP Conv Motor Run Forward	H-2-87717
09-XY	-206B	CV-09-101F Drum FAP Conv Motor Run Reverse	H-2-87717
09-XY	-211A	CV-09-103A NDA/NDE Airlock Inlet Conv Motor Run Forward	H-2-87718
09-XY	-211B	CV-09-103A NDA/NDE Airlock Inlet Conv Motor Run Reverse	H-2-87718
09-XY	-212A	CV-09-103B NDA/NDE Airlock Inlet Conv Motor Run Forward	H-2-87718
09-XY	-212B	CV-09-103B NDA/NDE Airlock Inlet Conv Motor Run Reverse	H-2-87718
09-XY	-213A	CV-09-104A NDA/NDE Airlock Conv Motor Run Forward	H-2-87718
09-XY	-213B	CV-09-104A NDA/NDE Airlock Conv Motor Run Reverse	H-2-87718
09-XY	-214A	CV-09-104B NDA/NDE Airlock Conv Motor Run Forward	H-2-87718
09-XY	-214B	CV-09-104B NDA/NDE Airlock Conv Motor Run Reverse	H-2-87718
09-XY	-215A	CV-09-201A NDA/NDE Airlock Outlet Conv Motor Run Forward	H-2-87718
09-XY	-215B	CV-09-201A NDA/NDE Airlock Outlet Conv Motor Run Reverse	H-2-87718
09-XY	-216A	CV-09-201B NDA/NDE Airlock Outlet Conv Motor Run Forward	H-2-87718
09-XY	-216B	CV-09-201B NDA/NDE Airlock Outlet Conv Motor Run Reverse	H-2-87718
09-XY	-221A	LT-09-201A RWM LLW Lift Table Motor Run Forward	H-2-87719
09-XY	-221B	LT-09-201A Lift Table Motor Run Reverse	H-2-87719
09-XY	-223A	LT-09-201B Lift Table Motor Run Forward	H-2-87719
09-XY	-223B	LT-09-201B Lift Table Motor Run Reverse	H-2-87719
09-XY	-225A	LT-09-201C Lift Table Motor Run Forward	H-2-87719
09-XY	-225B	LT-09-201C Lift Table Motor Run Reverse	H-2-87719
09-XY	-227A	LT-09-201D Lift Table Motor Run Forward	H-2-87719
09-XY	-227B	LT-09-201D Lift Table Motor Run Reverse	H-2-87719

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-XY	-229A	LT-09-201E Lift Table Motor Run Forward	H-2-87719
09-XY	-229B	LT-09-201E Lift Table Motor Run Reverse	H-2-87719
09-XY	-231A	LT-09-201F Lift Table Motor Run Forward	H-2-87719
09-XY	-231B	LT-09-201F Lift Table Motor Run Reverse	H-2-87719
09-XY	-233A	LT-09-201G Lift Table Motor Run Forward	H-2-87719
09-XY	-233B	LT-09-201G Lift Table Motor Run Reverse	H-2-87719
09-XY	-235A	LT-09-201H Lift Table Motor Run Forward	H-2-87719
09-XY	-235B	LT-09-201H Lift Table Motor Run Reverse	H-2-87719
09-XY	-237A	LT-09-201J Lift Table Motor Run Forward	H-2-87719
09-XY	-237B	LT-09-201J Lift Table Motor Run Reverse	H-2-87719
09-XY	-239A	LT-09-201K Lift Table Motor Run Forward	H-2-87719
09-XY	-239B	LT-09-201K Lift Table Motor Run Reverse	H-2-87719
09-XY	-241A	LT-09-201L Lift Table Motor Run Forward	H-2-87719
09-XY	-241B	LT-09-201L Lift Table Motor Run Reverse	H-2-87719
09-XY	-243A	LT-09-201M Lift Table Motor Run Forward	H-2-87719
09-XY	-243B	LT-09-201M Lift Table Motor Run Reverse	H-2-87719
09-ZEV	-222	LT-09-201A Lift Table	H-2-87719
09-ZEV	-224	LT-09-201B Lift Table	H-2-87719
09-ZEV	-226	LT-09-201C Lift Table	H-2-87719
09-ZEV	-228	LT-09-201D Lift Table	H-2-87719
09-ZEV	-230	LT-09-201E Lift Table	H-2-87719
09-ZEV	-232	LT-09-201F Lift Table	H-2-87719
09-ZEV	-234	LT-09-201G Lift Table	H-2-87719
09-ZEV	-236	LT-09-201H Lift Table	H-2-87719

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-ZEV	-238	LT-09-201J Lift Table	H-2-87719
09-ZEV	-240	LT-09-201K Lift Table	H-2-87719
09-ZEV	-242	LT-09-201L Lift Table	H-2-87719
09-ZEV	-244	LT-09-201M Lift Table	H-2-87719
09-ZL	-221A	LT-09-201A RWM LLW Lift Table Drum at End of Conv	H-2-87719
09-ZL	-221C	LT-09-201A Lift Table Lift Table Up	H-2-87719
09-ZL	-221D	LT-09-201A RWM LLW Lift Table Lift Table Down	H-2-87719
09-ZL	-221E	LT-09-201A RWM LLW Lift Table Drum Under Glove Box	H-2-87719
09-ZL	-223A	LT-09-201B Lift Table Drum at End of Conv	H-2-87719
09-ZL	-223C	LT-09-201B Lift Table Lift Table Up	H-2-87719
09-ZL	-223D	LT-09-201B Lift Table Lift Table Down	H-2-87719
09-ZL	-223E	LT-09-201B Lift Table Drum Under Glove Box	H-2-87719
09-ZL	-225A	LT-09-201C Lift Table Drum at End of Conv	H-2-87719
09-ZL	-225C	LT-09-201C Lift Table Lift Table Up	H-2-87719
09-ZL	-225D	LT-09-201C Lift Table Lift Table Down	H-2-87719
09-ZL	-225E	LT-09-201C Lift Table Drum Under Glove Box	H-2-87719
09-ZL	-227A	LT-09-201D Lift Table Drum at End of Conv	H-2-87719
09-ZL	-227C	LT-09-201D Lift Table Lift Table Up	H-2-87719
09-ZL	-227D	LT-09-201D Lift Table Lift Table Down	H-2-87719
09-ZL	-227E	LT-09-201D Lift Table Drum Under Glove Box	H-2-87719
09-ZL	-229A	LT-09-201E Lift Table Drum at End of Conv	H-2-87719
09-ZL	-229C	LT-09-201E Lift Table Lift Table Up	H-2-87719
09-ZL	-229D	LT-09-201E Lift Table Lift Table Down	H-2-87719
09-ZL	-229E	LT-09-201E Lift Table Drum Under Glove Box	H-2-87719

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-ZL	-231A	LT-09-201F Lift Table Drum at End of Conv	H-2-87719
09-ZL	-231C	LT-09-201F Lift Table Lift Table Up	H-2-87719
09-ZL	-231D	LT-09-201F Lift Table Lift Table Down	H-2-87719
09-ZL	-231E	LT-09-201F Lift Table Drum Under Glove Box	H-2-87719
09-ZL	-233A	LT-09-201G Lift Table Drum at End of Conv	H-2-87719
09-ZL	-233C	LT-09-201G Lift Table Lift Table Up	H-2-87719
09-ZL	-233D	LT-09-201G Lift Table Lift Table Down	H-2-87719
09-ZL	-233E	LT-09-201G Lift Table Drum Under Glove Box	H-2-87719
09-ZL	-235A	LT-09-201H Lift Table Drum at End of Conv	H-2-87719
09-ZL	-235C	LT-09-201H Lift Table Lift Table Up	H-2-87719
09-ZL	-235D	LT-09-201H Lift Table Lift Table Down	H-2-87719
09-ZL	-235E	LT-09-201H Lift Table Drum Under Glove Box	H-2-87719
09-ZL	-237A	LT-09-201J Lift Table Drum at End of Conv.	H-2-87719
09-ZL	-237C	LT-09-201J Lift Table Lift Table Up	H-2-87719
09-ZL	-237D	LT-09-201J Lift Table Lift Table Down	H-2-87719
09-ZL	-237E	LT-09-201J Lift Table Drum Under Glove Box	H-2-87719
09-ZL	-239A	LT-09-201K Lift Table Drum at End of Conv	H-2-87719
09-ZL	-239C	LT-09-201K Lift Table Lift Table Up	H-2-87719
09-ZL	-239D	LT-09-201K Lift Table Lift Table Down	H-2-87719
09-ZL	-239E	LT-09-201K Lift Table Drum Under Glove Box	H-2-87719
09-ZL	-241A	LT-09-201L Lift Table Drum at End of Conv	H-2-87719
09-ZL	-241C	LT-09-201L Lift Table Lift Table Up	H-2-87719
09-ZL	-241D	LT-09-201L Lift Table Lift Table Down	H-2-87719
09-ZL	-241E	LT-09-201L Lift Table Drum Under Glove Box	H-2-87719

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-ZL	-243A	LT-09-201M Lift Table Drum at End of Conv.	H-2-87719
09-ZL	-243C	LT-09-201M Lift Table Lift Table Up	H-2-87719
09-ZL	-243E	LT-09-201M Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-201	CV-09-101A Drum NDE Conv Drum on Conv	H-2-87717
09-ZS	-202	CV-09-101B Drum NDE Conv Drum on Conv	H-2-87717
09-ZS	-203	CV-09-101C Drum PAN Conv Drum on Conv	H-2-87717
09-ZS	-204	CV-09-101D Drum PAN Conv Drum on Conv	H-2-87717
09-ZS	-205	CV-09-101E Drum SGS Conv Drum on Conv	H-2-87717
09-ZS	-206	CV-09-101F Drum FAP Conv Drum on Conv	H-2-87717
09-ZS	-211A	CV-09-103A NDA/NDE Airlock Inlet Conv Drum on Conv	H-2-87718
09-ZS	-211D	CV-09-103A NDA/NDE Airlock Inlet Conv Drum at End of Conv	H-2-87718
09-ZS	-212A	CV-09-103B NDA/NDE Airlock Inlet Conv Drum on Conv	H-2-87718
09-ZS	-212D	CV-09-103B NDA/NDE Airlock Inlet Conv Drum at End of Conv	H-2-87718
09-ZS	-213A	CV-09-104A NDA/NDE Airlock Conv Drum on Conv.	H-2-87718
09-ZS	-213B	CV-09-104A NDA/NDE Airlock Gate Inlet Door Clear	H-2-87718
09-ZS	-213C	CV-09-104A NDA/NDE Airlock Gate Outlet Door Clear	H-2-87718
09-ZS	-214A	CV-09-104B NDA/NDE Airlock Conv Drum on Conv.	H-2-87718
09-ZS	-214B	CV-09-104A NDA/NDE Airlock Gate Inlet Door Clear	H-2-87718
09-ZS	-214C	CV-09-104A NDA/NDE Airlock Gate Outlet Door Clear	H-2-87718
09-ZS	-215A	CV-09-201A NDA/NDE Airlock Outlet Conv Drum on Conv	H-2-87718
09-ZS	-215D	CV-09-201A NDA/NDE Airlock Outlet Conv Drum at End of Conv	H-2-87718
09-ZS	-216A	CV-09-201B NDA/NDE Airlock Outlet Conv Drum on Conv	H-2-87718
09-ZS	-216D	CV-09-201B NDA/NDE Airlock Outlet Conv Drum at End of Conv	H-2-87718
09-ZS	-219	CV-09-105 Box NDA/NDE Conv Box on Conv	H-2-87718

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-ZS	-221A	LT-09-201A RWM LLW Lift Table Drum at End of Conv	H-2-87719
09-ZS	-221C	LT-09-201A RWM LLW Lift Table Lift Table up	H-2-87719
09-ZS	-221D	LT-09-201A RWM LLW Lift Table Lift Table Down	H-2-87719
09-ZS	-221E	LT-09-201A RWM LLW Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-223A	LT-09-201B Lift Table Drum at End of Conv	H-2-87719
09-ZS	-223C	LT-09-201B Lift Table Lift Table Up	H-2-87719
09-ZS	-223D	LT-09-201B Lift Table Lift Table Down	H-2-87719
09-ZS	-223E	LT-09-201B Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-225A	LT-09-201C Lift Table Drum at End of Conv	H-2-87719
09-ZS	-225C	LT-09-201C Lift Table Lift Table Up	H-2-87719
09-ZS	-225D	LT-09-201C Lift Table Lift Table Down	H-2-87719
09-ZS	-225E	LT-09-201C Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-227A	LT-09-201D Lift Table Drum at End of Conv	H-2-87719
09-ZS	-227C	LT-09-201D Lift Table Lift Table Up	H-2-87719
09-ZS	-227D	LT-09-201D Lift Table Lift Table Down	H-2-87719
09-ZS	-227E	LT-09-201D Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-229A	LT-09-201E Lift Table Drum at End of Conv	H-2-87719
09-ZS	-229C	LT-09-201E Lift Table Lift Table Up	H-2-87719
09-ZS	-229D	LT-09-201E Lift Table Lift Table Down	H-2-87719
09-ZS	-229E	LT-09-201E Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-231A	LT-09-201F Lift Table Drum at End of Conv	H-2-87719
09-ZS	-231C	LT-09-201F Lift Table Lift Table Up	H-2-87719
09-ZS	-231D	LT-09-201F Lift Table Lift Table Down	H-2-87719
09-ZS	-231E	LT-09-201F Lift Table Drum Under Glove Box	H-2-87719

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-ZS	-233A	LT-09-201G Lift Table Drum at End of Conv	H-2-87719
09-ZS	-233C	LT-09-201G Lift Table Lift Table Up	H-2-87719
09-ZS	-233D	LT-09-201G Lift Table Lift Table Down	H-2-87719
09-ZS	-233E	LT-09-201G Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-235A	LT-09-201H Lift Table Drum at End of Conv	H-2-87719
09-ZS	-235C	LT-09-201H Lift Table Lift Table Up	H-2-87719
09-ZS	-235D	LT-09-201H Lift Table Lift Table Down	H-2-87719
09-ZS	-235E	LT-09-201H Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-237A	LT-09-201J Lift Table Drum at End of Conv.	H-2-87719
09-ZS	-237C	LT-09-201J Lift Table Lift Table Up	H-2-87719
09-ZS	-237D	LT-09-201J Lift Table Lift Table Down	H-2-87719
09-ZS	-237E	LT-09-201J Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-239A	LT-09-201K Lift Table Drum at End of Conv	H-2-87719
09-ZS	-239C	LT-09-201K Lift Table Lift Table Up	H-2-87719
09-ZS	-239D	LT-09-201K Lift Table Lift Table Down	H-2-87719
09-ZS	-239E	LT-09-201K Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-241A	LT-09-201L Lift Table Drum at End of Conv	H-2-87719
09-ZS	-241C	LT-09-201L Lift Table Lift Table Up	H-2-87719
09-ZS	-241D	LT-09-201L Lift Table Lift Table Down	H-2-87719
09-ZS	-241E	LT-09-201L Lift Table Drum Under Glove Box	H-2-87719
09-ZS	-243A	LT-09-201M Lift Table Drum at End of Conv.	H-2-87719
09-ZS	-243C	LT-09-201M Lift Table Lift Table Up	H-2-87719
09-ZS	-243D	LT-09-201M Lift Table Lift Table Down	H-2-87719
09-ZS	-243D	LT-09-201M Lift Table Lift Table Down	H-2-87719

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
09-ZS	-243E	LT-09-201M Lift Table Drum Under Glove Box	H-2-87719
09-ZSC	-217	NDA/NDE Airlock Inlet Door 1	H-2-87718
09-ZSC	-218	NDA/NDE Airlock Outlet Door 1	H-2-87718
09-ZSC	-251	NDA/NDE Airlock Inlet Door 2	H-2-87718
09-ZSC	-252	NDA/NDE Airlock Outlet Door 2	H-2-87718
09-ZSO	-217	NDA/NDE Airlock Inlet Door 1	H-2-87718
09-ZSO	-218	NDA/NDE Airlock Outlet Door 1	H-2-87718
09-ZSO	-251	NDA/NDE Airlock Inlet Door 2	H-2-87718
09-ZSO	-252	NDA/NDE Airlock Outlet Door 2	H-2-87718
11-FE/FT	-602A	MA-11-203A Supply Fan Outlet	H-2-88158
11-FE/FT	-602B	MA-11-203B Supply Fan Outlet	H-2-88158
11-FE/FT	-617A	FT-11-201A Outlet	H-2-88159
11-FE/FT	-617B	FT-11-201B Outlet	H-2-88159
11-FE/FT	-618A	FT-11-202A Outlet	H-2-88159
11-FE/FT	-618B	FT-11-202B Outlet	H-2-88159
11-FE/FT	-619	Process Area Exhaust to Stack	H-2-88159
11-FEV	-601A	MA-11-203A Filter Train Inlet Damper	H-2-88158
11-FEV	-601B	MA-11-203B Filter train inlet damper	H-2-88158
11-FEV	-602A	MA-11-203A Filter Train Outlet Damper	H-2-88158
11-FEV	-602B	MA-11-203B Filter Train Outlet Damper	H-2-88158
11-FEV	-604	MA-11-203A/B Building Isolation Damper	H-2-88158
11-FEV	-611	Glove Box Exhaust Isolation Damper	H-2-88159
11-FEV	-612	Process Room Exhaust Isolation Damper	H-2-88159
11-FEV	-613A	FT-11-201A Filter Train Inlet Damper	H-2-88159

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
11-FEV	-613B	FT-11-201B Filter Train Inlet Damper	H-2-88159
11-FEV	-614A	FT-11-202A Filter Train Inlet Damper	H-2-88159
11-FEV	-614B	FT-11-202B Filter Train Inlet Damper	H-2-88159
11-FEV	-617A	FT-11-201A Outlet Damper	H-2-88159
11-FEV	-617B	FT-11-201B Outlet Damper	H-2-88159
11-FEV	-618A	FT-11-202A Outlet Damper	H-2-88159
11-FEV	-618B	FT-11-202B Outlet Damper	H-2-88159
11-FEV	-619	Process Stack Exhaust Isolation Damper	H-2-88159
11-FEV	-645	AH-11-501 Return Air Damper	H-2-88162
11-FEV	-646	AH-11-501 Make-up Air Inlet Damper	H-2-88162
11-FI	-619	Process Area Exhaust to Stack	H-2-88159
11-FIC	-601A	MA-11-203A Supply Fan Inlet Vane Damper	H-2-88158
11-FIC	-601B	MA-11-203B Supply Fan Inlet Vane Damper	H-2-88158
11-FIC	-615A	FT-11-201A Exhaust Blower Vane Damper	H-2-88159
11-FIC	-615B	FT-11-201B Exhaust Blower Vane Damper	H-2-88159
11-FIC	-616A	FT-11-202A Exhaust Blower Vane Damper	H-2-88159
11-FIC	-616B	FT-11-202B Exhaust Blower Vane Damper	H-2-88159
11-FSH	-654A	Chiller Water Loop 6" Bypass Flow Forward	H-2-88163
11-FSH	-654B	Chiller Water Loop 6" Bypass Flow Reverse	H-2-88163
11-FSL	-653A	CH-11-01A Chille Water Inlet	H-2-88163
11-FSL	-653B	CH-11-01B Chiller Inlet	H-2-88163
11-FV	-601A	MA-11-203A Filter Train Inlet Damper	H-2-88158
11-FV	-601B	MA-11-203B Filter Train Inlet Damper	H-2-88158
11-FV	-602A	MA-11-203A Filter Train Outlet Damper	H-2-88158

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
11-FV	-602B	MA-11-203B Filter Train Outlet Damper	H-2-88158
11-FV	-604	MA-11-203A/B Building Isolation Damper	H-2-88158
11-FV	-611	Glove Box Exhaust Isolation Damper	H-2-88159
11-FV	-612	Process Room Exhaust Isolation Damper	H-2-88159
11-FV	-613A	FT-11-201A Filter Train Inlet Damper	H-2-88159
11-FV	-613B	FT-11-201B Filter Train Inlet Damper	H-2-88159
11-FV	-614A	FT-11-202A Filter Train Inlet Damper	H-2-88159
11-FV	-614B	FT-11-202B Filter Train Inlet Damper	H-2-88159
11-FV	-615A	FT-11-201A Exhaust Blower Vane Damper	H-2-88159
11-FV	-615B	FT-11-201B Exhaust Blower Vane Damper	H-2-88159
11-FV	-616A	FT-11-202A Exhaust Blower Vane Damper	H-2-88159
11-FV	-616B	FT-11-202B Exhaust Blower Vane Damper	H-2-88159
11-FV	-617A	FT-11-201A Outlet Damper	H-2-88159
11-FV	-617B	FT-11-201B Outlet Damper	H-2-88159
11-FV	-618A	FT-11-202A Outlet Damper	H-2-88159
11-FV	-618B	FT-11-202B Outlet Damper	H-2-88159
11-FV	-619	Process Stack Exhaust Isolation Damper	H-2-88159
11-FV	-645	AH-11-501 Return Air Damper	H-2-88162
11-FV	-646	AH-11-501 Make-up Air Inlet Damper	H-2-88162
11-FY	-603A	MA-11-203A Supply Fan Inlet Vane Damper	H-2-88158
11-FY	-603B	MA-11-203B Supply Fan Inlet Vane Damp	H-2-88158
11-FY	-615A	FT-11-201A Exhaust Blower Vane Damper	H-2-88159
11-FY	-615B	FT-11-201B Exhaust Blower Vane Damper	H-2-88159
11-FY	-616A	FT-11-202A Exhaust Blower Vane Damper	H-2-88159

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
11-FY	-616B	FT-11-202B Exhaust Blower Vane Damper	H-2-88159
11-HS	-601A	MA-11-203A Control Panel H/O/A sw.	H-2-88158
11-HS	-601B	MA-11-203B Control Panel H/O/A sw.	H-2-88158
11-HS	-602	MA-11-203A/B Building Isolation Damper	H-2-88158
11-HS	-611A	FT-11-201A Air Handler Control Panel	H-2-88159
11-HS	-611B	FT-11-201B Air Handler Control Panel	H-2-88159
11-HS	-612A	FT-11-202A Air Handler Control Panel	H-2-88159
11-HS	-612B	FT-11-202B Air Handler Control Panel	H-2-88159
11-HS	-621	AH-11-302 Control Panel H/O/A sw.	H-2-88160
11-HS	-625	Shipping/Receiving Area Exhaust Fan Start/Stop Sw.	H-2-88160
11-HS	-626	NDA/NDE Area Exhaust Fan Start/Stop Sw.	H-2-88160
11-HS	-627	Shipping/NDA/NDE Roof Exhaust Fan Start/Stop Sw.	H-2-88160
11-HS	-641	AH-11-501 Contrl Panel	H-2-88162
11-HS	-644	RF-11-501 Return Air Fan Start/Stop Sw.	H-2-88162
11-HS	-645	EF-11-501 Exhaust Fan Start/Stop Sw.	H-2-88162
11-HS	-646	AH-11-501 Make-up Air Inlet Damper O/C Sw. (Open fully for smoke purge)	H-2-88162
11-HS	-651A	P-11-02A Chilled Water Pump H/O/A Sw.	H-2-88163
11-HS	-651B	P-11-02B Chill Water Pump H/O/A Sw.	H-2-88163
11-HS	-653	CH-11-01A/B Chiller Lead/Lag Panel A/B Lead Sw.	H-2-88163
11-HS	-653A	CH-11-01A Chiller Control Panel H/O/A Sw.	H-2-88163
11-HS	-653B	CH-11-01B Chiller Control Panel H/O/A Sw.	H-2-88163
11-HS	-655A	P-10-01A Chill Water Circ. Pump H/O/A Sw.	H-2-88163
11-HS	-655B	P-10-01B Chill Wtr Circ. Pmp Speed Cont. H/O/A Sw.	H-2-88163
11-KIS	-653A	CH-11-01A Chiller Control Panel Run Timer	H-2-88163

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
11-KIS	-653B	CH-11-01B Chiller Control Panel Run Timer	H-2-88163
11-MAH	-631	CR-11-801A Computer Room AC Humidity	H-2-88161
11-MAH	-632	CR-11-801B Computer Room AC Humidity	H-2-88161
11-MAL	-631	CR-11-801A Computer Room AC Humidity	H-2-88161
11-MAL	-632	CR-11-801B Computer Room AC Humidity	H-2-88161
11-ME	-601	MA-11-203A/B Inlet	H-2-88158
11-ME	-602A	MA-11-203A Filter Outlet	H-2-88158
11-ME	-602B	MA-11-203B Filter Outlet	H-2-88158
11-ME	-644	AH-11-501 Return Air	H-2-88162
11-MI	-621	AH-11-302 Shipping Area Filter Inlet	H-2-88160
11-MI	-624	AH-11-302 Filter Outlet	H-2-88160
11-MIT	-601	MA-11-203A/B Inlet	H-2-88158
11-MIT	-602A	MA-11-203A Filter Outlet	H-2-88158
11-MIT	-602B	MA-11-203B Filter Outlet	H-2-88158
11-MIT	-625	AH-11-302 Shipping/Receiving Area	H-2-88160
11-MIT	-626	AH-11-302 NDA/NDE Area	H-2-88160
11-MIT	-644	AH-11-501 Outlet	H-2-88162
11-MT	-631	CR-11-801A Computer Room AC	H-2-88161
11-MT	-632	CR-11-801B Computer Room AC	H-2-88161
11-PDAH	-631	CR-11-801A Computer Room AC Filter Clogged	H-2-88161
11-PDAH	-632	CR-11-801B Computer Room AC Filter Clogged	H-2-88161
11-PDAL	-633	CR-11-801A Computer Room AC Filter Missing	H-2-88161
11-PDAL	-634	CR-11-801B Computer Room AC Filter Missing	H-2-88161
11-PDAL	-635	CR-11-801A Computer Room AC Low Air Flow	H-2-88161

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TAG NUMBER	SERVICE REMARKS	FLOWSHEET
11-PDAL -636	CR-11-801B Computer Room AC Low Air Flow	H-2-88161
11-PDI -601	Airlock to Process Area Cascade	H-2-88158
11-PDI -602	Airlock -0.05"W.C.	H-2-88158
11-PDI -631	CR-11-801A Computer Room AC Chill Water	H-2-88161
11-PDI -632	CR-11-801B Computer Room AC Chill Water	H-2-88161
11-PDI -656A	Ship/Recv/NDA/NDE Area HVAC Chill Water C	H-2-88164
11-PDI -656B	Process Area HVAC Chill Water Coil MA-11-203A	H-2-88164
11-PDI -656C	Process Area HVAC Chill Water Coil MA-11-203B	H-2-88164
11-PDI -656D	Admin Area HVAC Chill Water Coil AH-11-501	H-2-88164
11-PDI -656E	Changing Room HVAC Chill Water Coil	H-2-88164
11-PDI -656F	Comp/Cont Room HVAC Chill Water Coil CR-11-801A	H-2-88164
11-PDI -656G	Comp/Cont Room HVAC Chill Water Coil CR-11-801B	H-2-88164
11-PDIC -655A	P-10-01A Chill Wtr Circ. Pmp Speed Cont.	H-2-88163
11-PDIC -655B	P-10-01B Chill Wtr Circ. Pmp Speed Cont.	H-2-88163
11-PDISH -601A	MA-11-203A Pre-filter	H-2-88158
11-PDISH -601B	MA-11-203B Pre-filter	H-2-88158
11-PDISH -602A	MA-11-203A Final Filter	H-2-88158
11-PDISH -602B	MA-11-203B Final Filter	H-2-88158
11-PDISH -611A	FT-11-201A Pre-Filter	H-2-88159
11-PDISH -611B	FT-11-201B Pre-Filter	H-2-88159
11-PDISH -612A	FT-11-202A Pre-Filter	H-2-88159
11-PDISH -612B	FT-11-202B Pre-Filter	H-2-88159
11-PDISH -613A	FT-11-201A HEPA Filter No. 1	H-2-88159
11-PDISH -613B	FT-11-201B HEPA Filter No. 1	H-2-88159

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TAG NUMBER	SERVICE REMARKS	FLOWSHEET
11-PDISH -614A	FT-11-202A HEPA Filter No. 1	H-2-88159
11-PDISH -614B	FT-11-202B HEPA Filter No. 1	H-2-88159
11-PDISH -615A	FT-11-201A HEPA Filter No. 2	H-2-88159
11-PDISH -615B	FT-11-201B HEPA Filter No. 2	H-2-88159
11-PDISH -616A	FT-11-202A HEPA Filter No. 2	H-2-88159
11-PDISH -616B	FT-11-202B HEPA Filter No. 2	H-2-88159
11-PDISH -621	AH-11-302 Pre-filter	H-2-88160
11-PDISH -622	AH-11-302 Final Filter	H-2-88160
11-PDISH -641	AH-11-501 Pre-filter	H-2-88162
11-PDISH -642	AH-11-501 Final Filter	H-2-88162
11-PDISL -603A	MA-11-203A Supply Fan	H-2-88158
11-PDISL -603B	MA-11-203B Supply Fan	H-2-88158
11-PDISL -617A	FT-11-201A Exhaust Blower	H-2-88159
11-PDISL -617B	FT-11-201B Exhaust Blower	H-2-88159
11-PDISL -618A	FT-11-202A Exhaust Blower	H-2-88159
11-PDISL -618B	FT-11-202B Exhaust Blower	H-2-88159
11-PDISL -623	AH-11-302 Air Handler	H-2-88160
11-PDISL -625	Shipping/Receiving Area Exhaust Fan	H-2-88160
11-PDISL -626	NDA/NDE Area Exhaust Fan	H-2-88160
11-PDISL -627	Shipping/NDA/NDE Roof Exhaust Fan	H-2-88160
11-PDISL -643	AH-11-501 Air Handler	H-2-88162
11-PDISL -644	RF-11-501 Return Air Fan	H-2-88162
11-PDISL -645	EF-11-501 Exhaust Fan	H-2-88162
11-PDIT -601	NDA/NDE Area -0.10"W.C.	H-2-88158

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
11-PDIT	-602	Process Area -0.15"W.C.	H-2-88158
11-PDIT	-603	NDA/NDE to Process Area Cascade	H-2-88158
11-PDIT	-655	HVAC Chill Water Loop	H-2-88164
11-PDSH	-631	CR-11-801A Computer Room AC Filter Filter Clogged	H-2-88161
11-PDSH	-632	CR-11-801B Computer Room AC Filter Filter Clogged	H-2-88161
11-PDSL	-633	CR-11-801A Computer Room AC Filter Filter Missing	H-2-88161
11-PDSL	-634	Computer Room AC-2 Filter Filter Missing	H-2-88160
11-PDSL	-635	CR-11-801A Computer Room AC Blower Low Flow	H-2-88161
11-PDSL	-636	CR-11-801B Computer Room AC Blower Low Flow	H-2-88161
11-PDY	-655A	P-10-01A Chill Wtr Circ. Pmp Speed Cont. Variable Speed Drive	H-2-88163
11-PDY	-655B	P-10-01B Chill Wtr Circ. Pmp Speed Cont. Variable Speed Drive	H-2-88163
11-PI	-651A	P-11-02A Chilled Water Pump Discharge	H-2-88163
11-PI	-651B	P-11-02B Chill Water Pump Discharge	H-2-88163
11-PISL	-653A	CH-11-01A Chiller Outlet	H-2-88163
11-PISL	-653B	CH-11-01B Chiller Outlet	H-2-88163
11-PISL	-655	P-10-01A/B Chill Wtr Circ. Pmps Discharge	H-2-88163
11-TAH	-635	CR-11-801A Computer Room AC Chill Water R	H-2-88161
11-TAH	-636	CR-11-801B Computer Room AC Chill Water R	H-2-88161
11-TAH	-637	CR-11-801A Computer Room AC Air Temp	H-2-88161
11-TAH	-638	CR-11-801B Computer Room AC Air Temp	H-2-88161
11-TAL	-637	CR-11-801A Computer Room AC Air Temp	H-2-88161
11-TAL	-638	CR-11-801B Computer Room AC Air Temp	H-2-88161
11-TE	-635	CR-11-801A Computer Room AC Chill Water R	H-2-88161
11-TE	-636	CR-11-801B Computer Room AC Chill Water R	H-2-88161

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TAG NUMBER	SERVICE REMARKS	FLOWSHEET
11-TE -637	CR-11-801A Computer Room AC Air	H-2-88161
11-TE -638	CR-11-801B Computer Room AC Air	H-2-88161
11-TE -653A	CH-11-01A Chille Water Inlet	H-2-88163
11-TE -653B	CH-11-01B Chiller Inlet	H-2-88163
11-TE/TIT-601	MA-11-203A/B inlet	H-2-88158
11-TE/TIT-602A	MA-11-203A Filter Outlet	H-2-88158
11-TE/TIT-602B	MA-11-203B Filter Outlet	H-2-88158
11-TE/TT -653A	CH-11-01A Chiller Outlet	H-2-88163
11-TE/TT -653B	CH-11-01B Chiller Outlet	H-2-88163
11-TI -601A	MA-11-203A Inlet	H-2-88158
11-TI -601B	MA-11-203B Inlet	H-2-88158
11-TI -602A	MA-11-203A Heat Recovery Coil	H-2-88158
11-TI -602B	MA-11-203B Heat Recovery Coil	H-2-88158
11-TI -603A	MA-11-203A Cooling Coil	H-2-88158
11-TI -603B	MA-11-203B Cooling Coil	H-2-88158
11-TI -604A	MA-11-203A Reheat Coil	H-2-88158
11-TI -604B	MA-11-203B Reheat Coil	H-2-88158
11-TI -611A	FT-11-201A HEPA Filter No. 2	H-2-88159
11-TI -611B	FT-11-201B HEPA Filter No. 2	H-2-88159
11-TI -612A	FT-11-202A HEPA Filter No. 2	H-2-88159
11-TI -612B	FT-11-202B HEPA Filter No. 2	H-2-88159
11-TI -613A	FT-11-201A Heat Recovery Coil	H-2-88159
11-TI -613B	FT-11-201B Heat Recovery Coil	H-2-88159
11-TI -614A	FT-11-202A Heat Recovery Coil	H-2-88159

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
11-TI	-614B	FT-11-202B Heat Recovery Coil	H-2-88159
11-TI	-621	AH-11-302 Shipping Area Filter Inlet	H-2-88160
11-TI	-622	AH-11-302 Final Filter	H-2-88160
11-TI	-623	AH-11-302 Cooling Coil	H-2-88160
11-TI	-624	AH-11-302 Reheat Coil	H-2-88160
11-TI	-625	AH-11-302 Filter Outlet	H-2-88160
11-TI	-631	CR-11-801A Computer Room AC Chill Water I	H-2-88161
11-TI	-632	CR-11-801B Computer Room AC Chill Water I	H-2-88161
11-TI	-633	CR-11-801A Computer Room AC Chill Water R	H-2-88161
11-TI	-634	CR-11-801B Computer Room AC Chill Water R	H-2-88161
11-TI	-641	AH-11-501 Final Filter	H-2-88162
11-TI	-642	AH-11-501 Cooling Coil	H-2-88162
11-TI	-643	AH-11-501 Heating Coil	H-2-88162
11-TI	-644	AH-11-501 Outlet	H-2-88162
11-TI	-651A	CH-11-01A Chille Water Inlet	H-2-88163
11-TI	-651B	CH-11-01B Chiller Inlet	H-2-88163
11-TI	-653A	CH-11-01A Chiller Outlet	H-2-88163
11-TI	-653B	CH-11-01B Chiller Outlet	H-2-88163
11-TI	-656A	Ship/Recv/NDA/NDE Area HVAC Chill Water I	H-2-88164
11-TI	-656B	Process Area HVAC Chill Water Inlet MA-11-203A	H-2-88164
11-TI	-656C	Process Area HVAC Chill Water Inlet MA-11-203B	H-2-88164
11-TI	-656D	Admin Area HVAC Chill Water Inlet AH-11-501	H-2-88164
11-TI	-656E	Changing Room HVAC Chill Water Inlet	H-2-88164
11-TI	-656F	Comp/Cont Room HVAC Chill Water Inlet CR-11-801A	H-2-88164

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
11-TI	-656G	Comp/Cont Room HVAC Chill Water Inlet CR-11-801B	H-2-88164
11-TI	-657A	Ship/Recv/NDA/NDE Area HVAC Chill Water O	H-2-88164
11-TI	-657B	Process Area HVAC Chill Water Outlet MA-11-203A	H-2-88164
11-TI	-657C	Process Area HVAC Chill Water Outlet MA-11-203B	H-2-88164
11-TI	-657D	Admin Area HVAC Chill Water Outlet AH-11-501	H-2-88164
11-TI	-657E	Changing Room HVAC Chill Water Outlet	H-2-88164
11-TI	-657F	Comp/Cont Room HVAC Chill Water Outlet CR-11-801A	H-2-88164
11-TI	-657G	Comp/Cont Room HVAC Chill Water Outlet CR-11-801B	H-2-88164
11-TIC	-641	AH-11-501 Office/Receptionist Area	H-2-88162
11-TIC	-642	AH-11-501 Lunch Area	H-2-88162
11-TIC	-643	AH-11-501 Conference Room	H-2-88162
11-TIC	-656A	Ship/Recv/NDA/NDE Area HVAC Chill Water	H-2-88164
11-TIC	-656B	Process Area HVAC Chill Water MA-11-203A	H-2-88164
11-TIC	-656C	Process Area HVAC Chill Water MA-11-203B	H-2-88164
11-TIC	-656D	Admin Area HVAC Chill Water AH-11-501	H-2-88164
11-TIC	-656E	Changing Room HVAC Chill Water	H-2-88164
11-TIC	-656F	Comp/Cont Room HVAC Chill Water CR-11-801A	H-2-88164
11-TIC	-656G	Comp/Cont Room HVAC Chill Water CR-11-801B	H-2-88164
11-TIT	-625	AH-11-302 Shipping/Receiving Area	H-2-88160
11-TIT	-626	AH-11-302 NDA/NDE Area	H-2-88160
11-TIT	-641	AH-11-501 Outlet	H-2-88162
11-TY	-656A	Ship/Recv/NDA/NDE Area HVAC Chill Water	H-2-88164
11-TY	-656B	Process Area HVAC Chill Water MA-11-203A	H-2-88164
11-TY	-656C	Process Area HVAC Chill Water MA-11-203B	H-2-88164

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
11-TY	-656D	Admin Area HVAC Chill Water AH-11-501	H-2-88164
11-TY	-656E	Changing Room HVAC Chill Water	H-2-88164
11-TY	-656F	Comp/Cont Room HVAC Chill Water CR-11-801A	H-2-88164
11-TY	-656G	Comp/Cont Room HVAC Chill Water CR-11-801B	H-2-88164
11-ZA	-601	Process Area Airlock Airlock Breached Alarm	H-2-88158
11-ZL	-603A	Process Area Airlock Door	H-2-88158
11-ZL	-603B	Process Area Airlock Door	H-2-88158
11-ZL	-604A	Men's Locker Room Airlock Door	H-2-88158
11-ZL	-604B	Men's Locker Room Airlock Door	H-2-88158
11-ZL	-605A	Women's Locker Room Airlock Door	H-2-88158
11-ZL	-605B	Women's Locker Room Airlock Door	H-2-88158
11-ZS	-603	Process Area Airlock Door	H-2-88158
11-ZS	-604	Men's Locker Room Airlock Door	H-2-88158
11-ZS	-605	Women's Locker Room Airlock Door	H-2-88158
11-ZSC	-604	AHU-12-1A/B Building Isolation Damper	H-2-88158
11-ZSC	-611	Glove Box Exhaust Isolation Damper	H-2-88159
11-ZSC	-612	Process Room Exhaust Isolation Damper	H-2-88159
11-ZSC	-619	Process Stack Exhaust Isolation Damper	H-2-88159
11-ZSO	-604	AHU-12-1A/B Building Isolation Damper	H-2-88158
11-ZSO	-611	Glove Box Exhaust Isolation Damper	H-2-88159
11-ZSO	-612	Process Room Exhaust Isolation Damper	H-2-88159
11-ZSO	-619	Process Stack Exhaust Isolation Damper	H-2-88159
12-AS	-051	NDA/NDE Area Radiation Criticality Detect Failure Alarm	
12-AS	-052	Ship/Recv Area Radiation Criticality Dete Failure Alarm	

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
12-AS	-053	Process Area Radiation Criticality Detect Failure Alarm	
12-AS	-054	Stack Monitor Radiation Detector Failure Alarm	
12-AS	-055	LLW RWM Vent Duct Radiation Detector Failure Alarm	
12-AS	-055	LLW RWM Vent Duct Radiation Detector Failure Alarm	
12-AS	-056	LLW Process Vent Duct Radiation Detector Failure Alarm	
12-AS	-056	LLW Process Vent Duct Radiation Detector Failure Alarm	
12-AS	-057	TRU RWM Vent Duct Radiation Detector Failure Alarm	
12-AS	-057	TRU RWM Vent Duct Radiation Detector Failure Alarm	
12-AS	-058	TRU Process Vent Duct Radiation Detector Failure Alarm	
12-AS	-058	TRU Process Vent Duct Radiation Detector Failure Alarm	
12-AS	-061	NDA/NDE Room In-Air Radiation Detector Failure Alarm	
12-AS	-061	NDA/NDE Room In-Air Radiation Detector Failure Alarm	
12-AS	-062	NDA/NDE Room In-Air Radiation Detector No 2 Failure Alarm	
12-AS	-062	NDA/NDE Room In-Air Radiation Detector No 2 Failure Alarm	
12-AS	-063	Ship/Recv Room In-Air Rad. Detector No. 1 Failure Alarm	
12-AS	-063	Ship/Recv Room In-Air Rad. Detector No. 1 Failure Alarm	
12-AS	-064	Ship/Recv Room In-Air Rad. Detector No. 2 Failure Alarm	
12-AS	-064	Ship/Recv Room In-Air Rad. Detector No. 2 Failure Alarm	
12-AS	-065	Process Room In-Air Rad. Detector No. 1 Failure Alarm	
12-AS	-065	Process Room In-Air Rad. Detector No. 1 Failure Alarm	
12-AS	-066	Process Room In-Air Rad. Detector No. 2 Failure Alarm	
12-AS	-066	Process Room In-Air Rad. Detector No. 2 Failure Alarm	
12-AS	-067	Process Room In-Air Rad. Detector No. 3 Failure Alarm	
12-AS	-067	Process Room In-Air Rad. Detector No. 3 Failure Alarm	

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
12-AS	-068	Process Room In-Air Rad. Detector No. 4 Failure Alarm	
12-AS	-068	Process Room In-Air Rad. Detector No. 4 Failure Alarm	
12-AS	-069	Process HVAC In-Air Rad. Detector Failure Alarm	
12-AS	-069	Process HVAC In-Air Rad. Detector Failure Alarm	
12-AS	-071	NDA/NDE Room Gamma Radiation Detector Failure Alarm	
12-AS	-071	NDA/NDE Room Gamma Radiation Detector Failure Alarm	
12-AS	-072	Ship/Recv Room Gamma Radiation Detector Failure Alarm	
12-AS	-072	Ship/Recv Room Gamma Radiation Detector Failure Alarm	
12-AS	-073	Proces Room Gamma Radiation Detector Failure Alarm	
12-AS	-073	Proces Room Gamma Radiation Detector Failure Alarm	
12-AS	-074	LLW RWM Operator Air Radiation Detector Failure Alarm	
12-AS	-074	LLW RWM Operator Air Radiation Detector Failure Alarm	
12-AS	-075	LLW Process Operator Air Radiation Detect Failure Alarm	
12-AS	-075	LLW Process Operator Air Radiation Detect Failure Alarm	
12-AS	-076	TRU RWM Operator Air Radiation Detector Failure Alarm	
12-AS	-076	TRU RWM Operator Air Radiation Detector Failure Alarm	
12-AS	-077	TRU Process Operator Air Radiation Detect Failure Alarm	
12-AS	-077	TRU Process Operator Air Radiation Detect Failure Alarm	
12-ASH	-051	NDA/NDE Area Radiation Criticality Detect High Level Alarm	
12-ASH	-051	NDA/NDE Area Radiation Criticality Detect High Level Alarm	
12-ASH	-052	Ship/Recv Area Radiation Criticality Dete High Level Alarm	
12-ASH	-052	Ship/Recv Area Radiation Criticality Dete High Level Alarm	
12-ASH	-053	Process Area Radiation Criticality Detect High Level Alarm	
12-ASH	-053	Process Area Radiation Criticality Detect High Level Alarm	

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
12-ASH	-054	Stack Monitor Radiation Detector High Level Alarm	
12-ASH	-054	Stack Monitor Radiation Detector High Level Alarm	
12-ASH	-055	LLW RWM Vent Duct Radiation Detector High Level Alarm	
12-ASH	-055	LLW RWM Vent Duct Radiation Detector High Level Alarm	
12-ASH	-056	LLW Process Vent Duct Radiation Detector High Level Alarm	
12-ASH	-056	LLW Process Vent Duct Radiation Detector High Level Alarm	
12-ASH	-057	TRU RWM Vent Duct Radiation Detector High Level Alarm	
12-ASH	-058	TRU Process Vent Duct Radiation Detector High Level Alarm	
12-ASH	-061	NDA/NDE Room In-Air Radiation Detector No 1 High Level Alarm	
12-ASH	-062	NDA/NDE Room In-Air Radiation Detector No 2 High Level Alarm	
12-ASH	-063	Ship/Recv Room In-Air Rad. Detector No. 1 High Level Alarm	
12-ASH	-064	Ship/Recv Room In-Air Rad. Detector No. 2 High Level Alarm	
12-ASH	-065	Process Room In-Air Rad. Detector No. 1 High Level Alarm	
12-ASH	-066	Process Room In-Air Rad. Detector No. 2 High Level Alarm	
12-ASH	-067	Process Room In-Air Rad. Detector No. 3 High Level Alarm	
12-ASH	-068	Process Room In-Air Rad. Detector No. 4 High Level Alarm	
12-ASH	-069	Process HVAC In-Air Rad. Detector High Level Alarm	
12-ASH	-071	NDA/NDE Room Gamma Radiation Detector High Level Alarm	
12-ASH	-072	Ship/Recv Room Gamma Radiation Detector High Level Alarm	
12-ASH	-073	Proces Room Gamma Radiation Detector High Level Alarm	
12-ASH	-074	LLW RWM Operator Air Radiation Detector High Level Alarm	
12-ASH	-075	LLW Process Operator Air Radiation Detect High Level Alarm	
12-ASH	-076	TRU RWM Operator Air Radiation Detector High Level Alarm	
12-ASH	-077	TRU Process Operator Air Radiation Detect High Level Alarm	

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
12-AY	-051	NDA/NDE Area Radiation Criticality Detect	
12-AY	-052	Ship/Recv Area Radiation Criticality Dete	
12-AY	-053	Process Area Radiation Criticality Detect	
12-AY	-054	Stack Monitor Radiation Detector	
12-AY	-055	LLW RWM Ventilation Duct Radiation Detect	
12-AY	-056	LLW Process Ventilatn Duct Radiation Dete	
12-AY	-057	TRU RWM Ventilatn Duct Radiation Detector	
12-AY	-058	TRU Process Ventilatn Duct Radiation Dete	
12-AY	-061	NDA/NDE Room Air Radiation Detector	
12-AY	-062	NDA/NDE Room Air Radiation Detector	
12-AY	-063	Ship/Rcv Room Air Radiation Detector	
12-AY	-064	Ship/Rcv Room Air Radiation Detector	
12-AY	-065	Process Area Room Air Radiation Detector	
12-AY	-066	Process Area Room Air Radiation Detector	
12-AY	-067	Process Area Room Air Radiation Detector	
12-AY	-068	Process Area Room Air Radiation Detector	
12-AY	-069	Process HVAC Room Air Radiation Detector	
12-AY	-071	NDA/NDE Room Gamma Radiation Detector	
12-AY	-072	Ship/Rcv Room Gamma Radiation Detector	
12-AY	-073	Process Area Room Gamma Radiation Detecto	
12-FSL	-074	LLW RWM Operator Air Radiation Detector Low Air Flow	
12-FSL	-075	LLW Process Operator Air Radiation Detect Low Air Flow	
12-FSL	-076	TRU RWM Operator Air Radiation Detector Low Air Flow	
12-FSL	-077	TRU Process Operator Air Radiation Detect Low Air Flow	

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TAG NUMBER		SERVICE REMARKS	FLOWSHEET
12-UA	-110	Annunciator Panel In Control Room	
13-AE	-715A	DR-13-105A Instrument Air Dryer	H-2-88226
13-AE	-715B	DR-13-105B Instrument Air Dryer	H-2-88226
13-AV	-715	DR-13-105A/B Instrument Air Dryer Inlet	H-2-88226
13-FV	-715A	DR-13-105A Instrument Air Dryer Exhaust	H-2-88226
13-FV	-715B	DR-13-105B Instrument Air Dryer Exhaust	H-2-88226
13-HS	-711	Instrument Air Compressor Start/Stop sw.	H-2-88226
13-HS	-712	Plant Air Compressor Start/Stop sw.	H-2-88226
13-PAL	-718	Breathing Air Header	H-2-88226
13-PCV	-700	Potable Water Header	H-2-88225
13-PCV	-716	Plant Air Header	H-2-88226
13-PCV	-717	Instrument Air Header	H-2-88226
13-PCV	-718	Breathing Air Header	H-2-88226
13-PCV	-719	Breathing Air Header	H-2-88226
13-PDISH	-713	F-13-106 Instrument Air Pre-Filter	H-2-88226
13-PDISH	-714	F-13-107 Instrument Air Pre-Filter	H-2-88226
13-PDISH	-716	F-13-108 Instrument Air After Filter	H-2-88226
13-PI	-711	V-13-103 Compressed Air Receiver	H-2-88226
13-PI	-712	V-13-104 Compressed Air Receiver	H-2-88226
13-PI	-714	DR-13-105A/B Instrument Air Dryer Outlet	H-2-88226
13-PI	-715A	DR-13-105A Instrument Air Dryer	H-2-88226
13-PI	-715B	DR-13-105B Instrument Air Dryer	H-2-88226
13-PIT	-700	Potable Water Header	H-2-88225
13-PIT	-716	Plant Air Header	H-2-88226

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WRAP MODULE 1 PRELIMINARY INSTRUMENT INDEX

TAG NUMBER		SERVICE REMARKS	FLOWSHEET
13-PIT	-717	Instrument Air Header	H-2-88226
13-PSL	-718	Breathing Air Header	H-2-88226
13-PSV	-711	Instrument Air Receiver	H-2-88226
13-PSV	-712	Plant Air Receiver	H-2-88226
13-PSV	-715A	DR-13-105A Instrument Air Dryer	H-2-88226
13-PSV	-715B	DR-13-105B Instrument Air Dryer	H-2-88226
13-PSV	-717	V-13-109 Instrument Air Receiver	H-2-88226
13-RO	-714	DR-13-105A/B Instrument Air Dryer Outlet	H-2-88226

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9.13 Instrument I/O List:

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
101-AI-001	CV-09-105 Box Conveyor Scale	09-WIT AI	-219
101-AI-002	DS-05-101A Recv Weigh Conv	05-WIT AI	-107
101-AI-003	DS-05-101B Stor Weigh Conv	05-WIT AI	-110
101-DI-001	CV-09-101A Drum NDE Inlet Conveyor Running	09-SI DI	-201
101-DI-002	CV-09-101A Drum NDE Inlet Conveyor Run Forward	09-XI DI	-201
101-DI-003	CV-09-101A Drum NDE Inlet Conveyor Run Reverse	09-XI DI	-201
101-DI-004	CV-09-101A Drum NDE Inlet Conveyor HOA Auto	09-HS DI	-201A
101-DI-005	CV-09-101A Drum NDE Inlet Conveyor Photoeye	09-ZS DI	-201A
101-DI-006	CV-09-101A Drum NDE Inlet Conveyor AGV Interlock 1	09-ZI DI	-201B
101-DI-007	CV-09-101A Drum NDE Inlet Conveyor AGV Interlock 2	09-ZI DI	-201B
101-DI-008	CV-09-101B Drum NDE Inlet Conveyor Running	09-SI DI	-202
101-DI-009	CV-09-101B Drum NDE Inlet Conveyor Run Forward	09-SI DI	-202
101-DI-010	CV-09-101B Drum NDE Inlet Conveyor Run Reverse	09-XI DI	-202A
101-DI-011	CV-09-101B Drum NDE Inlet Conveyor HOA Auto	09-HS DI	-202B
101-DI-012	CV-09-101B Drum NDE Inlet Conveyor Photoeye	09-ZS DI	-202
101-DI-013	CV-09-101B Drum NDE Inlet Conveyor AGV Interlock 1	09-ZI DI	-202B
101-DI-014	CV-09-101B Drum NDE Inlet Conveyor AGV Interlock 2	09-ZI DI	-202B
101-DI-015	CV-09-101C Drum PAN Inlet Conveyor Running	09-SI DI	-203
101-DI-016	CV-09-101C Drum PAN Inlet Conveyor Run Forward	09-XI DI	-203A
101-DI-017	CV-09-101C Drum PAN Inlet Conveyor Run Reverse	09-XI DI	-203A
101-DI-018	CV-09-101C Drum PAN Inlet Conveyor HOA Auto	09-HS DI	-203B
101-DI-019	CV-09-101C Drum PAN Inlet Conveyor Photoeye	09-ZS DI	-203
101-DI-020	CV-09-101C Drum PAN Inlet Conveyor AGV Interlock 1	09-ZI DI	-203B
101-DI-021	CV-09-101C Drum PAN Inlet Conveyor AGV Interlock 2	09-ZI DI	-203B

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
101-DI-022	CV-09-101D Drum PAN Inlet Conveyor Running	09-SI DI	-204
101-DI-023	CV-09-101D Drum PAN Inlet Conveyor Run Forward	09-XI DI	-204A
101-DI-024	CV-09-101D Drum PAN Inlet Conveyor Run Reverse	09-XI DI	-204A
101-DI-025	CV-09-101D Drum PAN Inlet Conveyor HOA Auto	09-XI DI	-204B
101-DI-026	CV-09-101D Drum PAN Inlet Conveyor Photoeye	09-ZS DI	-204
101-DI-027	CV-09-101D Drum PAN Inlet Conveyor AGV Interlock 1	09-ZI DI	-204B
101-DI-028	CV-09-101D Drum PAN Inlet Conveyor AGV Interlock 2	09-ZI DI	-204B
101-DI-029	CV-09-101E Drum SGS Inlet Conveyor Running	09-SI DI	-205
101-DI-030	CV-09-101E Drum SGS Inlet Conveyor Run Forward	09-XI DI	-205A
101-DI-031	CV-09-101E Drum SGS Inlet Conveyor Run Reverse	09-XI DI	-205A
101-DI-032	CV-09-101E Drum SGS Inlet Conveyor HOA Auto	09-HS DI	-205B
101-DI-033	CV-09-101E Drum SGS Inlet Conveyor Photoeye	09-ZS DI	-205
101-DI-034	CV-09-101E Drum SGS Inlet Conveyor AGV Interlock 1	09-ZI DI	-205B
101-DI-035	CV-09-101E Drum SGS Inlet Conveyor AGV Interlock 2	09-ZI DI	-205B
101-DI-036	CV-09-101F Drum FAP Inlet Conveyor Running	09-SI DI	-206
101-DI-037	CV-09-101F Drum FAP Inlet Conveyor Run Forward	09-XI DI	-206A
101-DI-038	CV-09-101F Drum FAP Inlet Conveyor Run Reverse	09-XI DI	-206A
101-DI-039	CV-09-101F Drum FAP Inlet Conveyor HOA Auto	09-HS DI	-206B
101-DI-040	CV-09-101F Drum FAP Inlet Conveyor Photoeye	09-ZS DI	-206
101-DI-041	CV-09-101F Drum FAP Inlet Conveyor AGV Interlock 1	09-ZI DI	-206B
101-DI-042	CV-09-101F Drum FAP Inlet Conveyor AGV Interlock 2	09-ZI DI	-206B
101-DI-043	CV-09-101G Drum FAP Inlet Conveyor Running	09-SI DI	-207
101-DI-044	CV-09-101G Drum FAP Inlet Conveyor Run Forward	09-XI DI	-207B
101-DI-045	CV-09-101G Drum FAP Inlet Conveyor Run Reverse	09-XI DI	-207B

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
101-DI-046	CV-09-101G Drum FAP Inlet Conveyor HOA Auto	09-HS DI	-207B
101-DI-047	CV-09-101G Drum FAP Inlet Conveyor Photoeye	09-ZS DI	-207
101-DI-048	CV-09-101G Drum FAP Inlet Conveyor AGV Interlock 1	09-ZI DI	-207B
101-DI-049	CV-09-101G Drum FAP Inlet Conveyor AGV Interlock 2	09-ZI DI	-207B
101-DI-050	CV-09-103A NDA/NDE Airlock Conveyor Running	09-SSL DI	-211
101-DI-051	CV-09-103A NDA/NDE Airlock Conveyor Run Forward	09-XI DI	-211A
101-DI-052	CV-09-103A NDA/NDE Airlock Conveyor Run Reverse	09-XI DI	-211A
101-DI-053	CV-09-103A NDA/NDE Airlock Conveyor HOA Auto	09-HS DI	-211B
101-DI-054	CV-09-103A NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-211A
101-DI-055	CV-09-103A NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-211D
101-DI-056	CV-09-103A NDA/NDE Airlock Conveyor AGV Interlock 1	09-ZI DI	-211B
101-DI-057	CV-09-103A NDA/NDE Airlock Conveyor AGV Interlock 2	09-ZI DI	-211B
101-DI-058	CV-09-103B NDA/NDE Airlock Conveyor Running	09-SSL DI	-212
101-DI-059	CV-09-103B NDA/NDE Airlock Conveyor Run Forward	09-XI DI	-212A
101-DI-060	CV-09-103B NDA/NDE Airlock Conveyor Run Reverse	09-XI DI	-212A
101-DI-061	CV-09-103B NDA/NDE Airlock Conveyor HOA Auto	09-HS DI	-212B
101-DI-062	CV-09-103B NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-212A
101-DI-063	CV-09-103B NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-212D
101-DI-064	CV-09-103B NDA/NDE Airlock Conveyor AGV Interlock 1	09-ZI DI	-212B
101-DI-065	CV-09-103B NDA/NDE Airlock Conveyor AGV Interlock 2	09-ZI DI	-212B
101-DI-066	CV-09-104A NDA/NDE Airlock Conveyor Running	09-SSL DI	-213A
101-DI-067	CV-09-104A NDA/NDE Airlock Conveyor Run Forward	09-XI DI	-213A
101-DI-068	CV-09-104A NDA/NDE Airlock Conveyor Run Reverse	09-XI DI	-213A
101-DI-069	CV-09-104A NDA/NDE Airlock Conveyor HOA Auto	09-HS DI	-213B

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
101-DI-070	CV-09-104A NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-213A
101-DI-071	CV-09-104B NDA/NDE Airlock Conveyor Running	09-SSL DI	-214
101-DI-072	CV-09-104B NDA/NDE Airlock Conveyor Run Forward	09-XI DI	-214A
101-DI-073	CV-09-104B NDA/NDE Airlock Conveyor Run Reverse	09-XI DI	-214A
101-DI-074	CV-09-104B NDA/NDE Airlock Conveyor HOA Auto	09-HS DI	-214B
101-DI-075	CV-09-104B NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-214A
101-DI-076	CV-09-201A NDA/NDE Airlock Conveyor Running	09-SSL DI	-215
101-DI-077	CV-09-201A NDA/NDE Airlock Conveyor Run Forward	09-XI DI	-215A
101-DI-078	CV-09-201A NDA/NDE Airlock Conveyor Run Reverse	09-XI DI	-215A
101-DI-079	CV-09-201A NDA/NDE Airlock Conveyor HOA Auto	09-HS DI	-215B
101-DI-080	CV-09-201A NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-215A
101-DI-081	CV-09-201A NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-215D
101-DI-082	CV-09-201A NDA/NDE Airlock Conveyor AGV Interlock 1	09-ZI DI	-215B
101-DI-083	CV-09-201A NDA/NDE Airlock Conveyor AGV Interlock 2	09-ZI DI	-215B
101-DI-084	CV-09-201B NDA/NDE Airlock Conveyor Running	09-SSL DI	-216
101-DI-085	CV-09-201B NDA/NDE Airlock Conveyor Run Forward	09-XI DI	-216A
101-DI-086	CV-09-201B NDA/NDE Airlock Conveyor Run Reverse	09-XI DI	-216A
101-DI-087	CV-09-201B NDA/NDE Airlock Conveyor HOA Auto	09-HS DI	-216B
101-DI-088	CV-09-201B NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-216A
101-DI-089	CV-09-201B NDA/NDE Airlock Conveyor Photoeye	09-ZS DI	-216D
101-DI-090	CV-09-201B NDA/NDE Airlock Conveyor AGV Interlock 1	09-ZI DI	-216B
101-DI-091	CV-09-201B NDA/NDE Airlock Conveyor AGV Interlock 2	09-ZI DI	-216B
101-DI-092	NDA/NDE Airlock Door 1 Open	09-ZSO DI	-217
101-DI-093	NDA/NDE Airlock Door 1 Closed	09-ZSC DI	-217

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
101-DI-094	NDA/NDE Airlock Door 1 HOA Auto	09-HS DI	-217B
101-DI-095	Process Airlock Door 1 Open	09-ZSO DI	-218
101-DI-096	Process Airlock Door 1 Closed	09-ZSC DI	-218
101-DI-097	Process Airlock Door 1 HOA Auto	09-HS DI	-218B
101-DI-098	NDA/NDE Airlock Door 2 Open	09-ZSO DI	-251
101-DI-099	NDA/NDE Airlock Door 2 Closed	09-ZSC DI	-251
101-DI-100	NDA/NDE Airlock Door 2 HOA Auto	09-HS DI	-251B
101-DI-101	Process Airlock Door 2 Open	09-ZSO DI	-252
101-DI-102	Process Airlock Door 2 Closed	09-ZSC DI	-252
101-DI-103	Process Airlock Door 2 HOA Auto	09-HS DI	-252B
101-DI-104	NDA/NDE Airlock Door 1 Door Clear	09-ZS DI	-217
101-DI-105	Process Airlock Door 1 Door Clear	09-ZS DI	-218
101-DI-106	NDA/NDE Airlock Door 2 Door Clear	09-ZS DI	-251
101-DI-107	Porcess Airlock Door 2 Door Clear	09-ZS DI	-252
101-DI-108	CV-05-101A Recv Weigh Inlet Index Conv Start/Stop	05-HS DI	-106B
101-DI-109	CV-05-101A Recv Weigh Inlet Index Conv Conveyor HOA Auto	05-HS DI	-106A
101-DI-110	CV-05-101A Recv Weigh Inlet Index Conv Run	05-XI DI	-106A
101-DI-111	CV-05-101A Recv Weigh Inlet Index Conv Index HOA Auto	05-HS DI	-106C
101-DI-112	CV-05-101A Recv Weigh Inlet Index Conv Drum at Exit	05-ZS DI	-106
101-DI-113	DS-05-101A Recv Weigh Conv Drum on Scale	05-ZS DI	-107
101-DI-114	DS-05-101A Recv Weigh Conv Conveyor HOA Auto	05-HS DI	-107A
101-DI-115	DS-05-101A Recv Weigh Conv Conveyor Index	05-HS DI	-107B
101-DI-116	DS-05-101A Recv Weigh Conv Run	05-XI DI	-107B
101-DI-117	CV-05-101B Recv Weigh Outlet Index Conv Conveyor Full	05-ZS DI	-108A

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
101-DI-118	CV-05-101B Recv Weigh Outlet Index Conv Conveyor HOA Auto	05-HS DI	-108A
101-DI-119	CV-05-101B Recv Weigh Outlet Index Conv Run	05-XI DI	-108B
101-DI-120	CV-05-101B Recv Weigh Outlet Index Conv Index HOA Auto	05-HS DI	-108B
101-DI-121	CV-05-101B Recv Weigh Outlet Index Conv Drum at End	05-ZS DI	-108B
101-DI-122	CV-05-101B Recv Weigh Outlet Index Conv AGV Interlock 1	05-ZI DI	-108C
101-DI-123	CV-05-101B Recv Weigh Outlet Index Conv AGV Interlock 2	05-ZI DI	-108C
101-DI-124	CV-05-102 Stor Weigh Index Conv Conv Full	05-ZS DI	-109A
101-DI-125	CV-05-102 Stor Weigh Index Conv Conv HOA Auto	05-HS DI	-109A
101-DI-126	CV-05-102 Stor Weigh Index Conv Start/Stop	05-HS DI	-109B
101-DI-127	CV-05-102 Stor Weigh Index Conv Index P.B.	05-HS DI	-109C
101-DI-128	CV-05-102 Stor Weigh Index Conv Drum at End	05-ZS DI	-109B
101-DI-129	CV-05-102 Stor Weigh Index Conv Running	05-XI DI	-109A
101-DI-130	CV-05-102 Stor Weigh Index Conv AGV Interlock 1	05-ZI DI	-109C
101-DI-131	CV-05-102 Stor Weigh Index Conv AGV Interlock 2	05-ZI DI	-109C
101-DI-132	DS-05-101B Stor Weigh Conv Drum on Conv	05-ZS DI	-110A
101-DI-133	DS-05-101B Stor Weigh Conv HOA Auto	05-HS DI	-110A
101-DI-134	DS-05-101B Stor Weigh Conv Running	05-XI DI	-110B
101-DI-135	DS-05-101B Stor Weigh Conv Index P.B.	05-HS DI	-110B
101-DI-136	DS-05-101B Stor Weigh Conv Drum Overrun	05-ZS DI	-110B
101-DO-001	CV-09-101A Drum NDE Inlet Conveyor Remote Forward	09-HIS DO	-201
101-DO-002	CV-09-101A Drum NDE Inlet Conveyor Remote Reverse	09-HIS DO	-201
101-DO-003	CV-09-101A Drum NDE Inlet Conveyor AGV Interlock 1	09-ZI DO	-201B
101-DO-004	CV-09-101A Drum NDE Inlet Conveyor AGV Interlock 2	09-ZI DO	-201B
101-DO-005	CV-09-101B Drum NDE Inlet Conveyor Remote Forward	09-HIS DO	-202

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
101-DO-006	CV-09-101B Drum NDE Inlet Conveyor Remote Reverse	09-HIS DO	-202
101-DO-007	CV-09-101B Drum NDE Inlet Conveyor AGV Interlock 1	09-ZI DO	-202B
101-DO-008	CV-09-101B Drum NDE Inlet Conveyor AGV Interlock 2	09-ZI DO	-202B
101-DO-009	CV-09-101C Drum PAN Inlet Conveyor Remote Forward	09-HIS DO	-203
101-DO-010	CV-09-101C Drum PAN Inlet Conveyor Remote Reverse	09-HIS DO	-203
101-DO-011	CV-09-101C Drum PAN Inlet Conveyor AGV Interlock 2	09-ZI DO	-203B
101-DO-012	CV-09-101C Drum PAN Inlet Conveyor AGV Interlock 2	09-ZI DO	-203B
101-DO-013	CV-09-101D Drum PAN Inlet Conveyor Remote Forward	09-HIS DO	-204
101-DO-014	CV-09-101D Drum PAN Inlet Conveyor Remote Reverse	09-HIS DO	-204
101-DO-015	CV-09-101D Drum PAN Inlet Conveyor AGV Interlock 1	09-ZI DO	-204B
101-DO-016	CV-09-101D Drum PAN Inlet Conveyor AGV Interlock 2	09-ZI DO	-204B
101-DO-017	CV-09-101E Drum SGS Inlet Conveyor Remote Forward	09-HIS DO	-205
101-DO-018	CV-09-101E Drum SGS Inlet Conveyor Remote Reverse	09-HIS DO	-205
101-DO-019	CV-09-101E Drum SGS Inlet Conveyor AGV Interlock 1	09-ZI DO	-205B
101-DO-020	CV-09-101E Drum SGS Inlet Conveyor AGV Interlock 2	09-ZI DO	-205B
101-DO-021	CV-09-101F Drum FAP Inlet Conveyor Remote Forward	09-HIS DO	-206
101-DO-022	CV-09-101F Drum FAP Inlet Conveyor Remote Reverse	09-HIS DO	-206
101-DO-023	CV-09-101F Drum FAP Inlet Conveyor AGV Interlock 1	09-ZI DO	-206B
101-DO-024	CV-09-101F Drum FAP Inlet Conveyor AGV Interlock 2	09-ZI DO	-206B
101-DO-025	CV-09-101G Drum FAP Inlet Conveyor Remote Forward	09-HIS DO	-207
101-DO-026	CV-09-101G Drum FAP Inlet Conveyor Remote Reverse	09-HIS DO	-207
101-DO-027	CV-09-101G Drum FAP Inlet Conveyor AGV Interlock 1	09-ZI DO	-207B
101-DO-028	CV-09-101G Drum FAP Inlet Conveyor AGV Interlock 2	09-ZI DO	-207B
101-DO-029	CV-09-103A NDA/NDE Airlock Conveyor Remote Forward	09-HIS DO	-211

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
101-DO-030	CV-09-103A NDA/NDE Airlock Conveyor Remote Reverse	09-HIS DO	-211
101-DO-031	CV-09-103A NDA/NDE Airlock Conveyor AGV Interlock 1	09-ZI DO	-211B
101-DO-032	CV-09-103A NDA/NDE Airlock Conveyor AGV Interlock 2	09-ZI DO	-211B
101-DO-033	CV-09-103B NDA/NDE Airlock Conveyor Remote Forward	09-HIS DO	-212
101-DO-034	CV-09-103B NDA/NDE Airlock Conveyor Remote Reverse	09-HIS DO	-212
101-DO-035	CV-09-103B NDA/NDE Airlock Conveyor AGV Interlock 1	09-ZI DO	-212B
101-DO-036	CV-09-103B NDA/NDE Airlock Conveyor AGV Interlock 2	09-ZI DO	-212B
101-DO-037	CV-09-104A NDA/NDE Airlock Conveyor Remote Forward	09-HIS DO	-213
101-DO-038	CV-09-104A NDA/NDE Airlock Conveyor Remote Reverse	09-HIS DO	-213
101-DO-039	CV-09-104B NDA/NDE Airlock Conveyor Remote Forward	09-HIS DO	-214
101-DO-040	CV-09-104B NDA/NDE Airlock Conveyor Remote Reverse	09-HIS DO	-214
101-DO-041	CV-09-201A NDA/NDE Airlock Conveyor Remote Forward	09-HIS DO	-215
101-DO-042	CV-09-201A NDA/NDE Airlock Conveyor Remote Reverse	09-HIS DO	-215
101-DO-043	CV-09-201A NDA/NDE Airlock Conveyor AGV Interlock 1	09-ZI DO	-215B
101-DO-044	CV-09-201A NDA/NDE Airlock Conveyor AGV Interlock 2	09-ZI DO	-215B
101-DO-045	CV-09-201B NDA/NDE Airlock Conveyor Remote Forward	09-HIS DO	-216
101-DO-046	CV-09-201B NDA/NDE Airlock Conveyor Remote Reverse	09-HIS DO	-216
101-DO-047	CV-09-201B NDA/NDE Airlock Conveyor AGV Interlock 1	09-ZI DO	-216B
101-DO-048	CV-09-201B NDA/NDE Airlock Conveyor AGV Interlock 2	09-ZI DO	-216B
101-DO-049	NDA/NDE Airlock Door 1 Remote Open	09-HIS DO	-217
101-DO-050	Process Airlock Door 1 Remote Open	09-HIS DO	-218
101-DO-051	NDA/NDE AirLock Door 2 Remote Open	09-HIS DO	-251
101-DO-052	Process AirLock Door 2 Remote Open	09-HIS DO	-252
101-DO-053	CV-05-101A Recv Weigh Inlet Index Conv Auto Forward	05-HS DO	-106A

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
101-DO-054	CV-05-101A Recv Weigh Inlet Index Conv	05-ZEV	-106
	Auto Index	DO	
101-DO-055	DS-05-101A Recv Weigh Conv	05-HS	-107A
	Auto Forward	DO	
101-DO-056	CV-05-101B Recv Weigh Outlet Index Conv	05-HS	-108A
	Auto Forward	DO	
101-DO-057	CV-05-101B Recv Weigh Outlet Index Conv	05-ZEV	-108
	Auto Index	DO	
101-DO-058	CV-05-101B Recv Weigh Outlet Index Conv	05-ZI	-108C
	AGV Interlock 1	DO	
101-DO-059	CV-05-101B Recv Weigh Outlet Index Conv	05-ZI	-108C
	AGV Interlock 2	DO	
101-DO-060	CV-05-102 Stor Weigh Index Conv	05-HS	-109A
	Auto Run	DO	
101-DO-061	CV-05-102 Stor Weigh Index Conv	05-ZEV	-109
	Index Clutch	DO	
101-DO-062	CV-05-102 Stor Weigh Index Conv	05-ZI	-109C
	AGV Interlock 1	DO	
101-DO-063	CV-05-102 Stor Weigh Index Conv	05-ZI	-109C
	AGV Interlock 2	DO	
101-DO-064	DS-05-101B Stor Weigh Conv	05-HS	-110A
	Auto Run	DO	
101-RS-001	NDA/NDE Area Carousel	09-NY	-201
	Bar Code Scanner	RS	
101-RS-002	CV-09-105 Box Conveyor/Scale	09-NY	-211
	Bar Code Scanner	RS	
101-RS-003	DS-05-101A Recv Weigh Conv	05-NY	-102
	Bar Code Scanner	RS	
102-DI-001	LT-09-201A Drum Lift Table	09-ZI	-221B
	AGV Interlock 1	DI	
102-DI-002	LT-09-201A Drum Lift Table	09-ZI	-221B
	AGV Interlock 2	DI	
102-DI-003	LT-09-201A Drum Lift Table	09-ZS	-221A
	Drum Loaded From AGV	DI	
102-DI-004	LT-09-201A Drum Lift Table	09-ZS	-221C
	Lift Up	DI	
102-DI-005	LT-09-201A Drum Lift Table	09-ZS	-221D
	Lift Down	DI	
102-DI-006	LT-09-201A Drum Lift Table	09-XI	-221A
	Run Forward	DI	
102-DI-007	LT-09-201A Drum Lift Table	09-XI	-221A
	Run Reverse	DI	
102-DI-008	LT-09-201A Drum Lift Table	09-HS	-221B
	HOA Auto	DI	
102-DI-009	LT-09-201A Drum Lift Table	09-ZS	-221E
	Drum Under Entry	DI	
102-DI-010	LT-09-201A Drum Lift Table	09-SSL	-221
	Running	DI	

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
102-DI-011	LT-09-201A Drum Lift Table Hydraulics Pump Running	09-XI DI	-222
102-DI-012	LT-09-201A Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-222
102-DI-013	LT-09-201B Drum Lift Table AGV Interlock 1	09-ZI DI	-223B
102-DI-014	LT-09-201B Drum Lift Table AGV Interlock 2	09-ZI DI	-223B
102-DI-015	LT-09-201B Drum Lift Table Drum Loade From AGV	09-ZS DI	-223A
102-DI-016	LT-09-201B Drum Lift Table Lift Up	09-ZS DI	-221C
102-DI-017	LT-09-201B Drum Lift Table Lift Down	09-ZS DI	-221D
102-DI-018	LT-09-201B Drum Lift Table Run Forward	09-XI DI	-223A
102-DI-019	LT-09-201B Drum Lift Table Run Reverse	09-XI DI	-223A
102-DI-020	LT-09-201B Drum Lift Table HOA Auto	09-HS DI	-223B
102-DI-021	LT-09-201B Drum Lift Table Drum Under Entry	09-ZS DI	-223E
102-DI-022	LT-09-201B Drum Lift Table Hydraulics Running	09-SSL DI	-223
102-DI-023	LT-09-201B Drum Lift Table Hydraulics Pump Running	09-XI DI	-224
102-DI-024	LT-09-201B Drum Lift Table Low Pressure	09-PSL DI	-224
102-DI-025	LT-09-201C Drum Lift Table AGV Interlock 1	09-ZI DI	-225B
102-DI-026	LT-09-201C Drum Lift Table AGV Interlock 2	09-ZI DI	-225B
102-DI-027	LT-09-201C Drum Lift Table Drum Loaded From AGV	09-ZS DI	-225A
102-DI-028	LT-09-201C Drum Lift Table Lift Up	09-ZS DI	-225C
102-DI-029	LT-09-201C Drum Lift Table Lift Down	09-ZS DI	-225D
102-DI-030	LT-09-201C Drum Lift Table Run Forward	09-XI DI	-225A
102-DI-031	LT-09-201C Drum Lift Table Run Reverse	09-XI DI	-225A
102-DI-032	LT-09-201C Drum Lift Table HOA Auto	09-HS DI	-225B
102-DI-033	LT-09-201C Drum Lift Table Drum Under Entry	09-ZS DI	-225E
102-DI-034	LT-09-201C Drum Lift Table Running	09-SSL DI	-225

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
102-DI-035	LT-09-201C Drum Lift Table Hydraulics Pump Running	09-XI DI	-224
102-DI-036	LT-09-201C Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-224
102-DI-037	LT-09-201D Drum Lift Table AGV Interlock 1	09-ZI DI	-227B
102-DI-038	LT-09-201D Drum Lift Table AGV Interlock 2	09-ZI DI	-227B
102-DI-039	LT-09-201D Drum Lift Table Drum Loaded from AGV	09-ZS DI	-227A
102-DI-040	LT-09-201D Drum Lift Table Lift Up	09-ZS DI	-227C
102-DI-041	LT-09-201D Drum Lift Table Lift Down	09-ZS DI	-227D
102-DI-042	LT-09-201D Drum Lift Table Run Forward	09-XI DI	-227A
102-DI-043	LT-09-201D Drum Lift Table Run Reverse	09-XI DI	-227A
102-DI-044	LT-09-201D Drum Lift Table HOA Auto	09-HS DI	-227B
102-DI-045	LT-09-201D Drum Lift Table Drum Under Entry	09-ZS DI	-227E
102-DI-046	LT-09-201D Drum Lift Table Running	09-SSL DI	-227
102-DI-047	LT-09-201D Drum Lift Table Hydraulics Pump Running	09-XI DI	-228
102-DI-048	LT-09-201D Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-228
102-DI-049	LT-09-201E Drum Lift Table AGV Interlock 1	09-ZI DI	-229B
102-DI-050	LT-09-201E Drum Lift Table AGV Interlock 2	09-ZI DI	-229B
102-DI-051	LT-09-201E Drum Lift Table Drum Loaded from AGV	09-ZS DI	-229A
102-DI-052	LT-09-201E Drum Lift Table Lift Up	09-ZS DI	-229C
102-DI-053	LT-09-201E Drum Lift Table Lift Down	09-ZS DI	-229D
102-DI-054	LT-09-201E Drum Lift Table Run Forward	09-XI DI	-229A
102-DI-055	LT-09-201E Drum Lift Table Run Reverse	09-XI DI	-229A
102-DI-056	LT-09-201E Drum Lift Table HOA Auto	09-HS DI	-229B
102-DI-057	LT-09-201E Drum Lift Table Drum Under Entry	09-ZS DI	-229E
102-DI-058	LT-09-201E Drum Lift Table Running	09-SSL DI	-229

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
102-DI-059	LT-09-201E Drum Lift Table Hydraulics Pump Running	09-XI DI	-230
102-DI-060	LT-09-201E Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-230
102-DI-061	LT-09-201F Drum Lift Table AGV Interlock 1	09-ZI DI	-231B
102-DI-062	LT-09-201F Drum Lift Table AGV Interlock 2	09-ZI DI	-231B
102-DI-063	LT-09-201F Drum Lift Table Drum Loaded from AGV	09-ZS DI	-231A
102-DI-064	LT-09-201F Drum Lift Table Lift Up	09-ZS DI	-231C
102-DI-065	LT-09-201F Drum Lift Table Lift Down	09-ZS DI	-231D
102-DI-066	LT-09-201F Drum Lift Table Run Forward	09-XI DI	-231A
102-DI-067	LT-09-201F Drum Lift Table Run Reverse	09-XI DI	-231A
102-DI-068	LT-09-201F Drum Lift Table HOA Auto	09-HS DI	-231B
102-DI-069	LT-09-201F Drum Lift Table Drumn Under Entry	09-ZS DI	-231E
102-DI-070	LT-09-201F Drum Lift Table Running	09-SSL DI	-231
102-DI-071	LT-09-201F Drum Lift Table Hydraulics Pump Running	09-XI DI	-232
102-DI-072	LT-09-201F Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-232
102-DI-073	LT-09-201G Drum Lift Table AGV Interlock 1	09-ZI DI	-233B
102-DI-074	LT-09-201G Drum Lift Table AGV Interlock 2	09-ZI DI	-233B
102-DI-075	LT-09-201G Drum Lift Table Drum Loaded From AGV	09-ZS DI	-233A
102-DI-076	LT-09-201G Drum Lift Table Lift Up	09-ZS DI	-233C
102-DI-077	LT-09-201G Drum Lift Table Lift Down	09-ZS DI	-233D
102-DI-078	LT-09-201G Drum Lift Table Run Forward	09-XI DI	-233A
102-DI-079	LT-09-201G Drum Lift Table Run Reverse	09-XI DI	-233A
102-DI-080	LT-09-201G Drum Lift Table HOA Auto	09-HS DI	-233B
102-DI-081	LT-09-201G Drum Lift Table Drum Under Entry	09-ZS DI	-233E
102-DI-082	LT-09-201G Drum Lift Table Running	09-SSL DI	-233

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
102-DI-083	LT-09-201G Drum Lift Table Hydraulics Pump Running	09-XI DI	-234
102-DI-084	LT-09-201G Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-234
102-DI-085	LT-09-201H Drum Lift Table AGV Interlock 1	09-ZI DI	-235B
102-DI-086	LT-09-201H Drum Lift Table AGV Interlock 2	09-ZI DI	-235B
102-DI-087	LT-09-201H Drum Lift Table Drum Loaded from AGV	09-ZS DI	-235A
102-DI-088	LT-09-201H Drum Lift Table Lift Up	09-ZS DI	-235C
102-DI-089	LT-09-201H Drum Lift Table Lift Down	09-ZS DI	-235D
102-DI-090	LT-09-201H Drum Lift Table Run Forward	09-XI DI	-235A
102-DI-091	LT-09-201H Drum Lift Table Run Reverse	09-XI DI	-235A
102-DI-092	LT-09-201H Drum Lift Table HOA Auto	09-HS DI	-235B
102-DI-093	LT-09-201H Drum Lift Table Drum Under Entry	09-ZS DI	-235E
102-DI-094	LT-09-201H Drum Lift Table Running	09-SSL DI	-235
102-DI-095	LT-09-201H Drum Lift Table Hydraulics Pump Running	09-XI DI	-236
102-DI-096	LT-09-201H Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-236
102-DI-097	LT-09-201J Drum Lift Table AGV Interlock 1	09-ZI DI	-237B
102-DI-098	LT-09-201J Drum Lift Table AGV Interlock 2	09-ZI DI	-237B
102-DI-099	LT-09-201J Drum Lift Table Drum Loaded from AGV	09-ZS DI	-237A
102-DI-100	LT-09-201J Drum Lift Table Lift Up	09-ZS DI	-237C
102-DI-101	LT-09-201J Drum Lift Table Lift Down	09-ZS DI	-237D
102-DI-102	LT-09-201J Drum Lift Table Run Forward	09-XI DI	-237A
102-DI-103	LT-09-201J Drum Lift Table Run Reverse	09-XI DI	-237A
102-DI-104	LT-09-201J Drum Lift Table HOA Auto	09-HS DI	-237B
102-DI-105	LT-09-201J Drum Lift Table Drum Under Entry	09-ZS DI	-237E
102-DI-106	LT-09-201J Drum Lift Table Running	09-SSL DI	-237

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
102-DI-107	LT-09-201J Drum Lift Table Hydraulics Pump Running	09-XI DI	-238
102-DI-108	LT-09-201J Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-238
102-DI-109	LT-09-201K Drum Lift Table AGV Interlock 1	09-ZI DI	-239B
102-DI-110	LT-09-201K Drum Lift Table AGV Interlock 2	09-ZI DI	-239B
102-DI-111	LT-09-201K Drum Lift Table Drum Loaded from AGV	09-ZS DI	-239A
102-DI-112	LT-09-201K Drum Lift Table Lift Up	09-ZS DI	-239C
102-DI-113	LT-09-201K Drum Lift Table Lift Down	09-ZS DI	-239D
102-DI-114	LT-09-201K Drum Lift Table Run Forward	09-XI DI	-239A
102-DI-115	LT-09-201K Drum Lift Table Run Reverse	09-XI DI	-239A
102-DI-116	LT-09-201K Drum Lift Table HOA Auto	09-HS DI	-239B
102-DI-117	LT-09-201K Drum Lift Table Drum Under Entry	09-ZS DI	-239E
102-DI-118	LT-09-201K Drum Lift Table Running	09-SSL DI	-239
102-DI-119	LT-09-201K Drum Lift Table Hydraulics Pump Running	09-XI DI	-240
102-DI-120	LT-09-201K Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-240
102-DI-121	LT-09-201L Drum Lift Table AGV Interlock 1	09-ZI DI	-241B
102-DI-122	LT-09-201L Drum Lift Table AGV Interlock 2	09-ZI DI	-241B
102-DI-123	LT-09-201L Drum Lift Table Drum Loaded from AGV	09-ZS DI	-241A
102-DI-124	LT-09-201L Drum Lift Table Lift Up	09-ZS DI	-241C
102-DI-125	LT-09-201L Drum Lift Table Lift Down	09-ZS DI	-241D
102-DI-126	LT-09-201L Drum Lift Table Run Forward	09-XI DI	-241A
102-DI-127	LT-09-201L Drum Lift Table Run Reverse	09-XI DI	-241A
102-DI-128	LT-09-201L Drum Lift Table HOA Auto	09-HS DI	-241B
102-DI-129	LT-09-201L Drum Lift Table Drum Under Entry	09-ZS DI	-241E
102-DI-130	LT-09-201L Drum Lift Table Running	09-SSL DI	-241

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
102-DI-131	LT-09-201L Drum Lift Table Hydraulics Pump Running	09-XI DI	-242
102-DI-132	LT-09-201L Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-242
102-DI-133	LT-09-201M Drum Lift Table AGV Interlock 1	09-ZI DI	-243B
102-DI-134	LT-09-201M Drum Lift Table AGV Interlock 2	09-ZI DI	-243B
102-DI-135	LT-09-201M Drum Lift Table Drum Loaded from AGV	09-ZS DI	-243A
102-DI-136	LT-09-201M Drum Lift Table Lift Up	09-ZS DI	-243C
102-DI-137	LT-09-201M Drum Lift Table Lift Down	09-ZS DI	-243D
102-DI-138	LT-09-201M Drum Lift Table Run Forward	09-XI DI	-243A
102-DI-139	LT-09-201M Drum Lift Table Run Reverse	09-XI DI	-243A
102-DI-140	LT-09-201M Drum Lift Table HOA Auto	09-HS DI	-243B
102-DI-141	LT-09-201M Drum Lift Table Drum Under Entry	09-ZS DI	-243E
102-DI-142	LT-09-201M Drum Lift Table Running	09-SSL DI	-243
102-DI-143	LT-09-201M Drum Lift Table Hydraulics Pump Running	09-XI DI	-244
102-DI-144	LT-09-201M Drum Lift Table Hydraulics Low Pressure	09-PSL DI	-244
102-DO-001	LT-09-201A Drum Lift Table Remote Forward	09-HIS DO	-221
102-DO-002	LT-09-201A Drum Lift Table Remote Reverse	09-HIS DO	-221
102-DO-003	LT-09-201A Drum Lift Table AGV Interlock 1	09-ZI DO	-221B
102-DO-004	LT-09-201A Drum Lift Table AGV Interlock 2	09-ZI DO	-221B
102-DO-005	LT-09-201B Drum Lift Table Remote Forward	09-HIS DO	-223
102-DO-006	LT-09-201B Drum Lift Table Remote Reverse	09-HIS DO	-223
102-DO-007	LT-09-201B Drum Lift Table AGV Interlock 1	09-ZI DO	-223B
102-DO-008	LT-09-201B Drum Lift Table AGV Interlock 2	09-ZI DO	-223B
102-DO-009	LT-09-201C Drum Lift Table Remote Forward	09-HIS DO	-223
102-DO-010	LT-09-201C Drum Lift Table Remote Reverse	09-HIS DO	-223

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
102-DO-011	LT-09-201C Drum Lift Table AGV Interlock 1	09-XI DO	-223B
102-DO-012	LT-09-201C Drum Lift Table AGV Interlock 2	09-XI DO	-223B
102-DO-013	LT-09-201D Drum Lift Table Remote Forward	09-HIS DO	-227
102-DO-014	LT-09-201D Drum Lift Table Remote Reverse	09-HIS DO	-227
102-DO-015	LT-09-201D Drum Lift Table AGV Interlock 1	09-ZI DO	-227B
102-DO-016	LT-09-201D Drum Lift Table AGV Interlock 2	09-ZI DO	-227B
102-DO-017	LT-09-201E Drum Lift Table Remote Forward	09-HIS DO	-229
102-DO-018	LT-09-201E Drum Lift Table Remote Reverse	09-HIS DO	-229
102-DO-019	LT-09-201E Drum Lift Table AGV Interlock 1	09-ZI DO	-229B
102-DO-020	LT-09-201E Drum Lift Table AGV Interlock 2	09-ZI DO	-229B
102-DO-021	LT-09-201F Drum Lift Table Remote Forward	09-HIS DO	-231
102-DO-022	LT-09-201F Drum Lift Table Remote Reverse	09-HIS DO	-231
102-DO-023	LT-09-201F Drum Lift Table AGV Interlock 1	09-ZI DO	-231B
102-DO-024	LT-09-201F Drum Lift Table AGV Interlock 2	09-ZI DO	-231B
102-DO-025	LT-09-201G Drum Lift Table Remote Forward	09-HIS DO	-233
102-DO-026	LT-09-201G Drum Lift Table Remote Reverse	09-HIS DO	-233
102-DO-027	LT-09-201G Drum Lift Table AGV Interlock 1	09-ZI DO	-233B
102-DO-028	LT-09-201G Drum Lift Table AGV Interlock 2	09-ZI DO	-233B
102-DO-029	LT-09-201H Drum Lift Table Remote Foraward	09-HIS DO	-235
102-DO-030	LT-09-201H Drum Lift Table Remote Reverse	09-HIS DO	-235
102-DO-031	LT-09-201H Drum Lift Table AGV Interlock 1	09-ZI DO	-235B
102-DO-032	LT-09-201H Drum Lift Table AGV Interlock 2	09-ZI DO	-235B
102-DO-033	LT-09-201J Drum Lift Table Remote Forward	09-HIS DO	-237
102-DO-034	LT-09-201J Drum Lift Table Remote Reverse	09-HIS DO	-237

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
102-DO-035	LT-09-201J Drum Lift Table	09-ZI	-237B
	AGV Interlock 1	DO	
102-DO-036	LT-09-201J Drum Lift Table	09-ZI	-237B
	AGV Interlock 2	DO	
102-DO-037	LT-09-201K Drum Lift Table	09-HIS	-239
	Remote Forward	DO	
102-DO-038	LT-09-201K Drum Lift Table	09-HIS	-239
	Remote Reverse	DO	
102-DO-039	LT-09-201K Drum Lift Table	09-ZI	-239B
	AGV Interlock 1	DO	
102-DO-040	LT-09-201K Drum Lift Table	09-ZI	-239B
	AGV Interlock 2	DO	
102-DO-041	LT-09-201L Drum Lift Table	09-HIS	-241
	Remote Forward	DO	
102-DO-042	LT-09-201L Drum Lift Table	09-HIS	-241
	Remote Reverse	DO	
102-DO-043	LT-09-201L Drum Lift Table	09-ZI	-241B
	AGV Interlock 1	DO	
102-DO-044	LT-09-201L Drum Lift Table	09-ZI	-241B
	AGV Interlock 2	DO	
102-DO-045	LT-09-201M Drum Lift Table	09-HIS	-243
	Remote Forward	DO	
102-DO-046	LT-09-201M Drum Lift Table	09-HIS	-243
	Remote Reverse	DO	
102-DO-047	LT-09-201M Drum Lift Table	09-ZI	-243B
	AGV Interlock 1	DO	
102-DO-048	LT-09-201M Drum Lift Table	09-ZI	-243B
	AGV Interlock 2	DO	
102-RS-001	Prcess Area Carousel	09-NY	-221
	Bar Code Scanner	RS	
102-RS-002	LLW Glove Box	07-NY	-321
	Bar Code Scanner	RS	
102-RS-003	LLW Glove Box	07-NY	-331
	Bar Code Scanner	RS	
102-RS-004	LLW Glove Box	07-NY	-332
	Bar Code Scanner	RS	
102-RS-005	LLW RWM Glove Box	07-NY	-381
	Bar Code Scanner	RS	
102-RS-006	LLW RWM Glove Box	07-NY	-390
	Bar Code Scanner	RS	
103-RS-001	TRU Glove Box	07-NY	-301
	Bar Code Scanner	RS	
103-RS-002	TRU Glove Box	07-NY	-311
	Bar Code Scanner	RS	
103-RS-003	TRU Glove Box	07-NY	-312
	Bar Code Scanner	RS	
103-RS-004	TRU RWM Glove Box	07-NY	-361
	Bar Code Scanner	RS	

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE
103-RS-005	TRU RWM Glove Box Bar Code Scanner	07-NY -370 RS
104-AI-001	MA-11-203A Proc Area Supply Fan Outlet Flow	11-FE/FT -602A AI
104-AI-002	MA-11-203B Proc.Area Supply Fan Outlet Flow	11-FE/FT -602B AI
104-AI-003	Process Area Air Handlers Inlet Temperature	11-TE/TIT-601 AI
104-AI-004	Process Area Air Handlers Inlet Humidity	11-MIT -601 AI
104-AI-005	Process Area 1 Differential Pressure	11-PDIT -601 AI
104-AI-006	Process Area 2 Differential Pressure	11-PDIT -602 AI
104-AI-007	Process Area Cascading Diff. Pressure	11-PDIT -603 AI
104-AI-008	FT-11-201A Glove Box Exhaust Flow	11-FE/FT -617A AI
104-AI-009	FT-11-201B Glove Box Exhaust Flow	11-FE/FT -617B AI
104-AI-010	FT-11-202A Process Area Exhaust Flow	11-FE/FT -618A AI
104-AI-011	FT-11-202B Process Area Exhaust Flow	11-FE/FT -618B AI
104-AI-012	Instrument Air Header Pressure	13-PIT -717 AI
104-AI-013	Potable Water Header Pressure	13-PIT -700 AI
104-AI-014	NDA/NDE Critical Radiation Detector	12-AY -051 AI
104-AI-015	Ship/Recv Critical Radiation Detector	12-AY -052 AI
104-AI-016	Process Area Critical Radiation Detector	12-AY -053 AI
104-AI-017	LLW RWM Ventilatn Duct Radiation Detectr	12-AY -055 AI
104-AI-018	LLW Process Area Ventil. Radiation Det.	12-AY -056 AI
104-AI-019	TRU RWM Area Vent. Duct Radiation Det.	12-AY -057 AI
104-AI-020	TRU Proc. Area Vent. Duct Radiation Det.	12-AY -058 AI
104-AI-021	NDA/NDE Room Air Radiation Detector	12-AY -061 AI
104-AI-022	NDA/NDE Room Air Radiation Detector	12-AY -062 AI
104-AI-023	Ship/Rcv Room Air Radiation Detector	12-AY -063 AI

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
104-AI-024	Ship/Rcv Room Air Radiation Detector	12-AY AI	-064
104-AI-025	Process Area Room Air Radiation Detector	12-AY AI	-065
104-AI-026	Process Area Room Air Radiation Detector	12-AY AI	-066
104-AI-027	Process Area Room Air Radiation Detector	12-AY AI	-067
104-AI-028	Process Area Room Air Radiation Detector	12-AY AI	-068
104-AI-029	Process HVAC Room Air Radiation Detector	12-AY AI	-069
104-AI-030	NDA/NDE Room Gamma Radiation Detector	12-AY AI	-071
104-AI-031	Ship/Recv Room Gamma Radiation Detector	12-AY AI	-072
104-AI-032	Process Area Room Gamma Radiation Det.	12-AY AI	-073
104-AO-001	MA-11-203A Proc.Area Supp.Blwr Vane Dmpr Remote Setpoint	11-FIC AO	-601A
104-AO-002	MA-11-203B Proc.Area Supp.Blwr Vane Dmpr Remote Setpoint	11-FIC AO	-601B
104-AO-003	FT-11-201A Glove Box Exh. Blwr Vane Dmpr Remote Setpoint	11-FIC AO	-611A
104-AO-004	FT-11-201B Glove Box Exh. Blwr Vane Dmpr Remote Setpoint	11-FIC AO	-611B
104-AO-005	FT-11-202A Proc.Area Exh. Blwr Vane Dmpr Remote Setpoint	11-FIC AO	-612A
104-AO-006	FT-11-202B Proc.Area Exh. Blwr Vane Dmpr Remote Setpoint	11-FIC AO	-612B
104-DI-001	MA-11-203A Air Handler Control Panel Trouble Alarm	11-XA DI	-601A
104-DI-002	MA-11-203A Air Handler Control Panel Blower Running	11-XI DI	-602A
104-DI-003	MA-11-203A Air Handler Control Panel Control 'Auto'	11-XI DI	-601A
104-DI-004	MA-11-203B Air Handler Control Panel Trouble Alarm	11-XA DI	-601B
104-DI-005	MA-11-203B Air Handler Control Panel Blower Running	11-XI DI	-602B
104-DI-006	MA-11-203B Air Handler Control Panel 'AUTO'	11-XI DI	-601B
104-DI-007	SU-11-203A Proc. Area Supply Blower	11-PDISH DI	-603A
104-DI-008	SU-11-203B Proc. Area Supply Blower	11-PDISH DI	-603B
104-DI-009	Process Area Isolation Damper 'AUTO'	11-XI DI	-604

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
104-DI-010	Process Area Isolation Damper Open	11-ZSO DI	-604
104-DI-011	Process Area Isolation Damper Close	11-ZSC DI	-604
104-DI-012	Glove Box Isolation Damper 'AUTO'	11-XI DI	-611
104-DI-013	Glove Box Isolation Damper Open	11-ZSO DI	-611
104-DI-014	Glove Box Isolation Damper Close	11-ZSC DI	-611
104-DI-015	Process Area Isolation Damper 'AUTO'	11-HS DI	-612
104-DI-016	Process Area Isolation Damper Open	11-ZSO DI	-612
104-DI-017	Process Area Isolation Damper Close	11-ZSC DI	-612
104-DI-018	FT-11-201A Glove Box Control Panel Trouble Alarm	11-XA DI	-611A
104-DI-019	FT-11-201A Glove Box Control Panel Running	11-XI DI	-615A
104-DI-020	FT-11-201A Glove Box Control Panel 'AUTO'	11-XI DI	-611A
104-DI-021	FT-11-201B Glove Box Control Panel Trouble Alarm	11-XA DI	-611B
104-DI-022	FT-11-201B Glove Box Control Panel Running	11-XI DI	-615B
104-DI-023	FT-11-201B Glove Box Control Panel 'AUTO'	11-XI DI	-611B
104-DI-024	FT-11-202A Proc. Area Control Panel Trouble Alarm	11-XA DI	-612A
104-DI-025	FT-11-202A Proc. Area Control Panel Running	11-XI DI	-616A
104-DI-026	FT-11-202A Proc. Area Control Panel 'AUTO'	11-XI DI	-612A
104-DI-027	FT-11-202B Proc. Area Control Panel Trouble Alarm	11-XA DI	-612B
104-DI-028	FT-11-202B Proc. Area Control Panel Running	11-XI DI	-616B
104-DI-029	FT-11-202B Proc. Area Control Panel 'AUTO'	11-XI DI	-612B
104-DI-030	Process Area Exhaust Stack Isolatn Dampr 'AUTO'	11-HS DI	-619
104-DI-031	Process Area Exhaust Stack Isolatn Dampr Open	11-ZSO DI	-619
104-DI-032	Process Area Exhaust Stack Isolatn Dampr Close	11-ZSC DI	-619
104-DI-033	AH-11-302 Ship/Recv Control Panel Trouble Alarm	11-XA DI	-621

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE
104-DI-034	AH-11-302 Ship/Recv Control Panel Running	11-XI -621 DI
104-DI-035	AH-11-302 Ship/Recv Supply Fan Diff. Press.	11-PDISL -623 DI
104-DI-036	Ship/Recv Vane Axial Exhaust Fan Running	11-XI -625 DI
104-DI-037	Ship/Recv Vane Axial Exhaust Fan Diff. Press	11-PDISL -625 DI
104-DI-038	NDA/NDE Vane Axial Exhaust Fan Running	11-XI -626 DI
104-DI-039	NDA/NDE Vane Axial Exhaust Fan Diff. Press.	11-PDISL -626 DI
104-DI-040	EF-11-302 Ship/Recv/NDA/NDE Roof Exh Fan Running	11-XI -627 DI
104-DI-041	EF-11-302 Ship/Recv/NDA/NDE Roof Exh Fan Diff. Press.	11-PDISL -627 DI
104-DI-042	AH-11-501 Admin Control Panel Trouble Alarm	11-XA -641 DI
104-DI-043	AH-11-501 Admin Control Panel Running	11-XI -641 DI
104-DI-044	AH-11-501 Admin Supply Fan Diff. Press	11-PDISL -643 DI
104-DI-045	RF-11-501 Admin Vane Axial Fan Running	11-XI -644 DI
104-DI-046	RF-11-501 Admin Vane Axial Fan Diff. Press	11-PDISL -644 DI
104-DI-047	EF-11-501 Admin Exhaust Fan Running	11-XI -645 DI
104-DI-048	C-13-101A Air Compressor Running	13-XI -711 DI
104-DI-049	C-13-101A Air Compressor Trouble Alarm	13-XA -711 DI
104-DI-050	C-13-101B Air Compressor Running	13-XI -712 DI
104-DI-051	C-13-101B Air Compressor Trouble Alarm	13-XA -712 DI
104-DI-052	DR-13-105A Air Dryer Trouble Alarm	13-XA -715 DI
104-DI-053	NDA/NDE Area Critical Radiation Det. Failure Alarm	12-AS -051 DI
104-DI-054	NDA/NDE Area Critical Radiation Det. High Level Alarm	12-ASH -051 DI
104-DI-055	Ship/Recv Area Critical Radiation Det. Failure Alarm	12-AS -052 DI
104-DI-056	Ship/Recv Area Critical Radiation Det. High Level Alarm	12-ASH -052 DI
104-DI-057	Process Area Critical Radiation Det. Failure Alarm	12-AS -053 DI

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
104-DI-058	Process Area Critical Radiation Det. High Level Alarm	12-ASH DI	-053
104-DI-059	Stack Monitor Radiation Det. Failure Alarm	12-AS DI	-054
104-DI-060	Stack Monitor Radiation Det. High Level Alarm	12-ASH DI	-054
104-DI-061	LLW RWM Area Vent. Duct Radiation Det. Failure Alarm	12-AS DI	-055
104-DI-062	LLW RWM Area Vent. Duct Radiation Det. High Level Alarm	12-ASH DI	-055
104-DI-063	LLW Proc. Area Vent. Duct Radiation Det. Failure Alarm	12-AS DI	-056
104-DI-064	LLW Proc. Area Vent. Duct Radiation Det. High Level Alarm	12-ASH DI	-056
104-DI-065	TRU RWM Area Vent. Duct Radiation Det. Failure Alarm	12-AS DI	-057
104-DI-066	TRU RWM Area Vent. Duct Radiation Det. High Level Alarm	12-ASH DI	-057
104-DI-067	TRU Proc. Area Vent. Duct Radiation Det. Failure Alarm	12-AS DI	-058
104-DI-068	TRU Proc. Area Vent. Duct Radiation Det. High Level Alarm	12-ASH DI	-058
104-DI-069	NDA/NDE Area Room Air Radiation Det. Failure Alarm	12-AS DI	-061
104-DI-070	NDA/NDE Area Room Air Radiation Det. High Level Alarm	12-ASH DI	-061
104-DI-071	NDA/NDE Area Room Air Radiation Det. Failure Alarm	12-AS DI	-062
104-DI-072	NDA/NDE Area Room Air Radiation Det. High Level Alarm	12-ASH DI	-062
104-DI-073	Ship/Recv Area Room Air Radiation Det. Failure Alarm	12-AS DI	-063
104-DI-074	Ship/Recv Area Room Air Radiation Det. High Level Alarm	12-ASH DI	-063
104-DI-075	Ship/Recv Area Room Air Radiation Det. Failure Alarm	12-AS DI	-064
104-DI-076	Ship/Recv Area Room Air Radiation Det. High Level Alarm	12-ASH DI	-064
104-DI-077	Process Area Room Air Radiation Det. Failure Alarm	12-AS DI	-065
104-DI-078	Process Area Room Air Radiation Det. High Level Alarm	12-ASH DI	-065
104-DI-079	Process Area Room Air Radiation Det. Failure Alarm	12-AS DI	-066
104-DI-080	Process Area Room Air Radiation Det. High Level Alarm	12-ASH DI	-066
104-DI-081	Process Area Room Air Radiation Det. Failure Alarm	12-AS DI	-067

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
104-DI-082	Process Area Room Air Radiation Det. High Level Alarm	12-ASH DI	-067
104-DI-083	Process Area Room Air Radiation Det. Failure Alarm	12-AS DI	-068
104-DI-084	Process Area Room Air Radiation Det. High Level Alarm	12-ASH DI	-068
104-DI-085	Process HVAC Room Air Radiation Det. Failure Alarm	12-AS DI	-069
104-DI-086	Process HVAC Room Air Radiation Det. High Level Alarm	12-ASH DI	-069
104-DI-087	NDA/NDE Room Gamma Radiation Det. Failure Alarm	12-AS DI	-071
104-DI-088	NDA/NDE Room Gamma Radiation Det. High Level Alarm	12-ASH DI	-071
104-DI-089	Ship/Recv Room Gamma Radiation Det. Failure Alarm	12-AS DI	-072
104-DI-090	Ship/Recv Room Gamma Radiation Det. High Level Alarm	12-ASH DI	-072
104-DI-091	Process Area Room Gamma Radiation Det. Failure Alarm	12-AS DI	-073
104-DI-092	Process Area Room Gamma Radiation Det. High Level Alarm	12-ASH DI	-073
104-DI-093	LLW RWM Operator Air Radiation Det. Low Air Flow	12-FSL DI	-074
104-DI-094	LLW RWM Operator Air Radiation Det. Failure Alarm	12-AS DI	-074
104-DI-095	LLW RWM Operator Air Radiation Det. High Level Alarm	12-ASH DI	-074
104-DI-096	LLW Proc Operator Air Radiation Det. Low Air Flow	12-FSL DI	-075
104-DI-097	LLW Proc Operator Air Radiation Det. Failure Alarm	12-AS DI	-075
104-DI-098	LLW Proc Operator Air Radiation Det. High Level Alarm	12-ASH DI	-075
104-DI-099	TRU RWM Operator Air Radiation Det. Low Air Flow	12-FSL DI	-076
104-DI-100	TRU RWM Operator Air Radiation Det. Failure Alarm	12-AS DI	-076
104-DI-101	TRU RWM Operator Air Radiation Det. High Level Alarm	12-ASH DI	-076
104-DI-102	TRU Proc. Operator Air Radiation Det. Low Air Flow	12-FSL DI	-077
104-DI-103	TRU Proc. Operator Air Radiation Det. Failure Alarm	12-AS DI	-077
104-DI-104	TRU Proc. Operator Air Radiation Det. High Level Alarm	12-ASH DI	-077
104-DO-001	MA-11-203A Proc. Area Control Panel Start Pulse	11-HIS DO	-601A

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WRAP MODULE 1 - PRELIMINARY I/O LIST

I/O NUMBER	SERVICE REMARKS	TAG NUMBER I/O TYPE	
104-DO-002	MA-11-203A Proc. Area Control Panel Stop Pulse	11-HIS DO	-601A
104-DO-003	MA-11-203A Proc Area Supp.Blwr Vane Dmpr Remote Setpoint Enable	11-FIC DO	-601A
104-DO-004	MA-11-203B Proc. Area Control Panel Start Pulse	11-HIS DO	-601B
104-DO-005	MA-11-203B Proc. Area Control Panel Stop Pulse	11-HIS DO	-601B
104-DO-006	MA-11-203B Proc Area Supp.Blwr Vane Dmpr Remote Setpoint Enable	11-FIC DO	-601B
104-DO-007	Process Area Isolation Damper Open	11-HIS DO	-604
104-DO-008	Glove Box Isolation Damper Open	11-HIS DO	-611
104-DO-009	FT-11-201A Glove Box Exh. Control Panel Start Pulse	11-HIS DO	-611A
104-DO-010	FT-11-201A Glove Box Exh. Control Panel Stop Pulse	11-HIS DO	-611A
104-DO-011	FT-11-201A Glove Box Exh. Blwr Vane Dmpr Remote Setpoint Enable	11-FIC DO	-611A
104-DO-012	FT-11-201B Glove Box Exh. Control Panel Start Pulse	11-HIS DO	-611B
104-DO-013	FT-11-201B Glove Box Exh. Control Panel Stop Pulse	11-HIS DO	-611B
104-DO-014	FT-11-201B Glove Box Exh. Blwr Vane Dmpr Remote Setpoint Enable	11-FIC DO	-611B
104-DO-015	FT-11-202A Proc. Area Exh. Control Panel Start Pulse	11-HIS DO	-612A
104-DO-016	FT-11-202A Proc. Area Exh. Control Panel Stop Pulse	11-HIS DO	-612A
104-DO-017	FT-11-202A Proc Area Exh. Blwr Vane Dmpr Remote Setpoint Enable	11-FIC DO	-612A
104-DO-018	FT-11-202B Proc. Area Exh. Control Panel Start Pulse	11-HIS DO	-612B
104-DO-019	FT-11-202B Proc. Area Exh. Control Panel Stop Pulse	11-HIS DO	-612B
104-DO-020	FT-11-202B Proc Area Exh. Blwr Vane Dmpr Remote Setpoint Enable	11-FIC DO	-612B
104-DO-021	Process Area Exhaust Stack Isolatn Dampr Open	11-HIS DO	-619
104-RS-001	Stack Monitor Radiation Detector	12-AY RS	-054

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10. ENGINEERING ASSESSMENTS

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10.0 ENGINEERING ASSESSMENTS

1. This section presents a summary of the engineering assessments that were performed to confirm the Preliminary Design technical basis, and to provide guidance on the facility and equipment layout to assure compliance to the project design criteria. The detail of each assessment is provided in **Volume VI, Engineering Assessments.**

2. Determination of the areas of the design requiring a systematic technical evaluation was based upon the requirements specified in the A-E Statement of Work, prudent engineering practices, and DOE Orders. The engineering assessment summaries presented in the ensuing sections include:

- Plant Throughput
- Shielding Analysis
- Criticality Analysis
- Safety Assessment
- Reliability Evaluation
- Human Factors
- Energy Management
- Design Basis Fire

10.1 Plant Throughput

10.1.1 Purpose

1. The purpose of this section is to summarize the Time and Motion work carried out to date, in support of the Title I Design for WRAP 1. It focuses on the drum throughput requirements for the facility. Waste box throughput is of such a low magnitude that it has no impact on the plant from a throughput standpoint.

2. The current throughput of the facility is taken from FDC Revision 1, and from the SDRD Revision 1, which in summary indicate that the plant is to accept and process 6,825 drums of waste per year.

10.1.2 Introduction

1. Assessment of the plant throughput commenced with an examination of the process as detailed in the WRAP 1 Conceptual Design Report. This assessment (Stage 1) is included in the **Engineering Studies Volume V.**

2. The second stage of assessment considered the plant layout and equipment as envisaged on completion of the Engineering Studies. An engineering application program titled "WITNESS" was utilized to model the WRAP 1 process operations from receipt of drums to shipment of drums. The details of this assessment are included in the **Engineering Assessments Volume VI.**

3. As the Preliminary Design evolved and matured,the plant time and motion model was utilized to interact with the design in a real time basis and evaluate "what if" scenarios to determine if the design option would support the plant throughput requirements. The results of this effort has culminated in a final time motion evaluation of the Preliminary Design submitted herein.

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10.1.3 Summary

1. **Figure 10-1** summarizes the results of the Preliminary Design throughput assessment The **Base Case** indicates the facility can achieve the required throughput as specified in the SDRD Revision 1.

10.1.4 Assessment

1. The FDC Revision 1 input to the plant of 6,825 drums per year has been modelled, along with the breakdown of WRAP 1 drum movements from the SDRD Table 1 and the back-up data provided (ref WHC letter 9152952). This has been translated onto The Main Process Flowsheet (ref H-2-87635, Rev 00), and the estimated numbers of output drums have been taken from this flowsheet for use in the model.

2. The plant has been modelled to operate for 175 days per year to accommodate the given 70% availability. The model has assumed that there are 5.5 operating hours available per day in plant areas where "whites" are worn (eg the Process Cell), and 7 operating hours per day in "blues" areas (eg NDA/NDE and the Control Room).

3. In the NDA area, the Segmented Gamma Scanner and the Fission and Activation Product assessment instruments have been replaced by a Gamma Energy Assay (GEA) instrument, and it assumed that all waste passes through the GEA.

4. To accommodate a limitation in the WITNESS simulation model, whereby the dual roller deck on-board the AGVs cannot be modelled, the AGV has been speeded up by 15%. The calculation of this speed-up factor is included in the **Engineering Assessment Volume VI**.

5. For the process area, the model has considered the case of 75% of drums entering the gloveboxes needing to be opened and sorted.

6. **Figure 10-1** summarizes the results of the modelling assessment work. Each plant area has been looked at in isolation (ie in the process area, it is assumed that drums are supplied and taken away as needed, and hence the throughputs are steady-state maximums).

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FIGURE 10-1
WRAP MODULE 1 FACILITY ANNUAL THROUGHPUT

OPERATING OPTION	No. of Shifts per Week	FACILITY		NDA/NDE	PROCESS	
		Receiving	Shipping	2 - GEA Machines (10 minute cycle)	SDRD REV. 1	OPEN/SORT (@ maximum input) 75/25 Split
SDRD REV. 1/FDC Rev. 1	5	6,825	5,587	8,632	3,045	
BASE CASE 1 SHIFT PER DAY S/R - 5.5 Hours NDA/NDE - 7 Hours Process - 5.5 Hours	5	6,825	6,808*	9,275		4,533
OPTION 1 2 SHIFTS PER DAY	10	13,650	13,616	18,550		
OPTION 2 3 SHIFTS PER DAY	15	20,475	20,424	27,825		

* Note: Shipping throughput is different than the SDRD Rev. 1 because the model includes the processed TRU drums returning from W112 and reshipped in TRUPACT 7-packs.

10.1.5 Conclusions and Recommendations

1. It is concluded that the required plant throughput can be achieved, on a single day shif basis, assuming that the three main areas of the plant operate for 5.5 hours, 7 hours, ano 5.5 hours, for Shipping & Receiving, NDA/NDE, and Process, respectively.

2. It is concluded that the required throughput can be achieved in the process gloveboxes for 75% of the drums needing to be opened and sorted.

3. It is concluded that the three main lag storage areas, in Shipping & Receiving, between the process and NDA/NDE, and for restricted waste awaiting analysis results are adequately sized.

4. It is recommended that the assumptions, methodology and results of this assessment work be endorsed as the baseline for commencement of Title II design work.

10.2 Shielding

10.2.1 Purpose

1. Dose assessments were performed in order to determine shielding requirements for the Process and the Shipping and Receiving areas of WRAP Title I design.

10.2.2 Introduction

1. Shielding calculations for Title I included the confirmation of a mixed fission product source term, evaluation of the waste Process and the Shipping and Receiving areas for radiation shielding and designation of full or part-time occupancy areas, evaluation of the extremity dose rates should hands-on work be performed in the process sorting gloveboxes, and a dose assessment of various maintenance activities.

2. QAD-CGGP was the shielding code utilized for gamma radiation dose point assessments. All waste containers preconfigured within the waste Process area and the Shipping and Receiving area for dose rate assessments were assumed to measure 10 mrem/h at their external surfaces. Quality factors for the gamma radiation considered in the dose calculations were assumed to be one (1).

10.2.3 Summary of Results

1. The following summary of results was obtained from each of the calculations performed for Title I:

a) Source Term

1) A decayed mixed fission product source term consisting of seven gamma ray energies was developed based on WHC's waste characterization data and a standard 55-gallon drum of waste measuring 200 mrem/h on its surface. A source term reduction factor was used for the 10 mrem/h drum. **Volume VI** provides the detailed source term calculation.

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b) Waste Process Area Evaluation

1) A preconfigured waste arrangement was evaluated inside of the various enclosures within the Process area of WRAP. Exposure contributions from the various waste containers were summed in order to determine the shielding required for various enclosures and to determine partial and full occupancy areas.

2) Shielding recommendations for Process area enclosures were evaluated twice in order to examine the effect of point kernel geometry on dose rate; the tighter the geometry, the higher the resulting dose rate.

3) Glovebox contamination was estimated at 7.5 grams per square meter and was determined not to contribute to personnel dose when compared to the contribution from waste drums.

4) A minimum of one-half inch of lead shielding was recommended for the TRU and LLW sorting enclosures and for the restricted waste management enclosures. A minimum of one-fourth inch lead was recommended for the occupied side of the LLW compactor enclosure.

5) With the recommended shielding, full time occupancy dose rates (0.2-0.5 mrem/h) were in the main assured at a distance of one foot from the external surfaces of the sorting enclosures and restricted waste management enclosures. Part time occupancy dose rates (2-5 mrem/h) were also in the main assured one foot from the external surfaces of the TRU and LLW compaction enclosures and the drum entry points for the TRU and LLW sorting enclosures. (See **Figures 10-2, 10-3 and 10-4.**) While it is noted that dose points DP4, DP12 and DP16 are not at the "detail design target" level of CM4-9 for full or part time occupancy, as appropriate it is proposed that they are within the acceptable range, and are accepted as satisfactory due to the low operating times achievable (5.5 hour per day), due to conservative number of sources modelled, and due to the mainly remote nature of the operations to be performed in the process area.

6) Based on points evaluated one foot from the ends of the process enclosures and between enclosure lines (not intended for occupancy during operation, but only for AGV access) only part time occupancies were designated. (See **Figure 10-3.**)

7) The lag storage area requires a minimum of 8 inches of average density concrete for shielding.

8) The TRU waste processing glovebox was examined a second time to determine dose contribution from a drum in the delidding device. It was determined that the drum's contribution would not change the shielding requirements since the software, which will control the delidding device and the action of dumping waste onto the sorting table, will not permit both actions to occur simultaneously. Either there will be waste on the sorting table or there will be a drum in the delidding device, but not both in each location at the same time. The full time and part time occupancy designations do not change. (See **Figure 10-4.**)

9) **Volume VI** provides the details of these calculations.

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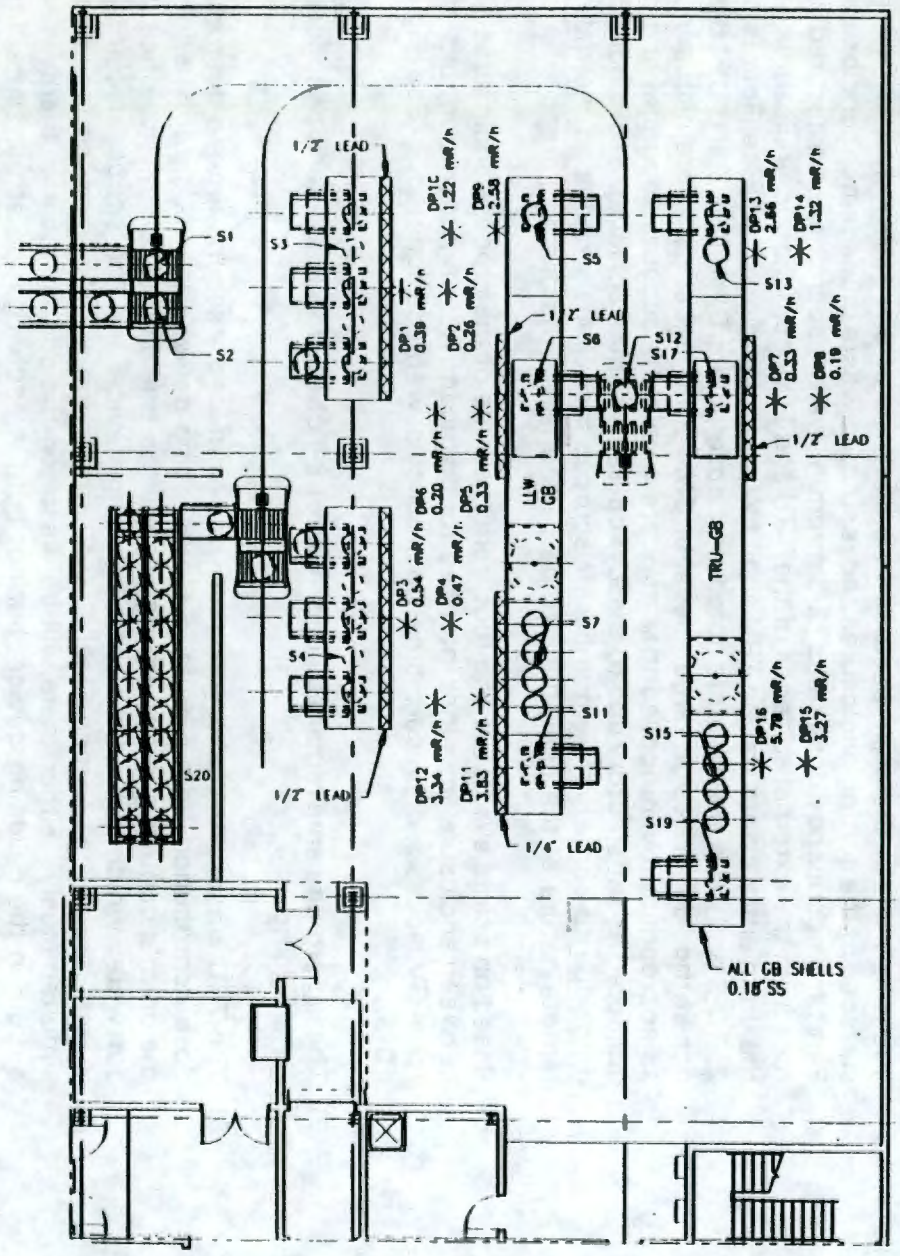
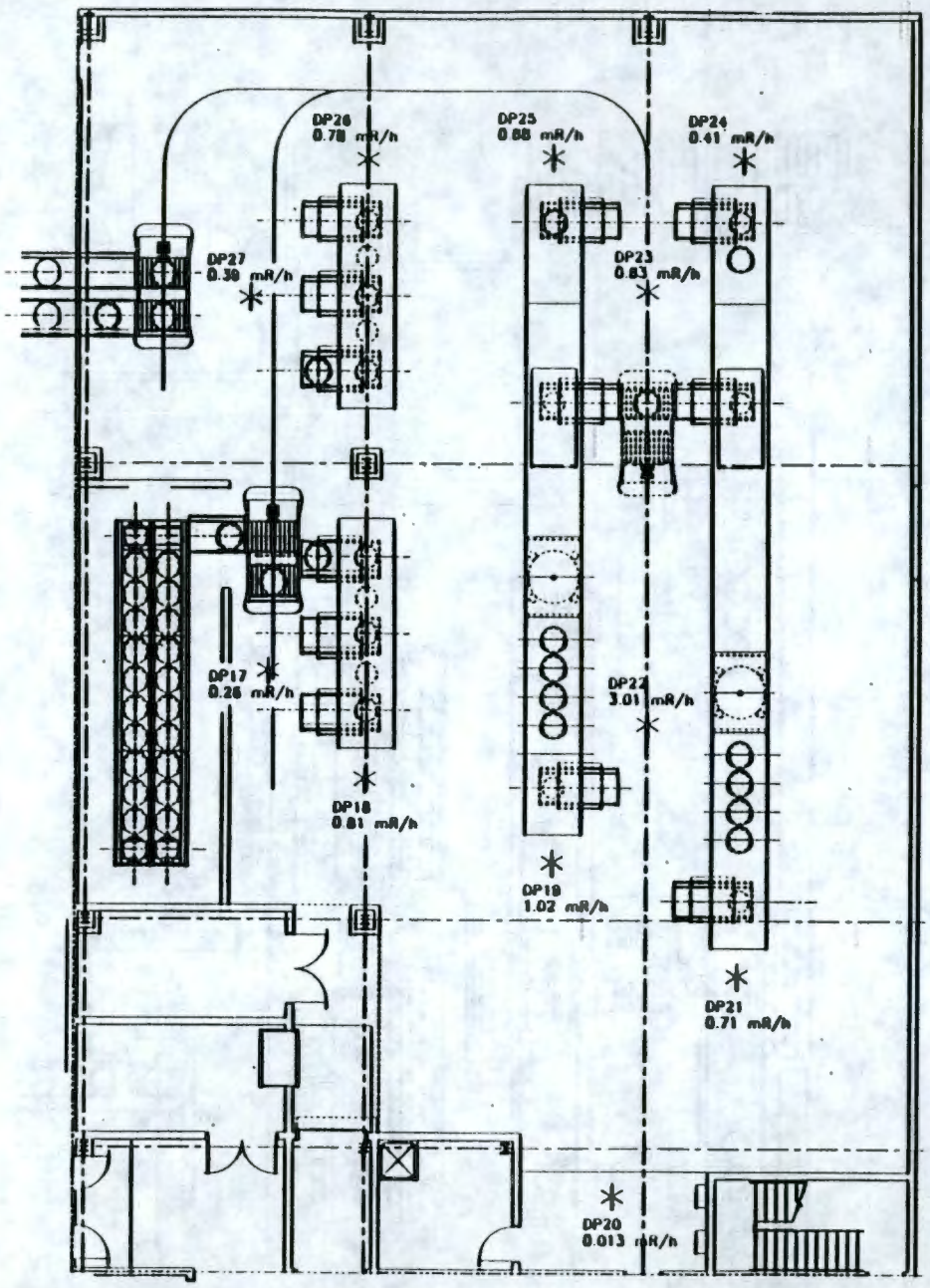


* DP = DOSE POINT

Figure 10-2

PROCESS AREA SOURCES AND ASSESSED DOSE POINTS



* DP = DOSE POINT

Figure 10-3

PROCESS AREA PERIPHERAL ASSESSED DOSE POINTS

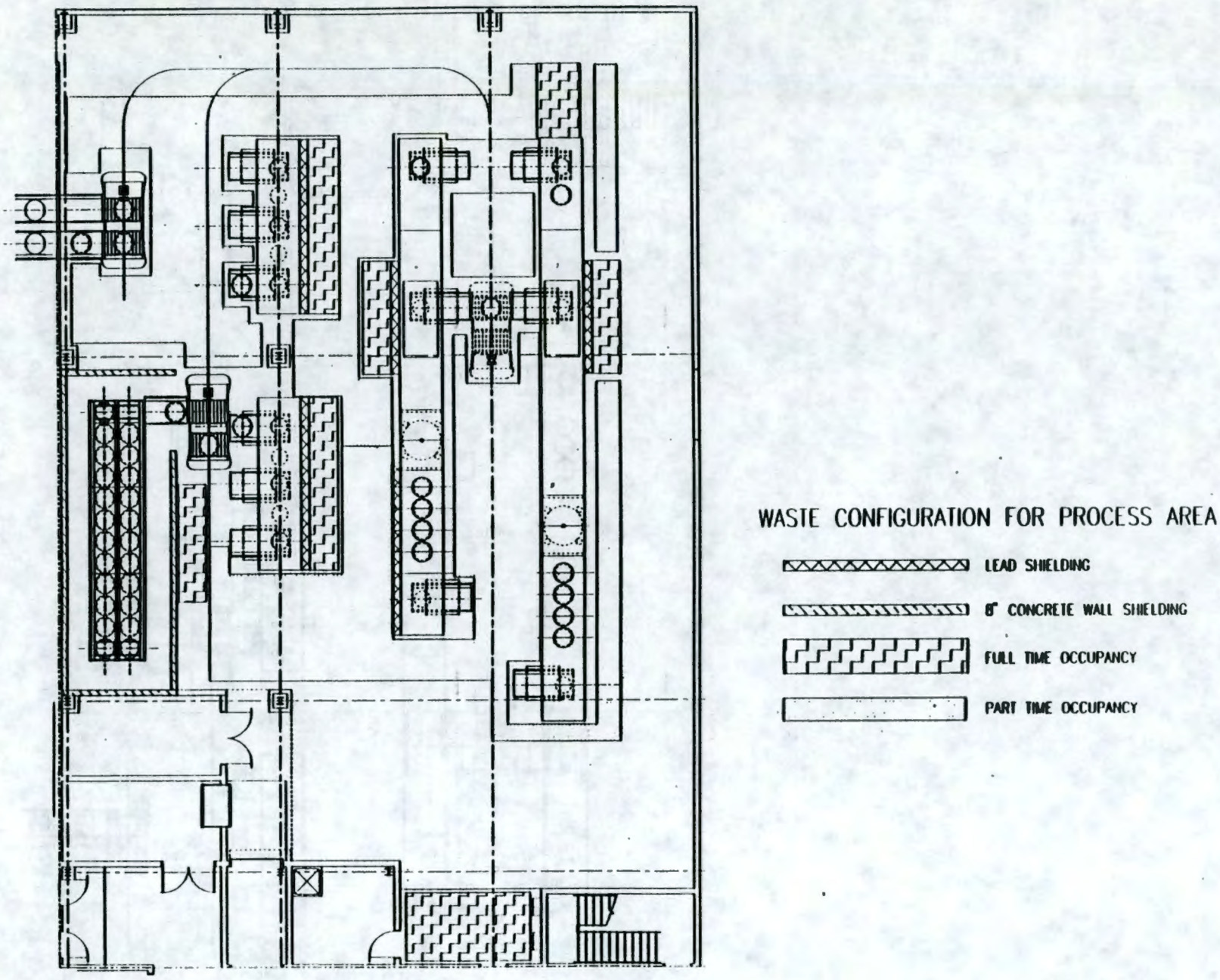


Figure 10-4

OCCUPANCY ZONE MAP WITH CLOSURE SHIELDING INDICATED

c) Shipping and Receiving Area Evaluation

1) Thirteen dose points were evaluated based on a preconfigured waste drum arrangement in the Shipping and Receiving Area of WRAP. The lag storage area is filled three high with drums which read 10 mrem/h on their external surfaces. Six banded 7-packs are present awaiting loading onto the TRUPACT-II shipping container. Eight-inch standard concrete walls surround the lag storage area and 7-pack storage area.

2) Loading and retrieving from these storage areas are accomplished by means of an aisle stacker system and two forklift vehicles. The lag storage areas need not be entered except for emergency repairs and weekly inspections.

3) Also in the Shipping and Receiving area are drums recently off-loaded and waiting for emplacement in lag storage, drums being prepared for 7-packing (TRU waste) and drums being prepared for palletizing with four-to-a-pallet (LLW.) **Volume VI** provides the complete description of the dose assessment. **Figures 10-5 and 10-6** show the Shipping and Receiving Area with its sources of exposure and assessed dose points.

4) For most operating personnel, the Shipping and Receiving Area will be occupied less than one hour per day. One area, where drums are banded in a 7-pack, will be occupied up to 3 hours per day. A forklift truck driver will spend up to 4 hours in various parts of the area but outside of the shielded storage areas.

5) Personnel off-loading the lids from the TRUPACT-II shipping container will be working in fields up to 0.36 mrem/h. At 3 h/d and 175 operating days per year, the annual dose received will be 0.189 rem. One individual banding the 7-packs will work in a radiation field of 5.2 mrem/h for 3 h/d times 175 operating days per year = 2.7 rem/y. These numbers will also be true for one individual who unbands the palletized drums. A drum receipt checker will work up to 3 h/d in a radiation of 1.1 mrem/h = 3.3 mrem/d times 175 operating days per year = 0.58 rem/year.

6) A forklift driver will receive exposure from various areas. Assuming an average field of 3 mrem/h within the Shipping and Receiving Area, the driver's exposure in a four hour work day will be 12 mrem/d. At 175 operating days per year, the driver's annual exposure will be 2.1 rem/y.

7) As can be observed, the estimated annual doses are too high (**one rem/year is the design goal**). Therefore, consideration will be given during Title II design to make more of these operations remote, providing further shielding, or rotating personnel performing these tasks in order to keep exposures below one rem per year (the least favorable option.) Also, assumptions made in the Shipping and Receiving area will be re-examined for this further dose assessment study. Additional consideration will be given to the potential daily loading of this area of WRAP for future dose assessments.

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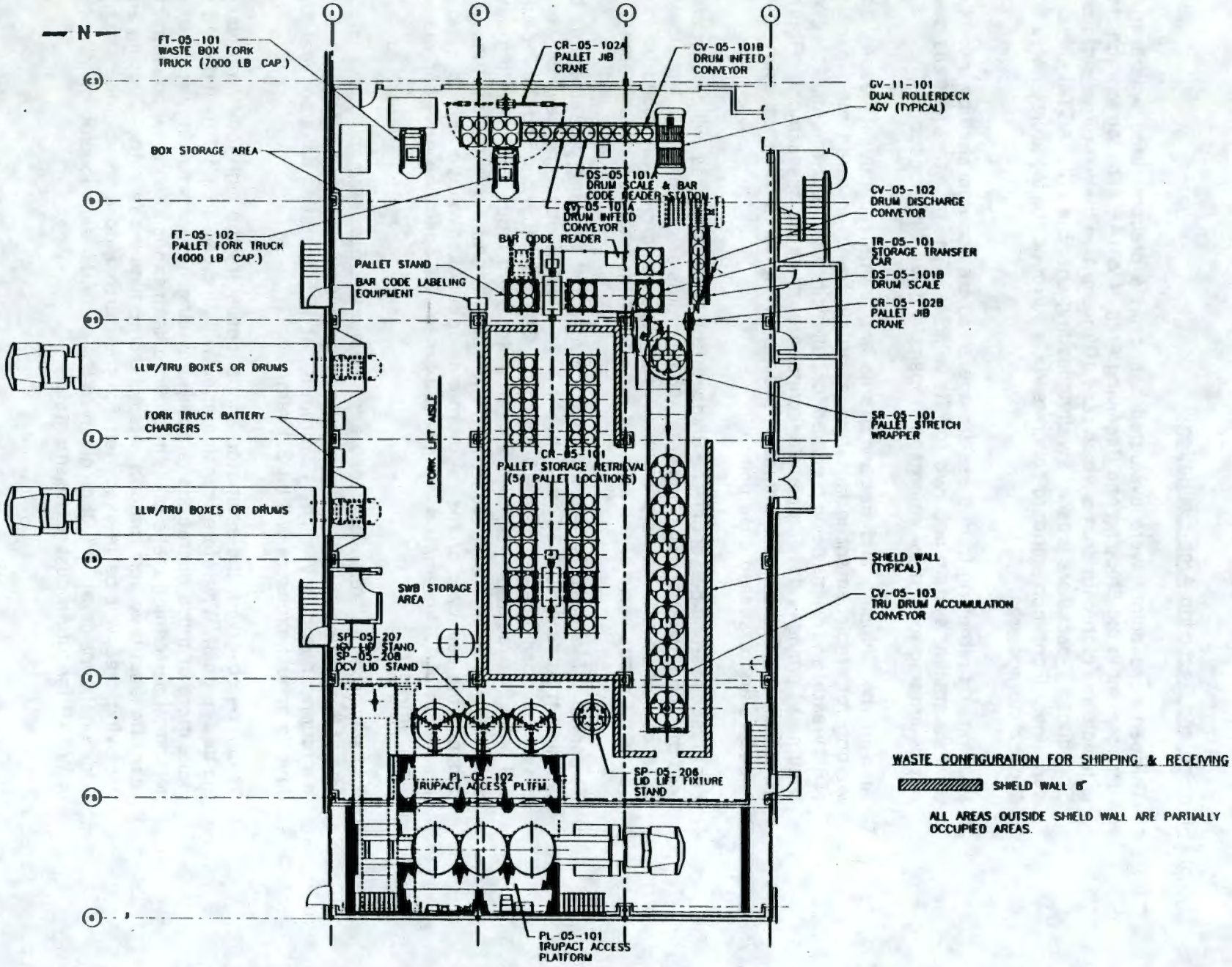

Figure 10-5

WASTE CONFIGURATION FOR SHIPPING AND RECEIVING

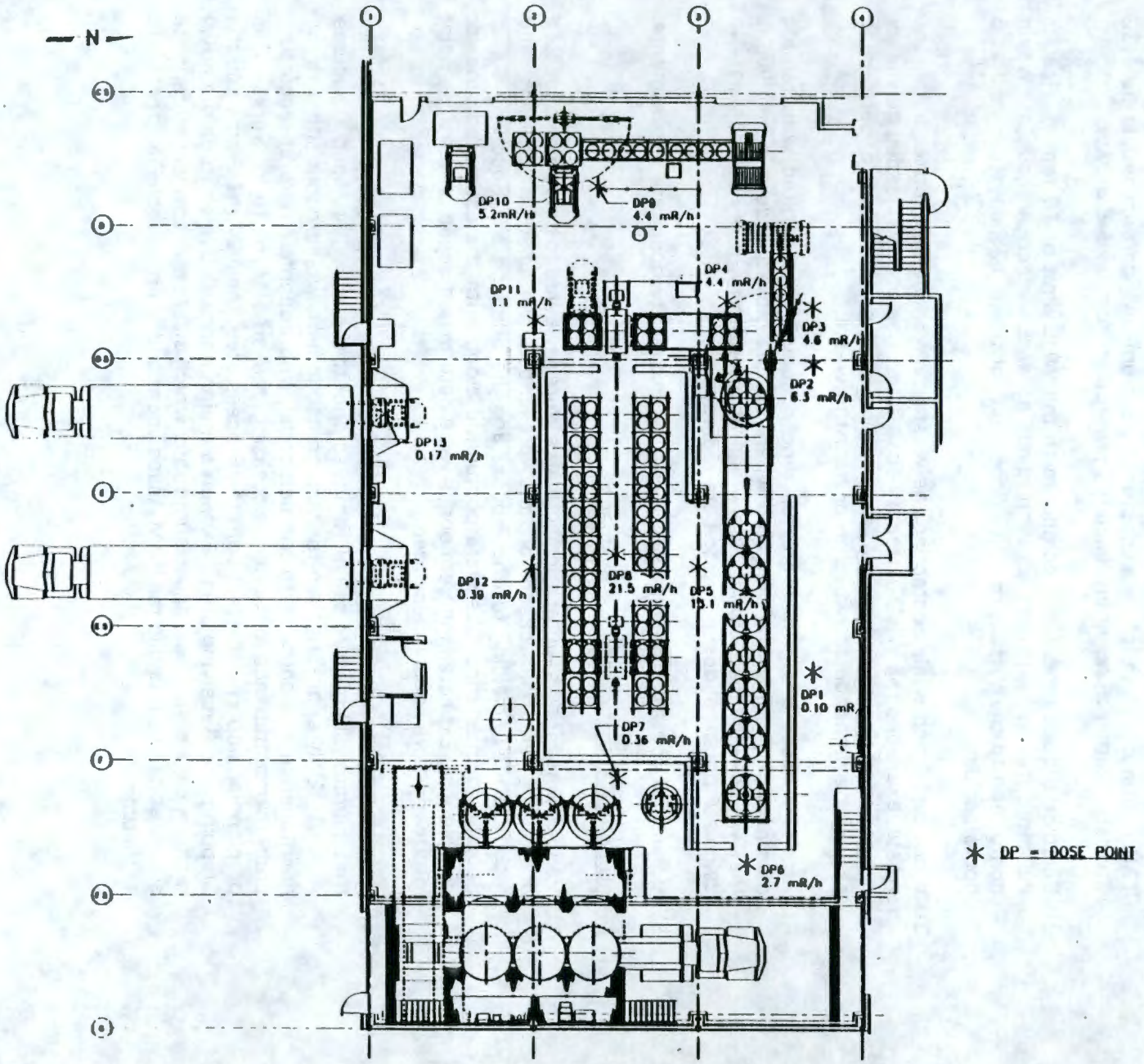

Figure 10-6

DOSE POINT ASSESSMENTS FOR SHIPPING AND RECEIVING

d) Extremity Dose Rate Assessment

1) Two assessments were performed; both postulated hands-on work inside of the TRU and LLW sorting enclosures. The first assessment considered the agreed on mixed fission product source term. The second calculation included dose rate contributions from 0.66 Curies and 1.32 Curies of Americium-241 to reflect the LLW and TRU processing enclosures, respectively. (Since the TRU waste processing enclosure will receive waste which has an average of 20.5 grams of TRU radionuclides in it, the expected Americium-241 content would be 1.32 Curies.) Neither assessment included protection from leaded gloves.

2) Calculated dose rates were compared to the WHC limit of 10 rem/y. Results indicated that work performed with hands at least 10 inches above the waste conformed to the WHC extremity dose limit for up to 175 days per year at 6 hours per day.

3) Work performed while contacting the waste, or working at 5 inches above the waste, exceeded the WHC extremity dose limit. Use of tools, leaded gloves, or remote operating equipment was recommended for sorting waste or performing certain maintenance activities on or near the waste.

4) As the process area which are full time occupied are operated with remote manipulators, and as the only area where routine gloved access is involved is that where unopened drums are swiped at drum entry, it is not necessary to calculate potential doses due to beta radiation.

5) **Volume VI** contains the details of these two extremity dose rate assessments.

e) Maintenance Activity Dose Assessment

1) Various prescribed maintenance activities were reviewed to determine expected doses to personnel based on the prescribed waste configurations and recommended shielding for the Process and the Shipping and Receiving areas. Specific maintenance jobs were postulated along with the estimated time for completion. Expected manrem doses were determined based on the dose point information previously calculated.

2) Routine maintenance activities will have the benefit of pre-planning time in order that sources of exposure can be removed prior to the activity to keep exposures ALARA. Only exposure from residual contamination would occur either to the maintenance personnel or to the personnel who decontaminate an enclosure prior to maintenance personnel accessing the area to perform work. This preplanning action will affect both the Process area, the NDA/NDE area and the Shipping and Receiving area. Expected maintenance activities, repair/removal techniques, frequencies, and assumptions which affect the routine maintenance activities can be found in the RAM Assessment and Maintenance Plan contained in **Volume VI.**

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3) Exceptions to source removal include maintenance activities undertaken in response to break-downs i.e., those activities which need to be performed in order to continue an ongoing process due to minor electro/mechanical failures. It is these activities which are difficult to anticipate and to estimate repair time; nevertheless, some of the likely hold up points, repair times and manrem exposures have been identified and calculated in **Figure 10-7**.

4) Dose Rate information was taken from the previous figures which presented calculated dose rates with prescribed shielding for the preconfigured waste arrangement of drums reading 10 mrem/h on their external surfaces.

10.2.4 Conclusions and Recommendations

1. Appropriate shielding has been recommended and various maintenance activity doses estimated in order to determine if WHC design goals were achieved for the Title I design (WHC-CM-4-9, Section 8.0, Table 1, "Shield Design Criteria.")

2. Options were provided to minimize extremity doses for waste sorting and for certain maintenance activities.

3. Dose reduction techniques must yet be applied in the Shipping and Receiving area of the WRAP facility in order to meet the design goal criteria.

10.3 Criticality

10.3.1 Purpose

1. Preliminary Criticality Safety Assessment was performed of the WRAP facility in order to determine the fissile material controls and limits which must be designed or utilized in WRAP.

2. A separate review of WHC-CM-4-29 was performed in order to determine if a criticality alarm system would be required for the WRAP facility.

10.3.2 Introduction

1. The criticality safety assessment was performed to review the maximum fissile material inventory and distribution within the WRAP facility based on the process flows proposed in the Title I design. This assessment is contained in **Volume VI**.

2. The WRAP 1 Facility was classified in accordance with WHC-CM-4-29, "Nuclear Criticality Safety Manual," in order to determine the need for a criticality alarm system.

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FIGURE 10-7
MANREM DOSES FROM EMERGENCY MAINTENANCE ACTIVITIES

MAINTENANCE ACTIVITY	ELAPSED TIME (IN MINUTES)	# PEOPLE	DOSE RATE mrem/h	MANREM mrem
Process Area				
• Glovebox entry doors stick	30	2	2.6	2.6
• Drum entry won't operate	< 30	2	0.33	0.33
• Overhead hoist fails	< 30	2	0.33	0.33
• Adjust or change positional switches at each glovebox 3 times per week	< 20	2	0.33 2.66 5.78 5.83	0.66 /wk 5.32 /wk 11.56 /wk 11.66 /wk
• Drum transfer air hose need replacing	< 30	2	5.83 (maximum)	5.83
• Delidding mechanism fails to fully remove lid	< 60	2	3.0 (interpolated)	6.0
• Manipulator arm fails	< 60	2	0.33	0.66
• Same action	< 60 (above shielding)	2	2.7 (interpolated)	5.4
• Core sampler sticks in waste	< 60	2	5.8 (maximum)	11.7
• Core sampler breaks and must be replaced	< 10	2	5.8 (maximum)	1.9
• Bagless transfer system failure	< 60	2	5.8 (maximum)	11.6
• AGV breaks down between process enclosures	< 60	2	2.01 (maximum)	4.02
Shipping and Receiving Area				
• Failure of overhead crane	< 120	2	0.36	1.44
• Loading device fails while extended to third tier inside of lag storage	< 30	2	22	22
• Adjust or change positional switches-3 times per week	< 20	2	5.2	10.5
• 2 switches inside of lag storage area-3 times per week	< 20	2	21.5 (maximum)	43 /wk
• Forklift failure	< 60	2	5.3	10.4
• Conveyor failure	< 60	2	13.1	26.2
• Jib crane failure	< 60	2	6.3	12.6

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10.3.3 Summary of Results

1. Preliminary Criticality Safety Assessment

   a) This assessment looked at safe arrays and followed a Hazard and Operability assessment of WRAP. Certain specific fissile material limits were recommended for the WRAP facility and have been compared with limits already determined for the Central Waste Complex at Hanford (reference CPS-SW-149-00002, Rev. A-2). These limits are contained in **Figure 10-8.**

   b) In the drum lag storage area of Shipping and Receiving, enforcement of the limits proposed in **Figure 10-8** would necessitate the use of simple administrative and operational controls. In addition, there is a need to incorporate some type of fissile material assay in the TRU waste processing enclosure since sorting will have to achieve the required 25 grams or less of fissile material per outgoing drum, when incoming drums could conceivably contain as much as 450 grams of fissile material. The value of 25 grams Pu per outgoing drum was provided by WHC for the purpose of estimating transport and disposal costs for alternative compaction scenarios, and has been used as the basis of the Title I design.

   c) There is a high degree of confidence that further detailed evaluation of this area, which will be performed during Title II Design, will allow these limits to be increased, so that there will be no restrictions in the handling of drums up to 200g fissile content. This would leave approximately 34 drums from the known WRAP 1 feed, which would be dealt with on a case by case basis.

   d) The limits proposed in **Figure 10-8** can also be applied to the glovebox operations, in that drums are processed singly through the glovebox lines, and are not stacked. The transfer drum between TRU open and sort operations and the TRU RWM glovebox is to be initially limited to 230g fissile, to account for potential build-up of materials in the gloveboxes, and to leave an appropriate safety margin. Again, this area will be further examined during Title II design to establish operating limits.

2. Classification of the WRAP Facility

   a) Following interpretation of WHC-CM-4-29 it is proposed that WRAP 1 be defined as a fissionable material facility (a facility which contains more than one-third of a minimum critical mass, and will be opening and sorting waste).

   b) WHC-EP-0225 confirms the inventory of drums and boxes of waste intended for WRAP at greater than one-third of a minimum critical mass (177 grams of plutonium, 190 grams of uranium-233 and various masses of enriched uranium depending on the per cent enrichment.)

10.3.4 Conclusions and Recommendations

1. The criticality safety assessment determined that criticality will be mainly prevented within the WRAP facility by the form and distribution of fissionable material (also in accordance with WHC-CM-4-29, Section 1.0, subsection 5.3.1.), provided certain specific initial fissile mass limits and controls are also applied.

2. As a Fissionable Material Facility, WRAP 1 will need a criticality alarm system, but the form and distribution of fissile material within the facility, coupled with the fact that drums are opened and sorted only within the process area, requires an alarm system be provided only in the waste process area.

9 3 1 2 7 0 1 1 5 1 3

FIGURE 10-8
PROPOSED FISSILE MASS LIMITS

Containment	Fissile Mass Limit (grams)	Comment
55-gallon drum	100-450	Fixed spacings, single-stacked, required throughout WRAP.
55-gallon drums	100	Acceptable in lag storage if the array is three high or less.
Standard Waste Box	325 maximum	Horizontal planar array storage. Standard waste boxes were not fully evaluated due to lack of processing in WRAP.
Compacted 55-gallon drum	<25 due to the 25 gram limit on TRUPACT-II drums	Two high stack permitted due to similarity to lag storage array in shipping and receiving.
Transfer container (between process enclosures and restricted waste management enclosures)	230	Horizontal planar array transfer containers.
Other containers	None	Not assessed.

Limits are based on the Criticality Prevention Specification for the Central Waste Complex. (Reference CPS-SW-149-00002, Rev. A-2 dated August 29, 1990, "Waste Storage in the Central Waste Complex".)

Detailed criticality evaluations will be performed during Title II design and may allow relaxation of these limits. The detailed criticality evaluations will also establish controls required for criticality safety in the Process and Restricted Waste Management Enclosures, as necessary.

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10.4 Safety

10.4.1 Overview

1. The Preliminary Design of the WRAP 1 Facility has considered the following safety-related objectives established by the DOE for its nuclear facilities:

a) Protect the public from hazards associated with the use of radioactive and other hazardous materials as a result of normal operations, anticipated operational occurrences, and accident conditions, including the effects of natural phenomena pertinent to the Hanford site.

b) Ensure compliance with DOE policies regarding nuclear safety, criticality safety, radiation safety, chemical safety, industrial safety, fire protection, and environmental protection.

c) Protect the health and safety of on-site personnel, government property, and essential operations from the effects of potential accidents.

d) Minimize exposures of personnel and the general public to hazardous materials by emphasizing these concerns during all design, construction, and operational phases.

2. In achieving the above stated objectives, the Preliminary Design of the WRAP 1 Facility has been guided by the following primary safety concerns regarding the waste to be processed:

a) The waste generates ionizing radiation requiring shielding for protection of workers. The waste material also presents potential inhalation and ingestion hazards so that contamination control within the plant and minimization of discharges to the environment are essential design features.

b) Alpha emitting particulates in the waste may potentially escape from drums and gloveboxes during handling and/or waste processing. Alpha contamination may cause health injury to the workers if inhaled. Confinement of alpha emitting particles is a primary safety requirement.

c) Radioactive waste in containers may contain liquids. Liquids are required to be processed within the plant in a criticality safe manner. Measures are required to prevent leaks, spills, or inadvertent transfer of these liquids to the environment or in inappropriate areas of the plant.

d) The waste may contain chemically hazardous liquids. Liquids generated from waste sorting and compaction require sampling, collection and treatment within process confinement areas.

e) The waste may contain pyrophoric materials, reactive materials, chelating compounds, lead, mercury and chemically incompatible materials. These materials will be removed from the waste, segregated and repackaged for treatment at other facilities.

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f) The waste may contain flammable gases. The waste containers retrieved from storage require venting and sampling of gases for volatile organic compounds and hydrogen prior to shipment to THE WRAP 1 Facility. Newly generated waste containers are required to have filtered vents where appropriate (per WHC-EP-0063) on the waste containers from the time they are filled. In addition, all waste containers within the WRAP 1 Facility require venting with carbon composite filters to preclude buildup of gases within the waste containers.

3. The WRAP 1 Facility is classified as a "Low Hazard" Facility in accordance with the criteria presented in WHC-CM-4-46. The facility-use category definition of the WRAP 1 Facility as "Low Hazard" is determined and documented in "Preliminary Safety Evaluation W-026 Waste Receiving and Processing Facility Module 1, Revision 0, WHC-SD-W026-PSE-001".

4. Low hazard facilities are of importance due to their waste disposal mission dependent considerations. The performance goal for these facilities per UCRL-15910 (UCRL 1990) is to maintain both capacity to function and occupant safety. Therefore, criteria for the design of low hazard facilities such as WRAP 1 Facility will allow only relatively minor structural damage in the event of natural phenomena hazards. That is damage that results in minimal interruption to facility operations and that can be easily and readily repaired following the event.

5. The performance goal for low hazard facilities is to limit the annual probability of exceedance of structure/equipment damage, with the facility being able to function with minimal interruption. To achieve this performance goal, low hazard facilities must be designed to survive natural phenomena hazards with an annual probability of exceeding 1×10^{-3}.

6. The WRAP 1 Facility systems, components and structure are classified as "non-safety" class items per the General Design Criteria, DOE Order 6430.1A (DOE 1989). Based on the WRAP 1 Facility Preliminary Safety Evaluation report, it has been established that risks associated with the WRAP Facility Module 1 normal operation, as well as risks assessed on a case-by-case basis for a spectrum of postulated accidents, do not adversely affect the environment or the safety and health of the public.

7. In addition to the Safety/Non-safety classification of systems, components and structures per DOE Order 6430.1A, structures, systems and components at the Hanford site are also classified through the implementation of WHC-CM-1-3, MRP 5.46, Management Requirements and Procedures "Safety Classification of Systems, Components and Structures" (WHC 1989b). This procedure defines four safety classes based on well defined safety criteria.

8. The systems, components and structure of WRAP 1 Facility have been evaluated against the classification criteria in the MRP 5.46. The results indicate that most WRAP 1 Facility systems, components and structures are Safety Class 3. The safety function of the Safety Class 3 items is to ensure industrial safety reduce environmental releases personnel exposure to ALARA and to provide occupational safety functions.

9. **Section 9.0** provides the Preliminary Safety Equipment List for the WRAP Facility Mechanical, Electrical and Controls Equipment, all of which are classified as Safety Class 3.

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10. The WRAP Facility Module 1 has been designed in accordance with the following requirements for Safety Class 3 items:

a) Natural Phenomena Hazards - Design and analysis for natural phenomena hazards for Safety Class 3 items are according to requirements for a low hazard facility as specified in SDC-4.1 and UCRL-15910.

b) Environmental Qualification - Equipment will be commercial grade designed for normal operating environmental conditions (e.g., heat, humidity). Special testing will ordinarily not be required.

c) Single Fault Failure - Redundancy and/or separation of equipment and systems in accordance with the IEEE 379-1988 (IEEE 1988) and IEEE 384-1981 (IEEE 1981) are not be required.

d) Protection Systems - Fire protection systems conform to NFPA 13 (NFPA 1989b) without additional redundancy or seismic qualification.

e) Emergency Power - Backup power source that meets single-fault failure and natural phenomena requirements will not be required.

10.4.2 Facility Safety Features

1. The following summarizes the key safety features of the WRAP Facility Module 1 building structure and Process systems.

2. **Building Structure:** The structural and mechanical design criteria for the WRAP Facility Module 1 are formulated to provide both capacity to function and occupant safety, and allow only relatively minor structural damage in the event of severe natural phenomena hazard that exceed the design basis criteria. The WRAP 1 building structure is designed in accordance with UCRL-15910 and SDC-4.1 to withstand the following Design Basis Natural Phenomena Hazard:

- Wind - 70 mph
- Seismic - UBC Seismic Zone 2B
- Flood - 100 year, 24-hour storm

3. **Shipping and Receiving:** Key safety features for this area include:

a) All incoming waste containers are radiologically surveyed upon entry into the facility. All outgoing waste containers are radiologically surveyed in preparation for shipment.

b) The drums arriving at the WRAP Facility Module 1 remain banded four to a pallet upon arrival and are then placed in lag storage on pallets. The lag storage area is serviced by a single aisle stacker with transfer carriage system, thereby enhancing safety during waste container handling operation.

c) Battery powered forklifts and AGV's are provided to eliminate the possibility of a diesel fuel fire. This safety feature is also applicable to other process areas as well.

d) The layout of the Shipping and Receiving area provides sufficient space for separate flow paths for forklifts and AGV traffic.

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e) Drum jib cranes and TRUPACT II bridge crane are specified to retain their lifted weight upon loss of power.

f) A concrete shield wall surrounds the lag storage area, the TRUPACT 2 accumulation conveyor to reduce worker exposure to ionizing radiation.

g) Health Physics monitoring is provided for this area.

h) A sprinkler fire protection system is provided for the Shipping and Receiving area where a petroleum fueled truck may be located for short periods of time.

i) Prior to being shipped to the WRAP 1 Facility, the vapor space of retrieved waste drums is sampled for the presence of flammable gas (organics and hydrogen) and then purged.

j) Retrieved waste drums entering the WRAP 1 Facility are wrapped in a plastic over-bag where appropriate, and are overpacked in 83-gal drums which provides double containment of the waste drum.

k) The surfaces of the interior walls and floor are designed for easy decontamination following an accidental waste container spill. This is applicable to the other process areas as well.

4. **NDE/NDA Area:** Key safety features include:

a) NDE/NDA stations are designed to be operated remotely during normal conditions.

b) Shielding is specified for each individual NDE/NDA station, as required, to protect personnel in the area during operation of the NDE/NDA stations.

c) A concrete shield wall surrounds the drum lag storage carousel to reduce worker exposure to radiation hazards.

d) Separate entry/exit doors and separate traffic flow paths are provided for forklift (box) and AGV (drum) which operate in the area.

e) Entry and exit airlocks (for material handling) are located between the NDE/NDA area and the waste process area to maintain the required negative pressure differential in the waste process area.

f) Health physics monitoring is provided in this area.

g) An emergency exit door (with airlock) is provided at the NDE/NDA area which exits outside the building. The exit door to the outside is alarmed and has no external entry hardware.

h) A sprinkler fire protection system is provided in the NDE/NDA area. A two-hour fire wall separates this area from the Waste Process Area.

i) For equipment comprising internal radiation generators, (NDE and PAN), a system of interlock switches and alarms will be provided to ensure the radiation generators cannot operate before the enclosure is completely sealed.

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5. **Waste Process Area:** Key safety features include:

   a) Two separate HVAC systems (with redundant exhaust fans and HEPA filters) are provided, one for the Waste Process enclosures and one for the Waste Process Area, to maintain the required negative pressure differentials. Alarms are provided to signal any HVAC upset.

   b) A process airlock is provided for personnel entry and exit into the Waste Process Area to maintain the required negative pressure differential.

   c) Separate waste process enclosures are provided for LLW and TRU waste processing to avoid the possibility of cross-contamination.

   d) Entry and exit ports for the waste process enclosures are designed to maintain confinement of waste within the enclosures and to maintain at least a minimum face velocity of air through the opened ports at all times when transferring waste containers and sample containers.

   e) Health physics monitoring is provided at the waste process enclosures and in the Waste Process Area.

   f) Provision for a warm maintenance facility is located in the vicinity of the waste process enclosures to facilitate repair and maintenance of potentially contaminated equipment.

   g) The equipment in the waste process enclosures are designed for ease of maintenance.

   h) Each waste process enclosure has an automatically activated dry chemical fire extinguishing system (refer to **Section 8.6.1**).

   i) Each waste process enclosure has a HEPA filter in its air inlet and outlet duct to maintain waste confinement upon loss of negative differential pressure inside the enclosure.

   j) Lead shielding is provided at the waste process enclosures to reduce worker exposure to ionizing radiation.

   k) A concrete shield wall surrounds the restricted waste drum lag storage carousel to reduce worker exposure to ionizing radiation.

   l) A sprinkler fire protection system is provided in the waste process area. A two-hour fire wall is provided for this area.

   m) The AGV traffic flow path is separated from the glovebox operator work stations to avoid potential material handling accidents.

   n) Hydraulic fluid for waste process enclosure equipment operation is non-flammable (glycol-water base) to avoid a potential fire hazard.

9 3 1 2 7 1 1 5 1 9

o) Process chemicals are not piped into the waste process enclosures. Small containers of chemicals (eg, neutralizing agents) are introduced into the enclosures on an as-needed basis and consumed. Chemicals are stored in segregated containers in the Restricted Waste Management area.

p) Free liquids collected from the sorting tables and supercompactor stations in the waste process enclosures are retained in criticality safe containers.

q) Aerosol cans are drained within the restricted waste management enclosures on an operationally controlled campaign basis to ensure that only compatible liquids are drained and collected together.

r) A radiological assay of individual waste items is to be performed in the waste process enclosures to ensure appropriate control of fissile material.

s) An emergency exit (with airlock) is provided in the waste process area which exits outside the building is provided. The exit door to the outside is alarmed and has no external entry hardware.

t) The gloveboxes are of modular configuration thereby permitting standard facility operations and minimizing operator error.

u) Processing operations are designed to reduce operator radiological and industrial hazard exposure to ALARA. Process and equipment design preclude direct gloved hand involvement in operations that may expose personnel to risk of puncture wounds, cutting wounds, skin contamination or contamination injuries. Equipment such as remote manipulator arms and hoists will be used to handle waste anytime there is a waste processing risk for puncture wounds, cutting wounds or contamination injuries. Remote manipulator arms and hoists are provided for process operations that require the use of sharp tools or involved forcing and prying operations.

6. **Electrical** system provides the following safety features:

a) A UPS is provided to maintain power to health physics and fire protection monitors and alarms, life safety communications equipment, and the control system.

b) Emergency lighting is provided in the process areas and at emergency exits.

c) A carbon dioxide total flooding fire protection system is provided for the electrical room, including UPS room. Two-hour and one-hour fire walls separate the electrical room from the waste process area and administrative areas, respectively.

7. **Additional Safety Features** for the facility include:

a) The operation of the HVAC system is designed to limit the concentration of hazardous materials in work spaces below the Threshold Limit Values.

b) Curbs are provided to contain spills of hazardous materials.

c) Segregated storage space is provided for incompatible chemicals.

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d) Emergency showers/eyewashes are located in work areas containing hazardous materials in accordance with ANSI Z87.1-1968.

e) Emergency response and first aid equipment is stored at a readily accessible location in the facility.

f) Breathing air (Grade D) is supplied and used in conjunction with a respirator per OSHA requirements.

g) Personnel protection equipment (clothing, gloves, boots, goggles, face shields, etc.) are utilized to provide protection from hazardous materials.

10.4.3 Safety Considerations

1. The WRAP Facility Module 1 is designed to meet applicable requirements of DOE Orders including DOE Order 6430.1A (DOE 1989), Division 1300-6, Radiation Protection, DOE 5480.11, Radiation Protection for Occupational Workers, and DOE Order 5400.5 (DOE 1990), Radiation Protection of the Public and the Environment; and site specific procedural criteria from WHC-CM-4-9, Radiological Design, WHC-CM-4-11, ALARA Program Manual, WHC-CM-4-10, Radiation Protection Manual, WHC-CM-4-29, Nuclear Criticality Safety, WHC-CM-4-46, Nonreactor Facility Safety Analysis, and WHC-CM-7-5, Environmental Compliance, which apply to the design of new facilities.

2. Radiological engineered design features are provided in accordance with the intent of WHC-CM-4-9, Radiological Design. Radiological designs of WRAP Facility Module 1 provide highly reliable equipment to minimize the risk of personnel exposure or release of radioactive material.

3. During the design of the WRAP 1 Facility, the design objectives for personnel exposure from external sources of radiation in continuously occupied controlled areas are ALARA and not exceeding 0.5 mrem (5 microsieverts) per hour on average (the initial design target being 0.2 mrem per hour). The design objectives for exposure rates for potential exposure to a radiation worker where occupancy is generally not continuous are ALARA and not exceeding 20 percent of the applicable standard in DOE 5480.11, Radiation Protection for Occupational Workers. Radiation exposure rates in controlled workplace areas have been reduced to as low as reasonable achievable levels by facility design and control. The primary means for maintaining exposures as low as reasonably achievable are through physical controls, e.g., confinement, ventilation, remote handling, and shielding.

4. The WRAP 1 Facility design meets or exceeds radiological protection criteria specified in DOE Order 5490.11 (DOE 1988d), Radiation Protection Requirements, at the "20% of maximum allowable dose" design basis criteria for new facilities, as mandated in DOE 6430.1A, General Design Criteria. These criteria limit personal doses to 10 mSv (1 rem) dose to the whole body, 30 mSv (3 rem) dose to the lens of the eye, and 0.1 Sv (10 rem) dose to any organ, tissue, or extremity of the body. Credit for internal radiation exposure from ingestion and inhalation has been included in dose calculations for workers. Internal dose evaluation programs (including routine bioassay programs) demonstrate compliance with the radiation protection standards in DOE 5490.11, Radiation Protection for Occupational Workers.

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5. Primary protection from exposure to ionizing radiation in the WRAP Facility Module 1 design is provided by use of design engineered features including:

a) Shielding

b) Confinement of radionuclides through ventilation systems making use of differential pressure zones and HEPA filtration

c) Physical barriers (sealed penetrations, airlocks, etc.) for containment of radionuclides have been incorporated into the facility structure and process equipment.

6. Personnel protection against ionizing radiation is provided by fixed mounted direct radiation monitoring systems for local and remote (data echoed to control room computer and annunciators) level indicators and alarms. Should the level of radiation at any monitoring point exceed a preset level, audible alarms are to sound at the monitoring point and in the control room so that immediate action can be taken to address the alarm condition. Area radiation monitors provide coverage in areas where exposure rates can exceed 5 mR/hour.

7. Air monitoring and warning systems are located in work areas. Continuous air monitors (CAM) provide real-time measurements of the presence of airborne radioactive contamination in the breathing zone. Air sampling heads provide a representative sample of airborne radioactive materials. CAMs detect, indicate levels, and alarm (when prescribed setpoints are exceeded) airborne radioactive contamination levels.

8. Entry into the WRAP 1 Facility building is limited through regulated entry areas or access control zones. Access control points are located between clean areas (e.g., outside, administrative offices, the control room) and potentially contaminated areas (e.g., waste process areas). Adequate physical protective features are provided in WRAP 1 Facility design so that administrative controls are minimized. Movement of personnel into and within the operating areas of the WRAP 1 Facility is in accordance with well-defined traffic patterns. Restrictive access into the waste process area is ensured by facility design.

9. The WRAP 1 Facility is designed to facilitate the arrival and entry of emergency personnel and equipment in the event of an emergency and to allow access for repair/corrective action personnel. The design criteria for response to emergency or accident conditions is in accordance with guidance in WHC-CM-4-9, Radiological Design.

10.4.4 Preliminary Safety Evaluation Deviation

1. The Preliminary Safety Evaluation (PSE) WHC-SD-W026-PSE-001, dated 4/3/91 documents the preliminary safety analysis and hazards classifications, performed in conjunction with the project Conceptual Design Report SD-W026-CDR-001, as required by DOE Order 6430.1A. Based on the results of the hazards classification included in the PSE, the WRAP 1 facility has been classified per UCRL 15910 as a "Low Hazard" facility. Likewise, based on the results of the Radiological Accident Analysis included in the PSE, the WRAP 1 facility has been classified as a "Safety Class 3" facility in accordance with WHC-CM-4-46.

2. As part of the Title I design effort, UE&C prepared nineteen evaluation/optimization engineering studies to critically examine the CDR design features in order to evaluate design alternatives and examine functional performance requirements prior to commencement of the preparation of the Title I design media (drawings and outline specifications).

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3. The detail CDR technical assessment studies resulted in several safety related changes to the WRAP 1 Facility design requirements. The key safety related changes are summarized in **Figure 10-9**, along with the appropriate rationale for each change. These changes have been incorporated in the Title I design media. The effects of these changes to the safety analysis of the facility will be verified by WHC during the preparation of the Accident Safety Analysis to be included in the PSAR.

4. An update of the bounding radiological and toxological releases as a result of the worst case accident scenario identified for WRAP 1 will be performed in the WRAP 1 PSAR, in conjunction with the Title I design configuration and process flow diagrams.

5. A preliminary analysis indicates the worst case radiological and toxological releases are enveloped by the releases identified in the PSE, thereby assuring the "Low Hazard" safety classification of the WRAP 1 facility is applicable.

10.5 Reliability

10.5.1 Purpose

1. A Reliability, Availability and Maintainability (RAM) assessment has been carried out for the WRAP 1 facility. The main purpose of this assessment was to determine whether the required plant availability of 70% can be achieved.

10.5.2 Introduction

1. For the purpose of the RAM assessment, the plant was divided into eleven subsystems and each subsystem was then allocated a RAM target to achieve the overall 70% plant availability target. Details on the RAM assessment performed for the Preliminary Design are provided in **Volume VI**.

2. For each of the subsystems, the major items of equipment have been examined and estimates of availability have been made. These estimates have then been mathematically combined together to provide a subsystem RAM estimate.

3. In addition, maintenance requirements for the major equipment items in the TRU and LLW processing enclosures have been considered.

10.5.3 Summary of Results

1. The results of the RAM assessment indicate that the required availability should be met for the WRAP Module 1 Facility. In one of the eleven subsystems, (NDE/NDA) the availability target will be met if each NDE and NDA station can achieve an availability of 0.95. This will need to be confirmed during Title II design.

2. In the LLW and TRU waste processing enclosures area the availability target (0.76) is met if both AGVs can achieve 0.95 availability. Manufacturers data (from Caterpillar) indicates that AGVs can typically achieve up to 0.90 availability. The Time and Motion model shows that the AGVs are occupied for only 87% and 34% of their time, and hence overall availability is not a problem in these areas.

3. In evaluation of maintenance requirements, no special "warm" facility requirements or other facilities on Hanford site requirements have been identified.

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FIGURE 10-9
PRELIMINARY SAFETY EVALUATION DEVIATIONS

TITLE I SAFETY RELATED DEVIATION	DEVIATION DESCRIPTION
• DELETE STANDBY EMERGENCY GENERATORS	The WRAP 1 facility has been classified based on the PSE as a non-safety class radioactive waste facility. Hence per DOE Order 6430.1A, the glovebox ventilation system is not required to be operational following a DBA. The effect of ventilation loss may result in a possible contamination release from the gloveboxes to the process area. The magnitude of release is expected to be small. Therefore, standby and/or emergency power is not required for the ventilation system. The UPS system and local battery packs will provide sufficient power upon loss-of-offsite power for other minor loads indicated in the CDR to be on the emergency diesel generator.
• REDUCTION IN THE TOTAL NUMBER OF HVAC CONFINEMENT ZONES. THE TITLE I HVAC DESIGN FOR THE WRAP 1 FACILITY CONSISTS OF ZONE 1 (GLOVEBOXES) AND ZONE 2 (PROCESS ROOMS SURROUNDING ZONE 1) AND NON-ZONED (REMAINDER OF THE FACILITY). THE NON-ZONED AREAS INCLUDE SHIPPING & RECEIVING, NDA/NDE, CONTROL ROOM, ADMINISTRATIVE AND MECHANICAL/ELECTRICAL EQUIPMENT ROOMS.	Per DOE order 6430.1A, Section 1324-6.1, the Shipping & Receiving area is classified as a radioactive solid waste storage area. A standby HEPA filtration system is not provided in the NDA/NDE, Shipping & Receiving and storage areas, as the potential for spreading contamination by the waste containers and handling methods is very minimal. The retrieved wastes will be double contained, i.e., bagged and overpacked in 83-gallon drums, also AGVs will be utilized in lieu of the fork lift trucks for internal transport of waste drums. This significantly minimizes accidental puncture of waste drums, thereby substantially reducing the spread of contamination. WHC-CM-4-10, Para. 4.5.1 permits non-ventilated storage for containers with two barriers. The WRAP 1 facility drum contents are contained in plastic bags. The drum itself is a barrier. If the drum is rusted or otherwise does not achieve containment status, it will be contained in a plastic liner and overpack drum to provide confinement barriers prior to receipt in the WRAP 1 facility. Therefore a standby HEPA filtration system for the NDA/NDE, Shipping & Receiving and storage areas is not considered essential for the safety of workers.
• DELETE HEPA FILTER DELUGE SYSTEM.	Per the results of the PSE accident analysis, a glovebox fire will not result in unacceptable safety consequences to on-site and off-site personnel. Also, DOE Order 6430.1A does not require confinement of release from a DBF. Therefore, deletion of the HEPA filter deluge system will not significantly affect the safety of the facility.
• REDUCTION IN SEISMIC DESIGN REQUIREMENTS FROM SEISMIC CATEGORY I FOR THE PROCESS AREA CONTAINING GLOVEBOXES AND ENCLOSURES, THE HVAC EQUIPMENT ROOM, THE SHIPPING & RECEIVING AREA, THE FIRE PROTECTION SYSTEM, AND THE OVERHEAD CRANE IN THE SHIPPING & RECEIVING AREA TO NON-SEISMIC CATEGORY I, SAFETY CLASS 3 PER SDC-4.1.	Per the results of the PSE accident analysis, the release resulting from equipment disruption, drums overturning, etc., from a DBE, even without HEPA filtration is within the WHC-CM-4-46 risk guidelines. As a result, Seismic Category I design is not required for the WRAP 1 facility.

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FIGURE 10-9 (CONTINUED)
PRELIMINARY SAFETY EVALUATION DEVIATIONS

TITLE I SAFETY RELATED DEVIATION	DEVIATION DESCRIPTION
• SUPERCOMPACTION IN LIEU OF IN-DRUM COMPACTION FOR TRU WASTE PROCESSING.	Process efficiency, waste minimization, reduction in radiation exposure and industrial accidents was the basis for incorporating supercompaction of TRU drums in lieu of in-drum compaction.
• INCORPORATION OF INCREASED MECHANIZATION AND REMOTE HANDLING IN THE OPEN/SORT AND RESTRICTED WASTE MANAGEMENT AREA.	Protection from injury to workers and minimization of worker exposure to radiation hazards was the basis for increased mechanization and remote handling, resulting in overall enhanced safety of the WRAP 1 facility operations.
• INCREASED WASTE CONTAINER INVENTORY IN THE WRAP 1 FACILITY.	The increased waste inventory is a result of the time and motion analysis performed to verify the capability of the WRAP 1 facility processing operations to meet the required throughput. Lag storage areas are provided in the NDA/NDE and Waste Process Areas including the Shipping & Receiving area to facilitate process operations and accommodate minor process upset conditions. Process operations in the waste sorting and Restricted Waste Management areas will result in increased waste inventory at risk from operational hazards in these areas.
• INCORPORATION OF THE THREE HIGH STORAGE RACK SYSTEM WITH A SINGLE AISLE STORAGE RETRIEVAL MACHINE. THIS INCREASES THE STORAGE DENSITY.	The three high storage rack system reduces the amount of required floor space for storage, thereby reducing the size of the WRAP 1 facility. The storage retrieval system machine increases the efficiency of the handling equipment and reduces the worker exposure. The storage system is also integrated with a shielding wall to further reduce worker exposure. The increased storage density will result in localized concentration of waste, thereby increasing risk from seismic hazards.

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10.5.4 Conclusions and Recommendations

1. From the qualitative RAM assessment is concluded that the WRAP Title I design can be reasonably expected to meet its 0.70 plant availability requirement.

2. A full assessment of the NDE/NDA stations could not be performed due to the custom nature of this specialized equipment. The 0.95 availability requirement allocated to each of these stations can be used as initial input in preparing specifications for this equipment.

3. The RAM assessment of the LLW and TRU waste processing subsystem has underscored the importance of utilizing highly reliable and easily maintainable process equipment. Because of the extensive serial linkage of the waste processing equipment with no in-place redundancy, the required availability is high. However, this feature is compensated by the higher than required operating rates expected for the waste processing equipment. The required average throughput rate can be achieved by avoiding planned periods when the waste process enclosures are purposely idled or are operated at reduced rates.

4. A safety analysis is required to confirm specific safety-related assumptions regarding the repair of failed equipment in the NDE/NDA area and in the waste processing area. Non-confirmation of these assumptions would impose safety constraints on operations and maintenance protocols which would severely reduce plant availability. This safety analysis can be performed as part of preparing the Preliminary Safety Analysis report.

5. A formal RAM analysis is to be performed during Title II design in support of the 60% design. At that point in the design, the equipment design will be sufficiently detailed to quantitatively analyze equipment availability to confirm the tentative conclusions made on this qualitative assessment.

6. An evaluation of the LLW and TRU waste process enclosures has provided a preliminary determination of facility features and methods necessary to access, remove, decontaminate, transport, and repair or dispose of contaminated equipment. The WRAP Module 1 warm maintenance areas has remained in the Title I design although no specific requirements have been identified at this stage. No requirements have been specifically identified at this time for off-site maintenance capabilities located at another Hanford facility.

10.6 Human Factor Engineering

1. Title I Design of the WRAP Facility Module I incorporates Human Factors requirements of DOE order 6430.1A, Section 1300-12.4 to the planning and preliminary design of the work environment and human/machine interface. The preliminary design of the work environment included considerations of human factors engineering requirements for ventilation, work space layout and equipment design and layout. The preliminary design of the human/machine interfaces included considerations of displays, controls, alarms and communication.

2. Human factors limitations of reach, strength, dexterity and endurance were considered in the selection, layout and space envelopes of equipment. The flexibility and limits of material handling and lifting devices considered reach, load capacities, clearances and other maintenance utility features. Adequate visibility of glovebox equipment is provided to support operation and maintenance activities through proper lighting and placement of windows.

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3. WRAP Module 1 includes a variety of manual operations, locally controlled remote operations and remote operations from a central control room. Plant operations areas have been studied for human/machine interfaces and allowance made for the design of plant and equipment in accordance with the requirement of DOE order 6430.1A, Section 1300-12.4.

4. Details of operator activity in each area are described in **Section 7.0** but can be summarized as follows:

a) Receipt/Shipping Area

- receipt of 55 gal drums and standard waste boxes
- contamination checking, labeling, and data logging
- fork lift truck operations
- depalletizing and manipulation of drums by hoist
- TRUPACT II packaging and loading ops

b) Process

- Operations involve locally controlled, remote opening of containers, glovebox manipulations (external - using manipulators and internal - using gloved actions) and other miscellaneous, drum, contacts.

- Treatment of non-compliant waste.

- Sample management to ensure that the waste is treated which meets the waste acceptance criteria.

c) NDA/NDE

- Mostly remote operations but with twice weekly fork lift transport for boxes.

d) Control Room

- Fully remote control of NDA/NDE, internal transport and main process
- direct viewing of all important operations.

5. During development of Title I design human factors were considered under three categories:

a) Personnel Safety

b) Plant Operability

c) Personnel Comfort

6. Personnel radiological safety is considered fully in **Section 10.2, 10.3, and 10.4** of this report. This section deals with design provisions made to optimize non-radiological safety, comfort and routine ergonomics for operating personnel.

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10.6.1 Receipt and Shipping Area

1. The large space allowance (130' x 75') necessary to provide interim storage of received and shipped drums ensures adequate personnel space. Routine operations involve drum manipulation and transport. All drum manipulations and movements are performed with mechanical devices such as fork lift trucks and jib cranes. Operators will not undertake any load bearing activities.

2. Position of work stations and drum movement have been ergonomically designed to minimize operator effort while not compromising the efficiency of drum receipt and storage. Studies of operator interaction were undertaken using the computer simulation program WITNESS (see **Section 10.1**), and the Time and Motion Studies. This enabled the design to optimize the percentage utilization of personnel for each area. For the receipt and storage area five personnel can most efficiently perform the necessary operations.

3. Where the interface between operators and equipment requires additional walkways and gantries (TRUPACT II handling area), access platforms have been provided. During Title II design the more detailed aspects of operator safety such as avoidance of fork lift truck accidents and injuries resulting from unhanding and opening of drums and boxes will be addressed.

10.6.2 NDE/NDA Area

1. Plant and equipment in this area have been designed to be automated for all operations except delivery of boxes into this area twice weekly by fork lift truck. All automated operations are controlled and monitored from the central control room where personnel can easily monitor the progress of NDE/NDA operations both by direct viewing through glass windows and by consoles.

10.6.3 Waste Process Area

1. The main waste process area of WRAP 1 involves the opening of drums (including overdrum) the sorting of drum contents, the refilling of drums, drum compaction, drum load-out, RWM operations and finally drum transport. All drums progress through these distinct operation by mechanized equipment within glovebox suites.

2. Operator interaction includes direct manipulation at some stages (eg. overdrum opening) and remote manipulation by means of a variety of mechanical devices within the gloveboxes but controlled locally. Direct, hands-on manipulation is achieved by the use of gloveports which allow the gloved arms of personnel to most efficiently achieve the required task.

3. The primary man/machine interface during processing operations occur at the gloveboxes. The preliminary design of the gloveboxes has incorporated the following human factors features to minimize operator discomfort and distraction which could potentially degrade operator performance or increase error:

a) Gloveport spacing, centerline to centerline is 18 inches, based on the 95 percentile male shoulder spacing average of 16.5 inches.

b) Glovebox overall width is based on relaxed workable reach at the palm, and use of the Sergeant Industries push through gloves.

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c) Glove height from the floor platform is designed to be 52 inches. Operations will provide booster platforms for shorter people.

4. The preliminary design of process operations incorporates Human Factors Considerations. Low risk routine operations on operations that involve minimal force or energy are specified to be performed using direct gloved hand involvement. Process and equipment design precludes direct gloved hand involvement in operations that expose personnel to risk of puncture wounds, cutting wounds, skin contamination or contamination injuries. Remote manipulator arms and hoists are provided for process operations that require the use of sharp tools or involve forcing or prying operations anytime there is a waste processing operations risk for puncture wounds, cutting wounds or contamination injuries.

5. All hydraulic power packs will be positioned in sound absorbing enclosures, so as to reduce noise levels in the process cell to acceptable levels.

6. Glovebox design is optimized to permit the operator maximum comfort in terms of reach, viewing and general dexterity. All glovebox operations are carried out under a reduced pressure (depression) to ensure the cascaded in-leakage of air from operating area into the glovebox chamber. This cascaded depression is achieved by the HVAC system (see **Section 8.4**).

7. Similarly the remotely controlled functions have been designed to afford the operation maximum viewing potential with minimum physical endurance.

8. Studies of operator interaction in the process area (again using the WITNESS program) showed the optimum number of personnel in this area to be 8.

9. As with the receipt and storage area more detailed assessments of operator safety and comfort with special regard to AGV avoidance and other machine interfaces will be addressed during Title II design.

10.6.4 Central Control Room Area

1. The central control room has been sited and designed to ensure maximum direct visibility to each part of the other three operating area. A minimum of 3 personnel were considered adequate for this area.

10.6.5 Summary

1. In summary, the preliminary design of WRAP Facility Module 1 includes consideration of human factors that affect operator performance, including:

a) Providing adequate space for personnel, equipment, and free volume for the movements required to be performed, during operation and maintenance tasks, under both normal and emergency conditions.

b) Providing adequate physical and visual links between personnel and the equipment under both normal and emergency conditions.

c) Providing efficient arrangements of process and maintenance equipment.

d) Providing adequate illumination for the performance of operations and maintenance.

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e) Provisions for minimizing stress and fatigue during operations and maintenance.

f) Providing design features to assure rapidity, safety, ease, and economy of operation and maintenance in normal, and emergency maintenance environments.

g) Providing satisfactory remote handling provisions and tools for hazardous operations.

2. The WRAP 1 Facility Title II design will include the following detail human factors considerations in accordance with DOE Order 6430.1A, Section 1300-12.4 to ensure detail design will allow operators to perform their duties effectively.

- Human Dimension
- Temperature and Humidity
- Ventilation
- Lighting
- Noise
- Vibration
- Aesthetics
- Component Arrangement
- Protective Equipment
- Display Devices
- System and Component Controls
- Warning and Annunciator Systems
- Communication Systems
- Maintainability
- Labeling

10.7 Energy Conservation Analysis

10.7.1 Purpose

1. The energy conservation study was completed in order to obtain a ranked order of energy conservation measures (ECM's) for use in saving energy within the facility.

10.7.2 Introduction

1. The analysis was performed utilizing the Trane "Trace-600" energy analysis program which performs hourly loads and energy analysis for each day in the year, and also performs present worth economic analysis in order to rank the preferred ECMs.

10.7.3 Summary of Results

1. The preliminary design assessment analyzed a "Base-Case" based upon a reasonably energy efficient building, in accordance with ASHRAE 90 standards.

2. The ranked order of ECMs was obtained based upon initial cost, energy and cost savings, and present worth of the ECM.

3. The ranked order of ECMs included the following:

a) Process run-around heat recovery coil for process AHU and filter trans. This consists of glycol pumped through warm exit air coils and then utilized to preheat or precool 100% outside makeup air.

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b) Heat wheel heat recovery for change room AHU. This consists of a rotating metal wheel that recovers heat from warmed exit air and then preheats 100% outside makeup air, thus reducing electrical heating power.

c) Domestic hot water heat recovery installed on chillers. This consists of a double bundle heat exchanger that recovers waste heat from refrigerant hot gas and preheats domestic potable water for use in change room showers, thus reducing electrical power to the hot water tank.

10.8 Design Basis Fire

10.8.1 Purpose

1. A preliminary fire protection analysis was performed of the Title I design of the WRAP facility in order to quantitatively determine risks, to assess proposed fire protection measures and to determine compliance with "Improved Risk Guidelines" outlined in DOE Order 5480.7.

10.8.2 Introduction

1. The WRAP facility was determined not to be considered a vital facility or program which would merit application of the "Higher Standard of Protection" criteria defined in the DOE Order. Nevertheless, criteria was developed for a design analysis which included definition (per NFPA 801), evaluation and quantification of risk for individual fire areas and fire zones.

2. The maximum credible fire was established for each fire zone and area. This included fires which could originate from within and without the respective area or zone. The maximum credible fire loss assumed the failure of both the automatic and manual fire extinguishing systems.

3. The detailed preliminary fire protection design analysis is contained in Volume VI.

10.8.3 Summary of Results

1. All fire areas and zones were determined to contain acceptable risks based on the maximum credible fire and the fire protection measures included in the design.

2. There are some uncertainties associated with the analysis that are listed in Section 13.0.

10.8.4 Conclusions and Recommendations

1. Several administrative procedures were recommended in order to maintain acceptable risk levels. These procedures included limiting the amount of combustible materials within the facility, procedures for inspections and maintenance of hydraulic equipment and procedures for safe removal of fire screens.

2. Use of self-restoring (recycling) sprinkler systems in areas susceptible to water damage were recommended in order to minimize the amount of water discharged.

3. Remote and local alarms should be used for the automatic smoke detectors located in the Process Area and in all glovebox exhaust ducts.

4. Installation of manual and selected areas of automatic dry chemical fire suppression systems in the gloveboxes.

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11.0 CONSTRUCTIBILITY ASSESSMENT

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11.0 CONSTRUCTIBILITY ASSESSMENT

1. This assessment of WRAP 1 constructibility accomplished several objectives. First, the integrity of schedules for design and construction was validated, taking procurement lead times into full account. Detail design activities are not required to be rescheduled to support related procurement and construction activity schedules. This is reported in 11.1, "Construction Packages" together with the description of the work to be covered by these packages.

2. To perform the schedule validation, required that some strategies for procurement and construction be assumed, which may require modification as the detail design matures. This achieved the second objective, to confirm the methods for procurement and construction. These elements exist as requirements, assumptions, logical relationships, and conclusions reached during schedule validation. They are reported in 11.2 and 11.3.

3. The third objective of this assessment is to identify construction inspection requirements. A preliminary listing is provided in 11.4, "Inspection Considerations."

11.1 Construction Packages

1. Title II design work is organized according to construction packages. The scope of engineering for Title II includes the preparation of drawings and specifications suitable for use for procurement of equipment and construction of the WRAP 1 facility. The Contract Work Breakdown Structure (CWBS) which organizes this work is designed to allow flexibility in the future construction process, to accommodate funding restrictions as may occur.

11.1.1 CWBS Reconfiguration

1. A change request was issued to modify the scope of two of the original CWBS elements and add two new ones. This change will separate the construction of the building shell from building internals and utilities and will separate procurement of process equipment from installation of the same. The CWBS elements which correspond to construction packages are listed below. Each includes a brief description of the scope of the construction activities to be covered in the package. The cost estimate for construction is organized according to this structure as well.

a) **CWBS 1.1.2.3 Site Preparation:** Scope includes site grading, underground utilities, sewer system, foundation earthwork, etc.

b) **CWBS 1.1.2.4 Building Structure:** Scope includes building foundation and structural steel, pre-engineered building and other building support items supplied by vendors.

c) **CWBS 1.1.2.5 Building Systems:** Scope includes interior structural and shield walls; floor slab and embedded pipe, conduit and raceways; architectural, mechanical, HVAC, electrical, and instrumentation systems for the facilities portion of the building; process equipment utility headers; and all material handling equipment outside of the gloveboxes and NDE/NDA equipment.

d) **CWBS 1.1.2.6 Waste Process Equipment:** Scope includes procurement and installation of process equipment and enclosures, NDE/NDA equipment, and necessary support systems (e.g. required instrumentation).

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e) **CWBS 1.1.2.7 Process Equipment Tie-Ins:** Scope includes connection of utilities from NDE/NDA and process equipment and enclosures to utility headers.

f) **CWBS 1.1.2.8 Site Completion:** Scope includes finish grading, landscape, parking, roads and area lighting, etc.

g) **CWBS 1.1.2.9 Computer Systems Procurement:** Scope includes turn-key computer and data acquisition systems, including hardware, software, and associated data link equipment to support process and facilities data processing and control requirements.

11.2 Procurement Considerations

1. WRAP Module 1 includes a variety of equipment, ranging from standard, general purpose items to complex, custom-designed systems. Because of this, varying procurement methods may be employed to obtain best value for the Government, while assuring conformance to technical and schedule requirements. Procurement strategy options considered in this assessment included:

- procurement by installation contractor;
- procurement by construction manager; or
- procurement by DOE.

2. Procurement by the WRAP Architect-Engineer or by the Hanford Site Management and Operating Contractor were not considered as options, although those organizations may participate in the procurement process by evaluating bids and reviewing vendor drawings. **Section 9.6** discusses a recommendation by UE&C for early procurement of the compaction equipment.

11.2.1 Procurement of Construction Items

1. Bulk material articles or commodities such as concrete, structural steel, pipe, conduit, wire, and general hardware are best provided by installation contractors. Other items such as siding, roofing, are also best provided by the contractor who provides and erects the building shell.

2. These items are commonly maintained in industrial suppliers' inventories, are routinely purchased by contractors, and do not require special procurement arrangements. Unless an article meets the criteria for Major Equipment, as discussed in 11.2.2, below, it should be provided by the installation contractor.

11.2.2 Procurement of Major Equipment

1. Major equipment is defined for this assessment as any item critical to WRAP mission, or that by its failure could cause significant cost or schedule impacts to the project. It includes the gloveboxes, glovebox internals, and the NDE/NDA equipment, which require an engineering judgment to be made on suitability for application in order to be selected for purchase. These items comprise a significant portion of the equipment list which is provided **Section 9.0**.

2. It is recommended that these equipment items be procured and furnished to the General Contractor as separate construction contracts. The scope would include design, fabrication, shipment, installation and start up of the equipment. Assistance in bid evaluation and approval of drawings and specifications is assumed to be performed by WHC, KEH and UE&C.

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11.2.3 Major Equipment Procurement Lead Times

1. Items with lead times sufficiently long to require initiation of the procurement bid packages immediately upon approval of the Title II design were evaluated. The evaluation process which identified the items involved estimates of the duration of all activities in the process of procuring major equipment, as described in the previous paragraph. It also examined logical relationships of construction activities to determine relative need dates for major equipment items. The assessment was based on Title II design completing on January 1993, procurement and construction beginning no sooner than August 1993 (after receipt of environmental permits, Key Decision 3, and PSAR approval). Construction and acceptance testing will be completed in March 1996.

2. Procurement cycle duration estimates include elements for:

- DOE review and approval of A/E Title II design
- Construction bid package preparation and award
- Vendor submittals preparation
- Vendor submittals review and approval
- Bulk material procurement and equipment fabrication
- Shop inspection and testing of equipment
- Shipment, installation and startup of supplied equipment

3. Four groups of equipment items were identified that will require considerable time to procure, which include:

a) Supercompactors and girth compactor

- Required prior to installation of gloveboxes.
- Likely to be procured from foreign vendor, which will increase delivery time and will require additional justification for purchase.
- Costly semi-custom items; components not stocked in inventory; casting machining, and plating operations required to fabricate.

b) Gloveboxes

- Entirely custom fabrication with weldments, machined parts, and lead-stainless steel laminates.
- Numerous items to be installed inside gloveboxes after fabrication of gloveboxes in shop: drum tippers, conveyors, X-ray equipment, manipulators, hoists, and core samplers.
- Workspace inside gloveboxes is limited.

9 3 1 2 7 1 1 5 3 5

c) Drum passive/active neutron assay system

- Semi-custom system with software
- Drum handling mechanism, plus detectors, instrumentation, and controls

d) Drum gamma energy assay

- Semi-custom system with software
- Drum handling mechanism, plus detectors, instrumentation, and controls.

4. A summary construction schedule which shows procurement cycles for these groups of items and key milestones and related activities is included as **Figure 11-1**.

11.3 Construction Considerations

1. The Title I design made certain assumptions regarding the methods and sequence of construction of WRAP 1. These have been factored into the preliminary design of the facility and equipment, and they will be perpetuated through Title II designs.

2. Because of this, certain constraints are automatically placed on the facility constructors. These constraints must be recognized and accounted for in construction planning. The purpose of this segment of the report is to document those items which may constrain the constructors as they build the facility.

11.3.1 Construction Assumptions

1. Construction packages and work will be organized according to the revised CWBS discussed in 11.1.

2. Construction management organization will be as shown in **Figure 11-2**.

3. Procurement and installation of the major process equipment will be separate construction contracts. The balance of equipment and hardware commodities will be procured by the General Contractor.

4. Funding for construction will be available as required, within limits of validated estimates.

5. There are no special access considerations for transport and placement of equipment in the facility (these have been addressed in facility design and confirmed). Consideration has been given for placement of the stacker/retriever (Shipping and Receiving) and the compaction equipment prior to installation of other equipment/enclosures associated with these items. Access panels are also required on the building structure to facilitate placement of the second floor HVAC equipment.

9 3 1 2 7 6 1 1 5 3 6

FIGURE 11-1
WRAP 1 OVERALL PROJECT SCHEDULE

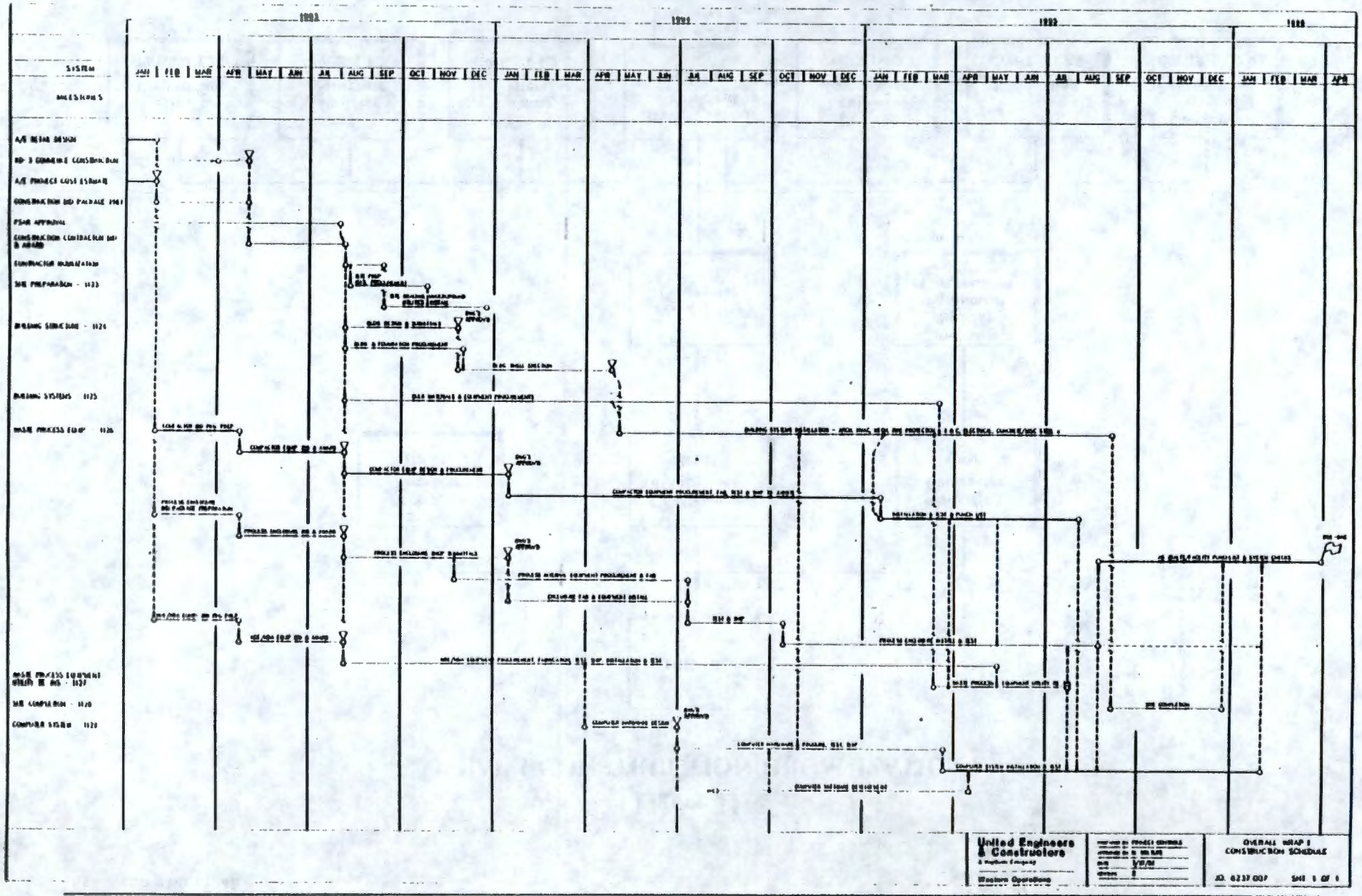
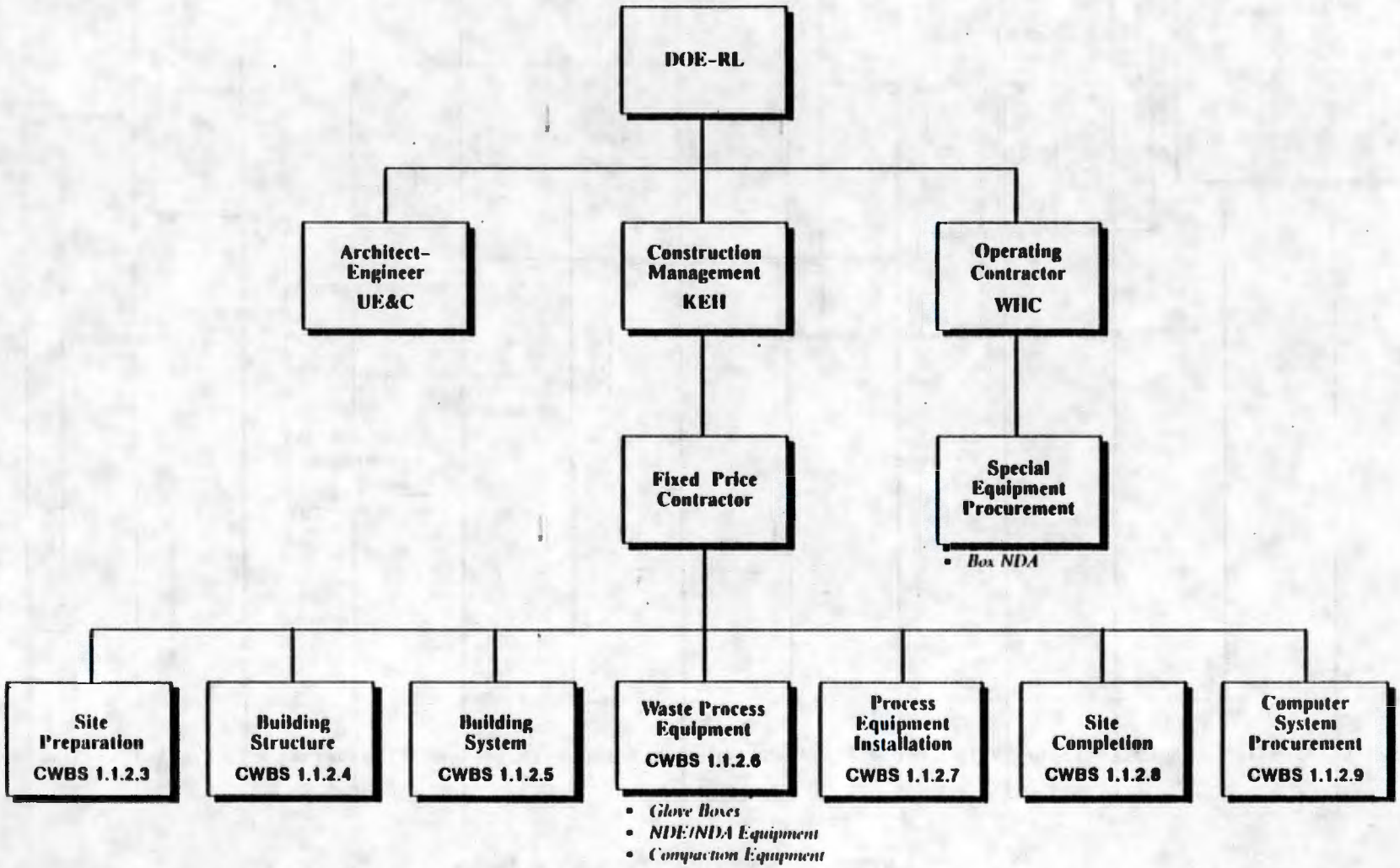


Figure 11-2

WRAP 1 CONSTRUCTION ORGANIZATION



11.3.2 Logical Relationships

1. Certain logical relationships exist between or among the construction tasks. These are reflected by or have resulted in process, utility, and equipment designs. Since the facility was designed to accommodate the process and equipment, the construction logic is straight forward and constrained primarily by the compaction equipment procurement.

2. This assessment does not identify routine predecessor relationships (e.g., assemble and install re-bar before forming and pouring concrete), but instead focuses on relationships which are unique to the WRAP 1 facility and the processes and equipment it contains. The logical relationships are presented by construction package.

a) **Site Preparation Package**

- Complete foundation excavation and compaction before beginning construction of Building Structure.
- Include provisions for underground utility entrances in foundation ring wall (in Building Structure Package).

b) **Building Structure Package**

- Contractor shop drawing/design calculations submittal to confirm foundation design.
- Foundation and building shell erection.

c) **Building Systems Package**

- Pour equipment foundations and install embedded pipe prior to pouring floor slab.
- Overhead utilities installation.
- Mechanical equipment installation.

d) **Process Equipment Procurement**

- Initiate timely procurement of compactors, gloveboxes and NDE/NDA equipment.
- Design, submittal approval, fabrication of equipment.
- Vendor shop witness testing of equipment.
- Onsite installation and functional testing of equipment.

e) **Process Equipment Utility Tie-Ins**

- Tie-in of building utility systems to equipment to support functional testing constraints.

9 3 1 2 7 1 1 5 3 9

f) **Site Completion - no unique logical relationships.**

g) **Computer Systems**

- Assure computer room HVAC and fire protection installed and operational before energizing computer and control system hardware.

- Computer hardware/software installed to complete facility functional tests.

11.4 Inspection Considerations

1. To assure conformance to requirements and correct fit-up and operation of WRAP 1 equipment and facilities without rework, it is important to inspect construction work at various stages of completion. In addition to being important elements of quality management, certain of the hold point inspections are prescribed by applicable building and safety codes as specified in the facility specifications. Those inspections which are required to be performed during construction of WRAP 1 are described in the following paragraphs.

2. **Soil and Earthwork Preparation:** Confirm construction staking per horizontal and vertical control as specified on the drawings. Perform tests to validate soil compaction, moisture content, etc. Assure proper completion of grading, backfilling and compaction operations. Assure proper excavation and preparations for building foundations. Verify underground utility lines for proper bedding, slope and invert elevations.

3. **Foundation Steel:** Verify correct reinforcing bar size, type and placement prior to pouring concrete for footings and foundations. Dowel, splice, and threaded connector locations to be verified for future concrete placement.

4. **Concrete Embedments and Cast-In-Place Features:** Verify correct size, location and slope of all underfloor water and sewer lines, electrical conduits and raceways, and ductwork prior to pouring the floor slab. Verify correct installation of reinforcing mesh before and during concrete slab pouring. Verify correct positioning of through-wall apertures in forms before pouring walls. Verify expansion joint placement and water stop location.

5. **Cast-In-Place Concrete:** Sample and test slump of concrete mix for each batch used for construction. Collect and test concrete cylinders for compressive strength.

6. **Bolts Installed in Concrete:** Verify placement of bolts and adequate grip for anchoring of structural steel or equipment prior to placement of concrete.

7. **Masonry:** Inspect foundation, bricks/blocks, and mortar materials to verify conformance to requirements prior to use. Inspect during construction to verify placement of reinforcing mesh and ties, reinforcing steel, bond beam locations and grouting as specified.

8. **Piers and Grade Beams:** Verify proper location of piers prior to installation. Ensure grade beams are formed, reinforced and cast in place per specification.

9 3 1 2 7 6 1 1 5 4 0

9. **Framing:** Inspect the framed structure shell after completion of roof, frame, bracing, and vents. Ensure horizontal and vertical bracing is installed per drawings. Inspect interior framing in administrative areas after placement and inspection of electrical, plumbing, heat pipe, wires, and ducts, prior to insulation and covering with wallboard.

10. **Gypsum Board:** Inspect gypsum board installation prior to plastering of joints and fasteners. Inspect finish of plastered joints prior to texturing and painting.

11. **Electrical:** Verify installation and proper operation of protective devices and ground fault circuit interrupters. Verify installation and proper operation of uninterruptible power supplies and transfer devices. Verify installation and proper operation of emergency equipment/systems, safety switches, and lockout features. Verify proper phasing/polarity of installed equipment and circuits. Verify insulation resistance on power feeder conductors. Verify installation of conduit supports and box covers. Verify installation and bonding of ground conductors. Check lighting for proper switching. Verify ratings, proper size and type of wiring and raceways.

12. **Instrumentation and Controls:** Verify that point-to-point electrical connections have been made on instrumentation wiring. Check proper installation of all instruments and calibrate. Check for grounding on power and signal lines. Perform electrical continuity checks on all input/output points to the Plant Management System. Test proper operation of all processors, power supplies, communications and input/output modules of the Plant Management System. Check proper communications along all communications networks associated with the Plant Management System.

13. **Mechanical Equipment:** Verify proper rotation or direction of travel for motors and drives. Verify installation of stops, latches, lockouts, and emergency shutoffs. Verify installation of safety interlocks and collision avoidance equipment. Verify anchoring of equipment and alignment of mating devices. Verify connection and adjustment of chains, belts, and couplings. Verify installation of guards. Verify installation and operation of ventilation system, per test and balance requirements.

14. **Life Safety Code Items:** Verify installation and proper operation of fire detection/protection system, including automatic and manual alarm systems, communications to external emergency response organizations, and internal voice communications. Verify installation of exit doors, egress routes, and emergency lighting. Verify operation of emergency shutoffs for HVAC, gas, fuel oil, and electric power.

15. **Final Inspection:** Inspect final grading and completion of building. Punch lists are to be generated based upon detail inspection of all building systems against the contract drawings and specifications. Correction of deficiencies to be completed and verified prior to performance of functional testing by contractor.

9 3 1 2 7 1 1 5 4 1

12.0 CONSTRUCTION SCHEDULE

9 3 1 2 7 1 1 5 4 2

12.0 CONSTRUCTION SCHEDULE

1. UE&C Construction Schedule for WRAP Module 1 TIES to the estimate of construction costs detailed in Volume IV of this Title I submittal. The schedule reflects constraints such as approval of Key Decisions, RCRA Part B permit and PSAR approval. It was prepared using Prima Vera project management software and is structured according to the seven construction design/work packages described in the CWBS.

2. The lowest level activities shown in the schedule correspond to plant subsystems or major equipment items. Detail is sufficient to permit analysis and future manipulation to forecast construction activities which may be accomplished under various funding scenarios.

12.1 Schedule Basis

12.1.1 Schedule Logic

1. The schedule logic was developed independently, while taking into account constraints and strategies for construction. Activities were grouped according to the seven CWBS elements described in 11.1.1, "CWBS Reconfiguration." Sequences and task dependencies were determined in accordance with normal construction practices, and to accommodate unique features of the WRAP Facility.

2. The logic incorporates programmatic constraints, including:

- Completion of Title II Design.
- Receipt of RCRA Part B permit prior to approval to commence construction (Key Decision 3).
- Approval of Key Decision 3 prior to issue of request for proposal for construction work.
- Organization of construction activities into four bid packages - for procurement and installation of specialized process equipment, and for facility construction by a general contractor.
- Approval of Preliminary Safety Analysis Report prior to issue of authorization to proceed with on-site construction work.

3. The logic, duration, and starting times in this schedule do not account for or anticipate any constraints due to availability of funds.

4. Task durations are estimated with consideration given to crew size. Time allotments are also included for procurement of equipment and construction materials.

5. The duration specified for field construction activities include contingency, which has been incorporated into the critical path. The assigned contingency was converted from dollars to manhours and the manhours were then added to the hours estimated to perform the field construction activities.

9 3 1 2 7 1 1 5 4 3

6. The basic construction logic evolved around the concept of once the building structure and concrete was in place, the internal equipment installation would be sequenced through the building. HVAC ductwork, firewater sprinkler piping, utility pipes, instrumentation and electrical bulk material installation would then follow in this order through the building. This provides reasonable crew sizes and installation efficiency.

7. A key point in the construction logic is the contractor submittals for technical review and approval of the super compactor procurement.

12.1.2 Construction and Procurement Strategies

1. DOE-RL is expected to engage a construction manager that will, in turn, hire a general contractor to perform or subcontract all construction activities and all procurement activities, except as otherwise noted, under a competitive fixed price bid structure.

2. Procurement and installation of major, engineered process equipment items is expected to be by a separate contractor from the construction general contractor.

3. The pre-engineered metal building is expected to be provided and erected by a single contractor, who will also perform the construction of the building's foundations. The general contractor will administer these activities.

4. The Process Control System (PCS) will be procured by the general contractor. Configuration of PCS software for WRAP will be provided with the system.

5. Data Management System (DMS) hardware will be procured by the general contractor. DMS software will be procured by the Hanford site Management and Operating (M&O) contractor.

6. Procurement and construction hold points have been included for A/E approval of additional designs provided by vendors (e.g., building foundations, software, and fabricator shop drawings).

12.1.3 Technical Basis for Cost and Schedule

1. The completed preliminary design presented in this Title I Design Report is the technical basis for the schedule and cost estimate for construction of the WRAP Module 1 Facility.

12.1.4 Assumptions and Qualifications

1. The construction schedule is based on a 40 - hour standard work week with no unscheduled work stoppages or delays.

2. Permanent fire suppression systems, other than supply of firewater via hydrants, are not required during construction.

3. Construction sequence for installation of Building Systems materials was assumed to be suspension from the roof, ductwork highest, then piping and finally electrical.

4. Parallel activities are scheduled whenever possible without interference in work areas.

9 3 1 2 7 6 1 1 5 4 4

5. Facility turnover from construction to operations will take place on March 20, 1996. Acceptance testing prior to turnover is assumed to be independent checks of proper operation of components or subsystems, end-to-end checks of electrical wiring, and system checkout and performance demonstration, as called for in the construction specifications.

6. Calibration of instruments will be by the contractor.

7. Completion of engineering and environmental permitting activities will be as scheduled in the A/E's schedule for Title II Design.

12.2 Schedule

1. A summary WRAP Module 1 Construction Schedule included as **Figure 12-1.**

2. The WRAP Module 1 Detail Construction Schedule in bar chart format is included as **Figure 12-2.**

3. The WRAP Module 1 Construction Schedule/Logic Diagram is included as **Figure 12-3.**

9 3 1 2 7 1 1 5 4 5

FIGURE 12-1

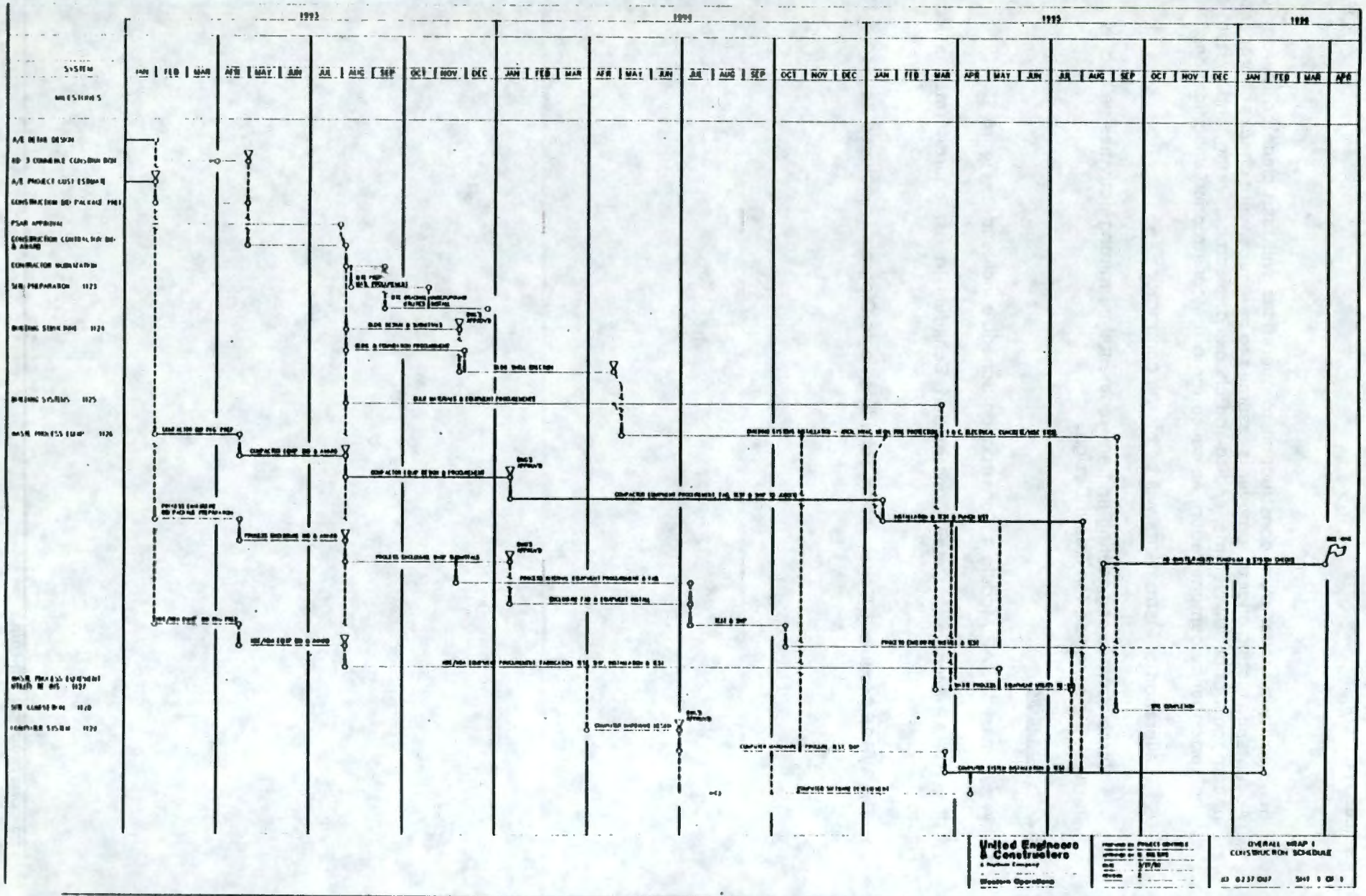
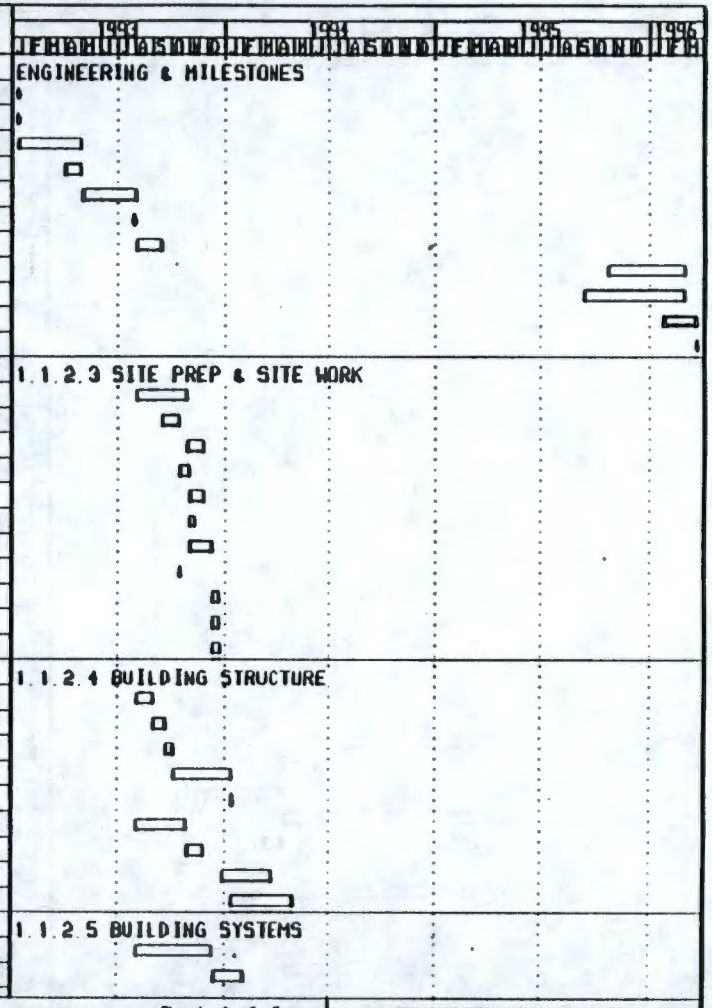

1993
1994
1995
1996
SYSTEM
MILESTONES
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
A/E DETAIL DESIGN
A/E PROJECT COST ESTIMATE
PSAR APPROVAL
SITE PREPARATION 1123
BUILDING STRUCTURE 1124
BUILDING SYSTEMS 1125
BASIC PROCESS EQUIP 1126
SITE COMPLETION 1128
COMPUTER SYSTEM 1129
United Engineers & Constructors
Western Operations
OVERALL WRAP I CONSTRUCTION SCHEDULE

FIGURE 12-2
PAGE 1 OF 5

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
	ENGINEERING & MILESTONES		
201	A/E DETAIL DESIGN		11JAN93
202	A/E PROJECT COST ESTIMATE		11JAN93
203	CONSTRUCTION BID PACKAGE PREP	12JAN93	30APR93
205	KD-3 COMMENCE CONSTRUCTION	2APR93	30APR93
206	CONSTRUCTION CONTRACTOR BID & AWARD	3MAY93	3AUG93
207	PSAR APPROVAL		30JUL93
208	CONTRACTOR MOBILIZATION	4AUG93	15SEP93
209	DEMOBILIZATION	21OCT95	29FEB96
210	AS-BUILTS	12SEP95	29FEB96
211	FACILITY FUNCTIONAL TESTS	21JAN96	20MAR96
212	OFFICIAL ACCEPTANCE OF CONSTRUCTION		20MAR96
	1.1.2.3 SITE PREP & SITE WORK		
301	PROCURE BULK MATERIALS	4AUG93	27OCT93
302	SITE GRADING	16SEP93	14OCT93
303	INSTALL ELECTRICAL FEEDER	28OCT93	24NOV93
304	EXCAVATE & BED EXTERIOR UTILITY TRENCHES	15OCT93	1NOV93
305	INSTALL EXTERNAL U/G SEWER SEPTIC SYSTEM	2NOV93	24NOV93
306	INSTALL U/G POTABLE WATER	2NOV93	9NOV93
307	INSTALL U/G FIRE HYDRANT SYSTEM	2NOV93	9DEC93
308	EXCAVATE BLDG FOOTINGS & FOUNDATIONS	15OCT93	15OCT93
309	BACKFILL EXTERIOR TRENCHES	10DEC93	21DEC93
310	BACKFILL EXTERIOR SEWER SEPTIC SYSTEM	10DEC93	21DEC93
311	WHC UTILITY TIE-INS	10DEC93	23DEC93
	1.1.2.4 BUILDING STRUCTURE		
401	CONCRETE & REBAR SUBMITTAL	4AUG93	31AUG93
402	CONCRETE & REBAR SUBMITTAL APPROVAL	1SEP93	22SEP93
403	POUR/FORM FOOTINGS	23SEP93	4OCT93
404	POUR FOUNDATIONS & EXTERIOR SLABS	5OCT93	11JAN94
405	BACKFILL FOUNDATIONS	12JAN94	12JAN94
406	PRE-ENGINEERED BUILDING SUBMITTAL	4AUG93	27OCT93
407	BUILDING SUBMITTAL APPROVAL	28OCT93	24NOV93
408	BUILDING STEEL ERECTION	27DEC93	21MAR94
409	BUILDING ROOF & SIDING INSTALLATION	11JAN94	29APR94
	1.1.2.5 BUILDING SYSTEMS		
501	HVAC SYSTEM SUBMITTAL	4AUG93	10DEC93
502	HVAC SUBMITTAL APPROVAL	13DEC93	1FEB94



Activity Bar/Early Dates
Critical Activity
Progress Bar

Primavera Systems, Inc 1984-1991

DEPARTMENT OF ENERGY
WASTE RECEIVING & PROCESSING
WRAP MOD I CONSTRUCTION SCHEDULE

Project Start : 1JAN92
Project Finish: 20MAR96

Sheet 1 of 5

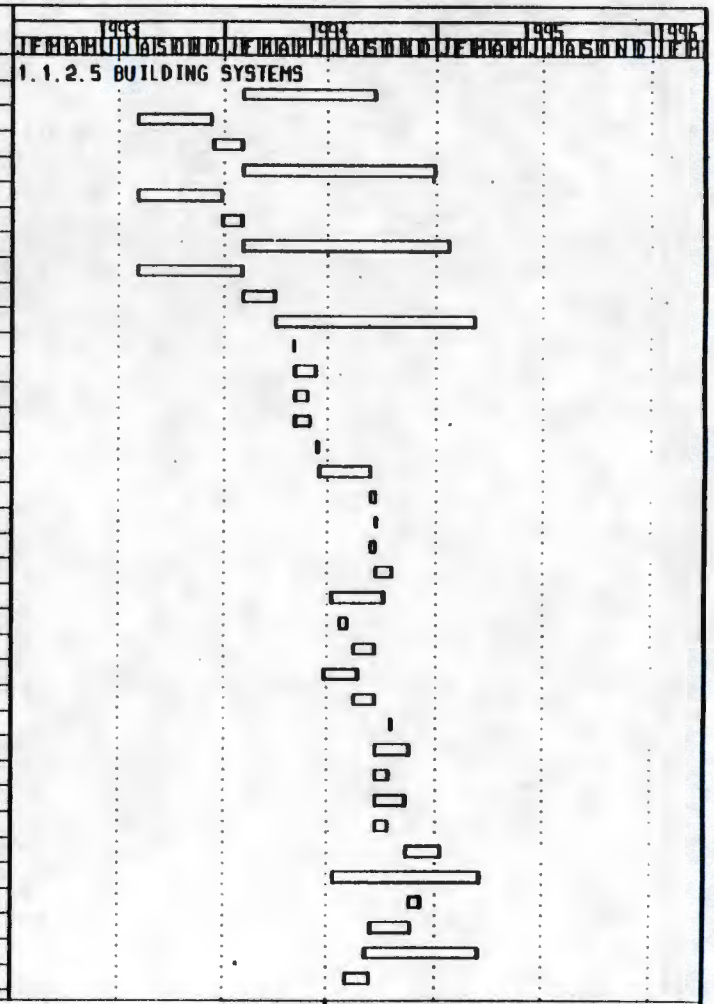
Data Date: 1JAN92
Plot Date: 31MAR92

UNITED ENGINEERS & CONSTRUCTORS, INC.

Date	Revision	Checked	Approved

FIGURE 12-2
PAGE 2 OF 5

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
	1.1.2.5 BUILDING SYSTEMS		
503	HVAC EQUIPMENT FABRICATION/PROCURE	2FEB94	19SEP94
504	MATERIAL HANDLING EQUIPMENT SUBMITTAL	4AUG93	10DEC93
505	MATERIAL HANDLING EQUIPMENT SUBMITTAL APPROVAL	13DEC93	1FEB94
506	MATERIAL HANDLING EQUIPMENT FABRICATION/PROCURE	2FEB94	30DEC94
507	ELECTRICAL EQUIPMENT SUBMITTAL	4AUG93	27DEC93
508	ELECTRICAL EQUIPMENT SUBMITTAL APPROVAL	28DEC93	1FEB94
509	ELECTRICAL EQUIPMENT PROCUREMENT	2FEB94	23JAN95
510	BULK MATERIAL SUBMITTAL	4AUG93	1FEB94
511	BULK MATERIAL SUBMITTAL APPROVAL	2FEB94	30MAR94
512	BULK MATERIAL PROCUREMENT	31MAR94	7MAR95
513	EXCAVATE & BED INTERIOR TRENCHES	2MAY94	2MAY94
514	INSTALL INTERIOR WATER MAIN	3MAY94	9JUN94
515	INSTALL SANITARY SEWER DRAIN PIPING	3MAY94	27MAY94
516	INSTALL INTERIOR ELECTRICAL MAIN FEEDER	3MAY94	31MAY94
517	BACKFILL INTERIOR TRENCHES/INSTALL INBEDS	10JUN94	15JUN94
518	FORM/POUR/CURE GRND FLOOR SLABS, EQP FOUNDATIONS	16JUN94	12SEP94
519	INSTALL BRIDGE CRANE RAILS	13SEP94	20SEP94
520	INSTALL BRIDGE CRANE	21SEP94	23SEP94
521	INSTALL STACKER/RETRIEVER	13SEP94	19SEP94
522	SET STACKER/RETRIEVER SHIELD WALLS	20SEP94	19OCT94
523	INSTALL MASONRY WALLS	8JUL94	5OCT94
524	FORM/POUR/CURE 2ND FLOOR SLABS	22JUL94	4AUG94
525	SET HVAC MEZZ EQUIPMENT	15AUG94	19SEP94
526	INSTALL HVAC DUCTWORK	24JUN94	22AUG94
527	INSTALL MECH ROOM #118 EQUIPMENT	15AUG94	19SEP94
528	SET PROCESS STACK	17OCT94	18OCT94
529	INSTALL CHILLERS	20SEP94	17NOV94
530	INSTALL ROOM #113 HVAC FILTER TRAINS	20SEP94	14OCT94
531	INSTALL CHILLED WATER PIPING	20SEP94	10NOV94
532	INSTALL HEAT RECOVERY PIPING	20SEP94	13OCT94
533	INSTALL COMPRESSED AIR PIPING	11NOV94	10JAN95
534	INSTALL ELECTRICAL/I&C RAILWAYS	11JUL94	17MAR95
535	INSTALL INTERIOR POTABLE WATER PIPING	18NOV94	7DEC94
536	INSTALL INTERIOR SEWER/SEPTIC PIPING	13SEP94	21NOV94
537	INSTALL BUILDING LIGHTING	5SEP94	15MAR95
538	FIRE PROTECTION SUBMITTAL	1AUG94	12SEP94



Activity Bar/Early Dates
Critical Activity
Progress Bar

Primavera Systems, Inc 1984-1991

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WASTE RECEIVING & PROCESSING
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Sheet 2 of 5

Data Date: 1JAN92
Plot Date: 31MAR92

UNITED ENGINEERS & CONSTRUCTORS, INC.

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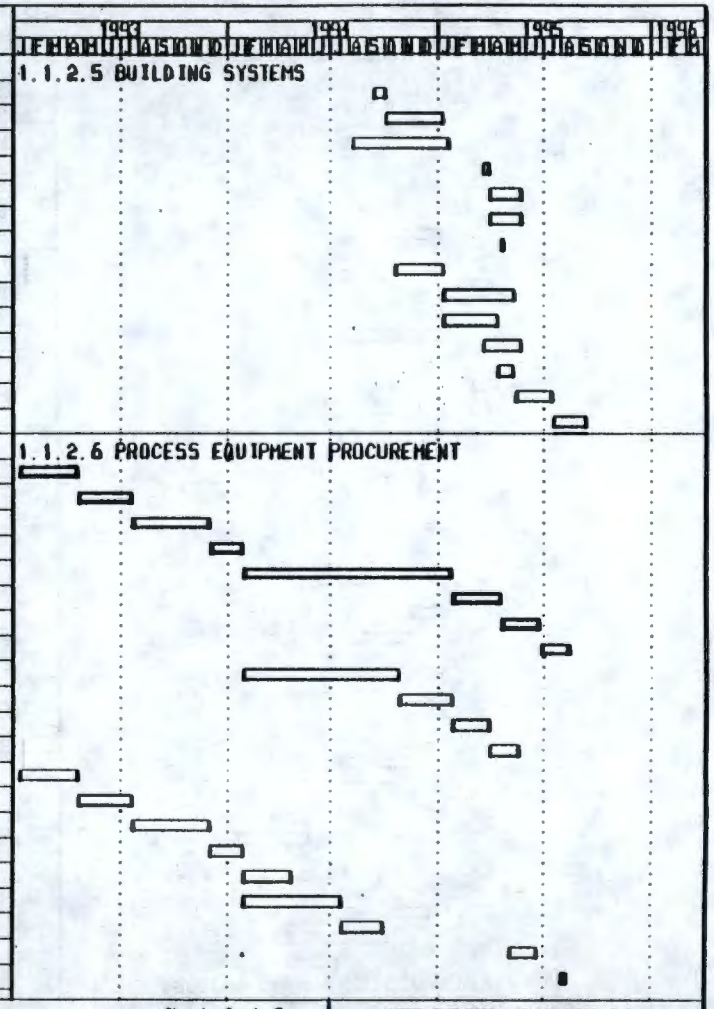
FIGURE 12-2
PAGE 3 OF 5

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
	1.1.2.5 BUILDING SYSTEMS		
539	FIRE PROTECTION SUBMITTAL APPROVAL	13SEP94	3OCT94
540	FIRE PROTECTION PROCURE & INSTALL	4OCT94	9JAN95
541	INSTALL BUILDING ARCHITECTURAL FINISH	8AUG94	19JAN95
542	INSTALL TRANSFORMERS	20MAR95	30MAR95
543	INSTALL ELEC SWITCHGEAR & MCC'S ROOM #116	31MAR95	23MAY95
544	INSTALL NDE/NDA & SHIPPING/REC MCC'S	31MAR95	23MAY95
545	INSTALL UPS EQUIPMENT ROOM #115	21APR95	24APR95
546	INSTALL MATERIAL HANDLING EQUIPMENT	20OCT94	10JAN95
547	INSTALL INSTRUMENTATION/CHECKOUT ALL CWBS 1125	11JAN95	12MAY95
548	INSTALL ELEC GROUND & CCTV SYSTEM	11JAN95	13APR95
549	INSTALL HANDRAILS/PLATFORMS ETC.	20MAR95	22MAY95
550	INSTALL/FINISH ELECTRICAL, I&C	14APR95	9MAY95
551	BUILDING PAINTING	15MAY95	14JUL95
552	PUNCHLIST/FUNCTIONAL TESTS CWBS 1125	17JUL95	11SEP95
	1.1.2.6 PROCESS EQUIPMENT PROCUREMENT		
601	LLW/TRU COMPACTORS BID PREP	12JAN93	20APR93
602	LLW/TRU COMPACTORS BID & AWARD	21APR93	22JUL93
603	COMPACTOR DESIGN SUBMITTAL	23JUL93	30NOV93
604	COMPACTOR SUBMITTAL APPROVAL	1DEC93	27JAN94
605	TRU COMPACTOR FABRICATION	28JAN94	25JAN95
606	TRU COMPACTOR TEST/SHIPMENT	26JAN95	20APR95
607	TRU COMPACTOR INSTALLATION ON-SITE	21APR95	23JUN95
608	TRU COMPACTOR ON-SITE PUNCHLIST	26JUN95	15AUG95
609	LLW COMPACTOR FABRICATION	28JAN94	26OCT94
610	LLW COMPACTOR TEST/SHIPMENT	27OCT94	25JAN95
611	LLW COMPACTOR INSTALLATION ON-SITE	26JAN95	30MAR95
612	LLW COMPACTOR ON-SITE PUNCHLIST	31MAR95	19MAY95
613	LLW/TRU GLOVEBOX ENCLOSURES BID PREP	12JAN93	20APR93
614	GLOVEBOX BID & AWARD	21APR93	22JUL93
615	GLOVEBOX SHOP DRAWING SUBMITTAL	23JUL93	30NOV93
616	GLOVEBOX SUBMITTAL APPROVAL	1DEC93	27JAN94
617	TRU PROCESSING GLOVEBOX FABRICATION	28JAN94	22APR94
618	TRU PROCESSING GLOVEBOX EQUIP INSTALLATION	28JAN94	19JUL94
619	TRU PROCESSING GLOVEBOX SHOP TEST/SHIP	20JUL94	28SEP94
620	TRU PROCESSING GLOVEBOX INSTALLATION ON-SITE	5MAY95	20JUN95
621	TRU PROCESSING GLOVEBOX PUNCHLIST	1AUG95	10AUG95



Activity Bar/Early Dates
Critical Activity
Progress Bar

Primavera Systems, Inc 1981-1991

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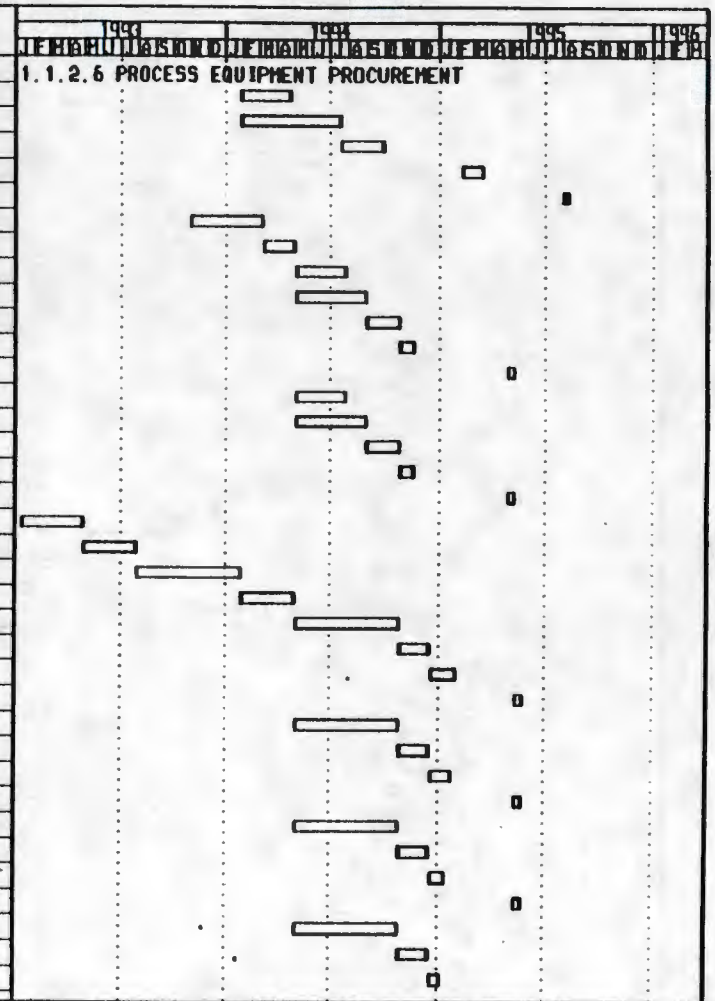
FIGURE 12-2
PAGE 4 OF 5

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
	1.1.2.6 PROCESS EQUIPMENT PROCUREMENT		
622	LLW PROCESSING GLOVEBOX FABRICATION	28JAN94	22APR94
623	LLW PROCESSING GLOVEBOX EQUIP INSTALLATION	28JAN94	19JUL94
624	LLW PROCESSING GLOVEBOX SHOP TEST/SHIP	20JUL94	28SEP94
625	LLW PROCESSING GLOVEBOX INSTALLATION ON-SITE	9FEB95	16MAR95
626	LLW PROCESSING GLOVEBOX PUNCHLIST	1AUG95	10AUG95
627	TRU/LLW RWM GLOVEBOX SHOP DRAWING SUBMITTAL	1NOV93	4MAR94
628	TRU/LLW RWM GLOVEBOX SUBMITTAL APPROVAL	7MAR94	29APR94
629	TRU RWM GLOVEBOX FABRICATION	2MAY94	26JUL94
630	TRU RWM GLOVEBOX EQUIP INSTALLATION	2MAY94	30AUG94
631	TRU RWM GLOVEBOX SHOP TEST/SHIP	31AUG94	26OCT94
632	TRU RWM GLOVEBOX INSTALLATION ON-SITE	27OCT94	18NOV94
633	TRU RWM GLOVEBOX PUNCHLIST	28APR95	9MAY95
634	LLW RWM GLOVEBOX FABRICATION	2MAY94	26JUL94
635	LLW RWM GLOVEBOX EQUIP INSTALLATION	2MAY94	30AUG94
636	LLW RWM GLOVEBOX SHOP TEST/SHIP	31AUG94	26OCT94
637	LLW RWM GLOVEBOX INSTALLATION ON-SITE	27OCT94	17NOV94
638	LLW RWM GLOVEBOX PUNCHLIST	28APR95	9MAY95
639	NDE/NDA BID PREP	12JAN93	27APR93
640	NDE/NDA BID & AWARD	28APR93	29JUL93
641	NDE/NDA SUBMITTAL	30JUL93	27JAN94
642	NDE/NDA SUBMITTAL APPROVAL	28JAN94	29APR94
643	NDE BOX EQUIP FABRICATION	2MAY94	26OCT94
644	NDE BOX SHOP TEST/SHIP	27OCT94	16DEC94
645	NDE BOX INSTALLATION ON-SITE	19DEC94	30JAN95
646	NDE BOX PUNCHLIST	12MAY95	23MAY95
647	NDE DRUM EQUIP FABRICATION	2MAY94	26OCT94
648	NDE DRUM EQUIP SHOP TEST/SHIP	27OCT94	16DEC94
649	NDE DRUM EQUIP INSTALLATION ON-SITE	19DEC94	23JAN95
650	NDE DRUM EQUIP PUNCHLIST	12MAY95	23MAY95
651	NDA DRUM PAN EQUIP FABRICATION	2MAY94	26OCT94
652	NDA DRUM PAN EQUIP SHOP TEST/SHIP	27OCT94	16DEC94
653	NDA DRUM PAN EQUIP INSTALLATION ON-SITE	19DEC94	12JAN95
654	NDA DRUM PAN EQUIP PUNCHLIST	12MAY95	23MAY95
655	NDA DRUM GEA EQUIP FABRICATION	2MAY94	26OCT94
656	NDA DRUM GEA EQUIP SHOP TEST/SHIP	27OCT94	16DEC94
657	NDA DRUM GEA EQUIP INSTALLATION ON-SITE	19DEC94	5JAN95



Activity Bar/Early Dates
Critical Activity
Progress Bar

Primavera Systems, Inc 1984-1991

DEPARTMENT OF ENERGY
WASTE RECEIVING & PROCESSING
WRAP MOD I CONSTRUCTION SCHEDULE

Project Start : 1JAN92
Project Finish: 20MAR95

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Data Date: 1JAN92
Plot Date: 31MAR92

UNITED ENGINEERS & CONSTRUCTORS, INC

Date	Revision	Checked	Approved

FIGURE 12-2
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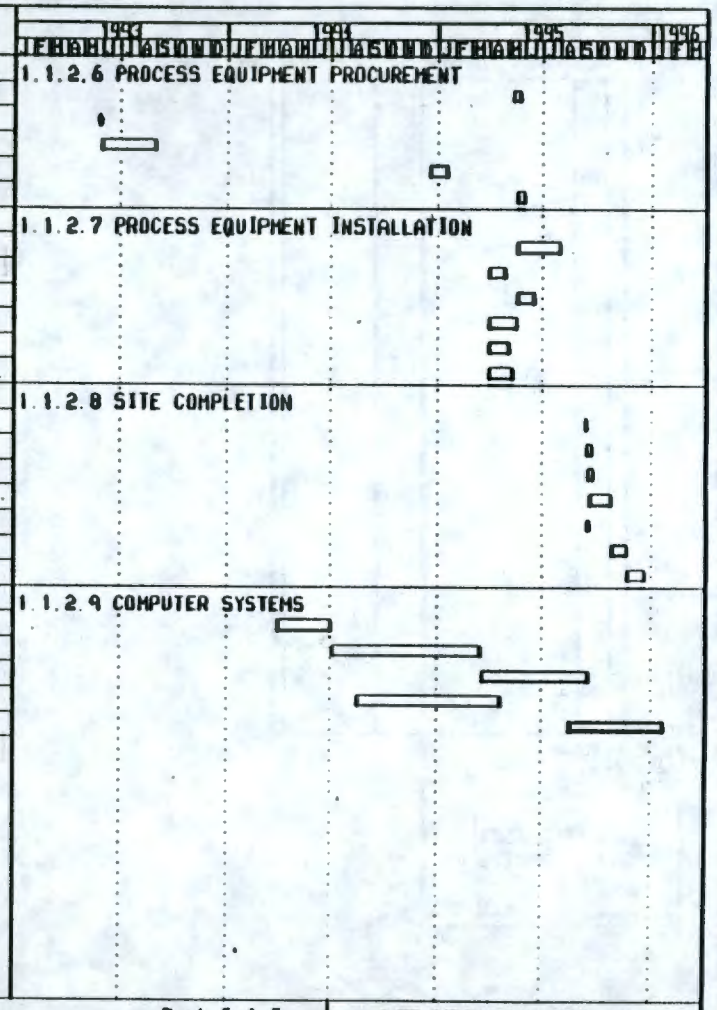
ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
	1.1.2.6 PROCESS EQUIPMENT PROCUREMENT		
658	NDA DRUM GEA EQUIP PUNCHLIST	12MAY95	23MAY95
659	GFE NDA BOX EQUIP FABRICATION COMPLETE		28MAY93
660	GFE NDA BOX EQUIP SHOP TEST/SHIP	31MAY93	30AUG93
661	GFE NDA BOX EQUIP INSTALLATION ON-SITE	14DEC94	17JAN95
662	GFE NDA BOX PUNCHLIST	19MAY95	31MAY95
	1.1.2.7 PROCESS EQUIPMENT INSTALLATION		
701	HVAC TIE-IN TO TRU/LLW PROCESS GLOVEBOX	19MAY95	31JUL95
702	HVAC TIE-IN TO TRU/LLW RWM GLOVEBOX	31MAR95	27APR95
703	ELEC/I&C TERMINATIONS ON TRU & LLW GLOVEBOXES	19MAY95	16JUN95
704	TERMINATIONS ON DRUM/BOX NDE EQUIPMENT	31MAR95	18MAY95
705	TERMINATIONS GFE BOX NDA EQUIPMENT	31MAR95	4MAY95
706	TERMINATIONS DRUM NDA EQUIPMENT	31MAR95	11MAY95
	1.1.2.8 SITE COMPLETION		
801	INSTALL IRRIGATION SYSTEM	12SEP95	13SEP95
802	REPLACE TOP SOIL	14SEP95	22SEP95
803	INSTALL CURBS & WALKS	18SEP95	25SEP95
804	PAVE ROADS & PARKING	20SEP95	26OCT95
805	INSTALL EXTERIOR LIGHTING	14SEP95	19SEP95
806	LANDSCAPING	27OCT95	21NOV95
807	PUNCHLIST/REWORK CWBS 1128	22NOV95	21DEC95
	1.1.2.9 COMPUTER SYSTEMS		
901	COMPUTER HARDWARE DESIGN	1APR94	1JUL94
902	COMPUTER HARDWARE PROCUREMENT/TEST/SHIP	5JUL94	17MAR95
903	COMPUTER INSTALLATION/TEST	20MAR95	18SEP95
904	COMPUTER SOFTWARE CONFIGURATION	16AUG94	21APR95
905	COMPUTER PUNCHLIST/RESOLUTION CWBS 1129	16AUG95	23JAN96



Activity Bar/Early Dates
Critical Activity
Progress Bar

Primavera Systems, Inc 1984-1991

DEPARTMENT OF ENERGY
WASTE RECEIVING & PROCESSING
WRAP MOD I CONSTRUCTION SCHEDULE

Sheet 6 of 6

Project Start : 1JAN92
Project Finish: 20MAR96

Data Date: 1JAN92
Plot Date: 31MAR92

UNITED ENGINEERS & CONSTRUCTORS, INC

Date	Revision	Checked	Approved

FIGURE 12-3
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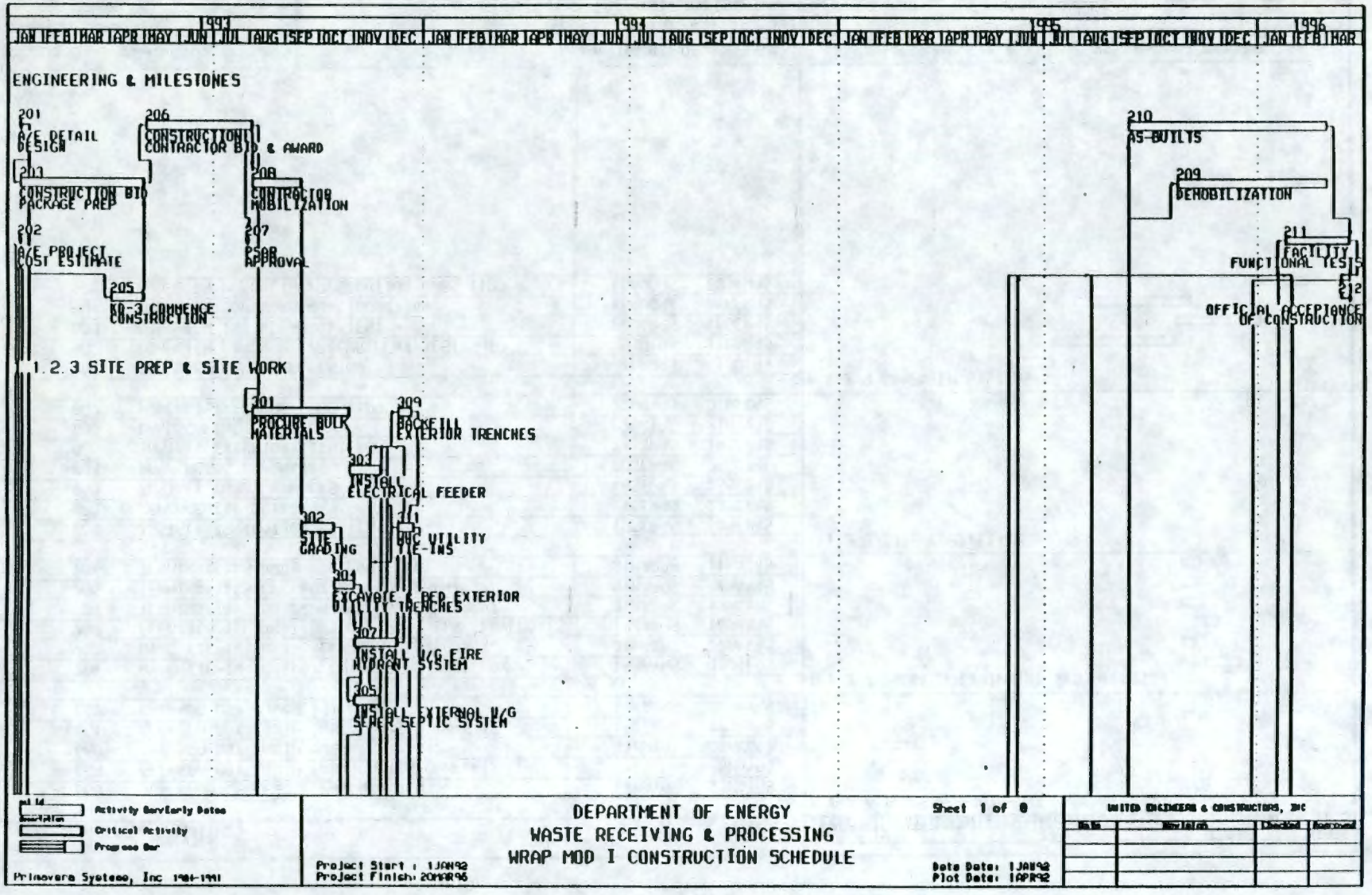

FIGURE 12-3
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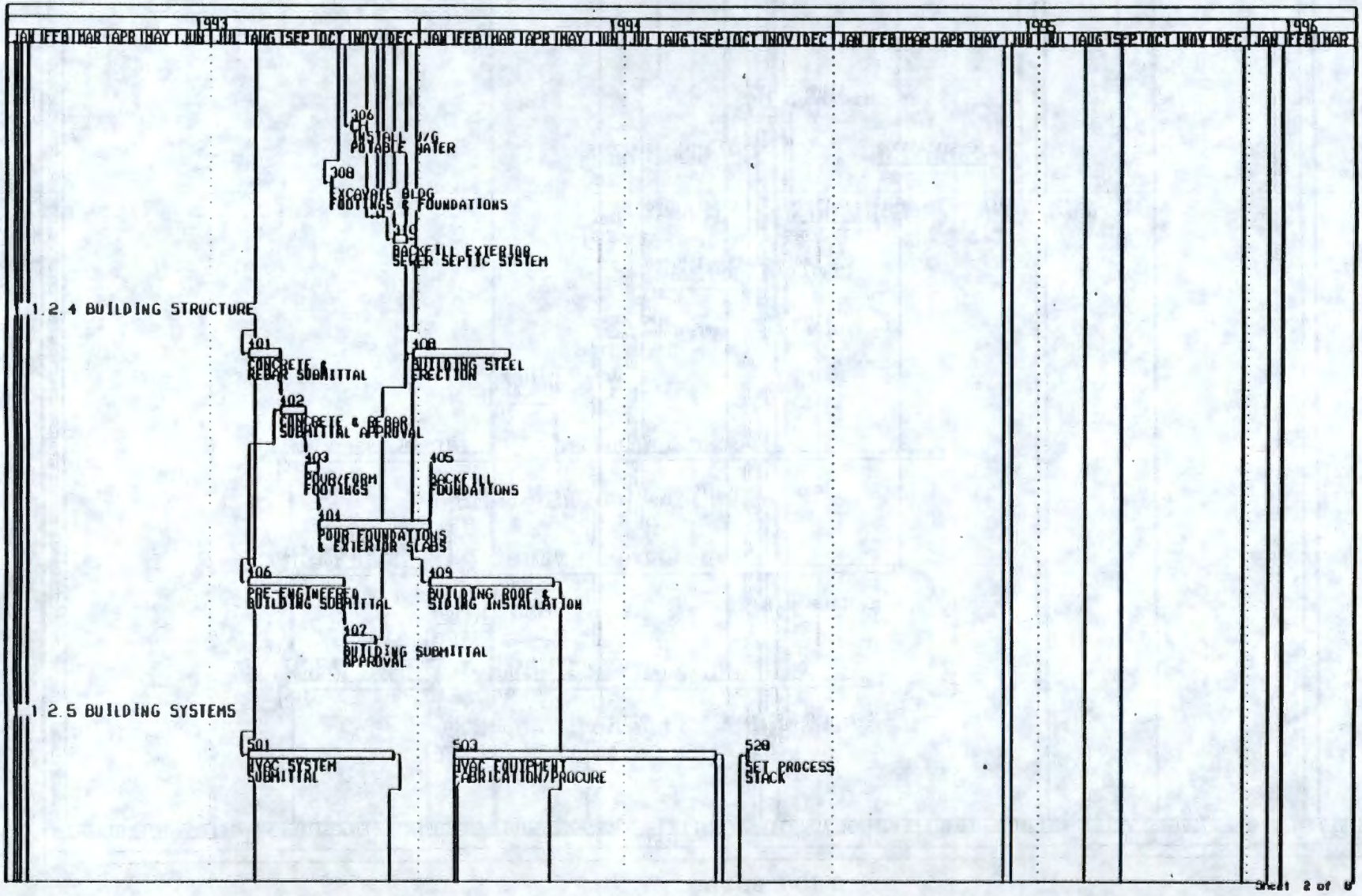

FIGURE 12-3
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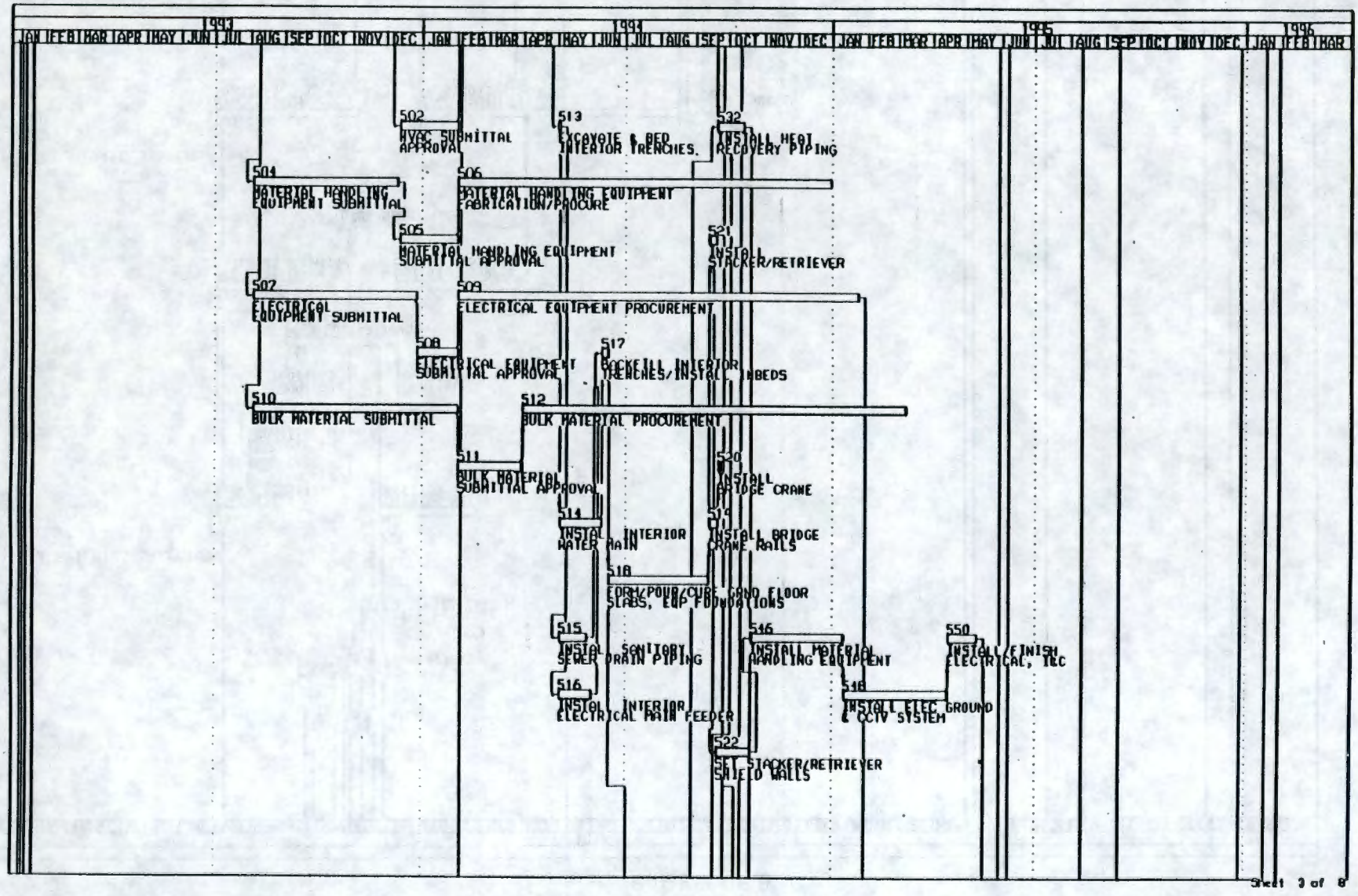

FIGURE 12-3
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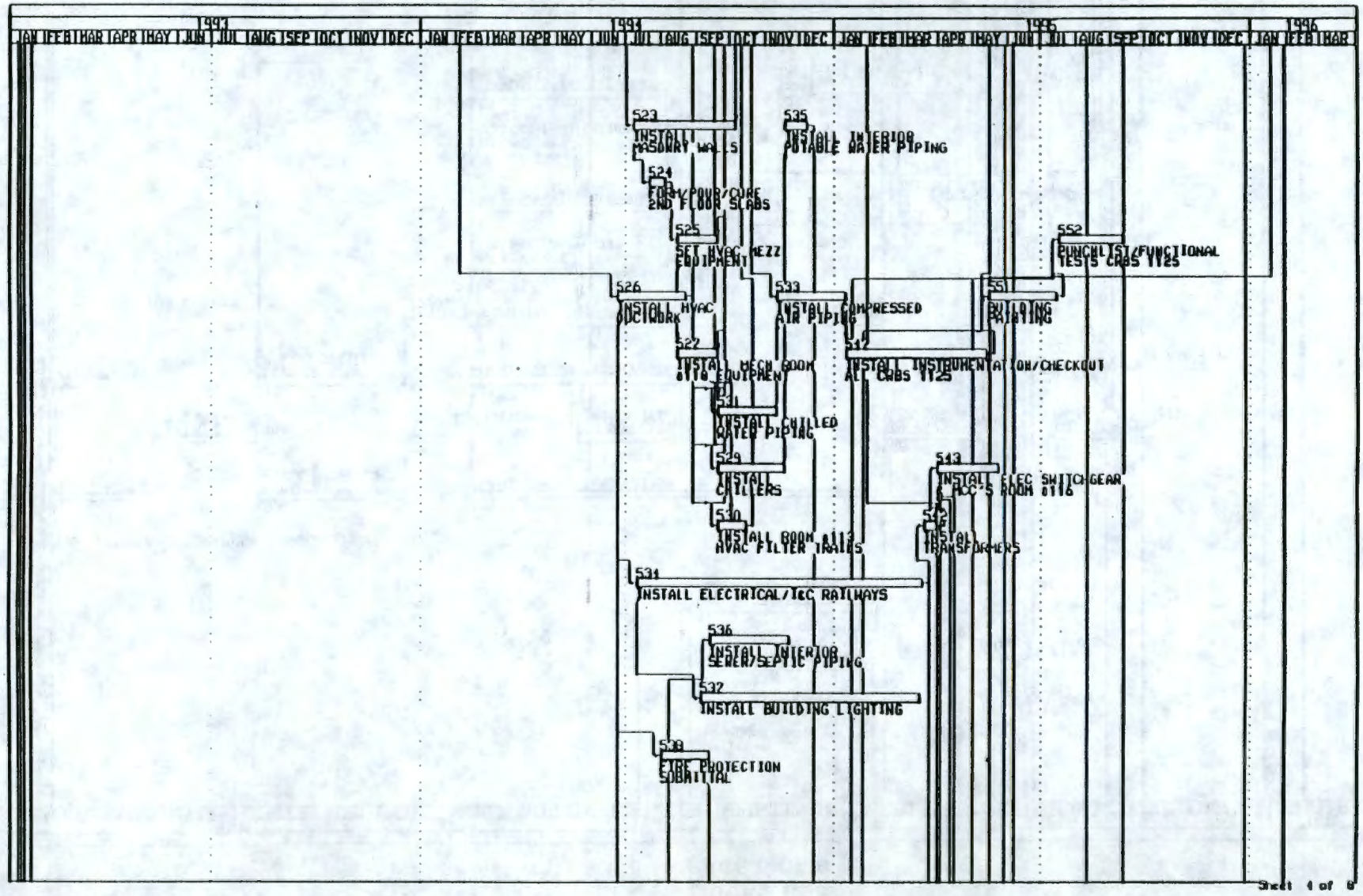

FIGURE 12-3
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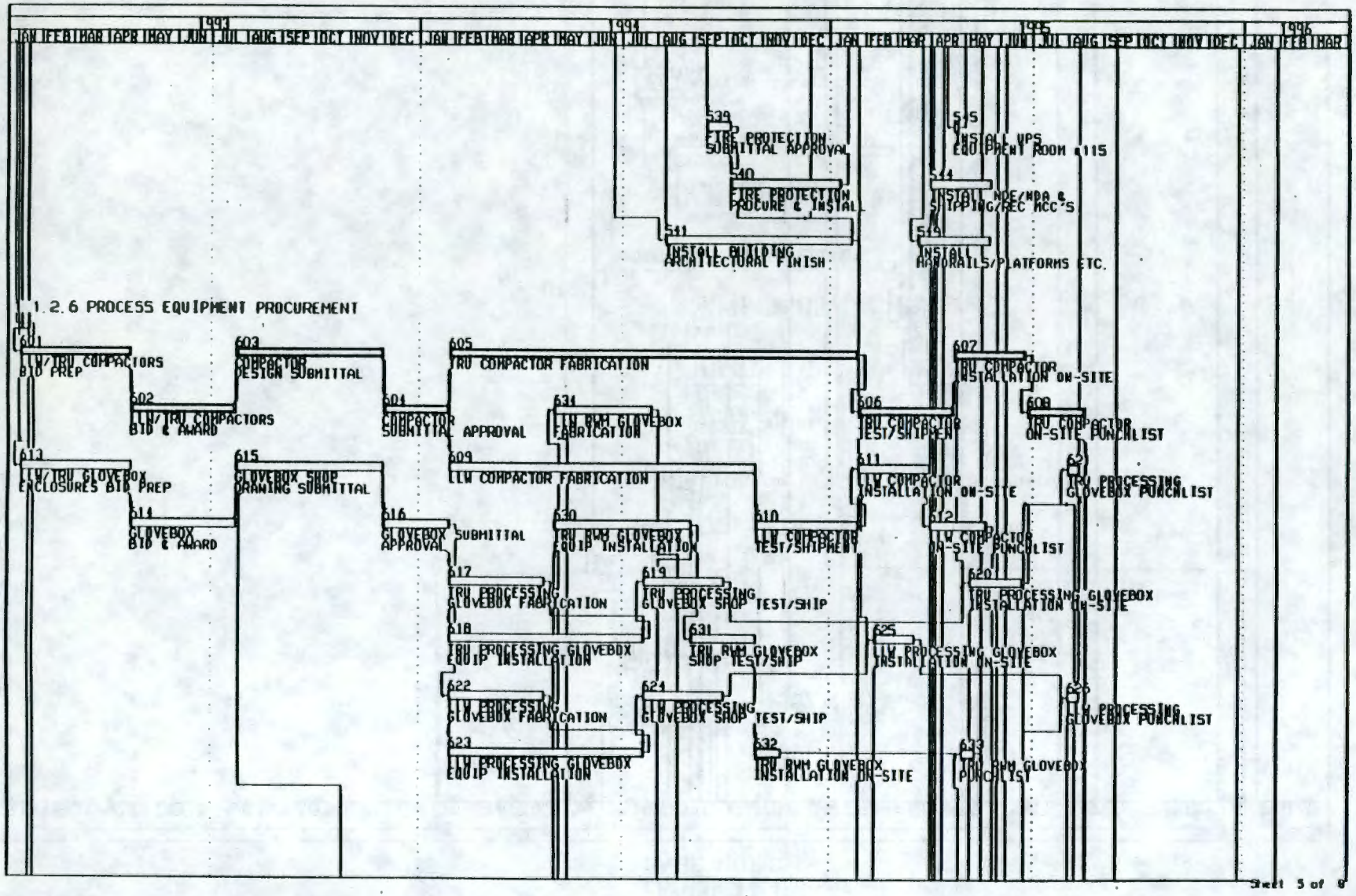

FIGURE 12-3
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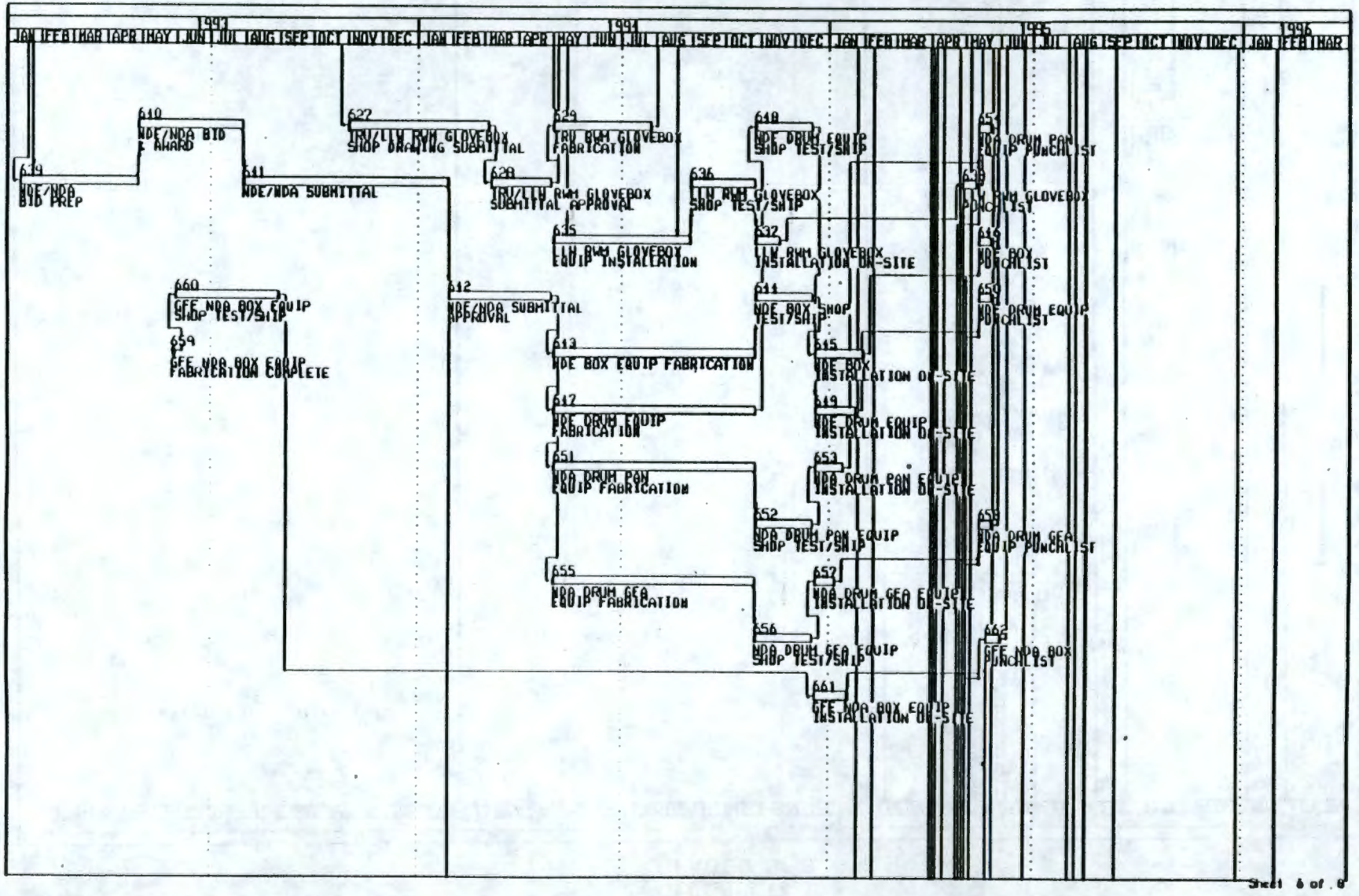

FIGURE 12-3
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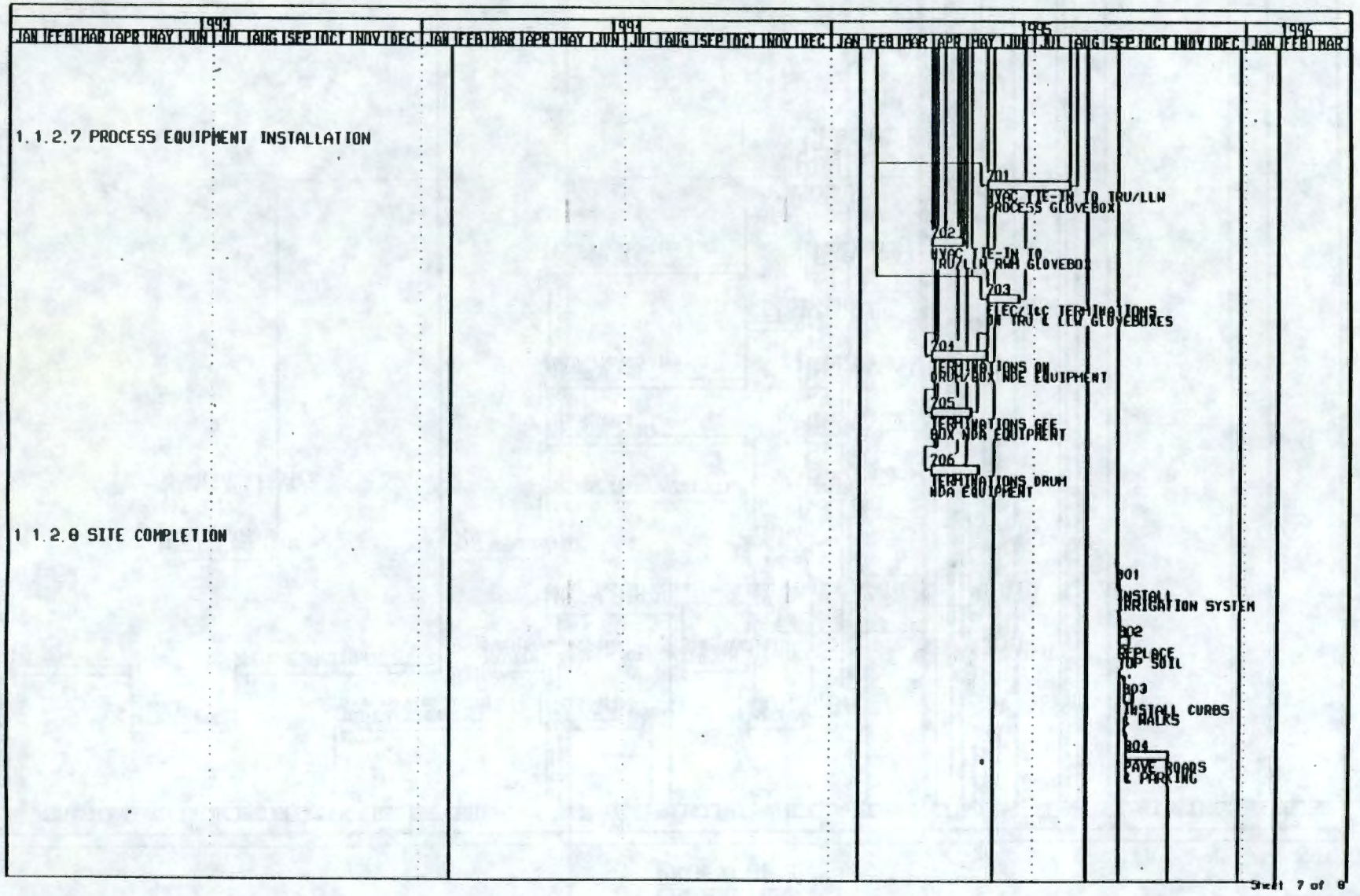

FIGURE 12-3
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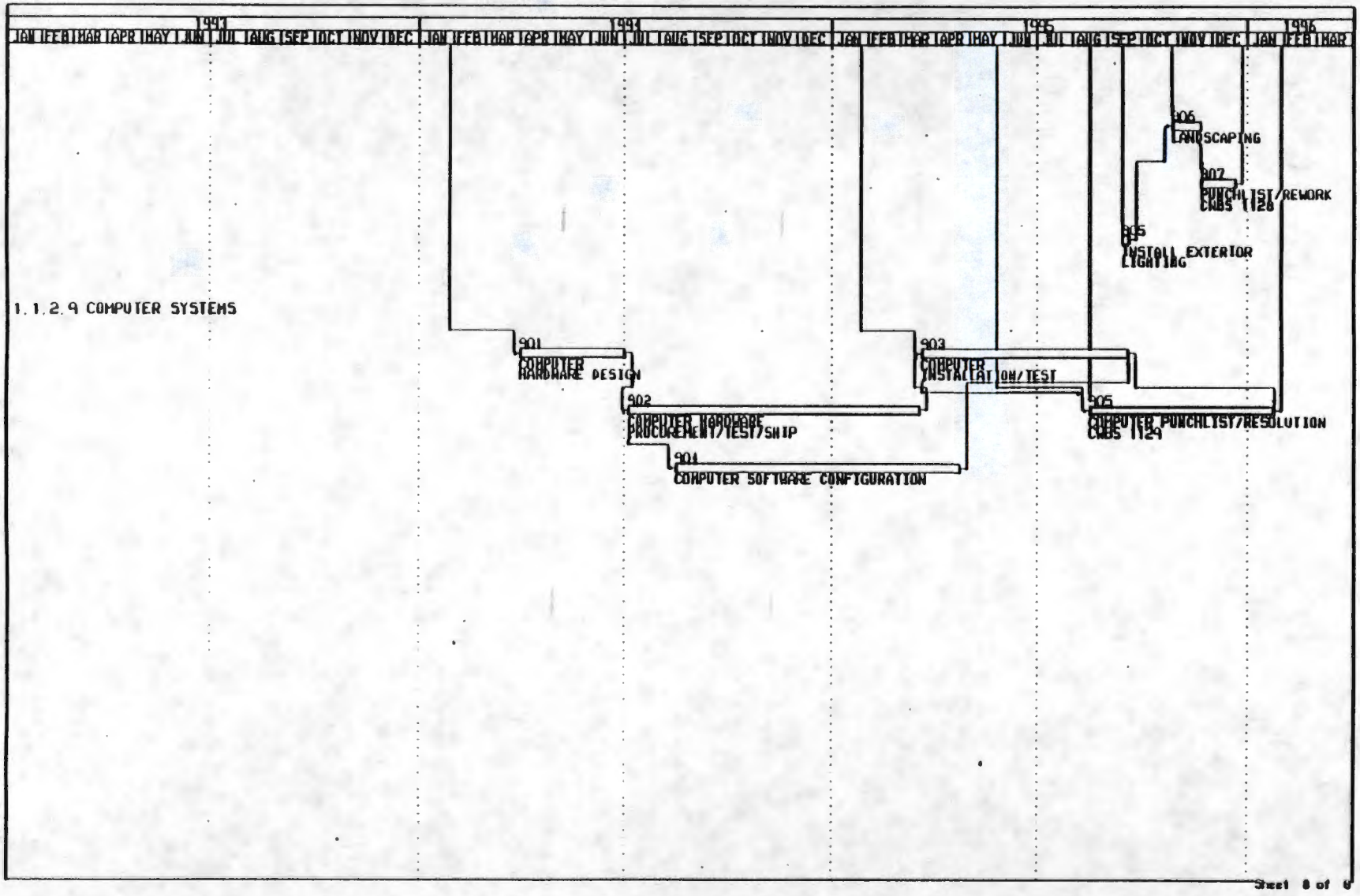

13.0 DESIGN UNCERTAINTIES

9 3 1 2 7 1 1 5 6 0

13.0 DESIGN UNCERTAINTIES

13.1 Areas of Concern

1. This Preliminary Design Report contains the Title I Design for the WRAP 1 facility. The design is based upon the technical baseline documents noted in **Section 5.0** of this report and incorporated the results of the Engineering Studies (**Volume V**) and Engineering Assessments (**Section 10.0** and **Volume VI**). All of the technical uncertainties identified in the reference Conceptual Design Report have been resolved (see **Section 6.0**).

2. The intent of this section is to identify those technical uncertainties that remain at the conclusion of the Title I design and the approach for resolving them during the Title II design phase. The technical areas of concern can be summarized based upon the following:

   a) Areas of the design which require development or proof testing work to confirm equipment suitability.

   b) Areas where criteria requirements need clarification or revision.

13.2 Design Resolution Approach

1. **Figure 13-1** lists the technical uncertainty items and UE&C's approach to resolve them.

9 3 1 2 7 1 1 5 6 1

FIGURE 13-1
TITLE I TECHNICAL UNCERTAINTIES SUMMARY

A) AREAS OF DESIGN REQUIRING DEVELOPMENT OR PROOF-TESTING WORK		
AREA OF CONCERN	**RESOLUTION**	**COMMENTS**
1. **BNFL Sphincter Entry System:** a) To verify ability to prevent alpha egress for WRAP-specific configuration. b) To confirm seal cycle life.	Included in the WHC development and testing program.	The BNFL sphincter system has been extensively cold tested in the UK, to meet BNFL specific needs in terms of drum sizes and ventilation conditions. Proof testing to WRAP-specific requirements is required. Also, extended testing is required to ascertain the number of cycles the seal surface can provide before seal failure occurs.
2. **Compacted Waste Coring:** To verify that core samples can be taken from supercompacted waste, using core sample drill system.	Included in the WHC development and testing program.	Waste to be supercompacted in both process lines will contain a large selection of material types, from paper and plastics to concrete and metal items. The core sample drill system proposed is a high torque, low speed electric unit fitted with a collet chuck holding a hollow diamond drill of approx 1" O.D. This will be drilled 2"-4" into the puck, and the sample punched from the center of the drill into a collection pot. This is a prototype application, and hence needs proof-testing.
3. **BNFL "One Trip" Double Lid Drum:** To verify ability to operate for WRAP-specific configuration.	Included in the WHC development and testing program.	The BNFL one trip drum system has been extensively cold tested, and has been hot proof-tested in the UK. For the WRAP application, the center (inner) lid needs to be larger than that tested, and hence proof testing is required.
4. **Drum Re-Lidding Station:** To verify the proposed re-lidding station operation and performance.	Propose this item to be included in the WHC development and testing program.	The drum lid fastener device consists of a commercially available pneumatic nail gun, which will be used to 'nail' to lid on to the drum at several points. It is important that this lid doesn't come off the drum during supercompaction, and hence lid fastening, followed by supercompaction trials are required.
B) AREAS WHERE REQUIREMENTS NEED CLARIFICATION OR MAY HAVE CHANGED		
AREA OF CONCERN	**RESOLUTION**	**COMMENTS**
1. **Clear Air Act:** The potential need for clean up of hazardous materials from process extract systems has not been included in the design.	WHC to clarify requirements, per action item list no. 101.	There is a potential need for the glovebox extract exhaust air to be routed through additional clean up equipment, in order to remove hazardous waste constituents entrained in the exhausted air. This area has been the subject of review by Hartcrowser, who have been commissioned by WHC to do this work.
2. **Core Sampling:** The acceptability of core sampling as the means of characterization of the waste.	WHC to obtain necessary approvals, per action item list no. 146.	The core sampling of compacted pucks of waste is believed to be the best means of obtaining a random sample, which is representative of a waste stream. This method of sampling needs to be agreed with the department of Ecology of the State of Washington as acceptable, and in compliance with EPA SW 846.

FIGURE 13-1 (CONTINUED)
TITLE I TECHNICAL UNCERTAINTIES SUMMARY

3. **TRU Waste Classification:** The current design assumes all drums for WIPP can be filled to a 25g fissile limit.	WHC to clarify requirements.	The current design globally assumes that WRAP will ship TRU drums to WIPP, filled to a 25g fissile limit. WHC currently do not have approved waste codes which contain supercompacted waste. WHC is to provide further guidance on this area.
4. **NDE Image Recording System:** The current design includes recording of NDE images by VCR.	WHC to clarify requirements.	The current design includes the ability to record NDE images on video tape. WHC is to advise what record archive requirements they have in this area, and whether this media is acceptable.
5. **Waste Packet Assay:** Assay equipment is currently not included in the TRU waste sorting area to allow tracking of fissile material.	UE&C to evaluate and incorporate this equipment during Title II.	The Preliminary Criticality Assessment has recommended that an assay system be installed at the TRU sorting area, to allow assay of non-complaint packets to be sent to RWM, and to allow assay of packets to facilitate splitting of high fissile content drums. There was not sufficient time to define appropriate equipment during Title I, so this will be undertaken during the Title II design.
6. **Drum Weight:** The current design is to handle incoming drums up to 1000 lb weight. FDC Rev 1 revised this figure to 3000 lb.	WHC to approve CR-W026-008	On revision of the FDC from Rev. 0 to Rev. 1, the incoming drum weight limit was raised from 1000 lb to 3000 lb. It is anticipated that a drum up to 3000 lb would probably contain large amounts of lead, and hence would be more appropriately routed to a future WRAP Module. Change Request CR-W026-008 reflected that the current design is based on drums up to 1000 lb being handled in WRAP 1. WHC are to approve the Change Request, in order that the design be verified as appropriate. Additionally, UE&C believes it is very conservative to design the glovebox line and internal material handling equipment for a 1000 lb. drum. A drum filled with water is approximately 500 lbs. and this would be excessive. Drum weights in the 1000 lb. range indicate heavy lead shielding and would not be processed in WRAP 1 in any event. Further evaluation by WHC requested to lower the drum weight to a 300-400 lb. range, which could reduce the robustness of the internal equipment design and the associated cost.
7. **Shipping & Receiving:** Dose exposures not in accordance with CM-4-9.	UE&C and WHC to agree modelling and calculations, and assess shielding requirements.	The Shielding Assessment work performed to date (see **Section 10.2**) has shown that initial design target dose exposure levels, per CM-4-9, are not met. There is a need to critically assess the modelling work and to ensure that appropriate shielding is incorporated in the Shipping and Receiving area. This will be done during Title II.
8. **Fire Protection:** All comments not resolved with WHC.	Resolve all comments on the Preliminary Fire Protection Design Analysis.	There are four areas that could affect the baseline design that has not been completely resolved with WHC: 1. Possibility of more coverage in the gloveboxes with the automatic system. 2. Waste in the closed drums must be considered part of the combustible load. 3. Need a fire barrier between the Process HEPA room and the Process room. 4. One hour corridor is not needed.

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