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Plutonium Immobilization Project

System Design Description
for
Can Loading System (U)

Revision E

December 15, 2000

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Plutonium Immobilization Project

System Design Description for Can Loading System

Revision E

December 2000

Plutonium Immobilization Project
Westinghouse Savannah River Company
Aiken, South Carolina

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Summary of Changes

Revision No. and Date	*Verified/Checked by and Date*	*Pages Affected by the Change*	*Reason for Change*
Rev A, 2/7/00		All	Initial Draft
Rev. B, 3/24/00		All	Revised Draft
Rev. C, 7/10/00		1-4 (Summary)	Comments
Rev. D, 12/15/00		All	PIP 50 to 13 MT throughput

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
A/E	Architect / Engineer
ALARA	As Low As Reasonably Achievable
Am	Americium
ANS	American Nuclear Society
BMS	Balanced magnetic switches
cc	Cubic Centimeter
CCD	Charged Coupled Device
CCTV	Closed-circuit television
CFR	Code of Federal Regulations
CO2	Carbon Dioxide
Doc.	Document
DOCDR	Design-only conceptual design report
DOE	Department of Energy
DOF	Degree of Freedom
dpm	Disintegration Per Minute
D&T	Development & Testing
FDD	Facility Design Description
ft	Feet
He	Helium
HEPA	High Efficiency Particulate Air
hr	Hour
HVAC	Heating Ventilating and Air Conditioning
HYDOX	Hydride / Oxidation
I/O	Input / output
kg	Kilogram
LLNL	Lawrence Livermore National Laboratory
MAA	Material Access Area
min	Minute
MT	Metric Ton (1000 kg)
MTS	Material Transfer System
MC&A	Material Control and Accountability
mrem	Milliroentgen equivalent for man
NFPA	National Fire Protection Association
PDCF	Pit Disassembly and Conversion Facility
PIP	Plutonium Immobilization Plant
Pu	Plutonium
Pu-U	Plutonium-uranium
psig	Pounds per Square Inch, Gauge
rem	Roentgen equivalent for man
SDD	System Design Description
SNM	Special Nuclear Material

SRTC	Savannah River Technology Center
TBD	To Be Determined/Designed
TIG	Tungsten Inert Gas
TRU	Transuranic
U	Uranium
VAC	Volts Alternating Current
WEP	Water extended polyester
WSRC	Westinghouse Savannah River Company
yr	Year
ZPPR	Zero Power Physics Reactor

SUMMARY

The purpose of this System Design Description (SDD) is to specify the system and component functions and requirements for the Can Loading System and provide a complete description of the system (design features, boundaries, and interfaces), principles of operation (including upsets and recovery), and the system maintenance approach. The PIP will immobilize up to 13 metric tons (MT) of U.S. surplus weapons usable plutonium materials. The throughput requirements for the can loading system will be identified by the A/E during preliminary design as part of the overall facility computer simulation model analysis for the 1.3MT per year facility design capacity. This SDD includes some 13 MT changes to the DOCDR, Rev 3 dated November 2000. Some of the changes affected the equipment described in this SDD. This document does not contain changes from equipment operations described in the FDD (reference A.7.1)

The overall function of the Can Loading System is to automatically load ceramic pucks into sealed stainless steel cans. There is one Can Loading process line.

The Can Loading subsystems are:

- Puck Transfer Tray Transport Subsystem
- Can Loading Subsystem
- Bagless Transfer Subsystem
- Can InspectionSubsystem
- Can Handling Subsystem

The system receives trays of pucks from the material transport system and transports the trays into the can loading glovebox. The puck transfer tray transport cart moves a tray to a tray lift station and the tray lifter removes the tray from the cart. The Can Loading bridge robot uses a vacuum lifting tool to remove each puck from the tray, move it to a scale and dimensional measurement station, and then load the puck into one of two puck cans. The cart moves the empty tray from the tray lift station to the elevator.

The Can Loading robot places the helium hood over the can plug. The helium hood then grabs the can plug using a vacuum cup. The Can Loading robot places the helium hood over the full puck can and the helium hood seals to the can via an inflatable seal. The helium hood automatically removes the air from the can, fills the can with helium, and inserts the plug into the can. The corresponding bagless transfer system welds the plug to the can wall, and cuts the can and plug leaving the can stub in the sphincter seal.

The bagless transfer can holder lowers the can under the glovebox and swings the can to the glovebox center. The inspection robot uses an alpha probe to inspect the can exterior middle section. After the survey is complete, the can robot grabs the can middle section and removes the can from the bagless transfer can holder. The bagless transfer can holder swings out of the way and the can robot presents the puck can to the inspection robot. The inspection robot surveys the puck can top and bottom. If no external contamination is found, the can robot places the can in the helium bell jar leak detector to ensure the weld is leak tight. After the leak test is complete, the can robot places the can in a pallet on the puck can transport cart which leaves the bagless transfer enclosure.

Empty new cans, manually pre-loaded with plugs, are placed in a holder external to the bagless transfer enclosure. The puck can transport system brings the pallet of cans to the bagless transfer enclosure. The can robot removes the cans from the pallet and places them in storage areas. The can robot moves an empty new can from storage into the empty bagless transfer can holder and then the bagless transfer system raises the can. The previous can stub is pushed by the new can into the Can Loading glovebox and the Can Loading robot places the stub on a special waste tray. The waste tray and can stub leave the can loading glovebox on the puck transfer tray transport cart. The facility material transport system moves the waste tray to the waste handling glovebox. The Can Loading robot removes the plug from the new can and the loading process resumes. The Can Loading Robot will load the puck can in the first bagless transfer unit and while that can is being welded, cut, and inspected, the robot will load the puck can in the second bagless transfer unit.

The Can Loading System has the capability to process 8 puck cans per day (**HOLD**). The average daily throughput based on annual material balance and 200 days/year operation is 7 kg (**HOLD**) of plutonium.

The Can Loading system utilizes a mix of manual and automated operations.

The Can Loading process is housed in a glovebox and the can inspection processes are housed in a hood. The glovebox has an atmosphere of dry air The box will include shielding for gamma and neutron radiation **TBD**. HEPA-filtered ventilation will be required in the gloveboxes and the process room. The process area will be provided with alpha air monitoring, criticality monitoring, and a physical protection alarm system.

These operations are shown in Figure 1-1, Process Flow Diagram, as highlighted.

The puck can robot maximum payload will be the 25 pound (HOLD) fully loaded puck can. The puck can robot requires 4 degrees of freedom (DOF) (HOLD) and a gripper. The four DOFs allow the robot to load and unload puck cans at various stations. The robot must be able to reach all the can stations inside the bagless transfer enclosure. The puck can robot requires a repeatability of +/- 0.020 inches. A commercial robot of appropriate size is planned.

The gripper will hold 3 inch diameter puck cans. The puck can robot and gripper parts will be fabricated from 304 stainless steel wherever possible and all moving parts will be covered when possible. If possible, the internal cavities will be slightly pressurized to help prevent contamination from entering the robot and gripper.

2.4.6 INSTRUMENTATION AND CONTROL

2.4.6.1 Instrumentation and Control Architecture

The instrumentation and control system will be implemented with a supervisory system hierarchical architecture. The architecture will implement the following functions:

- A control room interactive console from which the operator can setup a batch run (that is, load 20 pucks into a puck can), initiate the run, monitor its progress and react to any abnormal conditions. The interactive console will provide the operator with a display of the current plant processing procedure, equipment status, alarm conditions, camera views, and trends of pertinent real-time or historical operating variables.

- Data handling including acquiring and archiving batch run information along with equipment parameters, vision system pictures, and process variables.

- Controlling the order and timing of the equipment tasks while imposing interlocks and granting permissives on mutually interdependent processes in the procedure.

- Automating the can loading process steps.

- Monitoring the process and generating alarms on abnormal conditions.

- Monitoring all MC&A data for cans, puck transfer trays, pucks, etc.

A Human Machine Interface (HMI) and Supervisory Control & Data Acquisition (SCADA) system will carry out the supervisory functions. The supervisory system software architecture depicted in Figure 2.5.1-1 shows how the HMI and SCADA capabilities are achieved via interconnects with a memory resident Real-time Database, the History and Event/alarm Log Files in a hard disk resident database management system, and the Supervisory Engine. The Supervisory Engine in turn accesses the key operating variable data registers in the process equipment front end processors via point-to-point and network software device servers to carry out the data acquisition, engineering unit scaling, event/alarm handling and historical trending.

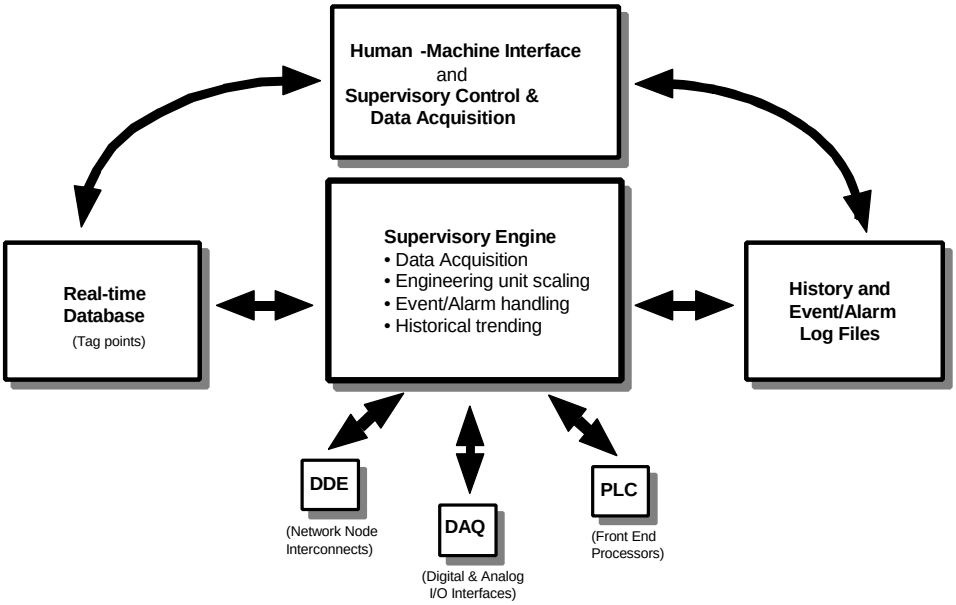


Figure 2.5.1-1. Can Loading Supervisory System Software Architecture

2.4.6.2 Can Loading Processing Sequence Control

The Supervisory Control System will direct the subsystem equipment in the Can Loading process batch run. The following is a sample of steps in this process:

1) Request puck transfer trays and record tray identification number.

2) Move puck transfer tray into can loading glovebox and record event.

3) Stop tray at one of two lift stations, raise tray, and record event.

4) Ask vision to find puck locations and record image.

5) Grab first puck , weigh, and measure thickness. Record these values.

6) Using the upward looking vision system, ask vision system to determine puck location, adjust robot position, recheck puck location, and record offsets and image.

7) Load puck into puck can and record event. During loading, ensure that total puck stack height is within maximum allowable limit.

A typical step is made up of a sequence of sub-steps; for example, the operation of moving a tray into the can loading glovebox involves the following sub-steps:

A) Verify the puck transfer tray transport cart is in the elevator position.

B) Lower the elevator and verify it is in the down position.

C) Open the first airlock door and verify it is open.

D) Move the tray transport cart into the air lock and verify it got there.

E) Close the airlock door and verify it is closed.

F) Open the second airlock door and verify it is open.

G) Move the transfer tray into the Can Loading glovebox and verify it got in.

H) Close the air lock door and verify it is closed.

2.4.6.3 Interlocks and Permissives

Equipment operation is usually dependent on the state of adjacent equipment in the processing line; for example, the can loading robot can not load pucks into the puck can until it receives a permissive indicating the tray lifter has a puck transfer tray in the up position, a puck is available, and there is space in the can for a puck.

During testing or maintenance activities where control has been transferred to the field remote control panel and adjacent equipment is off-line, there will be instances where it will be necessary to have interlock over-rides.

3.0 OPERATION

3.1 PRINCIPLES OF OPERATION

The Can Loading Subsystem will receive puck transfer trays containing 16 (HOLD) sintered pucks. The puck transfer trays are (TBD) inches by (TBD) inches. The pucks are in a (TBD) by (TBD) array. The pucks will vary in height from (TBD) inches to (TBD) inches and vary in diameter from 2.4 (HOLD) inches to 2.75 inches (HOLD). The pucks will not be in precise locations on the transport trays. The Can Loading Subsystem will remove each sintered puck from the transport tray, weigh and dimensionally measure each puck, assure that the puck will fit in a can and load the pucks into a puck can. The puck can will have an outside diameter of 3.00 inches, an internal diameter of 2.88 inches (HOLD) and be approximately 20 inches (HOLD) long. The system will stack pucks in the can until the can is filled to a height leaving room for less than one additional puck (nominally 20 pucks). The can will be evacuated and filled with 3 psig (HOLD) helium to ensure an atmosphere of 50% helium (HOLD) is in the puck can when it is seal welded. The can will be surveyed for contamination. If the can is contamination free, it will be leak tested for a gross leak and (TBD) atmospheric cc/sec of helium. The puck can will then be placed on the puck can transfer pallet transport system for transport to the facility material transport system. The Can Loading subsystem will produce 8 cans per day (HOLD) standard rate and (125% TBD) cans per day surge rate for 200 days per year. The cans will then be transported out of the Can Loading subsystem.

3.2 SYSTEM STARTUP, NORMAL OPERATIONS AND SHUTDOWN

The Can Loading System startup will include energizing all components, performing any required calibrations, and running all diagnostic tests. The system will be placed in a ready and waiting state once the startup procedure is complete. Normal operations will be ignited by events or commands from the PIP supervisor control system and executed automatically. An example event is a tray of pucks arrives at the Can Loading glovebox.

System shutdown will be initiated by the PIP supervisor control system or by a local operator. The Can Loading System control panel shall have a keyed Emergency Stop switch. This switch shall de-energize all Can Loading System items inside the glovebox including motors, drives, solenoids, and sensors. All items shall fail to a safe state when the Emergency Stop is activated or power is lost.

The Can Loading System control system shall interface closely with the PIP supervisory system for MC&A, material transport, and security. CCTVs will

be used to monitor the material transfer operations remotely. Before the system is shutdown, it is required to return all actuators to a safe position using the routine commands of automatic mode.

3.2.1 PUCK TRANSFER TRAY TRANSPORT SUBSYSTEM

During normal operations the Can Loading System supervisory control system shall send commands to the Puck Transfer Tray Transport Subsystem. The Puck Transfer Tray Transport Subsystem shall acknowledge these commands, execute the commands, and report status to the supervisory system upon completion. The Puck Transfer Tray Transport Subsystem shall also respond to supervisory status inquiries and halt commands at any time.

The Puck Transfer Tray Transport Subsystem shutdown process shall include stopping the current operations in a safe manner, operating the system to a safe condition, and de-energizing all motors, drives, and sensors. The Puck Transfer Tray Transport Subsystem control computer shall be left on in the shutdown mode. The Puck Transfer Tray Transport Subsystem control computer shall still respond to the supervisory computer system requests for status.

3.2.2 CAN LOADING SUBSYSTEM

During normal operations the Can Loading System supervisory control system shall send commands to the Can Loading Robot. The Can Loading Robot shall acknowledge these commands, execute the commands, and report status to the supervisory system upon completion. The Can Loading Robot shall also respond to supervisory status inquiries and halt commands at any time.

The Can Loading Robot shutdown process shall include stopping the current operations in a safe manner, operating the system to a safe condition (i.e. placing the current puck in the puck can and returning the puck lifting tool), and de-energizing all motors, drives, and sensors. The Can Loading Robot control computer shall be left on in the shutdown mode. The Can Loading Robot control computer shall still respond to the supervisory computer system requests for status.

3.2.3 BAGLESS TRANSFER SUBSYSTEM

The Bagless Transfer startup process shall include energizing motors, drives, and sensors. The control software shall activate any self test or diagnostic functions, determine current state of the cycle, and then enter a ready and waiting state.

During normal operations the Can Loading System supervisory control system shall send commands to the Bagless Transfer. The Bagless Transfer shall acknowledge these commands, execute the commands, and report status to the supervisory system upon completion. The Bagless Transfer shall also respond to supervisory status inquiries and halt commands at any time.

The Bagless Transfer shutdown process shall include stopping the current operations in a safe manner, operating the system to a safe condition, and de-energizing all motors, drives, and sensors. The Bagless Transfer control computer shall be left on in the shutdown mode. The Bagless Transfer control computer shall still respond to the supervisory computer system requests for status.

3.2.4 CAN INSPECTION SUBSYSTEM

During normal operations the Can Loading System supervisory control system shall send commands to the can inspection robot. The can inspection robot shall acknowledge these commands, execute the commands, and report status to the supervisory system upon completion. The can inspection robot shall also respond to supervisory status inquiries and halt commands at any time.

The Can Swiping shutdown process shall include stopping the current operations in a safe manner, operating the system to a safe condition, and de-energizing all motors, drives, and sensors. The Can Swiping control computer shall be left on in the shutdown mode. The Can Swiping control computer shall still respond to the supervisory computer system requests for status.

3.2.5 CAN HANDLING SUBSYSTEM

During normal operations the Can Loading System supervisory control system shall send commands to the puck can robot. The puck can robot shall acknowledge these commands, execute the commands, and report status to the supervisory system upon completion. The puck can robot shall also respond to supervisory status inquiries and halt commands at any time.

The Can Handling shutdown process shall include stopping the current operations in a safe manner, operating the system to a safe condition, and de-energizing all motors, drives, and sensors. The Can Handling control computer shall be left on in the shutdown mode. The Can Handling control computer shall still respond to the supervisory computer system requests for status.

4.0 SET-POINTS, SYSTEM LIMITATIONS, AND PRECAUTIONS

4.1 SYSTEM LIMITATIONS AND PRECAUTIONS

4.1.1 LIMITING CONDITIONS FOR OPERATIONS

The Can Loading System is operated with the Building TBD Concept of Operations, as described in the Facility Design Description (FDD), Section TBD (Reference TBD). The Can Loading System is operated and maintained in accordance with the Limiting Conditions for Operations (LCOs) and Administration Controls (AC) as defined in the FDD, Section TBD, Operating Conditions (Reference TBD). The Can Loading System is operated in accordance with the limitations and precautions specified below to ensure safe operation of the Can Loading System and interfacing systems.

4.1.1.1 Puck Transfer Tray Transport Subsystem

All actuators shall have limit switches and mechanical stops to prevent overruns and collisions. In addition, all motors shall have current limits to protect motors from over loading. Unless position set points or limit switches are satisfied, the control system will not proceed to the next step.

4.1.1.2 Can Loading Subsystem

All actuators shall have limit switches and mechanical stops to prevent overruns and collisions. In addition, all motors shall have current limits to protect motors from over loading. Valve actuators shall have limit switches to verify if valves are fully closed or opened before continuing to the next step. Unless position set points, limit switches, and can loading robot limitations are satisfied then the control system will not proceed to the next step. Puck weighing and dimensional measurements shall have an acceptability range depending upon sintered puck characteristics (**TBD**).

4.1.1.3 Bagless Transfer Subsystem

All actuators shall have limit switches and mechanical stops to prevent overruns and collisions. In addition, all motors shall have current limits to protect motors from over loading. Valve actuators shall have limit switches to verify if valves are fully closed or opened before continuing to the next step. Unless position set points, limit switches, puck can welder limitations, and puck can cutter are satisfied, the control system will not proceed to the next step.

4.1.1.4 Can Inspection Subsystem

All actuators shall have limit switches and mechanical stops to prevent overruns and collisions. In addition, all motors shall have current limits to protect motors from over loading. Unless position set points, limit switches, and puck can inspection robot limitations are satisfied, the control system will not proceed to the next step.

4.1.1.5 Can Handling Subsystem

All actuators shall have limit switches and mechanical stops to prevent overruns and collisions. In addition, all motors shall have current limits to protect motors from over loading. Unless position set points, limit switches, and puck can robot limitations are satisfied then the control system will not proceed to the next step.

4.2 SET-POINTS AND ALARMS

Instrument set points for alarms and interlocks are specified in the TBD Instrument Index/Set Point List (Reference TBD).

5.0 SYSTEM UPSETS AND RECOVERY PROCEDURES

It will be necessary to provide means for detecting abnormal equipment/operating conditions, and in certain situations, procedures for automatically overcoming these conditions.

Upset events are abnormal Can Loading System conditions which could affect the safe and functional operation of the system, or produce system degradation, and which will require corrective action to restore the system to a safe and orderly condition. Mitigation of these events is accomplished either by design features of the Can Loading System and/or by administrative controls to prevent or correct the event. In this section, the major anticipated Can Loading System upset events are described (Section 5.1), followed by a description of the design features intended to mitigate these events (Section 5.2), and then outlines of the recovery procedures to be followed by operations personnel (Section 5.3).

5.1 UPSET EVENTS

5.1.1 PUCK TRANSFER TRAY TRANSPORT SUBSYSTEM

The Tray Transfer Subsystem upset events include a collision with other equipment and (TBD).

5.1.2 CAN LOADING SUBSYSTEM

The Can Loading Robot upset events include a dropped tool, dropped puck, helium hood leak, dropped hollow plug, a robot collision with other equipment, robot failure, and (TBD).

The Can Loading vision system shall reject abnormal sintered pucks and they will be sent back for recycling.

5.1.3 BAGLESS TRANSFER SUBSYSTEM

The Bagless Transfer upset events include a weld failure, cutting failure, sphincter seal leak, contaminated puck can, damaged puck can, and (TBD).

Failed cans are cut open with the reject can cutter, the can loading robot removes the pucks, and the can is sent to the waste handling glovebox.

5.1.4 CAN INSPECTION SUBSYSTEM

The Can Swiping upset events include a robot failure, robot collision with other equipment, and (TBD).

The puck can inspection subsystem shall reject puck cans that have external contamination and send them to the can loading glovebox. These cans are cut open with the reject can cutter, the can loading robot removes the pucks, and the can is sent to the waste handling glovebox.

The puck can leak detector shall reject puck cans that are not sealed properly. These cans are sent to the can loading glovebox. These cans are cut open with the reject can cutter, the can loading robot removes the pucks, and the can is sent to the waste handling glovebox.

5.1.5 CAN HANDLING SUBSYSTEM

The Can Handling upset events include a dropped puck can, a leaking puck can, a robot failure, robot collision with other equipment, and (TBD).

5.2 DESIGN FEATURES TO MITIGATE EFFECTS OF UPSET EVENTS

5.2.1 TRAY TRANSFER SUBSYSTEM

TBD

5.2.2 CAN LOADING SUBSYSTEM

TBD

5.2.3 BAGLESS TRANSFER SUBSYSTEM

TBD

5.2.4 CAN INSPECTION SUBSYSTEM

TBD

5.2.5 CAN HANDLING SUBSYSTEM

TBD

5.3 RECOVERY PROCEDURES

5.3.1 PUCK TRANSFER TRAY TRANSPORTSUBSYSTEM

When the Puck Transfer Tray Transport Subsystem experiences a system upset during the program mode, the Tray Transport system will stop in place, alert the operator, and wait on operator intervention.

5.3.2 CAN LOADING SUBSYSTEM

TBD

5.3.3 BAGLESS TRANSFER SUBSYSTEM

The following describes the Bagless Transfer weld failure error recovery processes, which should be infrequent. Operators will use cameras and welder feedback to determine can weld failures during the bagless transfer process. The bagless transfer machine will push cans that experience weld failures up into the sphincter seal exposing the top 3 inches of the can above the sphincter seal. The reject can cutter in the can loading glovebox will move over the exposed can and the can cutter will cut the can open near the top. This cut will be in the void space (approximately 0.5”) above the pucks. The Can Loading robot will remove the can top (stub), the can cutter will move away, and the Can Loading Robot will remove pucks from the damaged can. The bagless transfer puck can holder will push the empty failed can up further into the sphincter seal. This allows the puck can robot room to place a new empty can in the bagless transfer puck can holder. The puck can robot will place an empty can in the bagless transfer puck can holder and the puck can holder will use the empty can to push the failed can into the Can Loading glovebox. The transfer carts will remove all pucks and support frames of cut can pieces from the Can Loading glovebox and all loaded cans from the bagless transfer enclosure. The cut can pieces and any can stubs will be sent to the waste handling glovebox. These items will have sharp edges and will require special handling procedures if they are manually processed. Operators will manually perform any system maintenance including sphincter seal replacement.

5.3.4 CAN INSPECTION SUBSYSTEM

The following describes the contaminated puck can error recovery. The can inspection subsystem will alert the control room when a can fails the survey. If the can fails the survey, the puck can robot will place it in the bagless transfer puck can holder. The bagless transfer puck can holder will push the failed can up into the sphincter seal and this will push the stub into the Can Loading glovebox. The Can Loading robot will place the stub in a support frame on an empty tray and the puck can robot will load a new can into the bagless transfer puck can holder. The bagless transfer puck can holder will continue to push the failed can further into the sphincter seal exposing the top 3 inches of the can above the sphincter seal. The Can Loading robot will process these reject cans in a similar manner as the weld failure cans described in section 5.3.3.

5.3.5 CAN HANDLING SUBSYSTEM

The following describes the Can Handling leaking puck can error recovery. The puck can robot will place cans that fail the leak check in the bagless transfer puck can holder. The bagless transfer puck can holder will push the failed can up into the sphincter seal and this will push a stub into the Can Loading glovebox. The Can Loading robot will place the stub on an empty tray and the puck can robot will load a new can into the bagless transfer puck can holder. The bagless transfer puck can holder will push the failed can into the sphincter seal exposing the top 3 inches of the can above the sphincter seal. The Can Loading robot will process these reject cans in a similar manner as the weld failure cans described in Section 5.3.3.

6.0 MAINTENANCE

This section defines the maintenance approach for the Can Loading System. This section provides maintenance procedure outlines for preventive and corrective maintenance, and identifies in-service inspections and surveillance only for those unique situations created by Can Loading System. The facility maintenance, in-service inspection and surveillance procedures will be modified to encompass the new SSCs which are not unique.

6.1 MAINTENANCE APPROACH

The SRS Plant maintenance philosophy is to construct gloveboxes so that there is an operation side and a maintenance side. Typically these sides would be separated into two (2) separate rooms by a floor-to-ceiling partition. Usually the operation side is more heavily shielded than the maintenance side, based on two points. The first point is more man-hours are spent on the operation side performing process checks and rounds than on the maintenance side. The second point is the radioactive material would be removed from the area before actual equipment maintenance is done. This permits reduced shielding on the maintenance side, which usually makes the equipment more accessible. Most of the equipment envisioned for the Can Loading System is compatible with this philosophy as discussed below.

Maintenance activities may be performed during the following three modes of operation provided the specified conditions are satisfied:

- Operation Mode
- Standby Mode (ready and waiting for inputs)
- Open-Glovebox Maintenance Mode

In addition, the proper balance of Preventive Maintenance (PM) and Corrective Maintenance (CM) activities provide a high degree of confidence that facility systems function as designed, personnel safety is enhanced, equipment degradation is identified and corrected, equipment life is optimized, and the Maintenance Program is cost effective.

The preventative maintenance shall include periodic glovebox cleaning. This will remove the small puck pieces that accumulate in the glovebox and thus reduce the radiation sources. The source reduction is consistent with SRS ALARA practices.

The following describes the specific maintenance approach for the Can Loading System. These items are in addition to the approach described in the FDD.

6.1.1 PUCK TRANSFER TRAY TRANSPORT SUBSYSTEM

The Puck Transfer Tray Transport Subsystem shall be designed so that most components are outside the glovebox so they remain contamination free and maintenance will be “hands on”. The components inside the glovebox shall be maintained by personnel using gloveports. A modular design concept is required for easy assembly and maintenance of the system. The modules shall be joined using large fasteners and guide pins. For example, each lift station module includes a fixture to hold the tray, an actuator, and support stand. This lift station module shall be joined to the glovebox using guide pins and large fasteners, see reference A.7.4. This will allow the module to be replaced easily via the gloveports. All critical and sensitive hardware shall be placed outside the enclosure to eliminate complex maintenance operation in the glovebox. The best possible materials and commercial components shall be selected and used to reduce the maintenance frequency.

The positioning systems shall be designed so the position calibration can be verified from outside the glovebox. For example, the cart and rail are marked and these marks align when the cart is at position zero.

6.1.2 CAN LOADING SUBSYSTEM

The Can Loading Subsystem shall be designed so that most components are outside the glovebox so they remain contamination free and maintenance will be “hands on”. Personnel using gloveports shall maintain the components inside the glovebox. A modular design concept is required for easy assembly and maintenance of the system. The modules shall be joined using large fasteners and guide pins. Whenever possible, critical and sensitive hardware shall be placed outside the enclosure to eliminate complex maintenance operation in the glovebox. The best possible materials and commercial components shall be selected and used to reduce the maintenance frequency.

The positioning systems shall be designed so the position calibration can be verified from outside the glovebox. For example, each robot axis is marked and these marks align when the axis is at position zero.

6.1.3 BAGLESS TRANSFER SUBSYSTEM

The Bagless Transfer subsystem shall be designed so that most components are outside the bagless transfer enclosure so they remain contamination free and maintenance will be “hands on”. Personnel using access ports shall maintain the components inside the bagless transfer enclosure. A modular design concept is required for easy assembly and maintenance of the system. The modules shall be joined using large fasteners and guide pins. Whenever possible, critical and sensitive hardware shall be placed outside the enclosure. The best possible materials and commercial components shall be selected and used to reduce the maintenance frequency.

The positioning systems shall be designed so the position calibration can be verified from outside the glovebox.

6.1.4 CAN INSPECTION SUBSYSTEM

The Can Inspection Subsystem shall be designed so that most components are outside the bagless transfer enclosure so they remain contamination free and maintenance will be “hands on”. Personnel using access ports shall maintain the components inside the bagless transfer enclosure. A modular design concept is required for easy assembly and maintenance of the system. The modules shall be joined using large fasteners and guide pins. Whenever possible, critical and sensitive hardware shall be placed outside the enclosure. The best possible materials and commercial components shall be selected and used to reduce the maintenance frequency.

The positioning systems shall be designed so the position calibration can be verified from outside the glovebox. For example, each robot axis is marked and these marks align when the axis is at position zero.

6.1.5 CAN HANDLING SUBSYSTEM

The Can Handling subsystem shall be designed so that most components are outside the bagless transfer enclosure so they remain contamination free and maintenance will be “hands on”. Personnel using access ports shall maintain the components inside the bagless transfer enclosure. A modular design concept is required for easy assembly and maintenance of the system. The modules shall be joined using large fasteners and guide pins. Whenever possible, critical and sensitive hardware shall be placed outside the enclosure. The best possible materials and commercial components shall be selected and used to reduce the maintenance frequency.

The positioning systems shall be designed so the position calibration can be verified from outside the glovebox. For example, each robot axis is marked and these marks align when the axis is at position zero.

6.2 PROCEDURE OUTLINES

6.2.1 PUCK TRANSFER TRAY TRANSPORT SUBSYSTEM

TBD

6.2.2 CAN LOADING SUBSYSTEM

TBD

6.2.3 BAGLESS TRANSFER SUBSYSTEM

TBD

6.2.4 CAN INSPECTION SUBSYSTEM

TBD

6.2.5 CAN HANDLING SUBSYSTEM

TBD

6.3 PREVENTIVE MAINTENANCE

6.3.1 PUCK TRANSFER TRAY TRANSPORT SUBSYSTEM

The Puck Transfer Tray Transport Subsystem preventative maintenance shall include inspecting the cart wheels and rails for obstructions and maintaining a clean glovebox floor between the transport cart rails TBD.

6.3.2 CAN LOADING SUBSYSTEM

TBD

6.3.3 BAGLESS TRANSFER SUBSYSTEM

TBD

6.3.4 CAN INSPECTION SUBSYSTEM

TBD

6.3.5 CAN HANDLING SUBSYSTEM

TBD

6.4 IN-SERVICE INSPECTION

6.4.1 TRAY TRANSFER SUBSYSTEM

TBD

6.4.2 CAN LOADING SUBSYSTEM

TBD

6.4.3 BAGLESS TRANSFER SUBSYSTEM

TBD

6.4.4 CAN INSPECTION SUBSYSTEM

TBD

6.4.5 CAN HANDLING SUBSYSTEM

TBD

6.5 SURVEILLANCE

6.5.1 PUCK TRANSFER TRAY TRANSPORT SUBSYSTEM

TBD

6.5.2 CAN LOADING SUBSYSTEM

TBD

6.5.3 BAGLESS TRANSFER SUBSYSTEM

TBD

6.5.4 CAN INSPECTION SUBSYSTEM

TBD

6.5.5 CAN HANDLING SUBSYSTEM

TBD

7.0 APPENDICES

Appendix A	References
Appendix B	Functions Interrelationship
Appendix C	Interface Requirements
Appendix D	Traceability Matrix
Appendix E	Process Cycle Time
Appendix F	Equipment List
Appendix G	Government Assisted Design List

APPENDIX A References

A.1 Correspondence

A.1.1 TBD

A.2 Technical Reports

A.2.1 *Plutonium Immobilization Can Loading Puck Can Size Evaluation (U)* USDOE Report WSRC-TR-98-00051, Savannah River Site, Aiken, SC 29808 (2/13/98)

A.2.2 *Plutonium Immobilization Can Loading Equipment Review (U)* USDOE Report WSRC-TR-98-00164, Savannah River Site, Aiken, SC 29808 (5/1/98)

A.2.3 *Plutonium Immobilization Preliminary Can Loading Concepts (U)* USDOE Report WSRC-TR-98-00165, Savannah River Site, Aiken, SC 29808 (5/29/98)

A.2.4 *Plutonium Immobilization Can Loading Conceptual Design (U)* USDOE Report WSRC -TR-98-00229, Savannah River Site, Aiken, SC 29808 (7/1/98)

A.2.5 *Plutonium Immobilization Can Loading Preliminary Specifications (U)* USDOE Report WSRC-TR-98-00291, Savannah River Site, Aiken, SC 29808 (9/1/98)

A.2.6 *Plutonium Immobilization Can Loading FY98 Year End Design Report (U)* USDOE Report WSRC-TR-98-00310, Savannah River Site, Aiken, SC 29808 (9/18/98)

A.2.7 *Plutonium* Immobilization Puck Handling Conceptual Design (U), Rev. 1, USDOE Report WSRC-TR-98-241, Savannah River Site, Aiken, SC 29808 (10/24/98)

A.2.8 *Plutonium Immobilization Can Loading FY99 Component Test Report (U)* USDOE Report WSRC-TR-99-00318, Savannah River Site, Aiken, SC 29808 (9/30/99)

A.2.9 *PIP Comparison of Bagless Transfer and Electrolytic Decontamination (U)* USDOE Report WSRC-TR-99-00480, Savannah River Site, Aiken, SC 29808 (12/99)

A.2.10 NQA-1-1997, "Quality Assurance Requirements for Nuclear Facility Applications"

A.2.11 DOE/RW-0333P Office of Civilian Radioactive Waste Management (OCRWM) Quality Assurance Requirements and Description

A.2.12 PIP 99-018, LLNL QA Program Description dated February 1999

A.3 Drawings and Specifications

A.3.1 TBD

A.4 Vendor Documents

A.4.1 TBD

A.5 Calculations

A.5.1 TBD

A.6 Codes, Orders, and Standards

A.6.1 Refer to FDD (Reference TBD), Section TBD, for Codes, Orders, and Standards

A.7 Other

A.7.1 PIP 00-67 Facility Design Description for the Plutonium Immobilization Plant, November 30,2000.

A.7.2 WSRC E7, Conduct of Engineering and Technical Support", Procedure 2.12, "Facility Design Descriptions and System Design Descriptions", Rev. 0, 09/30/93

A.7.3 WSRC-IM-93-18, Writer's Guide for the Preparation of Facility Design Descriptions and System Design Descriptions, Rev. 1, 09/30/96

A.7.4 American Nuclear Society Robotics and Remote Systems Division, "Design Guide for Radioactive Material Handling Facilities & Equipment," ANS order No. 690014, ISBN: 0-89448-554-7, Library of Congress No. 88-16610, 1988

A.7.5 WSRC-IM-95-58, Hood and Glovebox Guide, Rev 0,2/19/97

APPENDIX B Functions Interrelationship

Appendix B contains information, which shows the interrelationship between the applicable functions presented in SDD Section 1.1 and the interrelationship between these functions and the major system components described in SDD Section 2.0.

Figure B-1	Functional Hierarchy Diagrams, which show the top, level system functions broken down into sub-functions. These system functions are restated from the Function Hierarchy Diagram presented in Appendix G of the FDD. The sub-functions are the actions or capabilities necessary to perform the top-level functions.
Figure B-2	Functional Flow Diagram which shows the logical interrelationship of the functions/sub-functions.
Table B-1	Function to Component Allocation Matrix, which identifies the major system components that perform the sub-functions.

The function/sub-function numbers used in these diagrams and table are based on the top-level function numbers used in Appendix G of the FDD.

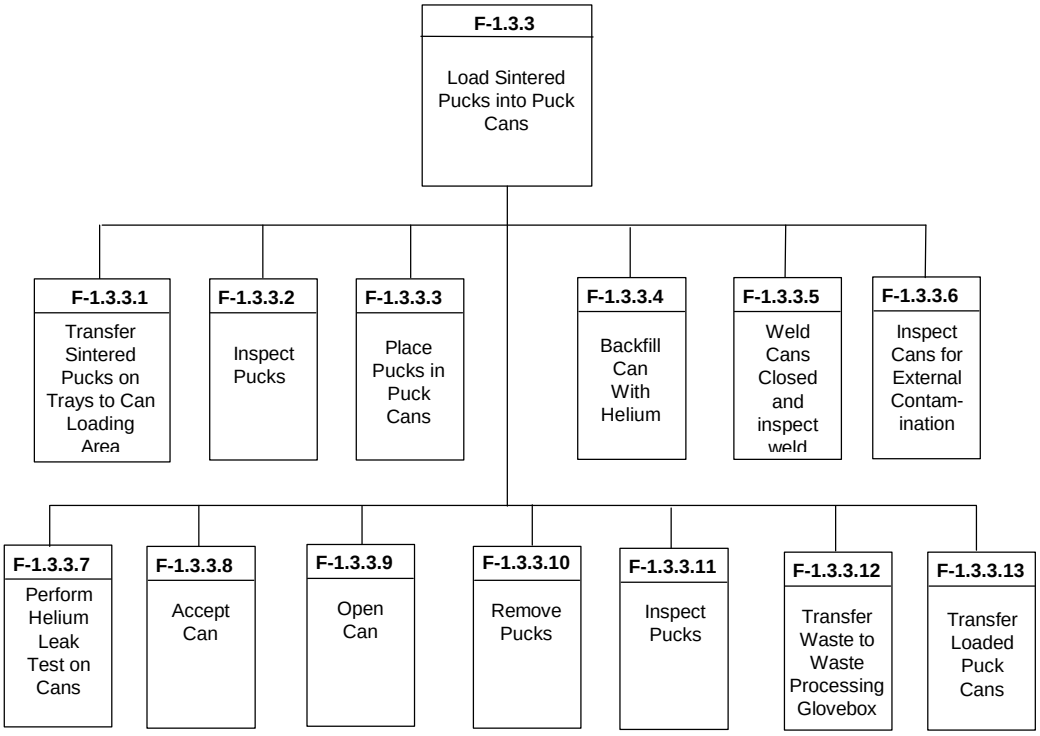


Figure B-1. Can Loading System Hierarchy Diagram

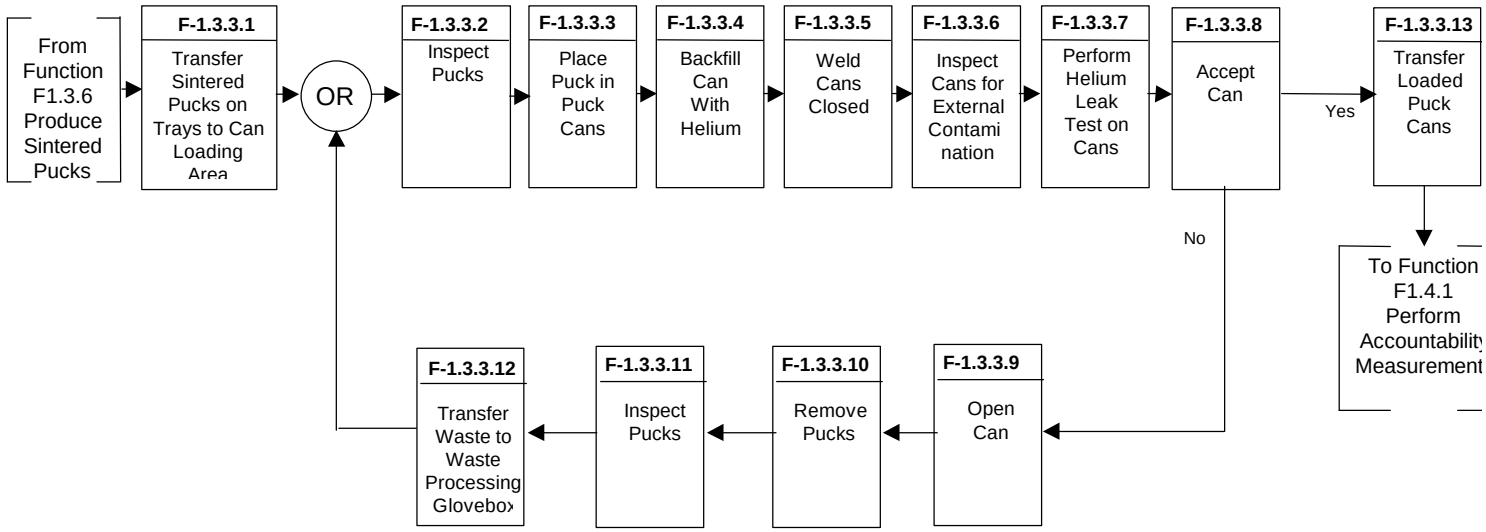


Figure B-2. Can Loading System Functional Flow Diagram

Table B-1
Can Loading System Functions to Component Allocation Matrix

Hierarchy Diagram Function No.	Function Description	Puck Transfer Tray Transporter and Lifter	Can Loading Robot	Bagless Transfer	Can Inspection Robot	Can Handling Robot	Puck Can Transferm Pallet Transporter	Control and Monitor Equipment
F-1.3.3	**Load Sinterd Pucks into Puck Can**							
F-1.3.3.1	Transfer Sintered Puck on Trays to Can Loading Are	X						X
F-1.3.3.2	Inspect Pucks	X	X					X
F-1.3.3.3	Place Puck in Puck Cans	X	X					X
F-1.3.3.4	Backfill Can With Helium		X	X				X
F-1.3.3.5	Weld Cans Closec			X				X
F-1.3.3.6	Inspect Cans foe External Contamination			X	X			X
F-1.3.3.7	Perform Helium Leak Test on Cans					X		X
F-1.3.3.8	Accept Car	X	X	X		X		X
F-1.3.3.9	Open Car		X	X				X
F-1.3.3.10	Remove Pucks	X	X					X
F-1.3.3.11	Inspect Pucks		X					X
F-1.3.3.12	Transfer Waste to Waste Processing Glovebo	X	X			X	X	X
F-1.3.3.13	Transfer Loaded Puck Cans						X	X

(1) Only components directly involved in the performance of system functions are included in this table.

(2) Primary confinement for the Can Loading System shall be provided by gloveboxes.

APPENDIX C Interface Requirements

This section presents the interface requirements between the Can Loading System and other systems. These systems may be internal or external.

The interfacing system is identified as either primary or secondary. These designations indicate the system imposing the requirement (primary system) or the system upon which the requirement is imposed (secondary system).

If the interface requirement is extensive (e.g., drawing, electrical load list, etc.) then the requirement consists of a qualitative statement and an Interface Control Document (ICD) is listed in the table which documents the interface details. This ICD documents and controls the interface. The system which agrees to accept responsibility for preparing, maintaining, and controlling the ICD are also identified. Both systems must agree to the interface requirements and any subsequent changes.

INTERFACING SYSTEMS		DESCRIPTION AND TOP LEVEL REQUIREMENTS OF INTERFACE	DOCUMENT CONTROLLING INTERFACE	SYSTEM RESPONSIBLE FOR CONTROLLING DOCUMENT
Primary	**Secondary**			
Material Transport System	Puck Transfer Tray Transporter	MTS shall provide trays of sintered pucks to the tray transporter.	TBD	TBD
Puck Transfer Tray Transporter	Tray Lifter	Tray transporter shall provide trays of sintered pucks.	TBD	TBD
Tray Lifter	Can Loading Robot	Tray lifter shall hold the trays of sintered pucks.	TBD	TBD
Can Loading Robot	Bagless Transfer	CL robot shall place sintered pucks into the puck can.	TBD	TBD
Bagless Transfer	Can Inspection Robot	BT shall present the sealed puck can to the puck robot.	TBD	TBD
Alpha Counter	Control System	Alpha counter shall provide count data to control system.	TBD	TBD
Bagless Transfer	Puck can robot	BT shall present the puck can to the puck can robot.	TBD	TBD

INTERFACING SYSTEMS		DESCRIPTION AND TOP LEVEL REQUIREMENTS OF INTERFACE	DOCUMENT CONTROLLING INTERFACE	SYSTEM RESPONSIBLE FOR CONTROLLING DOCUMENT
Primary	**Secondary**			
Puck can robot	Helium Leak System	Puck can robot shall place puck can into Helium Leak Chamber.	TBD	TBD
Helium Leak System	Puck can robot	Shall provide leak data to control system?	TBD	TBD
Puck can robot	Puck Can Transfer Pallet Transporter	Puck can robot shall place inspected puck can onpuck can transfer pallet transporter.	TBD	TBD
Puck Can Transfer Pallet Transporter	Material Transport System	Shall deliver puck cans to the building material transport system.	TBD	TBD
Electrical Power	TBD	TBD	TBD	TBD
HVAC	TBD	TBD	TBD	TBD
Waste	TBD	TBD	TBD	TBD
Controls	TBD	TBD	TBD	TBD

Interfacing Subsystems

C-1 Can Loading System

The Can Loading System receives trays of sintered pucks from the facility material transport system and delivers sealed puck cans to the puck can MC&A module.

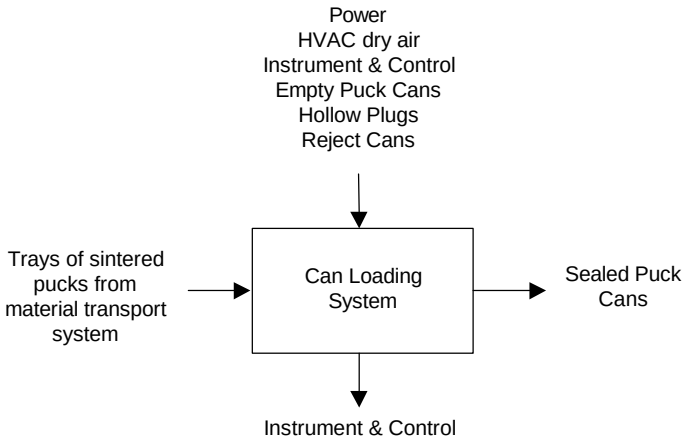
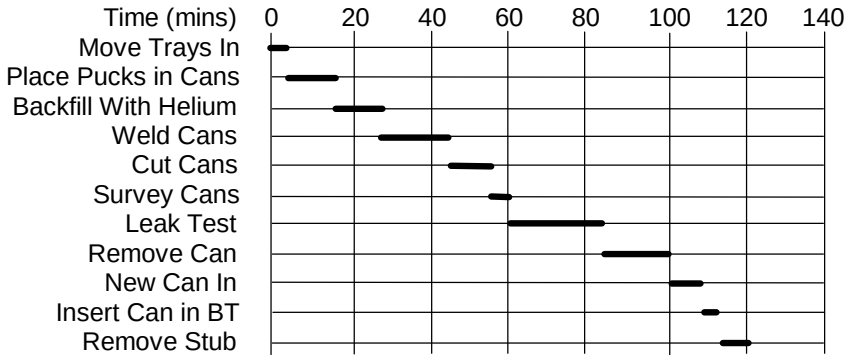


Figure C-1. Can Loading System Interfaces

APPENDIX D Traceability Matrix

TBD

APPENDIX E Process Cycle Time



Notes: All times are estimated.

Figure E-1. Can Loading Process Cycle Times

APPENDIX F Equipment List

Equipment Description	Quantity	Size	Comments
Tray Transfer Subsystem			
Cart	1	1' x 1' x 4"	inside glovebox
Cart Linear actuator	1	10' x 6" x 6"	outside - under glovebox
Rail system	1 set	10' x 1' x 2"	inside glovebox
Mechanical Tray Lifts	2 sets	6" x 6" x 1'	inside glovebox
Tray Lift Drives	2 sets	6" x 6" x 1'	outside - under glovebox
Can Loading Subsystem			
robot	1	3' x 10' x 5'	inside can loading glovebox
puck lifting tool	1	4" x 4" x 4'	inside can loading glovebox
helium hood tool	1	6" x 6" x 2.5'	inside can loading glovebox
puck weighing scale	1	1' x 1' x 0.5'	inside can loading glovebox
puck measurement system	1		inside can loading glovebox
vision system	1		outside can loading glovebox
reject can cutter	1	2' x 6" x 1'	inside can loading glovebox
barcode reader	1		inside can loading glovebox
Bagless Transfer Subsystem			
sphincter seal	2	9" dia x 4"	inside can loading glovebox
puck can welder	2	2' x 6" x 1'	bagless transfer enclosure
puck can cutter	2	2' x 6" x 1'	bagless transfer enclosure
puck can holder	2	2' x 6" x 1'	bagless transfer enclosure
Can Inspection Subsystem			
can inspection robot	1	4' x 4' x 4'	bagless transfer enclosure
alpha probe gripper	1		bagless transfer enclosure
alpha detector	1		bagless transfer enclosure
Can Handling Subsystem			
leak detector bell jar	1	6" dia x 2.5'	bagless transfer enclosure
puck can robot	1	8' x 3' x 3'	bagless transfer enclosure
puck can gripper	1		bagless transfer enclosure
barcode reader	1		bagless transfer enclosure
CCTV cameras	2		bagless transfer enclosure

APPENDIX G Government Assisted Design (GAD) List

I. System Requirements				
EQUIPMENT DESCRIPTION	Function: Basic functions of each structure, system and component	Performance requirements such as capacity, rating and system output for the system component	Codes and standards, regulatory requirements and commitments or responses to federal, state and local regulations which pertain to a given system component	Quality Assurance requirements, assurance that the materials, processes, parts and equipment are suitable for the application
Tray Transfer Subsystem				
Cart	DTO	A/E	A/E	A/E
Cart Linear Actuator	DTO	A/E	A/E	A/E
Rail System	DTO	A/E	A/E	A/E
Mechanical Tray Lifts	DTO	A/E	A/E	A/E
Tray Lift Drives	DTO	A/E	A/E	A/E
Can Loading Subsystem				
Robot	DTO	A/E	A/E	A/E
Puck Lifting Tool	DTO	A/E	A/E	A/E
Helium Hood Tool	DTO	A/E	A/E	A/E

Puck Weighing Scale	DTO	A/E	A/E	A/E

APPENDIX G Government Assisted Design (GAD) List

I. System Requirements (Continued)				
EQUIPMENT DESCRIPTION	Function: Basic functions of each structure, system and component	Performance requirements such as capacity, rating and system output for the system component	Codes and standards, regulatory requirements and commitments or responses to federal, state and local regulations which pertain to a given system component	Quality Assurance requirements, assurance that the materials, processes, parts and equipment are suitable for the application
Can Loading Subsystem (continued)				
Puck Measurement System	DTO	A/E	A/E	A/E
Vision System	DTO	A/E	A/E	A/E
Reject Can Cutter	DTO	A/E	A/E	A/E
Bagless Transfer Subsystem				
Sphincter Seal	DTO	A/E	A/E	A/E
Puck Can Welder	DTO	A/E	A/E	A/E
Puck Can Cutter	DTO	A/E	A/E	A/E
Puck Can Holder	DTO	A/E	A/E	A/E

APPENDIX G Government Assisted Design (GAD) List

I. System Requirements (Continued)				
EQUIPMENT DESCRIPTION	Function: Basic functions of each structure, system and component	Performance requirements such as capacity, rating and system output for the system component	Codes and standards, regulatory requirements and commitments or responses to federal, state and local regulations which pertain to a given system component	Quality Assurance requirements, assurance that the materials, processes, parts and equipment are suitable for the application
Can Inspection Subsystem				
Can Inspection Robot	DTO	A/E	A/E	A/E
Alpha Probe Gripper	DTO	A/E	A/E	A/E
Alpha Detector	DTO	A/E	A/E	A/E
Can Handling Subsystem				
Leak Detector	DTO	A/E	A/E	A/E
Puck Can Robot	DTO	A/E	A/E	A/E
Puck Can Gripper	DTO	A/E	A/E	A/E

APPENDIX G Government Assisted Design List (Continued)

II. System Description						
EQUIPMENT DESCRIPTION	Design conditions such as pressure, temperature, flow, fluid chemistry and voltage	Environmental Constraints: Loads such as seismic, wind, thermal and dynamic	Interface requirements including definition of the functional and physical interfaces involving structures, systems and components	Layout and arrangement requirements	Instrumentation and control requirements including indicating instruments, controls and alarms required for operation, testing and maintenance. Other requirements such as the type of instrument, installed spares, range of measurement, location of indication, calibration, measurement sensitivity and accuracy	Material requirements unique to the component
Tray Transfer Subsystem						
Cart	A/E	A/E	A/E	A/E	A/E	A/E
Cart Linear Actuator	A/E	A/E	A/E	A/E	A/E	A/E
Rail System	A/E	A/E	A/E	A/E	A/E	A/E
Mechanical Tray Lifts	A/E	A/E	A/E	A/E	A/E	A/E
Tray Lift Drives	A/E	A/E	A/E	A/E	A/E	A/E
Can Loading Subsystem						
Robot	A/E	A/E	A/E	A/E	A/E	A/E
Puck Lifting Tool	A/E	A/E	A/E	A/E	A/E	A/E
Helium Hood Tool	A/E	A/E	A/E	A/E	A/E	A/E
Puck Weighing Scale	A/E	A/E	A/E	A/E	A/E	A/E

APPENDIX G Government Assisted Design List (Continued)

II. System Description (continued)							
EQUIPMENT DESCRIPTION	Mechanical requirements	Structural requirements	Hydraulic requirements	Chemical Compatibility: Chemistry requirements (involves compatibility to chemical constituents in the system)	Electrical requirements	Handling, storage, cleaning and shipping requirements	Transportation requirements such as size and shipping weight, limitations and I.C.C. regulations
Can Loading Subsystem (continued)							
Puck Measurement System	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Vision System	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Reject Can Cutter	A/E	A/E	A/E	A/E	A/E	A/E	A/E
	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Bagless Transfer Subsystem							
Sphincter Seal	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Welder	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Cutter	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Holder	A/E	A/E	A/E	A/E	A/E	A/E	A/E

APPENDIX G Government Assisted Design List (Continued)

II. System Description (continued)							
EQUIPMENT DESCRIPTION	Mechanical requirements	Structural requirements	Hydraulic requirements	Chemical Compatibility: Chemistry requirements (involves compatibility to chemical constituents in the system)	Electrical requirements	Handling, storage, cleaning and shipping requirements	Transportation requirements such as size and shipping weight, limitations and I.C.C. regulations
Can Inspection Subsystem							
Can Inspection Robot	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Alpha Probe Gripper	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Alpha Detector	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Can Handling Subsystem	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Leak Detector	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Robot	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Gripper	A/E	A/E	A/E	A/E	A/E	A/E	A/E

APPENDIX G Government Assisted Design List (Continued)

III. Operational Requirements						
EQUIPMENT DESCRIPTION	Operating Environment: Environmental conditions anticipated during storage, construction, operation and accident conditions (such as storage of feed materials prior to introduction to the process)	Operational requirements of the component under various operating and upset conditions	Testing Requirements: Test requirements including preoperational and subsequent periodic tests and the conditions under which they will be performed	Personnel requirements and limitations including the qualification and number of personnel available for operation, maintenance, testing and inspection	Automation And Remoting Requirements: Degree of hands on versus remote or automated operation required during normal operations and routine maintenance	Visibility Requirements: Personnel visibility requirements for normal operations and off-normal events
Tray Transfer Subsystem						
Cart	A/E	A/E	A/E	A/E	A/E	A/E
Cart Linear Actuator	A/E	A/E	A/E	A/E	A/E	A/E
Rail System	A/E	A/E	A/E	A/E	A/E	A/E
Mechanical Tray Lifts	A/E	A/E	A/E	A/E	A/E	A/E
Tray Lift Drives	A/E	A/E	A/E	A/E	A/E	A/E
Can Loading Subsystem						
Robot	A/E	A/E	A/E	A/E	A/E	A/E
Puck Lifting Tool	A/E	A/E	A/E	A/E	A/E	A/E
Helium Hood Tool	A/E	A/E	A/E	A/E	A/E	A/E
Puck Weighing Scale	A/E	A/E	A/E	A/E	A/E	A/E

APPENDIX G Government Assisted Design List (Continued)

III. Operational Requirements (Continued)						
EQUIPMENT DESCRIPTION	Operating Environment: Environmental conditions anticipated during storage, construction, operation and accident conditions (such as storage of feed materials prior to introduction to the process)	Operational requirements of the component under various operating and upset conditions	Testing Requirements: Test requirements including preoperational and subsequent periodic tests and the conditions under which they will be performed	Personnel requirements and limitations including the qualification and number of personnel available for operation, maintenance, testing and inspection	Automation And Remoting Requirements: Degree of hands on versus remote or automated operation required during normal operations and routine maintenance	Visibility Requirements: Personnel visibility requirements for normal operations and off-normal events
Can Loading Subsystem (continued)						
Puck Measurement System	A/E	A/E	A/E	A/E	A/E	A/E
Vision System	A/E	A/E	A/E	A/E	A/E	A/E
Reject Can Cutter	A/E	A/E	A/E	A/E	A/E	A/E
Bagless Transfer Subsystem						
Sphincter Seal	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Welder	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Cutter	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Holder	A/E	A/E	A/E	A/E	A/E	A/E

Appendix G Government Assisted Design List (Continued)

III. Operational Requirements (Continued)						
EQUIPMENT DESCRIPTION	Operating Environment: Environmental conditions anticipated during storage, construction, operation and accident conditions (such as storage of feed materials prior to introduction to the process)	Operational requirements of the component under various operating and upset conditions	Testing Requirements: Test requirements including preoperational and subsequent periodic tests and the conditions under which they will be performed	Personnel requirements and limitations including the qualification and number of personnel available for operation, maintenance, testing and inspection	Automation And Remoting Requirements: Degree of hands on versus remote or automated operation required during normal operations and routine maintenance	Visibility Requirements: Personnel visibility requirements for normal operations and off-normal events
Can Inspection Subsystem						
Can Inspection Robot	A/E	A/E	A/E	A/E	A/E	A/E
Alpha Probe Gripper	A/E	A/E	A/E	A/E	A/E	A/E
Alpha Detector	A/E	A/E	A/E	A/E	A/E	A/E
						A/E
Can Handling Subsystem	A/E	A/E	A/E	A/E	A/E	A/E
Leak Detector	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Robot	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Gripper	A/E	A/E	A/E	A/E	A/E	

Appendix G Government Assisted Design List (Continued)

IV. Maintenance And Repair Requirements		
EQUIPMENT DESCRIPTION	Maintenance requirements: Accessibility, maintenance, repair and pre-service and in-service inspection requirements for the facility including the conditions under which they will be performed	Maintenance Access Path Requirements: Load path requirements for installation, removal and repair of equipment and replacement of major components
Tray Transfer Subsystem		
Cart	A/E	A/E
Cart Linear Actuator	A/E	A/E
Rail System	A/E	A/E
Mechanical Tray Lifts	A/E	A/E
Tray Lift Drives	A/E	A/E
	A/E	A/E
Can Loading Subsystem		
Robot	A/E	A/E
Puck Lifting Tool	A/E	A/E
Helium Hood Tool	A/E	A/E
Puck Weighing Scale	A/E	A/E

Appendix G Government Assisted Design List (Continued)

IV. Maintenance And Repair Requirements (Continued)		
EQUIPMENT DESCRIPTION	Maintenance requirements: Accessibility, maintenance, repair and pre-service and in-service inspection requirements for the facility including the conditions under which they will be performed	Maintenance Access Path Requirements: Load path requirements for installation, removal and repair of equipment and replacement of major components
Can Loading Subsystem (continued)		
Puck Measurement System	A/E	A/E
Vision System	A/E	A/E
Reject Can Cutter	A/E	A/E
	A/E	A/E
Bagless Transfer Subsystem	A/E	A/E
Sphincter Seal	A/E	A/E
Puck Can Welder	A/E	A/E
Puck Can Cutter	A/E	A/E
Puck Can Holder	A/E	A/E

Appendix G Government Assisted Design List (Continued)

IV. Maintenance And Repair Requirements (Continued)		
EQUIPMENT DESCRIPTION	Maintenance requirements: Accessibility, maintenance, repair and pre-service and in-service inspection requirements for the facility including the conditions under which they will be performed	Maintenance Access Path Requirements: Load path requirements for installation, removal and repair of equipment and replacement of major components
Can Inspection Subsystem	A/E	A/E
Can Inspection Robot	A/E	A/E
Alpha Probe Gripper	A/E	A/E
Alpha Detector	A/E	A/E
Can Handling Subsystem	A/E	A/E
Leak Detector	A/E	A/E
Puck Can Robot	A/E	A/E
Puck Can Gripper	A/E	A/E

Appendix G Government Assisted Design List (Continued)

V. Safety And Security Requirements								
EQUIPMENT DESCRIPTION	Security requirements to include access and administrative control requirements and system design requirements including redundancy, power supplies, support system requirements, emergency operational modes and personnel	Criticality Prevention: Requirements for criticality control and accountability of nuclear material	Personnel Safety: Safety requirements for preventing personnel injury	Fire protection or resistance requirements	Failure Mitigation: Failure effects requirements of structures, systems and components including a definition of those events and accidents which they must be designed to	Reliability: Reliability requirements of structures, systems and components including their interactions which may impair functions important to safety	Redundancy, diversity and separation requirements of structures, systems and components	Other requirements to prevent risk to the health and safety of the public
Tray Transfer Subsystem								
Cart	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Cart Linear Actuator	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Rail System	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Mechanical Tray Lifts	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Tray Lift Drives	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Can Loading Subsystem								
Robot	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Lifting Tool	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Helium Hood Tool	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Weighing Scale	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E

Appendix G Government Assisted Design List (Continued)

V. Safety And Security Requirements (Continued)								
EQUIPMENT DESCRIPTION	Security requirements to include access and administrative control requirements and system design requirements including redundancy, power supplies, support system requirements, emergency operational modes and personnel	Criticality Prevention: Requirements for criticality control and accountability of nuclear material	Personnel Safety: Safety requirements for preventing personnel injury	Fire protection or resistance requirements	Failure Mitigation: Failure effects requirements of structures, systems and components including a definition of those events and accidents which they must be designed to	Reliability: Reliability requirements of structures, systems and components including their interactions which may impair functions important to safety	Redundancy, diversity and separation requirements of structures, systems and components	Other requirements to prevent risk to the health and safety of the public
Can Loading Subsystem (continued)								
Puck Measurement System	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Vision System	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Reject Can Cutter	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Bagless Transfer Subsystem								
Sphincter Seal	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Welder	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Cutter	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Holder	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E

Appendix G Government Assisted Design List (Continued)

V. Safety And Security Requirements (Continued)								
EQUIPMENT DESCRIPTION	Security requirements to include access and administrative control requirements and system design requirements including redundancy, power supplies, support system requirements, emergency operational modes and personnel	Criticality Prevention: Requirements for criticality control and accountability of nuclear material	Personnel Safety: Safety requirements for preventing personnel injury	Fire protection or resistance requirements	Failure Mitigation: Failure effects requirements of structures, systems and components including a definition of those events and accidents which they must be designed to	Reliability: Reliability requirements of structures, systems and components including their interactions which may impair functions important to safety	Redundancy, diversity and separation requirements of structures, systems and components	Other requirements to prevent risk to the health and safety of the public
Can Inspection Subsystem								
Can Inspection Robot	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Alpha Probe Gripper	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Alpha Detector	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Can Handling Subsystem	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Leak Detector	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Robot	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E
Puck Can Gripper	A/E	A/E	A/E	A/E	A/E	A/E	A/E	A/E