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93-SWT-141

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M. M. McCARTHY

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Dear Messrs. Day and Stanley:

COMPLETION OF PROPOSED INTERIM MILESTONE M-19-03

This letter transmits the completed "Waste Receiving and Processing Module 2B Strategy Assessment" for review and comment by the U.S. Environmental Protection Agency and State of Washington Department of Ecology. This assessment fulfills Hanford Federal Facility Agreement and Consent Order proposed interim milestone M-19-03 for submittal of an engineering study covering the WRAP Module 2 Milestone Rescope by March 31, 1993.

The strategy in this document is based on a current planning by the U.S. Department of Energy to pursue two facilities: WRAP Module 2B and the Multipurpose Processing and Storage Complex (MPPSC). This study assumed the separate existence of these facilities and attempted to minimize the duplication of facility and process requirements. Specifically, rather than providing two hot cell facilities for High-Level Waste (HLW) at Hanford, one for the needs of Solid Waste and the other for the needs of Tank Waste Remediation, this study assumed only one facility with a hot cell to handle all HLW would be required. Therefore, identified feeds (Hanford Waste Vitrification Plant Melters, fuel and fuel pieces stored as solid waste) are planned to be shifted from WRAP 2B to the MPSC, where facilities tasked with HLW processing are currently planned. Additional study is planned by the Westinghouse Hanford Company and recommended by RL to determine the impacts and benefits of providing one facility to perform all HLW hot cell processing functions.

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If you have any questions, please contact J. M. Augustenborg of the Waste Management Division on (509) 376-5494.

Sincerely,

Steven H. Wisness
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WMD:JMA

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WASTE RECEIVING AND PROCESSING (WRAP) MODULE 2B STRATEGY ASSESSMENT

Signature and Approval Page

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WASTE RECEIVING AND PROCESSING (WRAP) MODULE 2B STRATEGY ASSESSMENT

by

T. J. Venetz
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February 22, 1993

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LIST OF ACRONYMS AND ABBREVIATIONS

CH	Contact Handled
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Field Office
DST	Double-Shell Tank
EBR-II	Experimental Breeder Reactor II
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FGE	Fissile Gram Equivalent
FRP	Fiberglass Reinforced Plywood
ft^3	Cubic Feet
HDW-EIS	Hanford Defense Waste-Environmental Impact Statement
HLW	High-Level Waste
HWVP	Hanford Waste Vitrification Plant
LLMW	Low Level Mixed Waste
LLW	Low-Level Waste
NDA	Non-Destructive Assay
NDE	Non-Destructive Examination
Pu	Plutonium
PA	Performance Assessment
PUREX	Plutonium/Uranium Extraction Plant
RCRA	*Resource Conservation and Recovery Act of 1976*
RH	Remote Handled
RMW	Radioactive and Hazardous Mixed Waste
ROD	Record of Decision
SST	Single-Shell Tank
SWB	Standard Waste Box
TPA	Tri-Party Agreement
TRU	Transuranic Waste
TRUM	Transuranic Mixed Waste
TRUPACT-II	Transuranic Package Transporter II
TTF	Thermal Treatment Facility
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing

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WASTE RECEIVING AND PROCESSING (WRAP) MODULE 2B STRATEGY ASSESSMENT

1.0 INTRODUCTION

The Waste Receiving and Processing (WRAP) Module 2B is proposed to provide treatment for radioactive and/or hazardous solid wastes at the U.S. Department of Energy (DOE), Richland Field Office (RL) Hanford Site. The current planning is for the WRAP Module 2B to be constructed as a separate Line Item, Project W-255.

1.1 BACKGROUND

The DOE Defense Waste Management Plan (DOE 1983) established WRAP as the facility that would provide the necessary treatment for certification of contact handled (CH) transuranic (TRU) waste at the Hanford Site. In April 1988, the Hanford Defense Waste-Environmental Impact Statement (HDW-EIS) Record of Decision (ROD) was issued (DOE 1988b). The HDW-EIS ROD committed DOE to build WRAP at the Hanford Site and initiate retrieval and treatment of TRU waste stored at the Hanford Site for emplacement in the Waste Isolation Pilot Plant (WIPP). In 1989, the *Hanford Federal Facility Agreement and Consent Order*, or Tri-Party Agreement (TPA), was signed by the U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), and DOE. This further reinforced DOE's commitment to build the WRAP Facility at the Hanford Site. The TPA also specified WRAP as the Hanford Site facility that would provide necessary treatment for low-level radioactive and hazardous mixed waste (RMW) in addition to TRU waste.

In 1988 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 treatments as much as possible, it was proposed by the operating contractor (and agreed to by RL) that the WRAP 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 to meet defined waste treatment and disposal criteria, while allowing more time to better define other technologies and processes considered for inclusion in WRAP (Pauly 1990).

Of the total post 1970 stored suspect TRU waste at the Hanford Site, 55-gal 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 5 mR/h), making them comparatively easier to process, it was decided that Module 1 should concentrate primarily on CH-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 processing in Module 2.

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Certification of retrieved solid waste will require that each retrieved container be opened, characterized, and proper treatment methods for reducing toxicity and mobility of RMW components identified and implemented. Classified waste will be shredded, compacted, or otherwise destroyed to eliminate classified aspects. Particulate wastes will be immobilized, liquids will be solidified (after RMW characterization), and compressed gas cylinders (e.g., aerosol cans) permanently vented. All waste will be repackaged into new containers and loaded within allowable weight and plutonium gram loading limits in accordance with the Waste Isolation Pilot Plant (WIPP)-waste Acceptance criteria (WAC).

The repository for TRU wastes, WIPP, has been involved in evaluation of their WAC. WIPP staffs have evaluated a wide range of alternate waste forms that may be required as a result of ongoing studies of the ability of WIPP to permanently dispose of the TRU waste. DOE/WIPP 91-007, Revision 0, July 1991, (DOE 1991) is the result of a major, multi-year study addressing the leading 14 alternative waste forms that may be required for TRU waste at WIPP. This uncertainty at WIPP suggests that proceeding with a major facility whose principal thrust is the processing of TRU waste for WIPP, such as WRAP 2 as previously planned, may not be in the best interest of the nation. Accordingly, the WRAP 2 Facility has been proposed to be split into two facilities.

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The WRAP 2 Facility was proposed to be rescoped into a CH mixed-waste treatment facility, WRAP Module 2A, and a TRU waste treatment facility, WRAP Module 2B, in February 1992. The change request was submitted for approval of the facility rescope to address the uncertainties of the final WAC for the WIPP (Wagoner 1992). The WRAP Module 2 Milestone Rescope (M-19-00 and M-19-01) proposed to complete the engineering study to develop alternatives for TRU treatment and recommendation for treatment (including WRAP 2B) by March 31, 1993 (M-19-03).

Concurrent with the planning for WRAP 2B was planning for those wastes that would require some form of thermal treatment before disposal. While most of the waste planned for the proposed thermal treatment facility (TTF) is expected to be CH-low-level mixed waste (LLMW), the TTF planning assumed that a small amount of remote handled (RH)-LLMW and TRU wastes would also be required to be processed. Additionally, the TTF planning assumed some other facility would perform all pre and post TTF activities, the TTF activities being limited to the thermal treatment per se. Accordingly, the pretreatment activities (characterization, segregation, sizing of the waste, and packaging for insertion into the kiln or furnace) would be performed by WRAP 2B; ash and residue treatment would be addressed by either WRAP 2A or WRAP 2B, depending on the state of the residue in terms of TRU contamination levels and gamma dose levels.

1.2 PURPOSE

This study was performed to identify known and projected feed streams for WRAP Module 2B and to determine necessary processes for treatment of those feed streams against the existing and possible alternative TRU WAC. The study includes an evaluation of facility requirements considering further

modularization and/or the use of existing facilities to perform the necessary treatment. The alternatives strategy assessment was prepared to meet the intent of the proposed milestone M-19-03.

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2.0 SUMMARY

The original scope of the WRAP 2 Facility was established to enable TRU waste material at the Hanford Site to be processed to the WIPP-WAC for disposal at WIPP and low-level waste (LLW)/LLMW to be processed for onsite disposal. Ongoing studies being conducted to determine the containment aspects of WIPP identified 14 engineered alternatives to the WIPP-WAC criteria that could become a requirement in the future. The uncertainties associated with the 14 alternatives were considered adequate justification to reevaluate the WRAP 2 Facility scope.

In February 1992, the scope of the WRAP 2 Facility was separated into two parts: a CH-LLMW treatment facility designated WRAP Module 2A, which had a well defined scope; and a TRU waste treatment facility designated WRAP Module 2B, whose scope was in question because of the uncertainties of the WIPP-WAC. The decision to divide WRAP 2 into two parts permitted the WRAP 2A project work to continue as scheduled and placed a delay on the WRAP 2B project work pending resolution of the uncertainties associated with the 14 alternatives to the WIPP-WAC. A TPA change request was submitted in February 1992 for the facility rescope. A milestone was identified for an engineering study to develop alternatives for TRU treatment and recommendation for treatment by March 31, 1993 (M-19-03). This document is the response to that milestone and presents the results of assessments to provide the preferred strategy and basis on which to proceed with the WRAP Module 2B project.

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An extensive testing program is still underway to resolve the uncertainties of the WIPP-WAC criteria and establish whether or not any of the 14 alternatives will be required. Unfortunately, the duration of the testing program is such that it is now apparent that full resolution of these uncertainties may take several years. A delay of this nature will cause an unacceptable delay in the start of the WRAP 2B project because it must come on line and be compatible with the operating lifetime of WIPP.

The proposed concept for WRAP 2B, at the time it was rescoped, recognized that some of the waste processes would be incompatible with selected alternatives being considered to the WIPP-WAC. These incompatible processes, which include grouting and a Plasma Arc furnace, must be removed from the WRAP 2B scope to establish a new baseline that permits the project work to continue. As the uncertainties are resolved in the future, appropriate new treatment processes can be added to the WRAP 2B baseline scope.

An evaluation of known and projected feeds for WRAP Module 2B was performed. Processing strategy alternatives were developed to accommodate all of the potential feed streams. After the proposed strategy for processing all potential feeds was completed, consideration was given to waste form uncertainties, which lead to the development of the preferred strategy.

The preferred strategy for Module 2B is to:

1. Provide a WRAP 2B module that will be a large remotely operated hot cell facility with moderate shielding requirements. It will process a large portion of the retrievably stored TRU waste that is not processed by the other WRAP modules, and also process a significant amount of projected waste in difficult forms that will be generated by future Hanford Site programs. Treatment capability will also be provided for RH LLW/LLMW to allow for onsite disposal. The large hot cell capability will be required regardless of possible changes in WIPP waste form criteria and the treatment suggested will not include anything that will preclude future reprocessing to an alternate waste form. Treatment of RH-LLMW waste is not affected by WIPP-WAC uncertainties.

2. A limited amount of identified feeds [Hanford Waste Vitrification Plant (HWVP) melters and research fuel and fuel pieces stored as solid waste] are not suggested for processing in WRAP 2B. It is suggested that they should be shifted to other facilities at the Hanford Site tasked with HLW processing. This is currently planned for the Multi-Purpose Storage Complex (MPSC).

3. Planning for thermal treatment processing, including feed preparation and treatment of TTF residues, should not be provided in Module 2B. TTF planning should provide for complete handling of the waste in either a privatized TTF or, the scope of the CH-LLMW pretreatment, if required, should be added to that of the WRAP CH-LLMW treatment facility, WRAP 2A. There is no identified reason to add CH-LLMW treatment to WRAP 2B when WRAP 2A is still in the planning stages. As an alternate, the onsite TTF scope could be increased to include any TTF specific pretreatment.

Feeds identified for processing in the proposed WRAP 2B Facility include:

- RH and CH boxes from retrieval, that do not include research fuel or research fuel pieces
- Newly generated waste in the form of large process equipment such as HWVP operations waste, double-shell tank (DST) equipment, and canyon tunnel waste
- Overweight and shielded drums from retrieval that exceed WRAP 1 limits
- Nitrate shipping containers
- Z-9 Pu contaminated soils
- Classified waste
- RH drums from retrieval
- RH-TRU waste projected to be received from offsite.

Feeds not planned for inclusion in the proposed facility concept and shifted to the MPSC are:

- Waste as research fuel or research fuel pieces, including caisson waste
- HVWP melters
- 12 drums containing high levels of ^{238}Pu.

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3.0 FEED STREAMS

Solid waste that has been identified for treatment in the WRAP Module 2B Facility include the post 1970 retrievably-stored waste, TTF feed and product, WRAP Module 1 operations and rejected waste, HWVP operations waste and failed melters, DST equipment, and waste from offsite generators. The Plutonium-Uranium Extraction Plant (PUREX) tunnel and canyon waste is also considered a likely waste stream.

The baseline waste stream for known waste was developed from characterization data based on existing records (Anderson 1991). The baseline waste stream for projected waste was developed from the 30 yr forecast document (Duncan 1992) and discussion with generator groups.

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3.1 GENERAL

3.1.1 Known Wastes

The known wastes are specified in historical records as the post 1970 retrievably stored CH and RH waste. Initially the waste was identified as retrieved boxes, retrieved drums, newly generated waste, oversize boxes, alpha caisson waste, and retrieved mixed-waste drums and boxes. The retrieved drums are those projected to not be suitable for WRAP 1. They include drums that are failed, overweight, have shielded contents, contain TRU soils or particulates, or classified waste.

3.1.2 Projected Wastes

The projected wastes identified in the 30 yr forecast include offsite sources, HWVP operations waste (not including melters), and DST equipment from tank waste retrieval. PUREX tunnel equipment was included as a projected waste stream because it is representative of large TRU contaminated equipment that might have to be processed in WRAP 2B.

3.2 GROUPING OF WASTE TO DETERMINE PROCESS SELECTION

The waste was divided into nine groups (A through I). This was done based on the feed streams head-end processing drivers and similarities between waste streams. Various physical properties (i.e., size, quantity, weight, and dose rate) were evaluated to determine the processing requirements and lead to the segmentation of the groups. The waste groups are defined below. A tabular form is presented in Appendix A, "WRAP 2B Waste Matrix."

3.2.1 Group A: Research Fuel and Fuel Pieces

Group A has a total volume of 30,820 ft^3 with a total TRU content of 26,190 g. Projections show 8,700 ft^3 of offsite generated waste, and 1,000 drums (55 gal) of overweight/shielded waste from retrieval. TTF

planning assumes an annual rate of 934 drums (55 gal) of TTF slag. The waste in this group is packaged into heavily shielded small casks, drums, and concrete boxes.

Over 2 dozen experimental breeder reactor II (EBR-II) casks are currently stored as TRU waste in 218-W-4C Burial Ground. Historical records indicate they contain irradiated experimental fuel, currently believed to be intact fuel pins (fuel pins are sometimes called fuel rods). The casks are shielded to CH levels.

Four underground caissons in the 218-W-4B Burial Grounds received canned laboratory wastes consisting of intact and segments of fuel elements from experimental core tests, fuel cladding, associated fuel hardware, examining tools, core inspection props, core cleaning and polishing equipment, plastic, and other miscellaneous equipment associated with the hot-cell fuel examination and research operations. This material was originally transported to the caissons in paint cans (1 gal, 1 gal imperial, and 5 gal) via a transfer cask. Along with this material, large quantities of plastic sheeting was placed in the caissons during a loading event. Current retrieval plans for the caissons include segregation of the plastic sheeting from the other laboratory wastes with the sheeting going to a CH processing line and the RH waste from the labs going to a highly shielded hot cell (and eventually to WIPP in WIPP designed and supplied RH casks).

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The TTF slag may be RH-TRU, in which case, it will require routing to a RH-TRU packaging cell for processing. Some of the waste will be RH-LLW and some will be RH LLMW. Both fractions are assumed to be Class III because of the activation of the waste. The LLW and LLMW fractions of the TTF slag will be further treated (as necessary) and packaged for disposal.

3.2.2 Group B: Pu 238

There are 12 drums (90 ft^3 total) containing nominally 235 to 590 g of approximately 85 wt% plutonium oxide (5,360 g total TRU content). It averages 18.4 wt% ^{238}Pu and has high thermal activity. The material was considered to be plutonium oxide scrap at the time of packaging. The material was packaged at Savannah River Laboratory in 1968 and sent to Pacific Northwest Laboratories (PNL) for criticality testing. In 1977, the drums were transferred to the Solid Waste Operations Contractor at the Hanford Site. In 1980, the drums were placed in below ground TRU retrievable storage in the Hanford Site burial grounds. The composition at the time of packaging (1968) is shown in Table 3-1.

The waste is uniformly characterized as scrap plutonium oxide in metal containers. No description mentions the inclusion of organic materials (e.g., plastic bags). The triple containment packaging configuration about the plutonium oxide is two concentric aluminum cans inside a Schedule 30 stainless steel pipe. The pipe is housed in a M-101/102 bird cage container assembly. The M-101/102 bird cage standard steel housing provides a fourth layer of containment. Each M-101/102 bird cage container resides in a 55-gal drum. The 55-gal drum provides the fifth and final layer of containment.

Table 3-1. Waste Container Parameters (Determined for 2000).

Container number	Total Pu (grams)	^{239}Pu equivalent activity (Ci)	Heat generation (watts)
T-102	521.82	1262.01	45.59
T-103	522.90	1266.59	45.75
T-104	524.44	1270.77	45.90
T-105	523.68	1266.65	45.75
T-106	520.97	1260.24	45.52
T-107	226.56	597.92	21.60
T-108	504.15	1320.77	47.72
T-109	498.20	1315.59	47.53
T-110	319.54	843.79	30.48
T-111	258.68	683.34	24.68
T-112	510.90	1356.25	49.00
T-113	404.65	1096.65	38.65

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3.2.3 Group C: Dirt/Ash

Group C consists of Z-9 soils with a total waste volume of 4,832 ft^3 with 58,000 g total TRU content and TTF ash. TTF planning assumes an annual rate of 4,200 drums (55 gal) of TTF ash. Most of the TTF ash is planned for treatment in WRAP Module 2A. A small amount of this total volume (26,900 ft^3) is assumed to become RH-LLMW or TRU after thermal treatment and identified as a potential WRAP 2B feed. The waste in this category is characterized by the need for particulate immobilization. Criticality concerns will have to be addressed during the processing of the Z-9 soils.

The Z-9 soil was packaged in 653 drums (55 gal) containing a total of 58 kg Pu in 5,222 canisters. The inner 10 L canisters were first lined with a 0.05 mm polyethylene bag, which was taped shut before the canister was sealed. The canister was loaded into a 0.3 mm polyethylene bag, which was heat sealed. Each bagged canister was then placed inside a slightly larger canister and its slip fit lid sealed. The plutonium content of each canister was measured with a sodium iodide assay monitor system. Every tenth canister and every canister containing 20 g or more of Pu were verified by the segmented gamma scan assay system in the 234-5Z Building. Drum packaging was with plywood spacers placed on top of the lower four cans of soil. Some drums may only contain seven cans of soil to stay within the 185 g limit. Packets of hydrogen/oxygen recombining catalyst were added to the drums on top of vermiculite packing. The soil is also considered to be cadmium contaminated as cadmium nitrate was added to the soil to thwart criticality concerns.

The TTF ash could be RH-TRU, in which case, it will require routing to the RH-TRU packaging cell for processing. Some of the waste will be RH-LLW and some will be RH-LLMW. Both fractions are assumed to be Class III because of the activation of the waste. The LLW and LLMW fractions of the TTF ash will be further treated (as necessary) and packaged for disposal.

3.2.4 Group D: Large RH and CH Containers

Group D historical records indicate this waste feed has a total volume of 273,173 ft^3 with 26,471 g total TRU content. The waste in this group consist of large sized, heavy weighted boxes of concrete, fiber glass-reinforced plywood (FRP), plywood, and metal. Also, included are failed drums and large and small cartons (4.5-360 ft^3).

Newly generated standard waste boxes (SWB) exiting WRAP 1, that either are assayed as a non-TRU or TRU, are determined not to meet the WIPP-WAC and/or Transuranic Package Transporter II (TRUPACT II) criteria need to be processed in WRAP 2B. This group also includes a waste stream, potentially small in volume, that consists of LLW and LLMW shipped to Solid Waste Disposal in boxes too large for operations in WRAP 2A. For this stream, the processing operations are limited to resizing to boxes and drums that will be acceptable to WRAP 2A.

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During the 1970's and 1980's, TRU waste was placed in oversize boxes for storage. Oversize boxes are boxes that are too large to fit into the TRUPACT solid waste box without compaction. Gloveboxes and other assorted pieces of hardware were received from onsite and offsite sources that were contaminated with various quantities of CH-TRU material. The oversize boxes were made from FRP, plywood, steel, or concrete. The sizes range from 64 to 1,250 ft^3 weighing in excess of 35,000 lb (Anderson 1991). Some of the boxes contain whole gloveboxes into which several kinds of debris was placed. Some of the concrete boxes contain shielded RH waste and spent fuel.

Considerable handling operations are characteristic of this waste group. A wide variety of package size, shape, mass, and handling features will exist in this group. The processing will be equally varied with package handling (with careful segregation from the package payload so as not to contaminate the package material itself), size reduction, characterization of the waste (a potentially massive effort considering the wide variety of sources and contents), repackaging and non-destructive examination (NDE)/non-destructive assay (NDA). Decontamination processes will be required to ensure that any overpack boxes (used in retrieval operations) are recycled back to retrieval in a contamination free state. Decontamination may be a process used to change the waste classification from TRU to LLW to reduce the volume of TRU waste. Other processing operations are expected to be similar to that of other waste groups, such as encapsulation, neutralization, and immobilization.

3.2.5 Group E: Nitrate Shipping Containers

The nitrate shipping containers consist of retired and breached 10 L shipping containers, 3 L containers, and product receiver (PR) cans. The total volume is approximately 2,478 ft^3 containing 17,043 g total TRU content. Some are expected to include residual amounts of free liquids that could not be recovered from breached polybottles.

The 10-L containers can be either an FL-10, L-10, or a 10 L. Although the details of construction vary between each type, they consist of a 10-L polyethylene bottle, wrapped in plastic, in a pressure vessel made of 5-in. stainless pipe with a flanged top, that was held in place in the center

of an outer container that consisted of two 55-gal drums welded end to end. The space between the pressure vessel and outer container was filled with either phenolic foam, fiberboard rings, or loose vermiculite.

The 3-L containers were similar in construction to the 10-L containers but used a 3-L polyethylene bottle as the inner container and the outer container was a single 55-gal drum.

The styles of PR cans also varied slightly in details. The inner container was made of 5 in. schedule 80 pipe with a gasketed lid. The outer container was a 55-gal drum. The inner container was centered in the outer drum using a steel framework. Older PR cans used an outer container made of rolled 1/4-in. plate with welded bottom and a flanged top.

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3.2.6 Group F: Classified Waste

Records show 1,240 55-gal drums (9,176 ft^3) containing classified waste are buried in the trenches and they contain an estimated 338 g total TRU content. There are additional classified drum in the trenches, but because they are not classified as potentially TRU wastes, they are not planned for retrieval. The task in processing this group of wastes is to declassify the contents of the waste container, and then process the waste in a normal fashion for the waste class (e.g., package TRU waste for WIPP).

Administrative issues regarding declassification have not yet been addressed. This feed stream could impose additional physical safeguard requirements on the facility. Treatment needed to destroy classified aspects of waste could bound the types of processing equipment (e.g., plasma torch, shredder) needed. Contents vary from documents and drawings to classified shapes and isotopes. Most declassification should be able to be performed using simple mechanical processing operations.

3.2.7 Group G: Feed for TTF

The projected total volume for Group G is 31,700 ft^3 of LLMW in 55-gal drums requiring thermal treatment from the WRAP Module 1. This waste group is feed intended for treatment in the TTF. The waste in this category would require handling, repackaging, and size reduction.

Current solid waste TTF planning assumes WRAP 2B will have the capability to process 50 drums/day of CH-LLMW for the rotary kiln, 5 drums/day of RH-LLMW and 5 drums/day of TRU-mixed waste (CH and RH) for the plasma arc. The TTF feed preparation is assumed to operate 175 days/yr.

3.2.8 Group H: HWVP Melters

The projected volume of failed melters (76,500 ft^3) constitutes the waste in Group H based on a melter failure occurring once every 2 to 3 yr. The HWVP melter in its overpack is large (twenty-seven ft by fifteen ft by twenty-one ft), heavy (400,000 lbs), and contains HLW. Melters from the HWVP will be a waste stream requiring treatment as a special waste stream. It is

assumed the melters will be packaged for transportation by the HWVP for onsite transport in overpacks and that all aspects of packaging and transportation will be addressed by the shipper.

The following was assumed pending refinement of data. Rail shipments will arrive via a special dedicated rail car. Surface dose rates will not exceed 10 R/h on the exterior of the melter overpack shipping box. Unpacked from the melter shipping box, the melter will have an average surface radiation level in the range of 100 to 300 R/h with local hot spot levels not exceeding 10,000 R/h. The waste will be RH-LLW-III, RH-TRU, and HLW. Total melter weight is 200,000 lb (melter full of glass). It is assumed that the glass residue is HLW (15,000 lb), any metals in contact with the glass or feed stream is RH-TRU (30,000 lb), and all other materials will be RH-LLW-III. While there may be some CH waste, it is not possible to estimate this fraction at this time. The melter overpack is assumed to weigh 200,000 lb and will be recycled to the HWVP Facility after decontamination at WRAP 2B. The total mass of melter and transportation overpack is assumed not to exceed 400,000 lb.

The assumptions made, based on informal meetings with representatives of the HWVP project involved in the disposal of spent melters, impose significant criteria on the WRAP 2B project. The acceptance of waste into the WRAP 2B shipping and receiving area with surface dose rates of 10 R/h is far greater than the plant's normal operational guideline of 0.2 R/h. The physical size and mass of the melter, in the overpack, will size the entire shipping and receiving area as well as size the airlock and in-cell handling equipment. The waste, some of which will be HLW, must be either processed to the HLW acceptance criteria, or packaged for shipment back to the HWVP for final packaging. If packaged within WRAP 2B, then HLW shipping cask capability must be provided as part of the facility. In either event, some new shipping cask capability will have to be provided to bring the outgoing shipment down to some TBD surface dose rate criteria (this would most likely be the 200 mrem/h upper limit for CH waste).

3.2.9 Group I: Large Process Equipment

The projections for Group I indicate a total waste volume of 288,000 ft^3. The waste in this category consist of HWVP operations waste, DST equipment, and possibly, PUREX tunnel waste (Duncan 1992).

Over 60,000 ft^3 of canyon equipment is on flat cars in the PUREX tunnels. This material is not presently included in the waste forecast, however, it contains RH and CH, TRU and LLW, with mixed waste (MW) components. Typically, the source for this material is from failed canyon process equipment, tanks, jumpers, piping, dunnage, and other miscellaneous waste.

Equipment removed from the DSTs as part of the tank clean-out will be treated in WRAP 2B. This is expected to be a major source of RH-LLW and RH-LLMW. The equipment may initially be sent to the T Plant where it will be size reduced to fit into the WRAP 2B entry airlock. The use of T Plant is only in the event WRAP 2B cannot be configured to receive the long packages from the DST clean-out system directly. It is preferable to have this capability as part of WRAP 2B to enable other long packages to be processed in

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WRAP 2B, but in the event this becomes cost prohibitive, T Plant would be the alternative size reduction facility. Items that will be received include 60 ft assemblies, pumps, thermocouples, and other tank equipment.

Operations waste from the HWVP is projected at ~70,000 ft^3. Some of the waste will be transported to WRAP 2B in drums and boxes. Although not currently in the forecast, discussion with HWVP personnel indicate some large pieces of failed equipment will be generated and shipped in melter storage boxes or other equivalent size containers.

Most shipments of waste in this group are assumed to arrive by truck to the W-112 Storage Facility for batching into WRAP 2B. Rail shipments will include an extraordinary box from retrieval (140,000 lbs), and possibly a multi-purpose rail car container proposed by PUREX for shipping their canyon waste.

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4.0 FACILITY/PROCESS OUTPUTS

The waste forms generated by the waste feed Groups A through I are identified in decision analysis diagrams (Appendix B). These waste forms constitute the final product to be generated in relation to waste feed Groups A through I. These waste forms were identified using the facility/processing requirements imposed by the WIPP-WAC (DOE 1991), Hanford Site Solid Waste Acceptance Criteria (Willis 1991), and limited acceptance criteria for HLW and GTC-III waste.

The determination of the final waste forms were established based on the waste groups' content. Such items as packaging were included to identify LLW streams. The waste class associated with a particular waste group has an abbreviated explanation of the contents on their respective diagrams. These diagrams were used as an aid to develop the process flow diagrams (Section 5.0) and to further organize the waste groups (e.g., Groups B and C show similar final waste forms demonstrating an avenue of investigation to identify possible process overlapping and integration).

The final waste forms shown on the diagrams are considered the major streams that will result from processing the material. These major streams will drive design and facility requirements, which are expected to be able to accommodate the minor streams.

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5.0 PROCESS FLOW

Process flow diagrams for processing each feed group are found in Appendix C. The processing steps that each feed group takes to meet the acceptance criteria for output forms identified in the respective decision analysis diagrams (Appendix B) are shown. Process steps are shown functionally and detail has not been developed for the processes, equipment, and design features. Specific details will be selected and evaluated for use in the facility in later stages of the project documentation, i.e., Engineering Study.

The flow diagrams include dotted lines indicating where confinement features for contamination control and shielding features for radiation protection will be required. Where feasible, reuse of overpacks, casks, and shielding is shown. In other cases, (Group B, C, E, and F) the overpacks are considered sacrificial and processed as LLW.

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WRAP 2B functions shown on the flow diagrams are described below.

- Receiving

  - Receipt of feed material can be either by rail, truck, or transport device from storage. Rail receipt is available for massive or large items such as HWVP melters, large process equipment, and large boxes from retrieval. Truck receipt is used for some boxes from retrieval that bypass storage and shielded transport casks. Receipt of material from Phase V storage using automated guided vehicle (AGV) or forklift via the transport corridor will also occur.

  - The receiving function has crane capability to remove the waste container and overpack from the transport vehicle. Provision for shielding in the area and remote operation of the crane will be required. This will accommodate HWVP melters and other equipment and boxes that cannot be shielded down to CH levels.

- Separation

  - The separation function occurs outside and inside of process containment. Separation outside of containment includes removal of the waste package from the reusable overpack and removal of any reusable shielding materials. Separation functions occurring inside of containment are separation of the waste from the package (box, drum) and separation of the waste package from the overpack where the overpack is not reusable. Specialized processes to perform this function should be developed that allow separation of these items while minimizing contamination of the package and overpack. This would allow their disposal as LLW.

- Loading

  - Loading will consist of introduction of the feed material into the containment area. This consists of an airlock area where separation of waste package and overpack can be done. Other feeds utilizing sacrificial overpacks are introduced directly into containment.

- Treatment

  - Salvage--Salvage treatment functions for articles that are to be reused (overpacks and shielding) will consist of survey for contamination, decontamination processes where required, and release.

  - Process--Treatment functions for the waste include size reduction, sorting and characterization, splitting, absorption, immobilization, neutralization, and declassification. Size reduction is performed to make some of the items more manageable and able to fit into approved containers (SWBs, drums, and RH canisters). Sorting is performed to remove noncompliant articles and those requiring sampling and analysis for characterization. Splitting is required to reduce Pu loading on some items to meet transportation limits. Absorption of liquids, immobilization of particulates, and neutralization of corrosives and reactives is required treatment for WIPP prohibited articles. Treatment of RH-LLMW would use processes similar to those planned for WRAP 2A. A declassification treatment function is identified for the classified waste.

- Certification

  - Certification functions include sampling, survey, NDA, and NDE. Sampling may be required to complete characterization or verify treatment. Survey establishes radiation and contamination levels to allow for separation for RH and CH handling. NDA is performed to separate TRU waste from LLW. NDE is required for TRU certification.

- Repackage

  - Repackaging functions are identified for waste destined for storage, WIPP, or land disposal. Packaging for storage is required for the HLW from the HWVP melters, intact fuel, and GTC-III waste. Packaging of waste for WIPP would include functions for CH-TRU packaging in SWBs and drums and packaging of RH-TRU in canisters, including loading and closure of the RH canister. Packaging functions for LLW for disposal are also required.

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- Loadout

  - Loadout involves removal of the material from containment. It will involve the use of SWBs, drums, and canisters. The flow diagrams show loadout occurring after packaging because the use of bagless transfer systems is envisioned. These steps could be reversed if conventional bag out techniques are used.

- Transfer/Ship

  - Exit functions include shipping of RH canisters to WIPP, transfer of CH-TRU in SWBs or drums and CH-LLMW back to Phase V storage for shipment to WIPP or treatment in WRAP Module 2A, transfer of HLW to storage at the MPSC, and shipment of RH and CH-LLW to disposal.

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6.0 DEVELOPMENT OF ALTERNATIVE STRATEGIES

Section 3.0 describes the grouping of waste according to the head-end process drivers. Section 4.0 identifies the individual waste forms that would result from processing each of the waste groups. Section 5.0 shows the processing functions that would be required for each group to produce the waste forms identified in Section 4.0. Many of the requirements and functions identified in Sections 3.0, 4.0, and 5.0 would be duplicated if each group were slated for processing in individual systems. This section describes the steps that were taken to integrate process and facility requirements to minimize the overall scope of the WRAP 2B project. The development of the integration steps began by identifying the requirements and systems for processing the waste in Group A. Each succeeding group was then evaluated to determine the adequacy of previously described systems for processing that groups' waste. If it was determined that a new system was required, that new system was described and added to the facility requirements. In some cases, a determination was made to modify a previously described system rather than replace it and when this occurred the previous system identifier was changed to note the modification.

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The strategies developed in this section are not the final recommendation. The recommended strategy for WRAP 2B is presented in Section 8.0. This section provides the development of individual strategies for processing the waste in each group without consideration given to uncertainties and other site programmatic plans.

The following discussion presents the sequential steps of the integration process as described earlier by starting with the first group of waste. The referenced figures can be found in Appendix D.

6.1 FEED GROUP STRATEGIES

Group A--The concept for processing waste in Group A is designated System-1. System-1 is a highly shielded, small hot-cell concept. Most of the feed material exists as RH-TRU from research fuel, however, a projected waste is slag from the TTF. The fuel pieces were loaded into 22 concrete boxes in the trench. If the boxes are removed intact, the packaged waste weighs less than 40,000 lbs and the maximum dimension on any container is approximately six by six by seven ft. Processing requirements include sorting, splitting, reactives treatment, packaging, certification, and loadout. Figure D-1 shows the initial step to integrate process and facility requirements for WRAP 2B and depicts a block diagram of the Group A, System-1 concept.

Group B--The only waste in this group is ^{238}Pu packaged in 55-gal drums. Shielding is not a major issue for handling this material but special consideration for containment issues will be required in the design. A second processing system, System-2, was deemed necessary to handle this waste material. The concept for this system would be a minimal shielded glovebox type operation with manipulators and special devices installed to protect operational and maintenance personnel. Processing requirements include splitting, immobilization, packaging, and loadout. Figure D-2 shows the

second step of integrating waste processing in the WRAP 2B Facility. In this block diagram Groups A and B each require a separate processing system.

Group C--Group C material contains two waste forms, Z-9 soil and TTF ash from TTF. These two waste forms are identified as C1 and C2, respectively, in the WRAP 2B Waste Matrix diagram in Appendix A. It is likely that this group will include other soil and particulate type waste forms that will be identified in the future operations [including decontamination and decommissioning (D&D) operations of the Site facilities]. Both of these currently identified waste forms could be processed in System-2, however, when consideration is given to the projected 4,200 drums/yr of TTF ash that will be generated it is apparent that a dedicated system for processing the ash is justified. The concept for processing ash, System-3, would be a small glovebox type operation containing immobilization, packaging, and loadout equipment. The Z-9 soil will be processed in System-2. Figure D-3 block diagram shows that the introduction of Group C material into the integration process recognizes the capability to utilize a previous system for part of the waste and shows the need to create a new system to handle the remaining waste in this group.

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Group D--Most of the waste in this group is contained in large CH and RH boxes, whose maximum dimension on any side would be nine by thirteen by twenty ft. The maximum weight of any box is 140,000 lbs. This group will also contain waste in drums that for one reason or the other are unsuitable to be processed in the WRAP 1 Facility. The concept for processing this waste is a hot-cell type operation. The main functional difference between the waste in this group and group A will be the requirement to size reduce the waste before the processing step. Two alternates to System-1 were considered in evaluating how the waste in this group would be integrated into the WRAP 2B processing systems.

The first alternate, System-1A, would be a concept where a second hot-cell would be added to accommodate the large boxes. This large cell would permit size reduction activities to occur and the pieces would be transferred to the smaller hot-cell where processing activities would be shared with those associated with the small hot-cell.

The second and preferred alternate, System-1B, would be a concept where one hot-cell would accommodate both Group A and D waste containers. This large cell would have several small adjoining cells equipped to perform different processing functions. The large cell would accommodate unloading, disassembly, and size reduction functions and permit concurrent multiple waste processing steps to occur in the smaller adjoining cells. The retrieval of Group D waste is expected to generate large quantities of contaminated soil. At least one of the adjoining cells will be set up to process/immobilize the soil for local burial. Figure D-4 shows the two System-1 alternates when Group D is considered in the integration steps for WRAP 2B.

Group E--This group contains several different kinds of Pu nitrate shipping containers. They are all relatively small and require minimum shielding to handle and process. This waste group will be processed through System-2. Figure D-5 shows the inclusion of this waste group into the WRAP 2B processing systems.

Group F--This group contains classified material. It is packaged in small containers that require minimum shielding. The primary processing function for this material will be a declassification step. Depending on the requirement, declassification may precede or be a part of normal waste processing. Because of the nature of the material, special handling procedures will be invoked and personnel will be appropriately cleared. This waste group will be processed through System-2. Figure D-6 shows the inclusion of this waste group into the WRAP 2B processing systems.

Group G--All of the waste in this group is to be prepared as feed for processing through the TTF Facility. This specific processing activity is unique in that the material is not being prepared for final disposition. Because there are no other similar activities, the addition of another processing system, System-4, is justified. Criteria for this activity has not been developed to date, however, the processes may include size reduction, segregation and removal of prohibited material, segregation into like material groups, packaging, and assay of outgoing packages. Figure D-7 shows the inclusion of this waste group into the WRAP 2B processing systems and it is noted that Systems-3 and 4 are dedicated to the TTF product and feed streams respectively.

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Group H--This group is comprised of the HWVP melters. The inclusion of melters, as feed to be processed by WRAP 2B, has a major influence on facility design. The worse case scenario for melters is to have one fail with a full melt and not be able to drain it. This melter condition would have a major impact to the facility because of the large size, extreme weight, and massive shielding required to process one of these units. Empty melters may contain enough residual glass to present similar handling problems. Two alternatives were evaluated for processing this waste form.

The first alternative would be to increase the size of the System-1B hot cell (size driven by retrieved boxes) to be large enough to handle melters. The shielding requirements in the size reduction area would be increased to handle full melters with a dose of 10,000 R/h. HLW removed in the form of glass and refractory would still be sent to the MPSC. The addition of melters into the original System-1B would also require a shielded receiving area to accommodate receipt of packages that could have a dose rate up to 10 R/h.

The second alternative and preferred alternative would provide another hot cell, similar in shielding requirements to the HWVP, to handle the melter and provide the means to disassemble the unit. This alternate would be an addition to the previously discussed systems and have the designation System-5. Melt/refractory would be removed and stored with other HLW in the MPSC. TRU and LLW, likely to be RH, could be transferred to System-1B for final processing. This alternative would allow descoping of System-1B to remove the high gamma cell portion of that system. Other sources of HLW, the fuel and fuel pieces in the Group A feeds, could be shifted over to this high gamma cell used for melter disassembly. System-1B then becomes a separate hot cell with moderate shielding requirements, processing TRU and LLW, and is given the designation System-1C. Figure D-8 shows this concept for processing Group H waste.

Group I--The processing of the large failed equipment could be accommodated in this proposed hot cell system with moderate shielding

requirements, System-1C. The functional steps required are most similar to that required for the retrieved boxes. The size of the facility would be increased to accommodate an overpack the size of a HWVP melter storage box. Failed equipment from HWVP is expected to be received in packages up to the size of the melter storage box. With the increase in size of the hot cell system to accommodate the failed equipment group, the system designation becomes System-1D as shown in Figure D-9. Some additional capability for treatment for RH-mixed waste, using processes similar to that planned for WRAP 2A may be required to treatment the RH-LLMW for burial.

Figure D-10 depicts the development and consideration of alternative systems as each waste group is integrated into the WRAP 2B Facility.

Figure D-11 shows the fully integrated WRAP 2B systems for processing waste.

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6.2 SUMMARY OF ALTERNATIVE STRATEGIES

System-1D will handle the waste material from Groups D and I, the retrieved boxes, and large failed equipment. The System-1D is a relatively large hot cell concept where packaged waste material can be received, unloaded, sorted and size reduced, if necessary, and transferred to adjoining smaller cells for processing. System-1D will receive waste material via truck, railroad, and integrated storage facilities. The facility will process TRU and LLW/LLMW waste and have moderate shielding requirements. The smaller adjoining hot cells will provide capability for concurrent multifunctional processing of the waste forms. The design drivers for the smaller hot cells will be primarily process related.

System-2 will handle the waste material from Groups B, C1, E, and F. All of this waste is CH and the concept for this system is a glovebox type operation with manipulators installed to reduce personnel exposure and waste handling hazards. These waste forms will be received from integrated storage facilities in relatively small drums, overpacks, and boxes. Waste material will be sorted, size reduced if necessary, processed as required, certified, and repackaged for loadout.

Systems-3 and -4 are respectively dedicated to the disposal of ash and preparation of feed for the TTF. Criteria for the TTF will be developed in the future. The current concept for System-3 is that it would provide a process for immobilizing ash and System-4 would provide capability for packaging waste in incinerable containers to facilitate feeding material to the TTF.

System-5 will handle waste feeds from groups A and H, research fuel and fuel pieces, and HWVP melters. It will have massive shielding requirements and be driven entirely by the size, weight, and dose of failed melters. The processing of the small amount of research fuel in the Group A feed will not impose any additional design conditions. It will be the only system requiring remote handled receiving capability. HLW, separated from the waste feeds, will be sent to the MPSC for storage.

7.0 UNCERTAINTIES

7.1 WASTE ISOLATION PILOT PLANT WASTE ACCEPTANCE CRITERIA UNCERTAINTIES

A performance assessment for WIPP has been underway for several years with periodic refinements required in the analytical models used in predicting performance. A report, DOE/WIPP 91-007, Revision 0, July 1991, (DOE 1991) was issued and is the culmination of several years of concern over the ability of WIPP to demonstrate adequate containment of radionuclide and hazardous constituents of the buried waste. Literally hundreds of alternatives were reviewed and 14 were selected by the team as being representative of the variations considered. Table 7-1 is extracted from this report and identifies the 14 alternatives selected as changes to the baseline. There are seven variables identified in Table 7-1 in which different combinations make up the 14 alternatives to the WIPP baseline. The seven variables are; sludges, solid organics, solid inorganics, backfill, waste container, waste management, and facility design. These variables identify for each of the 14 alternatives what constitutes an acceptable waste form, how the waste form will be packaged, and how the WIPP Facility will be designed and operated. WRAP 2B will be required to produce a product that constitutes an acceptable waste form for sludges, solid organics, and solid inorganics, and to package the material in a waste container that is acceptable for storing waste at WIPP. The other variables (backfill, waste management, and facility design) have no direct impact on planned treatment of the waste at WRAP 2B, but could indirectly result in some modified WIPP-WAC as a result of design changes at WIPP. It is assumed that the only impacts to the proposed WRAP 2B Facility, caused by the 14 alternatives, are related to preparation and packaging of the waste for WIPP.

Because of concerns over the alternatives then under study, the Hanford Site has proposed to split the planned WRAP Module 2 into two separate facilities, WRAP 2A to address the known processing requirements related to treatment of LLMW exclusively, and WRAP 2B to address the remainder of the TRU wastes. This proposal was outlined in the Hanford Federal Facility Agreement and Consent Order Change Form M-19-91-1 and in essence stated that WRAP 2A work is proposed to follow the original WRAP Module 2 schedule and WRAP 2B work is to be delayed until resolution of WIPP uncertainties. The full resolution of WIPP uncertainties may take considerable time as further performance studies utilizing Rocky Flats Plant waste exclusively are just now commencing. The delay of WRAP 2B therefore cannot solely be based on the resolution of WIPP uncertainties as it is now apparent the resultant programmatic impacts would be unacceptable. TRU waste processing must occur in a time frame to permit shipping the material to WIPP within their proposed operational period. Accordingly, a delay beyond a 1997 Line Item Authorization for WRAP 2B with a plant startup in approximately 2004 would be programmatically unacceptable. The discussion that follows is based on the position that WRAP 2B should provide baseline processes that meet the current WIPP-WAC up to the point of preventing further processing by the 14 alternatives if chosen. This position provides a facility whose baseline scope is not affected by the 14 alternatives other than planning for a future addition if required by the future resolution of a WIPP uncertainty. The

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Table 7-1. The 14 WIPP Engineered Alternatives Relative to the Baseline Case.

Alternative #	Sludges	Solid organics	Solid inorganics	Backfill	Waste container	Waste management	Facility design
Baseline	As received	As received	As received	Salt	As received	As designed	As designed
Alternative 1	As received	Shred/Cement	Shred/Cement	Salt	As received	As designed	As designed
Alternative 2	Cement	Shred/Cement	Shred/Cement	Salt	As received	As designed	As designed
Alternative 3	Cement	Shred/Cement	Shred/Cement	Cement grout	As received	As designed	As designed
Alternative 4	Cement	Incin./Cement	Shred/Cement	Salt	As received	As designed	As designed
Alternative 5	Cement	Incin./Cement	Shred/Cement	Cement grout	As received	As designed	As designed
Alternative 6	Vitrify	Incin./Vitrify	Melt metals[a]	Salt	As received	As designed	As designed
Alternative 7	Vitrify	Incin./Vitrify	Melt metals[a]	Cement grout	As received	As designed	As designed
Alternative 8	Vitrify	Incin./Vitrify	Melt metals[b]	Salt	Non-ferrous	As designed	As designed
Alternative 9	Vitrify	Incin./Vitrify	Melt metals[b]	Cement grout	Non-ferrous	As designed	As designed
Alternative 10	As received	As received: Less Metals	Decontaminate Metals[c]	None	Non-ferrous/ Rectangular	Minimize space around waste	New dimensions: 10' x 31' x 188'
Alternative 11	As received	Supercompact	Supercompact	Salt	As received	Single layer: 2000 drums	New dimensions: 6' x 33' x 300'
Alternative 12	As received	Supercompact	Supercompact	Cement grout	As received	Single layer: 2000 drums	New dimensions: 6' x 33' x 300'
Alternative 13	Vitrify	Incin./Vitrify	Melt metals[b]	None	Non-ferrous/ Rectangular	Minimize space around waste	New dimensions: 10' x 31' x 188'
Alternative 14	As received	Supercompact	Supercompact	Salt aggregate grout	As received	Compartmentalize waste, 2000 drums per room	Salt dikes: Waste Separation

[a]Metals are melted into TRU waste Ingots.
[b]Metals are melted with glass/glass frit; radionuclides partition into the slag, and metals are eliminated from the WIPP Inventory.
[c]Metals are decontaminated by vibratory finishing and eliminated from the WIPP Inventory.

impacts then are defined as an added scope or capability commensurate to the selected alternate. This concept will minimize the risk of proceeding with the project because the baseline design effort will remain constant and additional processing systems can be added when WIPP criteria is finalized.

7.1.1 Baseline Processes

The reference noted above identifies significant restrictions on the waste form to enable it to be acceptable for shipping to and storage at WIPP. Waste certification will be an important and basic function of WRAP 2B. Inherent to the process of waste certification will be the need to sort waste into the various constituents, which includes three of the variables; sludges, solid organics, and solid inorganics noted in the 14 alternatives.

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7.1.2 Sludges

The baseline processes for treating sludges (liquids) will probably include drying and/or absorption as both of these are compatible with a possible future requirement to cement or vitrify this waste.

Alternatives 1, 10, 11, 12, and 14 would receive sludges treated by the baseline process and therefore if selected would not impact the baseline WRAP 2B.

Alternatives 2, 3, 4, and 5 require that sludges be cemented. This requirement would not have a major impact on WRAP 2B because this process is relatively simple, requires little space to accomplish, material costs are low, and cementing is compatible to the baseline process. The baseline WRAP 2B should probably allocate sufficient space to install this system in the event this process is selected.

Alternatives 6, 7, 8, 9, and 13 require that sludges be vitrified. The addition of this requirement would have a major impact on WRAP 2B because of the complexity of the process because equipment, enclosures, space allocation, offgas systems, operations, maintenance, and other aspects of the facility would be adversely affected. However, the baseline WRAP 2B process would be compatible with a vitrification process and could be considered a pretreatment step. A new facility would be justified to house a vitrification process if it were chosen as a WIPP requirement rather than providing for its possible selection in the baseline WRAP 2B.

7.1.3 Solid Organics

The proposed baseline process for handling solid organics, until the 14 engineered alternatives were announced, was a shred/cement system. This system would meet the particulate criteria for solid organics and was proposed to include processing solid inorganics at the same time. Because cementing is incompatible with some of the 14 alternatives, the cementing portion of the baseline process will be eliminated and the baseline process for solid organics will be shredding only.

Alternatives 1, 2, and 3 require a shred/cement system. This requirement would impact the baseline case and would require the addition of a cementing process. However, this requirement would not have a major impact on WRAP 2B for the same reasons stated above for cementing sludges. Likewise, the baseline WRAP 2B should provide the space for adding a cementing process in the future in the event one of these alternatives is selected.

Alternatives 4 and 5 require an incineration/cement system. The requirement to incinerate solid organics would have a major impact on WRAP 2B for the same reasons cited for sludge vitrification above. Shredding the solid organics would probably be a pretreatment requirement for incineration and therefore would be a compatible process but a new facility to house the incineration process would be justified rather than try to provide the space as part of the baseline WRAP 2B.

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Alternatives 6, 7, 8, 9, and 13 require an incineration/vitrification system, which as noted previously will have a major impact for both systems on WRAP 2B. Again, shredding the material as stated in the baseline case would be an acceptable pretreatment step for these alternatives but the selection of any one of these would require new facilities to house the processes.

Alternative 10 requires that metals be removed from the solid organics. This requirement would not impact the baseline concept because sorting the material for certification purposes will be required. Sorting may occur before the shredding process but if the waste is shredded simultaneously, a separation step will occur afterward and in either case metal will be separated from the solid organics.

Alternatives 11, 12, and 14 require the waste to be supercompacted. A supercompaction process would have moderate impact on the overall WRAP 2B project. The equipment and space required for supercompaction would be on the same order as a cementing process. The baseline shredding process could be considered as a pretreatment step and is compatible with a supercompaction process. Space should be provided in the baseline WRAP 2B Facility to accommodate supercompaction.

7.1.4 Solid Inorganics

The proposed baseline process for handling solid inorganics, until the 14 engineering alternatives were announced, was to shred/cement both solid organics and solid inorganics together. However, because cementing is incompatible with some of the 14 alternative processes it will be eliminated from the baseline WRAP 2B process. The baseline process for solid inorganics will be shredding if sorting does not occur as the first step. If sorting does occur as the first step, solid inorganics will accumulate as-found or undergo size reduction as required to fit into the waste containers.

Alternatives 1, 2, 3, 4, and 5 require a shred/cement process and therefore, impact the baseline for processing this waste because cementing would have to be added. This addition would not have a major impact for the same reasons stated for cementing sludges and space should be provided in the baseline WRAP 2B Facility to accommodate this process.

Alternatives 6 and 7 require that metals be melted into TRU waste ingots. This requirement would have a major impact on WRAP 2B Facilities in a similar way that incineration or vitrification would have on processing solid organic material. Shredding/separation or sorting the metal would be compatible to the melting process, however the selection of either of these alternates would require additional facilities to house the process.

Alternatives 8, 9, and 13 require a different melting process, which would eliminate shipping metal to WIPP but the impact to WRAP 2B Facilities would be on the same order of magnitude as the first melter process described above. Likewise, new facilities would be required to house the process.

Alternative 10 requires that metal be decontaminated and thus eliminated from WIPP. This process would have a major impact to the WRAP 2B because of the complexity of the process and the associated equipment required to decontaminate metal. Shredding/separation of the metal could be considered as a pretreatment step to decontamination but a sorting step would require further size reduction to accommodate the decontamination process. In either case, selection of this alternate would require new facilities to house the decontamination process.

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Alternatives 11, 12, and 14 require the metal to be supercompacted. This mechanical process would have a moderate impact on WRAP 2B for space allocation and for the equipment and maintenance considerations. Shredding/separation or sorting the metal would be a pretreatment step to supercompaction and would be compatible to these alternates. Consideration should be given to providing the space in the baseline WRAP 2B Facilities to accommodate the supercompaction alternates in the event one of them is selected in the future.

7.1.5 Waste Container

The baseline for waste containers is such that CH waste will be shipped in either 55-gal steel drums or SWBs and RH waste will be shipped in canisters. It is assumed that only 55-gal drums are affected by the container types noted in this variable.

Alternatives 1 through 7, 11, 12, and 14 will accept the baseline containers and therefore will not impact WRAP 2B.

Alternatives 8 and 9 require non-ferrous containers and Alternatives 10 and 13 require non-ferrous/rectangular containers. The requirement to use any of these containers would not have a major impact to the baseline WRAP 2B. An early decision for their use would permit appropriate equipment selection during the equipment design phase and a late decision might require the addition of a repackaging system and/or modification of an existing baseline steel drum handling system.

7.2 OTHER UNCERTAINTIES

There are other uncertainties that have been identified that could affect the WRAP 2B design and/or the way it will be operated.

7.2.1 TRU Mixed Waste

Current land disposal restriction (LDR) treatment criteria does not apply to TRU-mixed waste. Depending on the outcome of the no migration petition at WIPP, this could change. The baseline WRAP 2B will have a sorting step that will permit all mixed waste to be separated from other waste forms. TRU-mixed waste will be repackaged and stored until such time that final disposition for this waste form is selected. Minimal processing may be required to reduce storage hazards.

7.2.2 RH TRU Waste

This waste form is not receiving a high priority at WIPP at this time because they are concentrating on CH waste. While this may be prudent from the standpoint of WIPP, the costs associated with facilities and equipment to process this material could be adversely affected by changes to current RH processing requirements.

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7.2.3 Operations

There is uncertainty of operations at the Hanford Site and at the other sites around the nation that send waste to the Hanford Site for final treatment and disposal. At the Hanford Site, the mission is changing from production of nuclear materials and research on new reactor systems to cleanup of the existing Site. Planning of the cleanup operations are underway, but the extent of the volumes and characteristics of the waste are not well characterized. There is considerable uncertainty related to these wastes.

7.2.4 Mission

Mission changes can impact both volume and types of waste to be processed. An example is the recent inclusion of DST equipment to be processed by WRAP 2B, a decision that caused a major volume increase of waste to be handled by WRAP 2B. Some PUREX equipment is in the current forecast, however, there is a huge uncertainty as to the extent of the TRU contamination and the extent of the TRU waste volumes associated with this waste form.

7.2.5 Fuel Stored as Solid Waste

Fuel stored as solid waste is irradiated fuel from experimental and research reactors. Some are intact pins and others are fuel pieces. Based upon DOE Order 5820.2A, these are considered by RL to be TRU wastes. Other Site irradiated fuels are from production reactors and are currently planned for encapsulation and storage at the MPSC with eventual disposal in the high level repository.

7.3 WRAP 2B Baseline Summary (Items affected by the 14 alternatives)

- Sludges
  - Provide drying and/or absorption capability
  - Provide space for possible cementitious process
  - Plan for additional facilities if vitrification is required

- Solid Organics
  - Provide sort/shred or shred/separate capability
  - Provide space for possible cementitious process
  - Plan for additional facilities if incineration is required
  - Plan for additional facilities if vitrification is required
  - Provide space for possible supercompaction process

- Solid Inorganics
  - Provide sort/size reduction or shred/separate capability
  - Provide space for possible cementitious process
  - Plan for additional facilities if melting metal into ingots is required or melting metal and separating slag is required
  - Plan for additional facilities if metal decontamination is required
  - Provide space for possible supercompaction process

- Waste Containers
  - Provide equipment to handle 55-gal steel drums
  - Plan for equipment to handle non-ferrous drums if required.

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8.0 PREFERRED ALTERNATIVE

8.1 DEVELOPMENT OF PREFERRED STRATEGY

Section 6.0 described a strategy to minimize facilities and processing while accommodating all the identified feeds with baseline treatments to meet current WIPP-WAC. Uncertainties relating to WIPP-WAC were discussed in Section 7.0. In this section, evaluation of the feed groups and the related proposed process systems will be done with consideration given to treatment uncertainties. The preferred alternative will be a strategy on how to proceed with the WRAP 2B project, what the facility limitations will be with respect to projected feeds and, for those feeds not included, what options are available for treatment in alternate facilities.

Table 8-1 presents an evaluation of the feed groups with a discussion of some of the uncertainties and drivers associated with processing. Table 8-2 presents a similar evaluation of the proposed process systems developed in Section 6.0.

While the proposed WRAP 2B plant can be sized and outfitted to perform most of the treatment and packaging options, there are several options that have such a dramatic impact on the plant design and costs that they should not be included in the preferred alternative at this time.

Ingot production--The facilities necessary to sort ferrous and aluminum metals from the waste form are relatively easy to provide, but the facilities necessary to melt these contaminated metals into ingots is a major addition. Because ingot production is not a likely requirement for WIPP, it should not receive any further consideration as a baseline capability.

Vitrification--The facilities necessary to vitrify the waste is a major addition. Because vitrification is not a likely requirement for WIPP, it should not receive any further consideration as a baseline capability.

Thermal treatment of hazardous TRU wastes--To date, the data on the extent of the fraction of TRU wastes that contain hazardous material is very poorly defined. One screening showed about 12% of the volume included hazardous materials. The final data on the TRU waste in trench storage shows 16%. The forecasted fraction for 1992 through 2021 shows 43% of the TRU waste will contains hazardous contaminants. The volume of material is not well defined, nor is the thermal treatment of TRU waste developed to the point of being a state-of-the-art process. Additionally, it is possible that the "No Migration Petition" will be approved by EPA. Accordingly, thermal treatment capability should not be included in the baseline capability. Process support for TTF activities should be descoped from Module 2B and be provided as part of the future thermal treatment module.

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Table 8-1. Feed Grouping Evaluation.

Feed group	Feed description	Gms Pu in known waste	Vol of known waste (ft^3)	Vol of projected waste (ft^3)	Risk or uncertainty	Drivers for processing Common driver for all processing is reduction of waste inventory at the Hanford Site.
Group A	Fuel and fuel pieces, caisson waste	26,190	14,720	16,100	Final disposition of research fuel subject to HQ determination, other Site fuels are considered HLW with different disposal strategies.	Continued storage has little risk, caisson integrity good, storage cask integrity good, exceptions may be material in concrete boxes and drums. Small volume of material, with highest facility cost for processing. Could be dispositioned with other irradiated fuels.
Group B	^{238}Pu in drums	6,360	90	0	Immobilization to meet current WIPP-WAC would preclude future treatment to alternative waste form.	Needs little or no characterization. Very small volume, minimal impact on storage.
Group C	Z-9 soils and ash from TTF	58,000	4,832	26,900	Z-9 soils known waste and has low uncertainty. TTF ash is projected and has higher uncertainty. Immobilization may preclude further treatment. Volume of soils requiring treatment likely to increase.	Large amount of Pu in a small volume with Z-9 soils. Drum integrity degrading. Z-9 soils volume have minor impact on storage. Little or no characterization required. Would require immobilization treatment to meet current WIPP-WAC.
Group D	RH and CH boxes	26,471	268,373	14,800	Contents require significant characterization. Likely to be wide variety of treatment and packaging required as box contents vary greatly.	Box integrity highly questionable. Major volume of waste generated from retrieval. Oversize, requires significant amount of size reduction and characterization regardless of final waste form and treatment. Low-level waste fraction could be permanently disposed.
Group E	Nitrate shipping containers	17,043	2,478	0	Well characterized, may contain some residual liquids	Significant amount of Pu for the volume. Will require some size reduction.
Group F	Classified waste	338	9,176	0	The exact nature of the classified items is unknown, which prevents selection of a declassification method.	Classified articles prohibited from WIPP. Not a processing design issue, impacts administrative requirements. Storage of classified items will require design features to create an approved repository and impose additional administrative requirements.
Group G	Feed for TTF from WRAP 1	N/A	N/A	18,500	Treatment of LLMW may be privatized. Amount requiring thermal treatment and pretreatment requirements not well identified.	Some LLMW will require thermal treatment before disposal. Whether or not pretreatment should be accomplished in WRAP 2B, WRAP 2A, or at the TTF site is open to further review.
Group H	HWVP melters	N/A	N/A	76,500	HWVP will operate past life of WIPP. Melter design may be changed. Uncertainty in transportation issues, dose of failed melter, ability to drain failed melter, processing of HLW in WRAP 2B.	A disposal method is needed to support a major Hanford Site cleanup effort. Residual HLW and contaminated refractory must be removed, cannot go to WIPP. Oversize, requires size reduction and characterization regardless of final waste disposition. Low-level fraction could be separated and permanently disposed. Some fraction of melter will be TRU and will be sent to TRU repository.
Group I	Large process equipment	N/A	N/A	288,000	Amount may increase. Timing of some of the waste is uncertain. Size and mass of equipment uncertain, could require size reduction before receipt.	Contains RH-LLMW, which requires treatment before disposal and is not affected by WIPP uncertainties. Treatment of this waste is needed to support Hanford Site cleanup effort. Oversize, requires size reduction and characterization regardless of final waste disposition. Low-level fraction could be separated and permanently disposed, TRU fraction will go to WIPP.

Table 8-2. Proposed Process System Evaluation.

Process system	Description	Feed groups	Grams Pu in known feeds	Volume of known waste (ft^3)	Volume of projected waste (ft^3)	Uncertainty or risks	Drivers for this process system
System 1D	Large hot cell, with moderate shielding requirements	Groups D and I, Group A material that is not fuel.	26,637	263,393	318,900	Some of group I material not in forecast. Some waste packages may exceed size of melter storage box. Uncertainty in throughput requirements, max size, weight, dose imposed by failed process equipment.	Supports retrieval and future cleanup programs (HWVP plans to ship waste in packages as large as a melter storage box). Size reduction and characterization required as preliminary treatment for any waste forms. Site lacks large size hot cell for RH-TRU, RH-LLW/RH-LLMW processing.
System 2	Special purpose Pu process glovebox	Groups B, C1, E, and F	80,741	16,576	Note 1	Another Pu process facility may not be justifiable. Final treatment process cannot be specified at this time because of WIPP-WAC uncertainties.	Large amount of Pu can be processed and sent to WIPP by addressing these streams. Small volume impact on storage requirements after retrieval. Feeds can be processed in System 1D, existing facilities (includes WRAP 1), or deferred.
System 3	TTF post treatment	Group C2	N/A	N/A	26,900	Tied to TTF and TTF uncertainty. Role of WRAP 2B with a privatized LLMW TTF is uncertain.	Ash immobilization required for TTF ash. Amount of ash that is not suitable for WRAP 2A (either RH or TRU) is estimated at 7.5% of total.
System 4	TTF pre treatment	Group G	N/A	Note 2	Note 2	Tied to TTF and TTF uncertainty. Role of WRAP 2B, versus alternatives of WRAP 2A and use of the TTF itself, is uncertain.	Pretreatment must occur, in some facility, before thermal treatment. Thermal treatment is required for some waste before disposal. Current Hanford planning has pretreatment in WRAP 2B because WRAP 2A scope has been set.
System 5	HLW processing in large high gamma cell	Group H and Group A material that is fuel	26,024	9,700	76,500	Processing of fuel is not consistent with other irradiated fuel disposition. HLW processing is planned for other Hanford Site facilities.	Melter disposal method required for HWVP operation. Most of melter is LLW and could be disposed of if separated from TRU and HLW. Current storage configurations for fuel are of better integrity than other solid waste.

Note 1 = Additional Volume of TRU soils may result from retrieval of failed packages but no amount has been forecast yet.
Note 2 = Current planning assumes 2,500 drums of CH-LLMW requiring thermal treatment will be generated from WRAP 1 LLW sorting.

Evaluation of the proposed process System-1D indicates there is sufficient need for the large hot cell with moderate shielding. The need to size reduce and characterize the large CH and RH boxes (Group D feeds) exists regardless of final waste form acceptance criteria. The large amount and deteriorating condition of this feed group is not conducive to continued storage. The lack of a facility to process large packages of projected waste from future Hanford Site cleanup programs (Group I) will seriously interfere with key cleanup activities. Processing of these feed groups is likely to result in a large volume of LLW that can be disposed of. Processing of the TRU fraction for disposal to WIPP should be consistent with the approach for WRAP Module 1. No processing or treatment of TRU waste will be done that would preclude reprocessing to one of the alternative waste forms. Treatment of RH-LLMW is needed and is not affected by WIPP uncertainties.

Evaluation of the proposed process System-2, a special purpose Pu processing facility, indicates that another CH Pu process facility may not be justifiable. Most of the material requires specialized treatment, which is difficult to recommend given the uncertainty in the WIPP-WAC. With the exception of the classified waste, characterization requirements are minimal. The large amount of Pu in the feed groups proposed for this system support the decision to retrieve it, but the impact on storage after retrieval is low. The feeds selected for this systems can be absorbed into the large hot cell concept or shifted to other facilities for processing.

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Evaluation of the proposed process System-5, a high gamma facility for melter disassembly and fuel processing, suggests that these items should be shifted to the MPSC for processing. To serve the programmatic needs of Tank Waste Remediation, the MPSC is planning a high gamma hot cell for encapsulation and storage of Site irradiated fuels. They are also tasked with storage of HLW canisters from vitrification of the single-shell tank (SST) waste. Rather than provide two hot cell facilities for high dose rate waste processing, one to serve the needs of solid waste and the other for SST waste, it is preferable to combine these into one facility. Order of magnitude cost comparisons indicate there is not significant difference in the cost to modify WRAP 2B to handle melters compared to the cost of providing that capability at the MPSC hot cell. The close location of the MPSC to the HWVP will also greatly simplify the transportation issue associated with a full melter. The Group A material identified as irradiated material stored as solid waste can easily be accommodated by the MPSC.

In summary, the preferred strategy for Module 2B is to provide a large hot cell with moderate shielding requirements that will process the majority of the feed. Feeds not identified for processing in the proposed facility will be shifted to other facilities. Table 8-3 listed totals associated with the proposed process system for WRAP Module 2B and identifies the feeds, which are shifted to other facilities. Re-evaluation of the makeup of each feed group was done and feed items in a group that could be processed in the new WRAP 2B Facility concept were extracted. Nitrate shipping containers (Group E) and some of the Group A feeds that were originally identified for processing in the small highly shielded hot cell could be processed in the proposed facility.

Table 8-3. Feeds Processed in the Proposed WRAP 2B Facility.

Feed group	Description	Pu (gms)	Volume of known waste (ft^3)	Volume of projected waste (ft^3)
Group D	RH and CH boxes	26,471	258,373	14,800
Group E	Nitrate shipping containers	17,043	2,478	
Group I	Large process equipment			288,000
Group A, Item 1	Casks without fuel	157	2,627	
Group A, Item 5	Overweight/shielded drums			7,400
Group A, Item 7	RH cask	3	1,393	
Group A, Item 8	RH drums from retrieval	6	1,000	
Group A, Item 11	RH offsite waste			8,700
Group F	Classified waste	338	9,176	
Group C, Item 1	Z-9 soil drums	58,000	4,832	
Group C, Item 2	TTF ash, RH-LLMW or TRU			26,900
	Feed group totals	102,018	279,879	345,800
	Percentage of complete total	77%	97%	78%

Feeds Processed by Other Facilities and not included in the proposed process system

Feed group	Description	Pu (gms)	Volume of known waste (ft^3)	Volume of projected waste (ft^3)	Future options
Group B	Pu^{238} drums	5,300	90		Store with other Pu residuals at MPSC. Alternately could be processed by Solid Waste.
Group H	HWVP melters			76,500	Processed at MPSC, with TRU and LLW stream coming to WRAP
Group A, Item 2	Fuel- EBR II cask	14,010	368		Research fuel and fuel pieces stored as solid waste will be processed at MPSC with other Site irradiated fuels. MPSC needs for packaging and interface requirements can be worked at retrieval, bypassing WRAP 2B.
Group A, Item 3	Fuel- concrete boxes	4,704	3,868		
Group A, Item 4	Fuel- drums	13	96		
Group A, Item 6	Fuel- GE cask	1,097	188		
Group A, Item 9	Alpha caissons	6,200	5,180		
Group G	Feed prep for TTF			18,500	TTF feed prep can be done at source in WRAP 2A or in TTF.
	Feed group totals	31,324	9,790	95,000	
	Percentage of complete total	23%	3%	22%	

NOTE: The waste volumes given in table are based on historical records and the 1992 Solid Waste Forecast. As the mission at the Hanford Site and the offsite generators change, the forecast volume will change. It is likely that they will increase with time.

Pu-contaminated soils are also identified for inclusion in the proposed facility concept. The Pu contained in this group accounts for almost half of all the plutonium in the known feeds. Current WIPP-WAC requires this material be immobilized because of its particulate nature. The process likely to be selected would be a grout process, on the basis of cost and complexity, although an alternate waste form could require vitrification of this material. The decision to select a process for treatment of the soils can be made in future. During design of the facility, if uncertainties in the WIPP-WAC have not reduced to the point to recommend an immobilization process, an alternate process such as encapsulation in a welded container can be pursued. There may be acceptable risk to plan on providing some immobilization treatment capability as part of the 2B project. The WRAP 2B Facility will have to be equipped to handle soils that are present in the retrieved boxes, because of box failure and incidental soils that accumulate from retrieval. This soil, if contaminated to the point of becoming TRU waste will also have to be immobilized before disposal. Additional capability to handle TRU soils should be a minor impact. If vitrification of the soils is determined to be the desired treatment, the TRU soils treatment can be descoped from the 2B project with negligible impact. If treatment of this material cannot be done subsequent to retrieval, the additional impact on planning for storage after retrieval may be minor because of the relatively small volume (less than 700 drums) but a desirable alternative considering the amount of plutonium in these drums.

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The small volume of ash from TTF not suitable for WRAP 2A is also included in the proposed facility concept. Estimates assume limited amount of ash could become RH-LLMW and TRU waste after thermal treatment. If a TTF becomes a certainty, this stream can be accommodated by WRAP 2B without additional process capability. The RH-LLMW fraction can be treated for disposal with other RH-LLMW waste where treatment capability is not affected by WIPP uncertainties. The TRU fraction can be handled with the Pu-contaminated soils.

Classified waste is also identified for inclusion in the proposed facility. It will not impose significant constraints on the design of the facility but will impose administrative requirements during processing. Operators involved in processing will require security clearances. A classification officer will have to be present during sorting to determine what items are classified and specify an appropriate declassification process. Until the waste is characterized to determine what is the nature of the classified items, declassification processes cannot be selected. Some baseline declassification processes to handle likely contents could be provided. Initially the waste can be sorted to remove the classified items and process them for declassification. The resultant waste can be processed for disposal and any classified items not treatable by baseline declassification processes would be repackaged and stored until declassification methods can be determined. Processing can be done in the WRAP 2B Facility or an existing facility, such as Plutonium Finishing Plant (PFP), with an upgrade of administrative security for this activity. Sorting out classified items could also possibly be done in WRAP 1. The storage of this material will require additional physical security measures in the creation of an approved repository but they are not expected to be extensive.

8.2 DISPOSITION OF FEEDS SHIFTED TO OTHER FACILITIES

Table 8-3 gives brief descriptions of the options for the feeds not planned for processing in the proposed WRAP 2B Facility.

The 12 drums containing high levels of ^{238}Pu (Group B feed) can also be sent to the MPSC for storage, with other similar Pu materials. Alternately, options can be explored for disposal such as overpacking intact drums in a SWB for shipment to WIPP. The small quantity of material should not pose much of a problem if alternate disposal methods are selected.

HWVP melter processing will be shifted to the MPSC, where a programmatic mission for HLW processing is planned. TRU and LLW waste resulting from the melter disassembly will be sent to WRAP 2B for processing. This is expected to be the major fraction of the melter waste volume identified in Table 8-3.

Research fuel stored as RH-TRU in concrete boxes, drums, casks, and caissons are planned to be sent to the MPSC hot cell for processing. This is consistent with the disposition of other Site irradiated fuels. MPSC needs for repackaging and interface requirements should be worked directly with retrieval. It is also possible that some waste material from the caissons could be sent to WRAP 2B if the dose determined at retrieval does not exceed the WRAP 2B capability. The MPSC will have the capability to certify the high dose RH-TRU waste (greater than 100 R/h) for shipment to WIPP.

The remaining group of feed deferred was Group G material, identified as LLMW from WRAP 1 requiring thermal treatment. This material could probably be sent directly to a privatized TTF with feed prep being either done at the source in WRAP 2A, WRAP 2B, or at the TTF itself. It is concluded that feed preparation for the TTF processing facility and treatment of ash/residue from the TTF processes should not be included in WRAP 2B. The extent of the treatment necessary, the potential for a commercial thermal treatment operation to perform any pretreatment, the potential for an onsite TTF option to perform the necessary pretreatment raise serious questions as to the need to scope WRAP 2B to perform this function. On the ash/residue treatment scope, WRAP 2A, is currently scoped to treat some of the ash/residue and this could be expanded to include all the LLMW returning from the TTF. The ash/residue is expected to be a LLMW because the metallic hazardous material will not be removed by the thermal treatment process. The ash/residue that assays as TRU or is RH waste will be treated in WRAP 2B. This is forecast to be about 7.5% of the total TTF ash volume.

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9.0 RECOMMENDATIONS

9.1 PREFERRED STRATEGY

The purpose of this effort is to provide a basis for continuing work on the WRAP Module 2B in spite of uncertainties in the final waste form criteria. The strategy recommended is to:

1. Provide a WRAP 2B module that will be a large remotely operated hot cell facility with moderate shielding requirements. It will process a large portion of the retrievably stored TRU waste that is not processed by the other WRAP modules and also process a significant amount of projected waste in difficult forms that will be generated by future Hanford Site programs. Treatment capability will also be provided for RH LLW/LLMW to allow for onsite disposal. The large hot cell capability will be required regardless of possible changes in WIPP waste form criteria and the treatment suggested will not include anything that will preclude future reprocessing to an alternate waste form. Treatment of RH-LLMW waste is not affected by WIPP-WAC uncertainties.

2. Identified feeds (HWVP melters and fuel and fuel pieces stored as solid waste) that are not planned for processing in WRAP 2B will be shifted to the MPSC where facilities tasked with HLW processing are planned.

3. Planning for thermal treatment processing, including feed preparation and treatment of most TTF residues, should not be provided in Module 2B. TTF planning should provide for complete handling of the waste in either a privatized TTF or, if determined a future requirement, a government thermal treatment module for TRU and RH wastes.

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9.2 PROPOSED WRAP 2B FACILITY REQUIREMENTS

The engineering study to follow will define in detail the facility and process requirements for the proposed WRAP 2B Facility in order to develop a cost estimate. However, preliminary requirements can be developed from constraints imposed by the selected feeds and extent of processing proposed. Some preliminary facility requirements are given in Table 9-1.

In the follow on engineering study, an optimum facility layout will be determined that minimizes the material movement within the facility and supports the addition of future treatment modules if required. The current concept consists of a large process hot cell used for disassembly and size reduction of the large items. Adjacent to the large cell are several small cells to provide for sorting, treatment, and packaging of the waste into containers. The size of the main cell and the number of processing cells will be determined in the engineering study to provide adequate processing capability to meet throughput requirements.

Table 9-1. Proposed Facility Requirements.

Facility requirement	Defining condition	Discussion
Shielding in hot cell to 100 R/h	Exceeds dose from known feeds and expected dose from some failed equipment	Other identified feeds also have high dose rate: RH drums 30 R/h, DST equipment w/dose est. to 100 R/h.
Mass Limits to 200,000 lbs	Exceeds heaviest box from retrieval 140,000 lbs with overpack	May have to increase depending on weight of HVWP failed equipment and overpack used.
Hot cell airlock sizing	Melter overpack 27'L x 15'W x 20'H, HWVP failed equipment may come in a melter overpack.	Retrieved boxes - largest overpack size 22'L x 13'W x 14.5'H. Long assemblies from DSTs (60') may require specialized entry ports or preliminary size reduction, unless airlock size can accommodate.
Interface requirements (incoming)	With W112 via transfer corridor, rail and truck receipt	Facility will receive some boxes and failed equipment via rail, Items from retrieval will come via W112 and direct. Newly generated waste will come in batches from W112.
Interface requirements (outgoing)	With W112 and WIPP.	CH TRU will return to W112 for shipment to WIPP, RH TRU will be shipped direct to WIPP via shielded cask truck, LLW will go to W112 and then to onsite disposal or possible processing in WRAP 2A if LLMW.

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9.3 PROPOSED WRAP 2B PROCESS REQUIREMENTS

The processing functions described during this study were of a functional nature as described in Section 5.0. The follow on engineering study will develop the specific processing functions in greater detail by evaluating and selecting specific process technologies. Processing and treatment of TRU waste will include that required regardless of the final waste form and not result in a product that could not be reprocessed to an alternate waste form. Specific processing requirements are briefly discussed in Table 9-2.

9.4 DIFFERENCES BETWEEN PROPOSED WRAP 2B AND WRAP MODULE 2

A summary of changes between the proposed facility concept for WRAP 2B and what was originally proposed in the WRAP Module 2 Engineering Study (Pauly 1990) is given in Table 9-3.

9.5 FEEDS SHIFTED TO OTHER FACILITIES

Feed not planned for inclusion in the proposed facility concept are identified in Table 8-3. The shifted feeds can be generalized as HWVP melters, research fuel and fuel pieces, plutonium oxide high in ^{238}Pu, and LLMW feed for the TTF.

Table 9-2. Proposed Facility Process Requirements.

Process requirement	Discussion
Size reduction	Most of the feeds are very large and require significant size reduction to allow packaging in a compliant container, i.e., SWBs, RH TRU casks, or 55-gal drums.
Sorting	Sorting and segregation of waste will be performed to remove untreatable articles. Segregation will also allow staging of like material into specialized processed systems.
Low-level waste treatment	Low-level waste and low level mixed waste treatment is not affected by WIPP-WAC uncertainties. Treatment of RH-LLW/LLMW will be performed. LLW resulting from size reduction and repackaging operations will be packaged for local disposal. CH-LLMW will be routed to WRAP 2A for mixed waste treatment.
Treatment of TRU waste	If WIPP prohibited articles cannot be treated to a waste form that is amenable to reprocessing to an alternate waste form, the item will be stored for future disposition.
Opening of packages	Package contents will be separated from the packaging. The package (box, cask, drums, etc.) should be mostly LLW, where the contents will contain most of the TRU waste.
Characterization	Characterization of the waste done to aid in disposal can also aid in selection of future treatment processes.
Soils treatment	Selection of a soils treatment process will be done in the future. Immobilization is likely candidate, but is irreversible with respect to alternate waste form.
Packaging	This will include packaging of both RH and CH TRU waste and LLW for disposal and LLMW for routing to WRAP 2A.
Assay	NDA and NDE of waste, including RH waste, will be done to certify the material as TRU or LLW.

Table 9-3. Summary of Significant Differences Between Proposed WRAP 2B Facility and WRAP Module 2 Facility.

Change in proposed WRAP 2B Facility compared to WRAP Module 2	Discussion
No CH-LLMW treatment in WRAP 2B	CH-LLMW treatment will be provided by WRAP 2A, not affected by WIPP-WAC uncertainties.
Grouting not included as baseline TRU treatment process	Grouting not considered a reversible treatment process. Would preclude future treatment to an alternative waste form.
Plasma Arc not included as RH-TRU treatment	Plasma Arc not considered a reversible treatment process. Would preclude future treatment to an alternative waste form. The thermal treatment of RH wastes planned for TTF.
No 2,000 R/h hot cell will be provided	This was needed to process irradiated material (caisson waste, pins, and pins pieces). This feed has been shifted to another facility planned at the Hanford Site with a high gamma cell and tasked with processing HLW.
Facility requirements with respect to cranes, airlock, and size reduction cell will increase	Some identified feeds have weights that exceed 50 T (capacity of crane provided in WRAP Module 2). Airlock and size reduction cell WRAP Module 2 too small to except largest identified feeds. Assumed overpack to end loading, not top and bottom loading.
Decon capability needed for retrieved box and HWVP overpacks.	Decon capability was not provided for these streams in WRAP Module 2. Reuse of the overpack will require their decontamination.
RH-TRU volumes are higher	The project amount of newly generated RH-TRU has increased significantly.

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It is recommended that waste feeds containing HLW, HWVP melters, and research fuel and pieces, be shifted to the MPSC for processing. HLW will be removed and stored there and most of the TRU and LLW waste resulting from melter disassembly will be returned to WRAP 2B for processing. The MPSC will certify as RH-TRU the small amount of high dose RH-TRU expected to exceed WRAP 2B capability.

It is recommended to transfer the 12 drums containing high levels of ^{238}Pu (Group B feed) to the MPSC, which will be used to store significant amounts of Pu oxide residuals from cleanout of Site facilities. Alternately, alternate packaging and disposal methods could be explored for this, small amount of, material.

The remaining group of feed deferred was Group G material, identified as LLMW from WRAP 1 requiring thermal treatment. It is recommended to descope the majority of the TTF related work from WRAP 2B, given the likelihood of a privatized TTF for LLW and the uncertainty associated with a TRU waste TTF.

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APPENDIX A

WASTE MATRIX

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WRAP 2B WASTE MATRIX

(Grouped by Head-End Process Drivers)

ITEM NUMBER	WASTE STREAM	CHARACTERISTIC	DESCRIPTION		TIMING	PACKAGE	COMMENTS
GROUP A: SMALL, HIGH DOSE			Description: Highly Sheilded (2000 R/hr), Small				
1	CH-Retreived		Casks/Compressors	C,234	-	CH	
2	CH-Retreived	Reactor Fuel	Casks - EBRII		-	CH	Research Reactor Fuel Waste
3	CH-Retreived	Reactor Fuel	Concrete Boxes		-	CH	Research Reactor Fuel Waste
4	CH-Retreived	Reactor Fuel	Drums		-	CH	Research Reactor Fuel Waste
*5	CH-Retreived	Overweight/Shielded	Drums		1999-2016	CH	
6	RH-Retreived	GE	Casks		2003-2012	RH	Fuel Pieces
7	RH-Retreived	Other	Casks		2003-2012	RH	3A & 4C Trenches
8	RH-Retreived		Drums	&S	2007-2015	RH	10 Drums are Over 10 R/hr
9	Alpha Caisson		Stored in Cans Retreived in 55-		2005-2010	RH	Destructively Examined Irradiated Fuel
*10	TTF	Slag	Drums		-	RH	Slag Waste Stream from TTF
*11	Offsite		Drums	xus	-	RH	
GROUP B: PU 238			Description: CH, Criticality Concerns, Splitting, Immobilizatic				
1	CH-Retreived	Pu-238	Drums		1999-2016	CH	Thermally Hot, Food-Pack Can/Bird Ca
GROUP C: DIRT/ASH			Description: Particles-Immobilization, Criticality Concerns				
1	CH-Retreived	Z-9 Dirt	Drums		1999-2016	CH	
*2	TTF	Ash	Drums		-	CH	Ash Waste Stream from TTF
GROUP D: LARGE RH & CH BOXES			Description: Weight-140klb with Overpack,				
1	CH-Retreived		Concrete Boxes		-	CH	
2	CH-Retreived		Fiber Glass-Reinforced Boxes		-	CH	With Overpack 140,000 lb
*3	CH-Retreived	Failed	Drums		1999-2016	CH	
1	CH-Retreived		Metal Boxes		-	CH	
2	CH-Retreived	Other	Other		-	CH	Cartons, Filters, Tanks, etc.
3	CH-Retreived		Plywood Box		-	CH	
4	RH-Retreived		Concrete Boxes		2003-2012	RH	4B Trench
5	RH-Retreived		Fiber Glass-Reinforced Boxes		2003-2012	RH	3A & 4B Trenches
6	RH-Retreived		Metal Boxes		2003-2012, 2014	RH	4B & 12B Trenches
7	RH-Retreived		Plywood Box		2003-2012	RH	3A Trench
8	RH-Retreived	Other	Large & Small Cartons		2003-2012, 2014	RH	Filter, Truck Load, Cartons
*9	WRAP 1	Waste	Standard Waste Boxes		1997-2018	CH	Rejected Items
GROUP E: NITRATE SHIPPING CONTAINERS			Description: CH, Mixed Waste, C				
1	CH-Retreived	Other	L-10 Container		-	CH	Pu-nitrate Shipping Containers
2	CH-Retreived	Other	3 L Container		-	CH	Pu-nitrate Shipping Containers
3	CH-Retreived	Other	PR Cans		-	CH	Pu-nitrate Shipping Containers
4	CH-Retreived	Other	100 gal Drum		-	CH	Pu-nitrate Shipping Containers
GROUP F: CLASSIFIED WASTE			Description: Declassify, Special Storage				
1	CH-Retreived	Classified	Drums/Boxes		2008-2014	CH	Classified
GROUP G: FEED FOR TTF			Description: Handling, Repackaging, Cut Up Boxes				
*1	WRAP 1		Drums		1999-2016	CH	
GROUP H: HWVP MELTERS			Description: Big Size, High Dose Rate, Heavy, High				
*1	HWVP	Melters	Melter Overpack		2000-2015	RH	Failed Melters, HLW
GROUP I: LARGE PROCESS EQUIPMENT			Description: Rail Car Receiving, Size L				
*1	HWVP	Waste	Melter Overpack		2000-2015	RH	Operations Waste
*2	DST	Equipment	Boxes		-	RH	60 ft Long Assemblies
*3	PUREX	Tunnel Waste	RH-TRU		-	RH & CH	Canyon Equipment
*4	PUREX	Tunnel Waste	RH-LLMW		-	RH & CH	Dissolver 16 ft

* Indicates projected feed streams.

APPENDIX B

DECISION ANALYSIS DIAGRAMS

These diagrams are used to indicate the major expected waste streams that are likely to result from processing of each feed group. They are not necessarily inclusive.

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DECISION ANALYSIS DIAGRAM

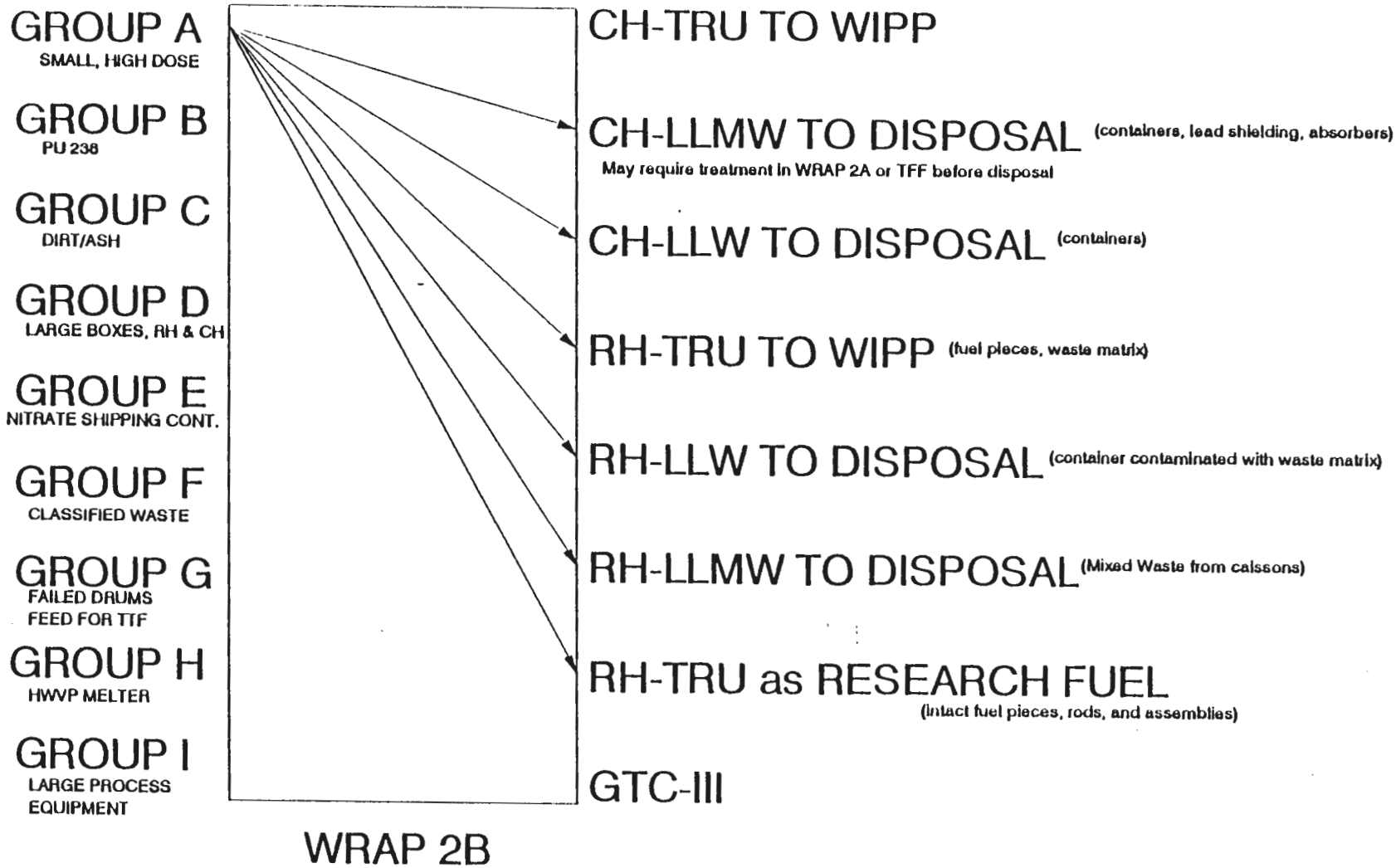


Figure 8-1

DECISION ANALYSIS DIAGRAM

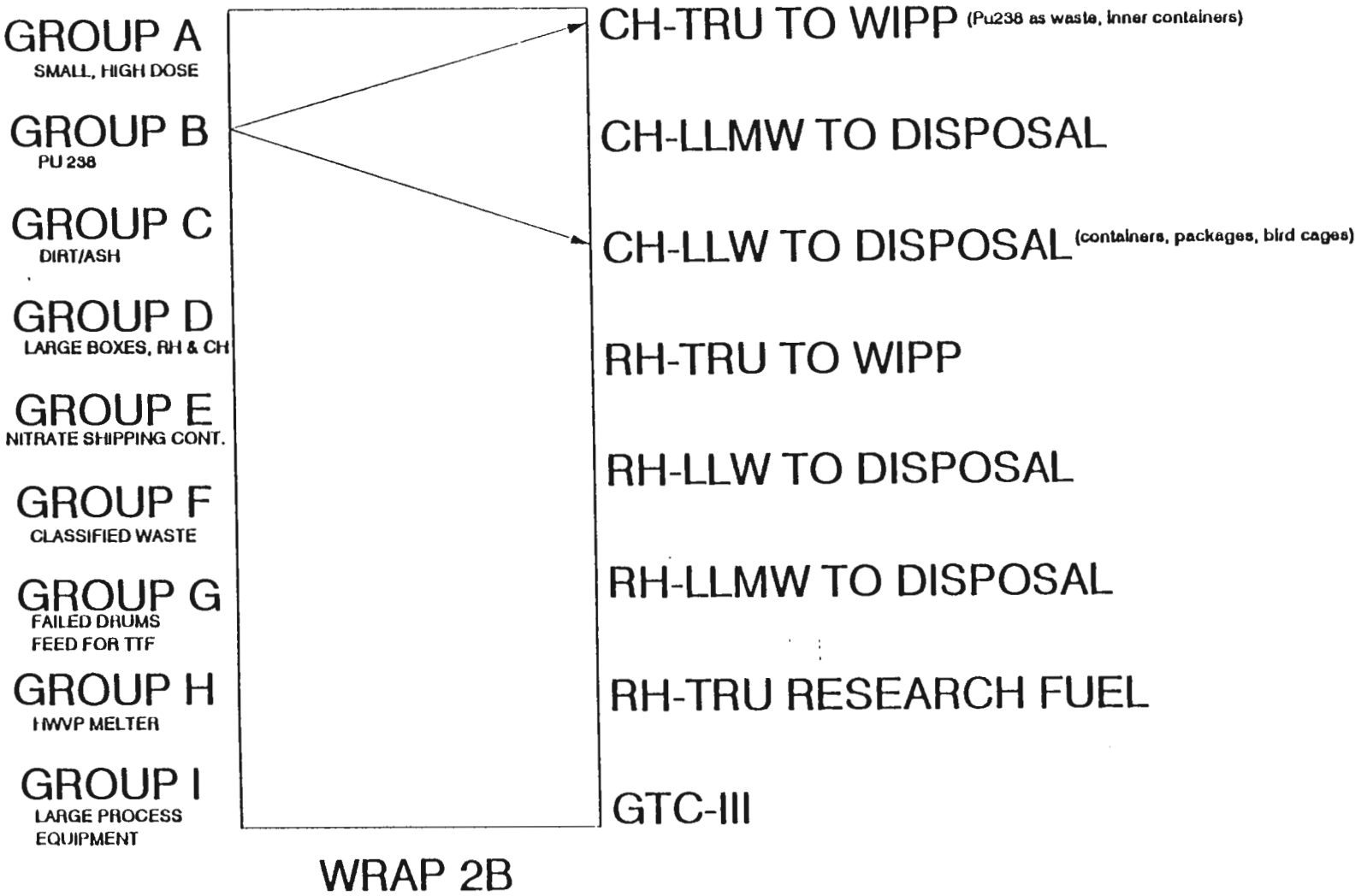


Figure B-2

DECISION ANALYSIS DIAGRAM

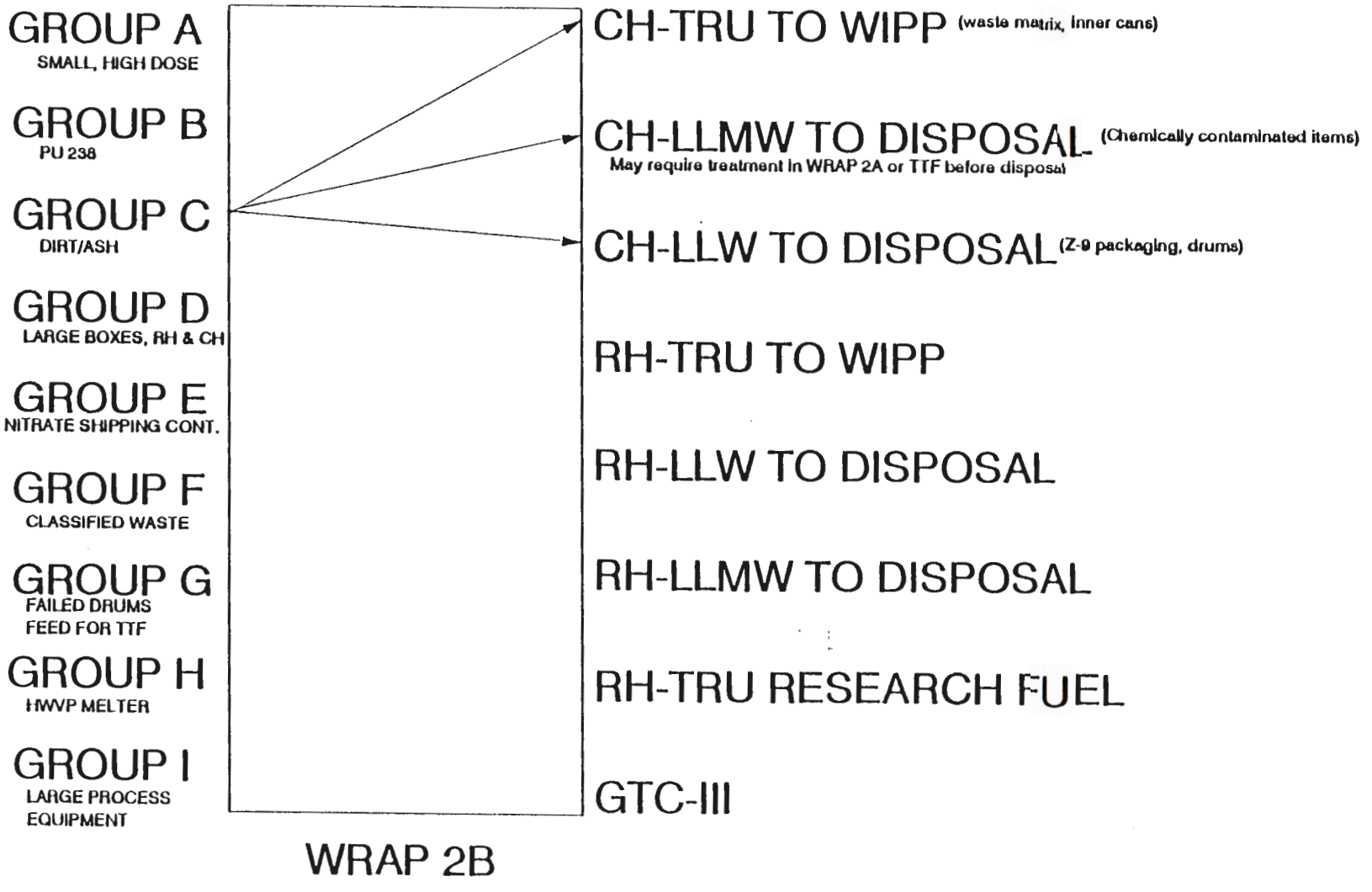
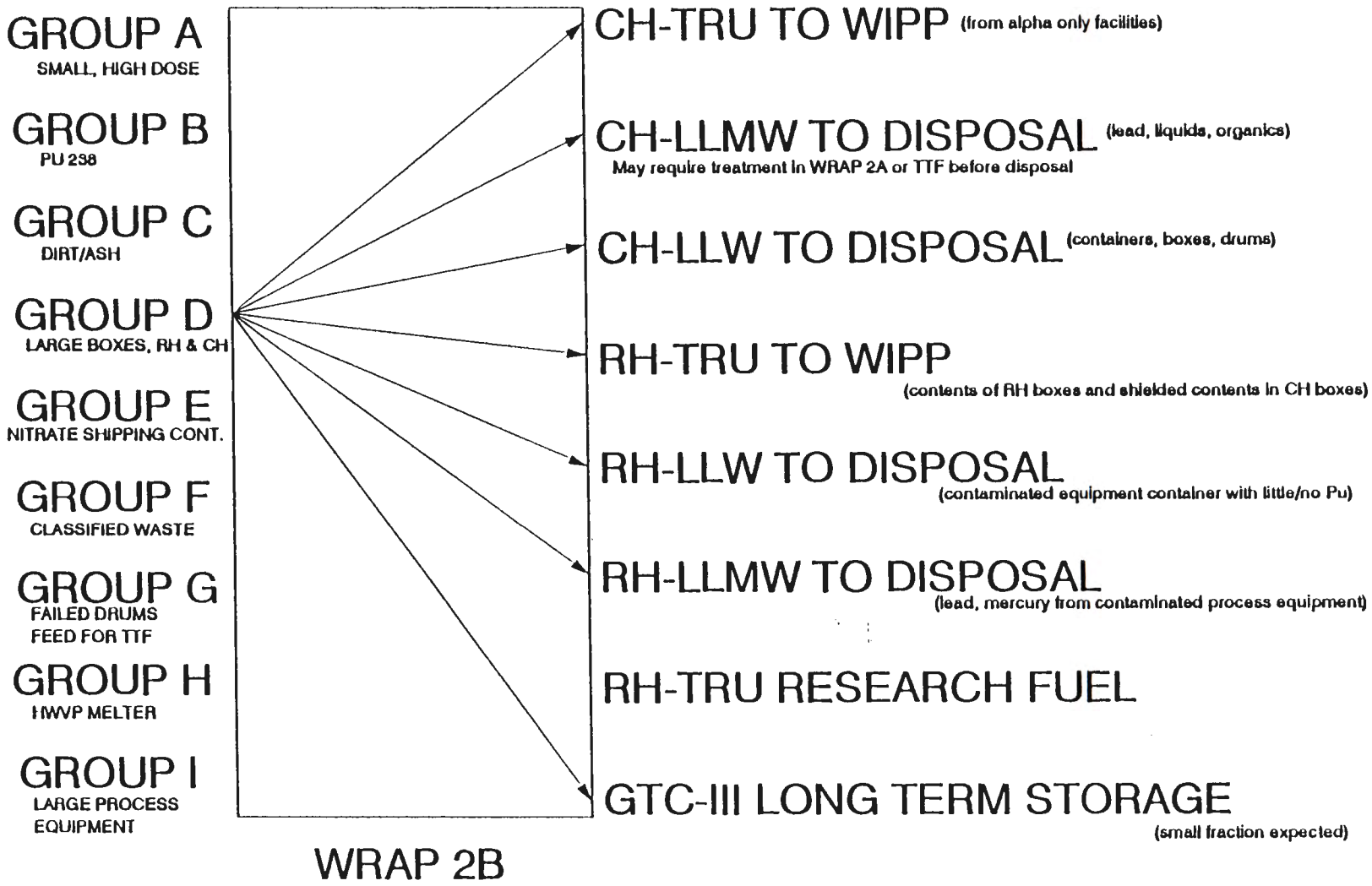


Figure B-3

DECISION ANALYSIS DIAGRAM



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DECISION ANALYSIS DIAGRAM

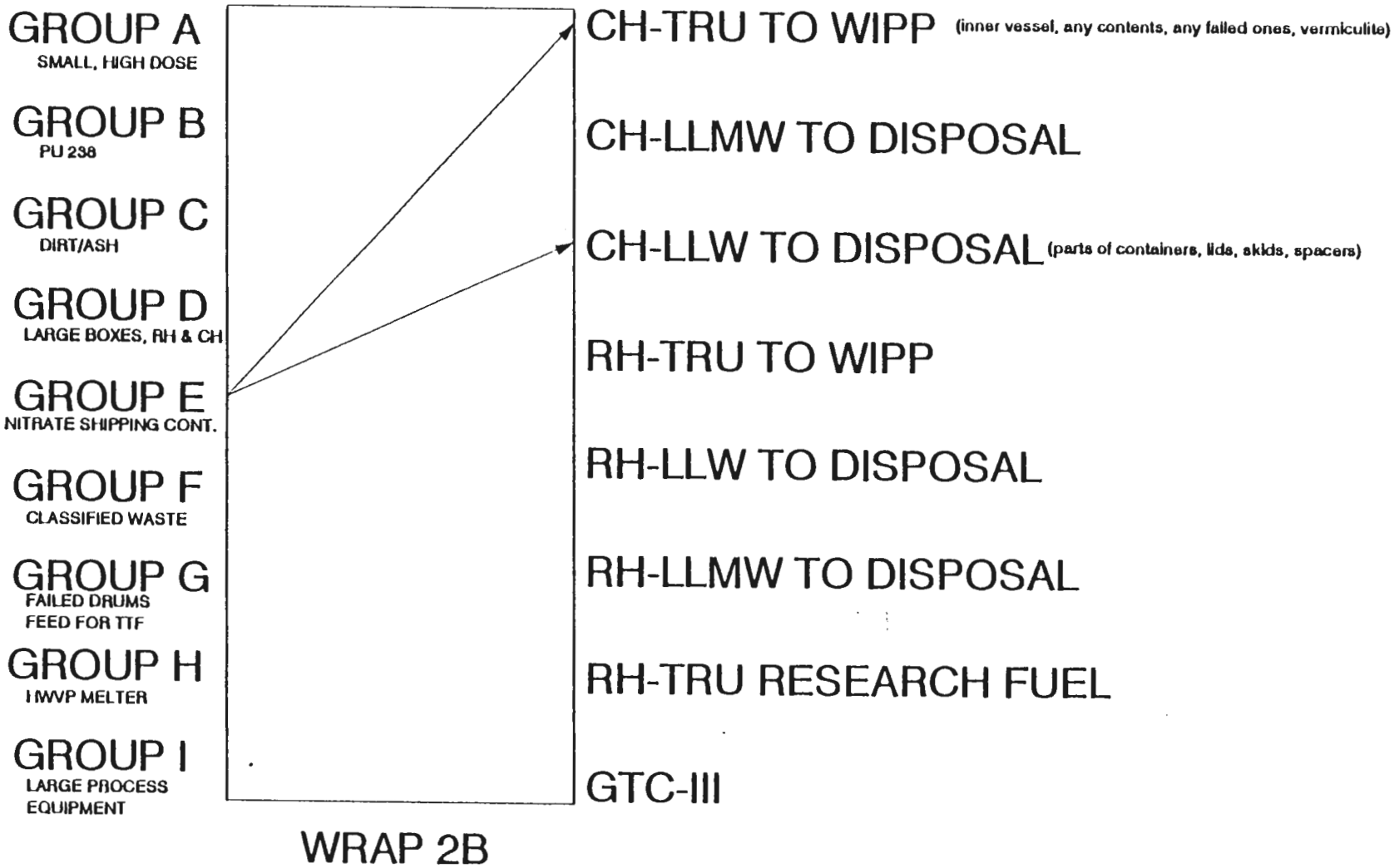
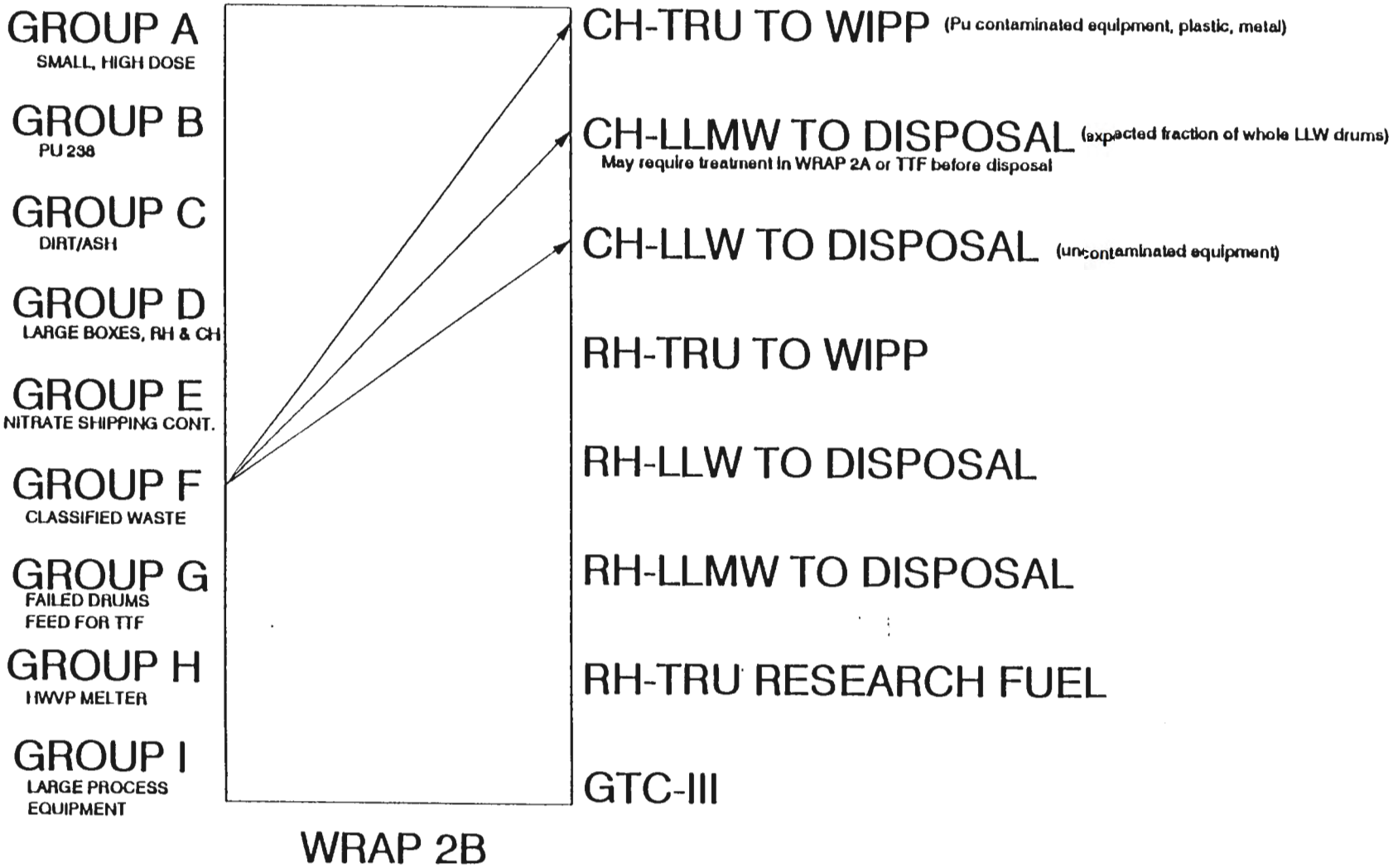


Figure B-5

DECISION ANALYSIS DIAGRAM



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DECISION ANALYSIS DIAGRAM

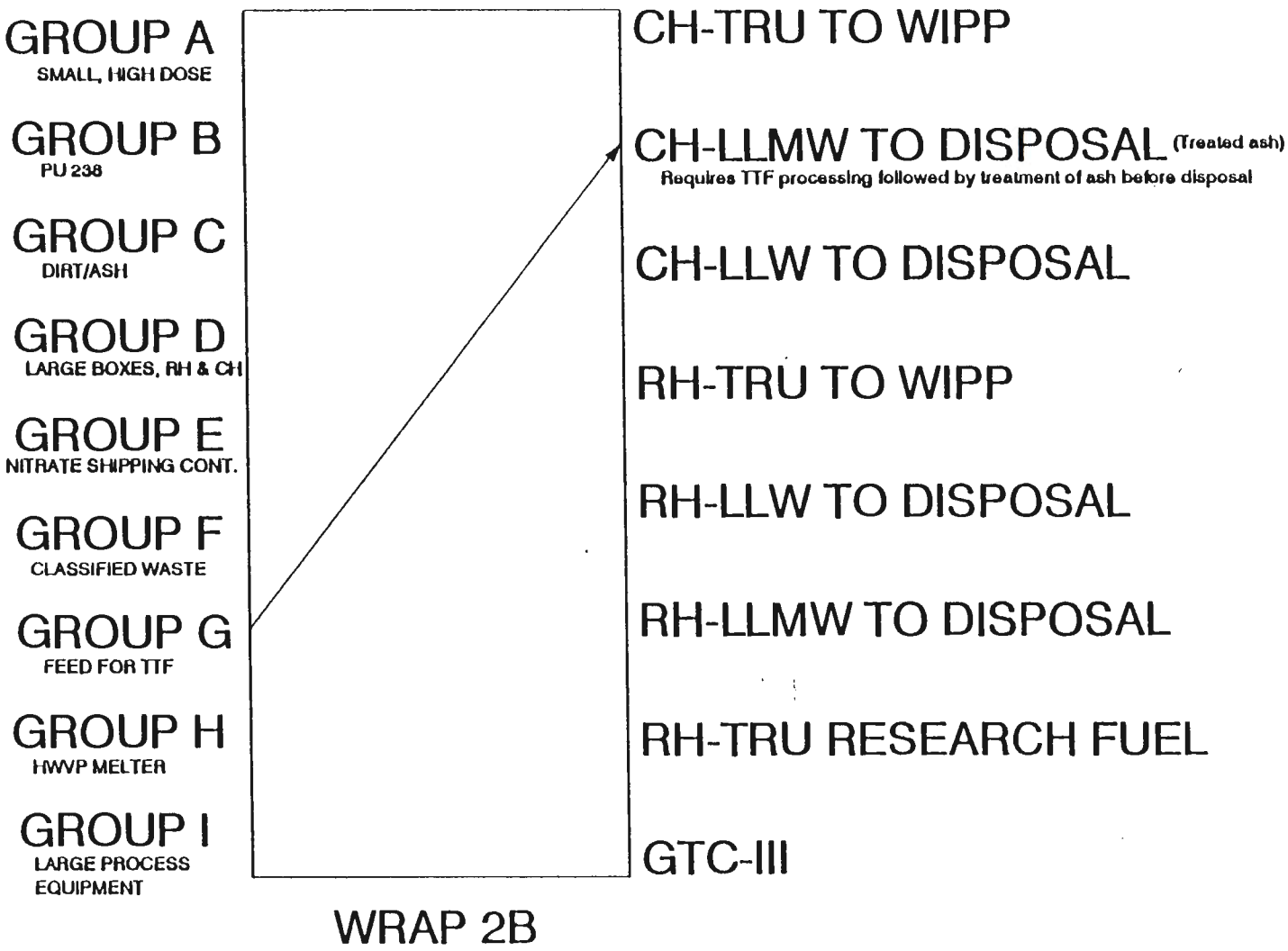
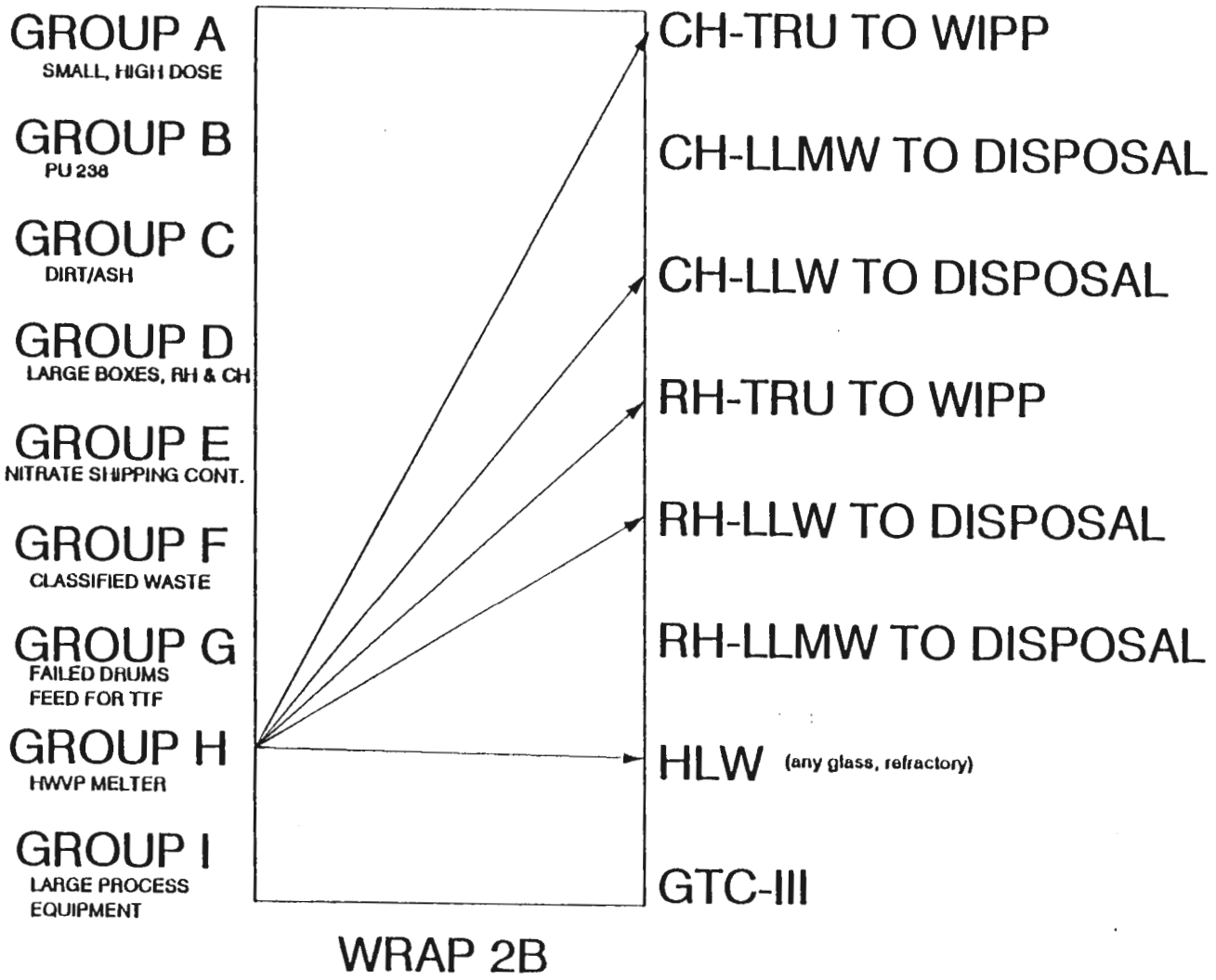


Figure B-7

Figure B-8

DECISION ANALYSIS DIAGRAM



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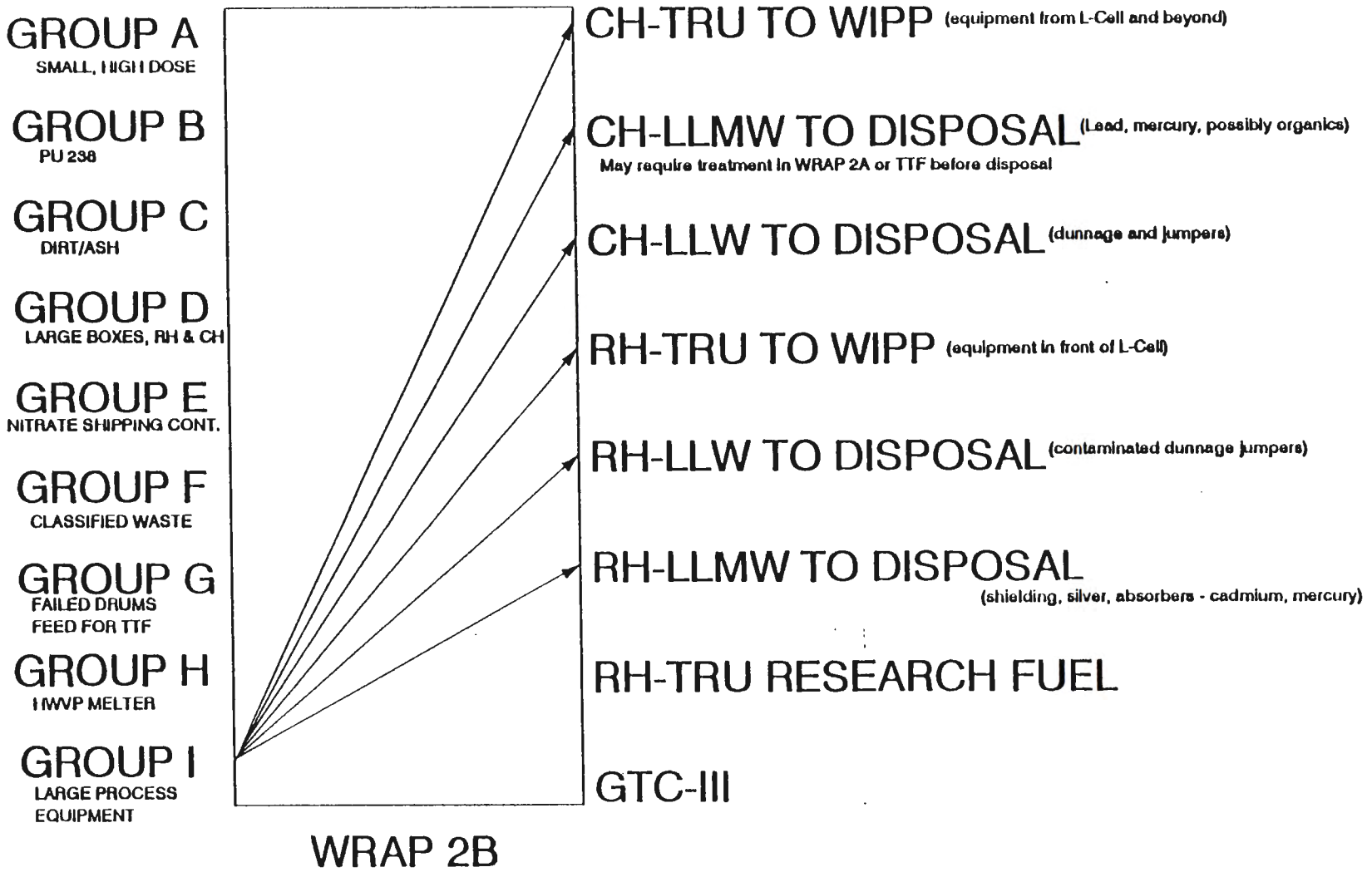

Figure B-9

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APPENDIX C

PROCESSING FLOW DIAGRAMS

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Group A (Small, High Dose)

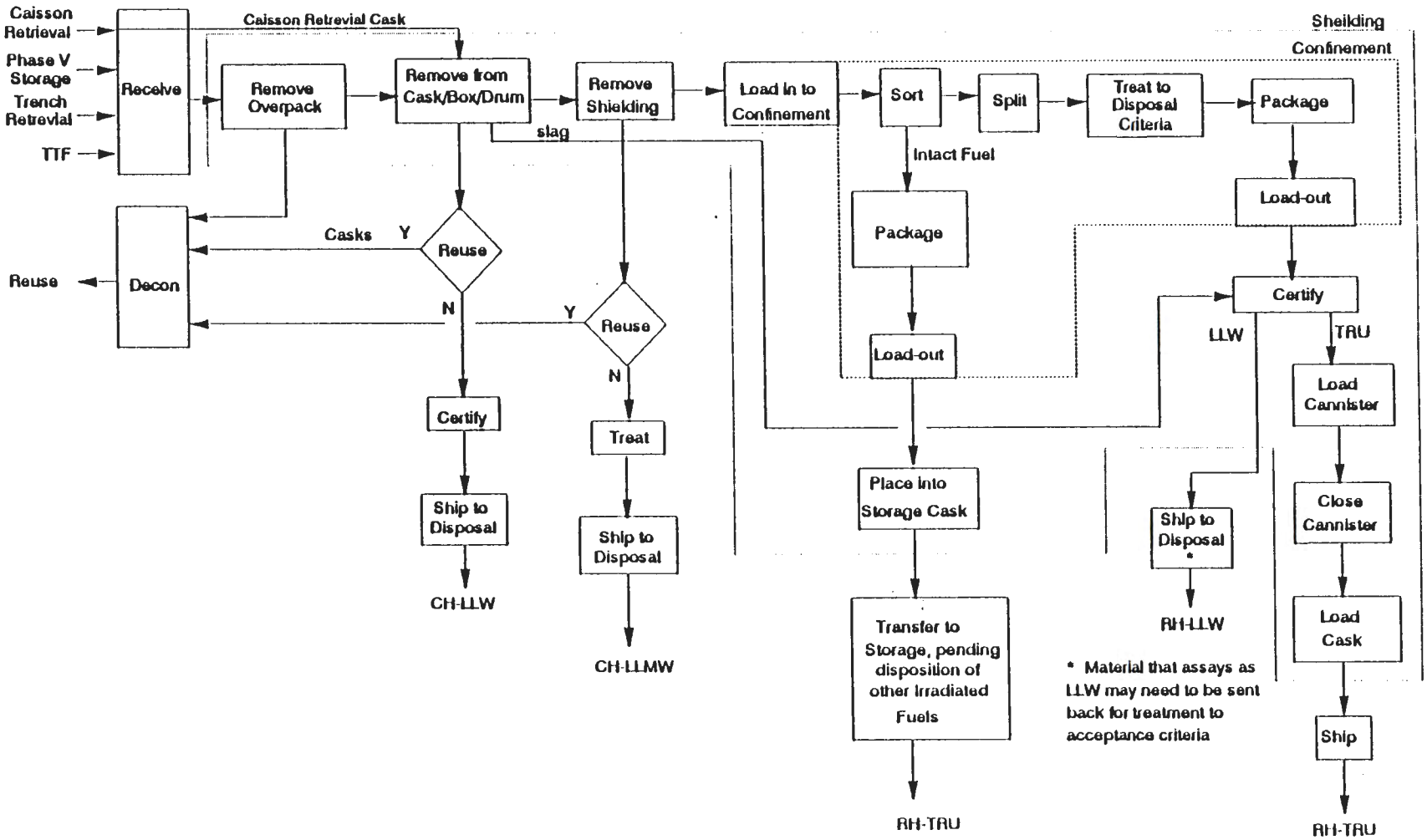
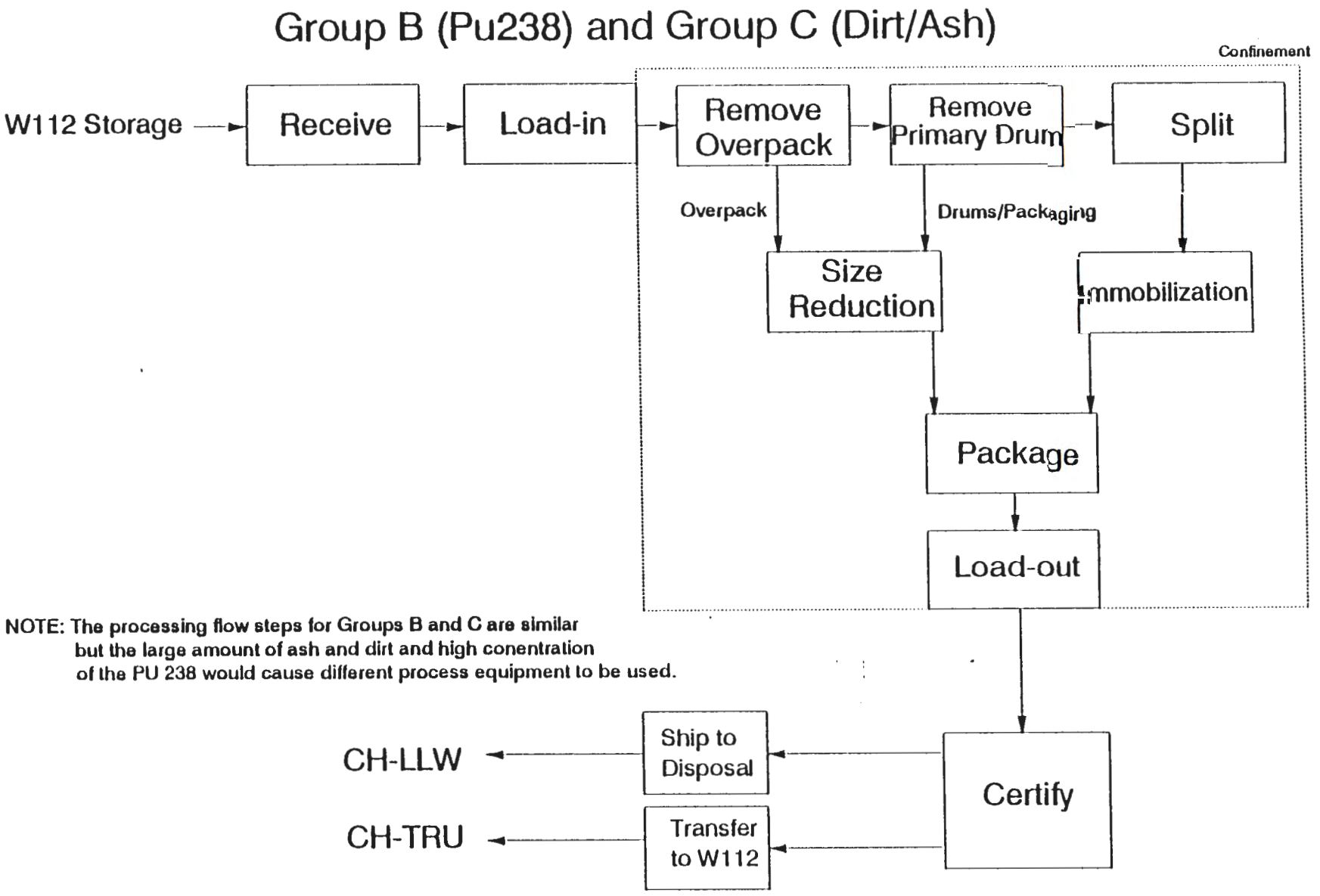


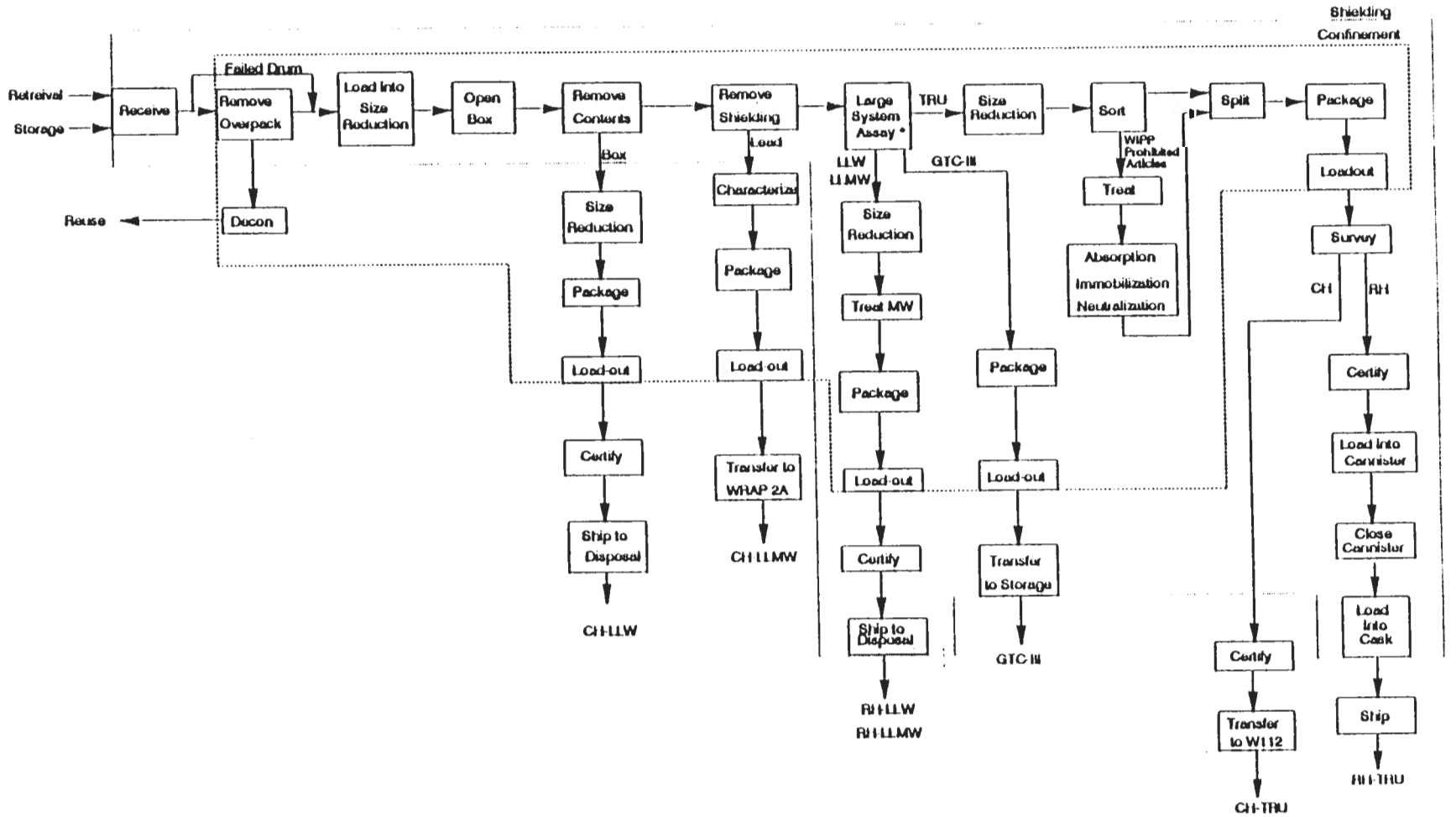
Figure C-1

Figure C-2



NOTE: The processing flow steps for Groups B and C are similar but the large amount of ash and dirt and high conentration of the PU 238 would cause different process equipment to be used.

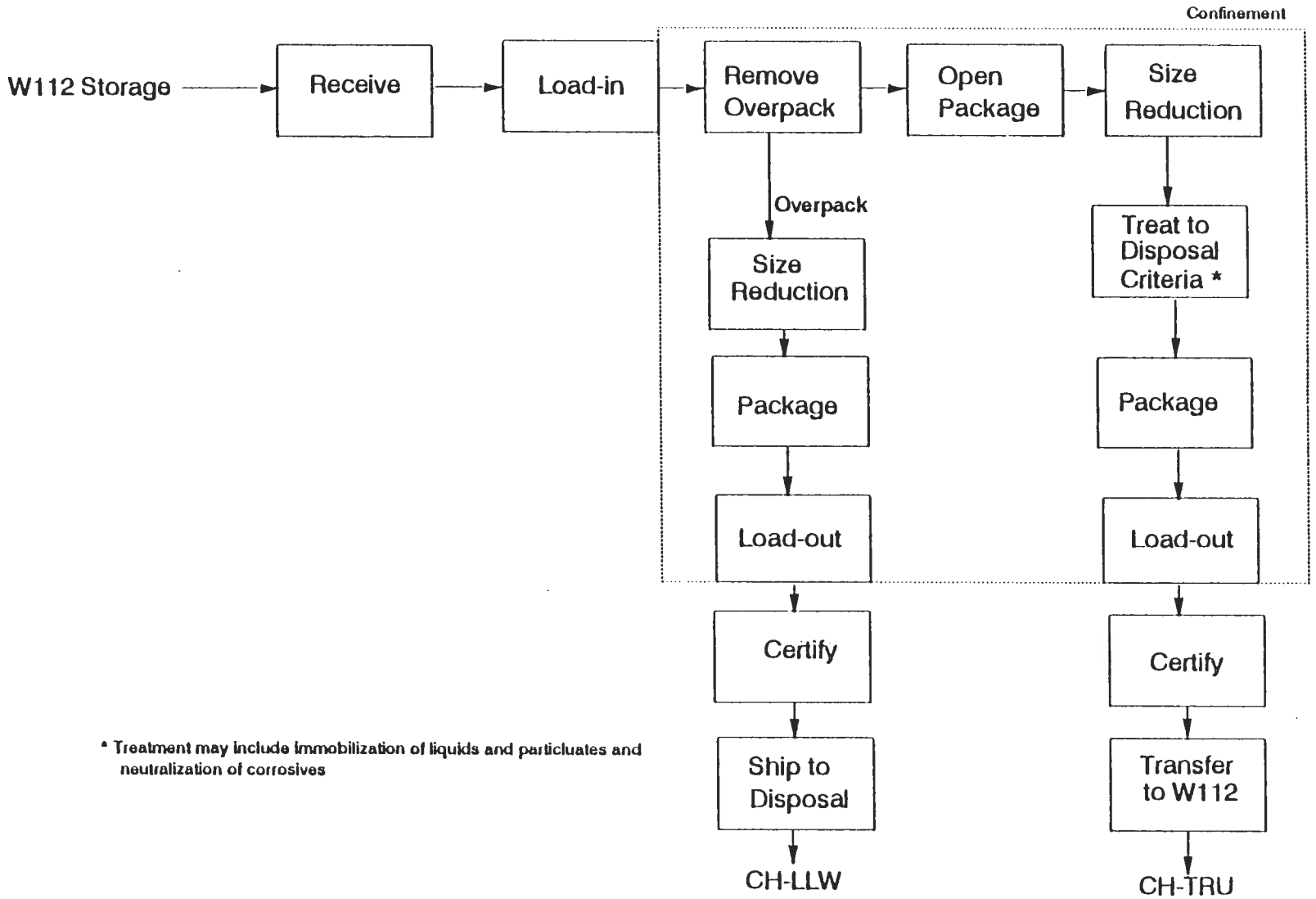
Group D (Large RH & CH Boxes)



* Large System Assay assumes development of equipment to allow separation of TRU and LLW packages for seperate processing for waste minimization. Without it, seperation will be made after certification.

Figure C-3

Group E (Nitrate Shipping Containers)



* Treatment may include immobilization of liquids and particulates and neutralization of corrosives

Figure C-4

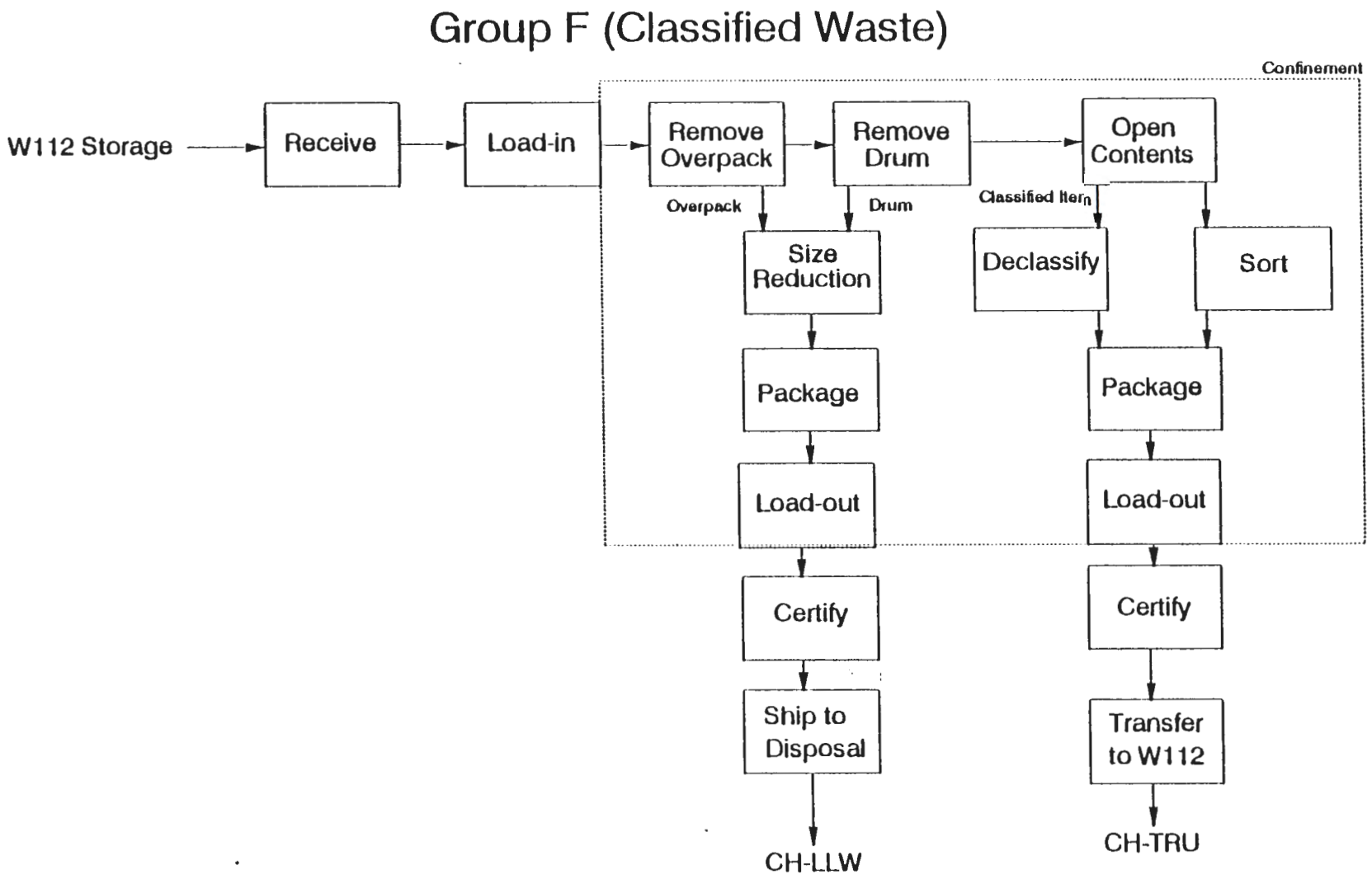
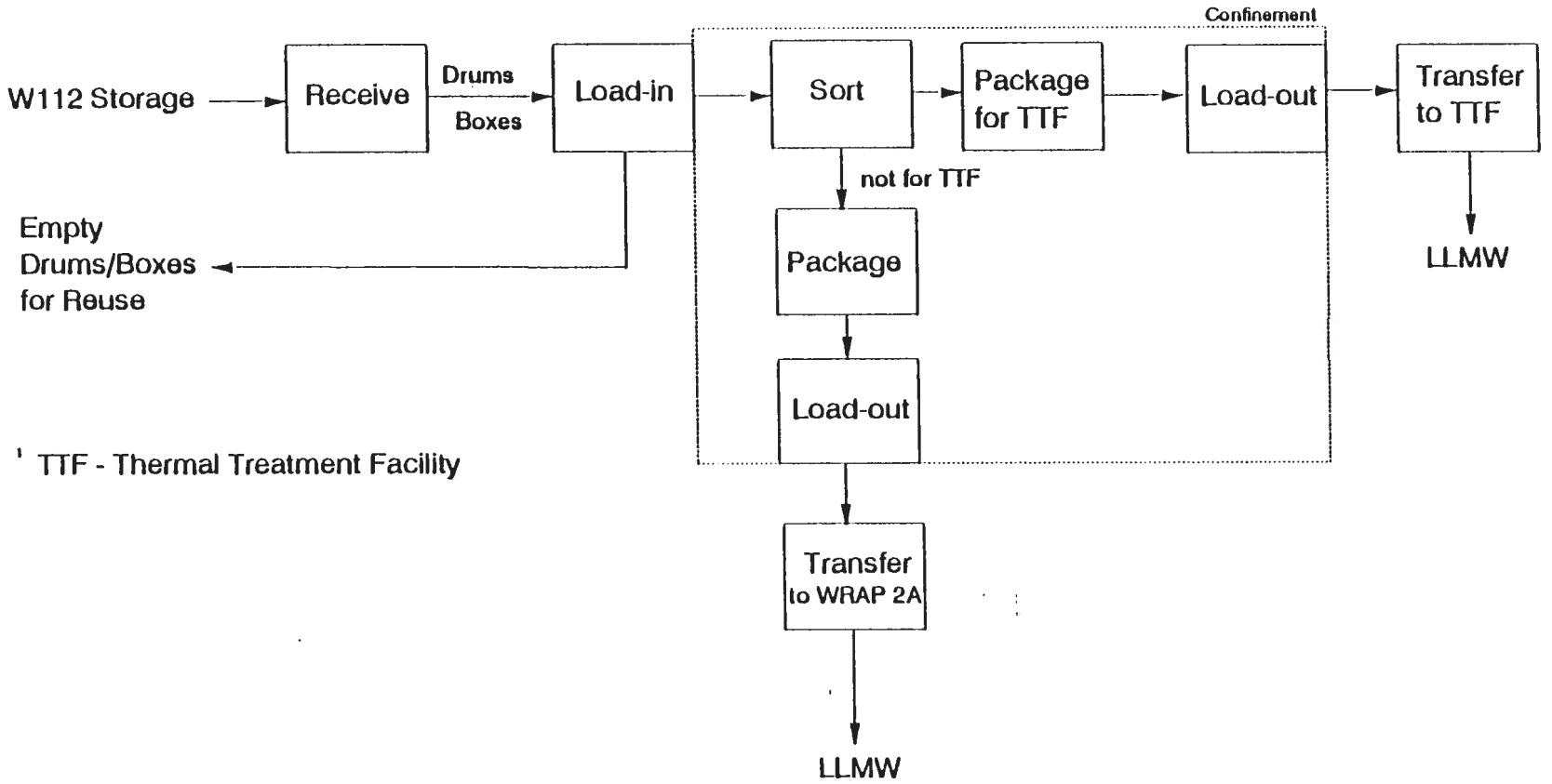

Group F (Classified Waste)
Confinement
W112 Storage
Receive
Load-in
Remove Overpack
Remove Drum
Open Contents
Overpack
Drum
Classified Item
Size Reduction
Declassify
Sort
Package
Package
Load-out
Load-out
Certify
Certify
Ship to Disposal
Transfer to W112
CH-LLW
CH-TRU

Figure C-5

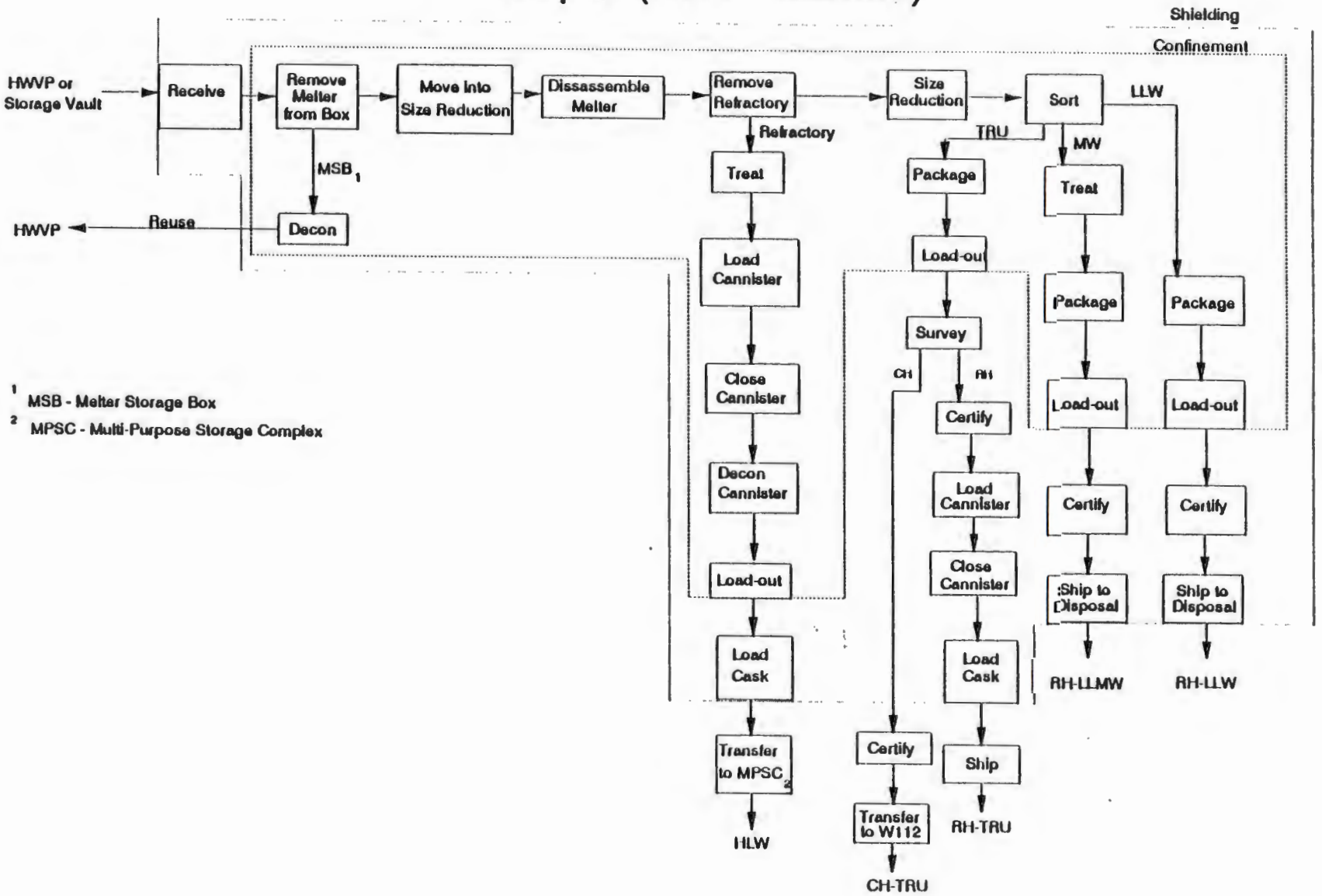
Group G (TTF[1] Feed)



[1] TTF - Thermal Treatment Facility

Figure C-6

Group H (HWVP Melters)



[1] MSB - Melter Storage Box
[2] MPSC - Multi-Purpose Storage Complex

Figure C-7

Group I (Large Process Equipment)

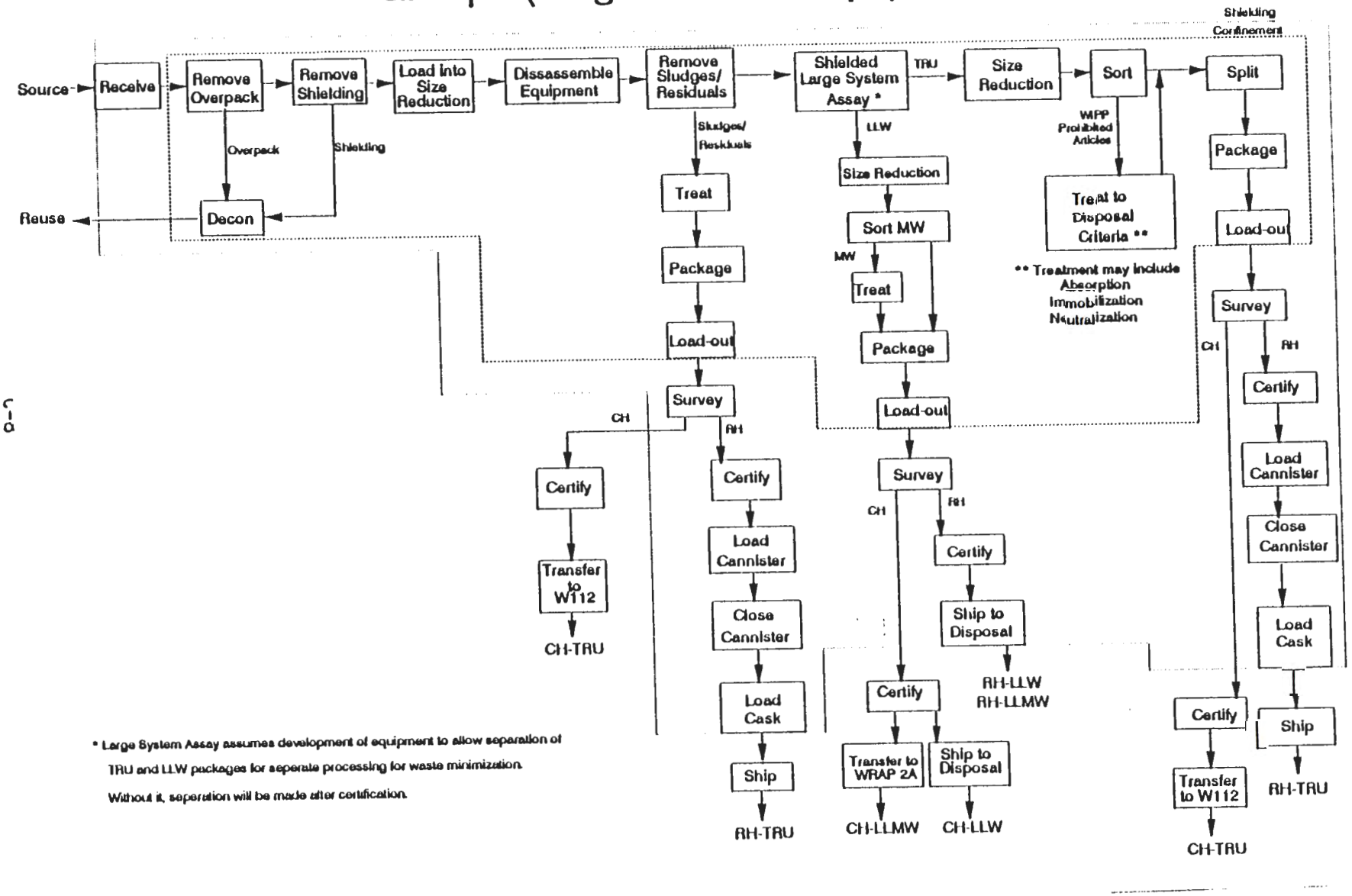


Figure C-8

APPENDIX D

STRATEGY DEVELOPMENT DIAGRAMS

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Figure D-1

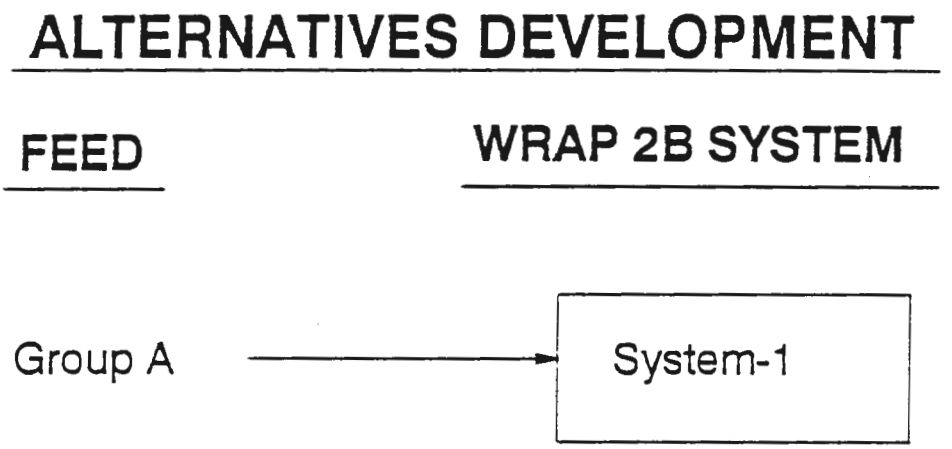

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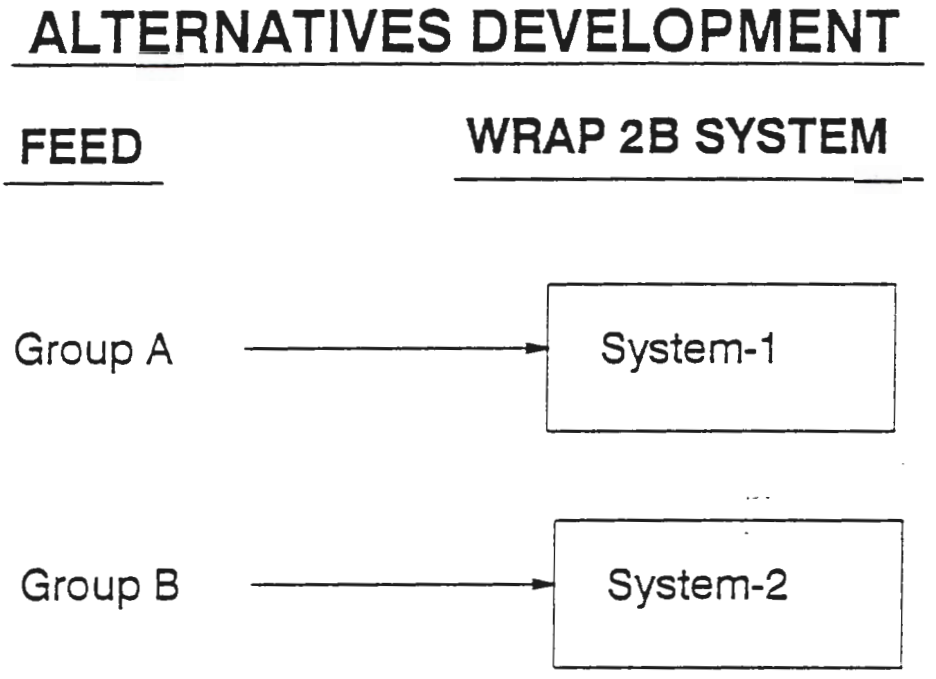
Figure D-2



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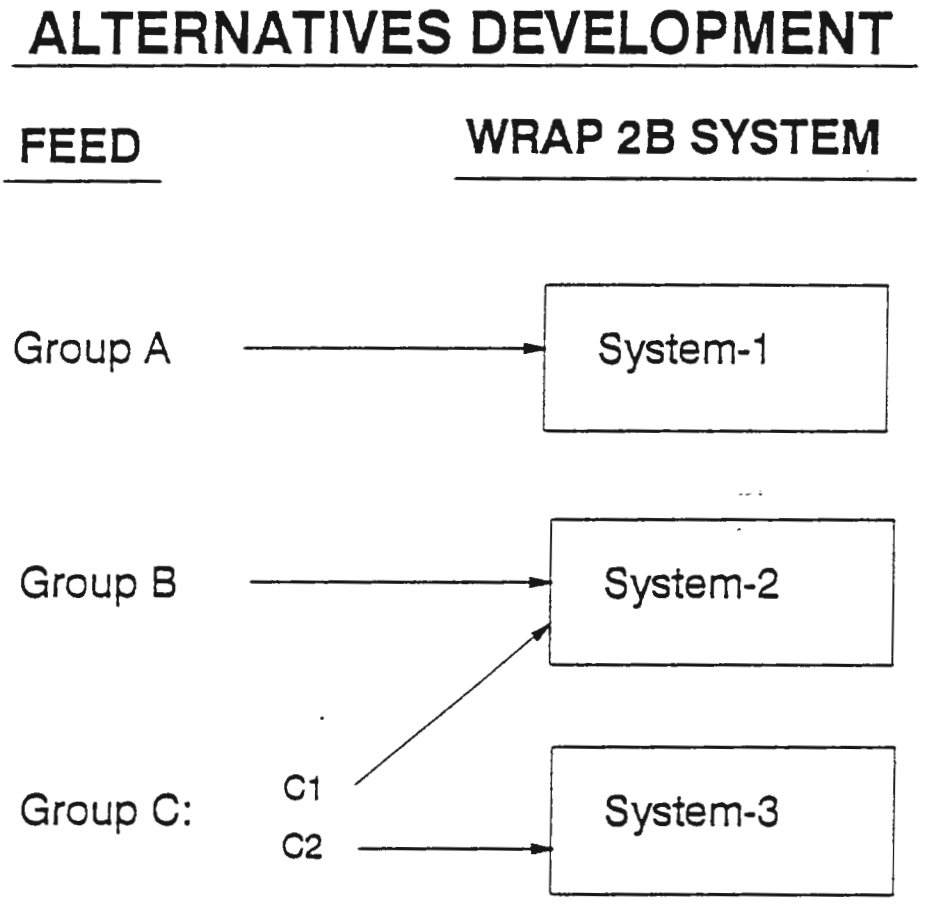

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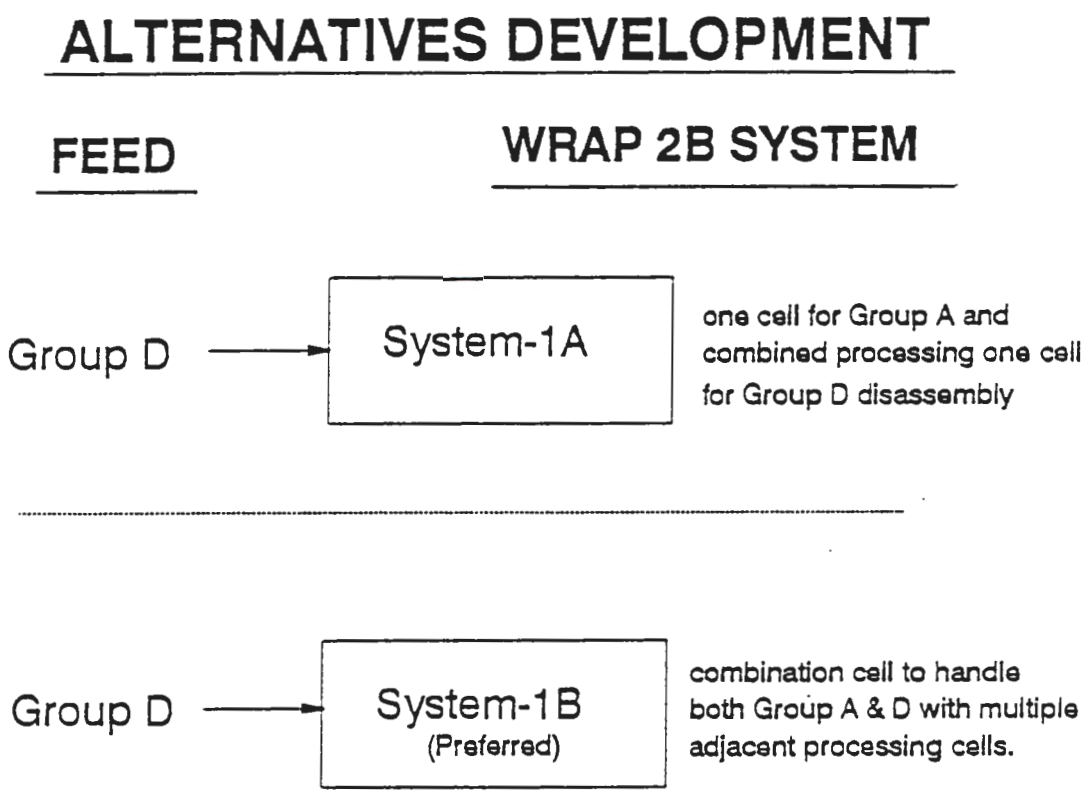

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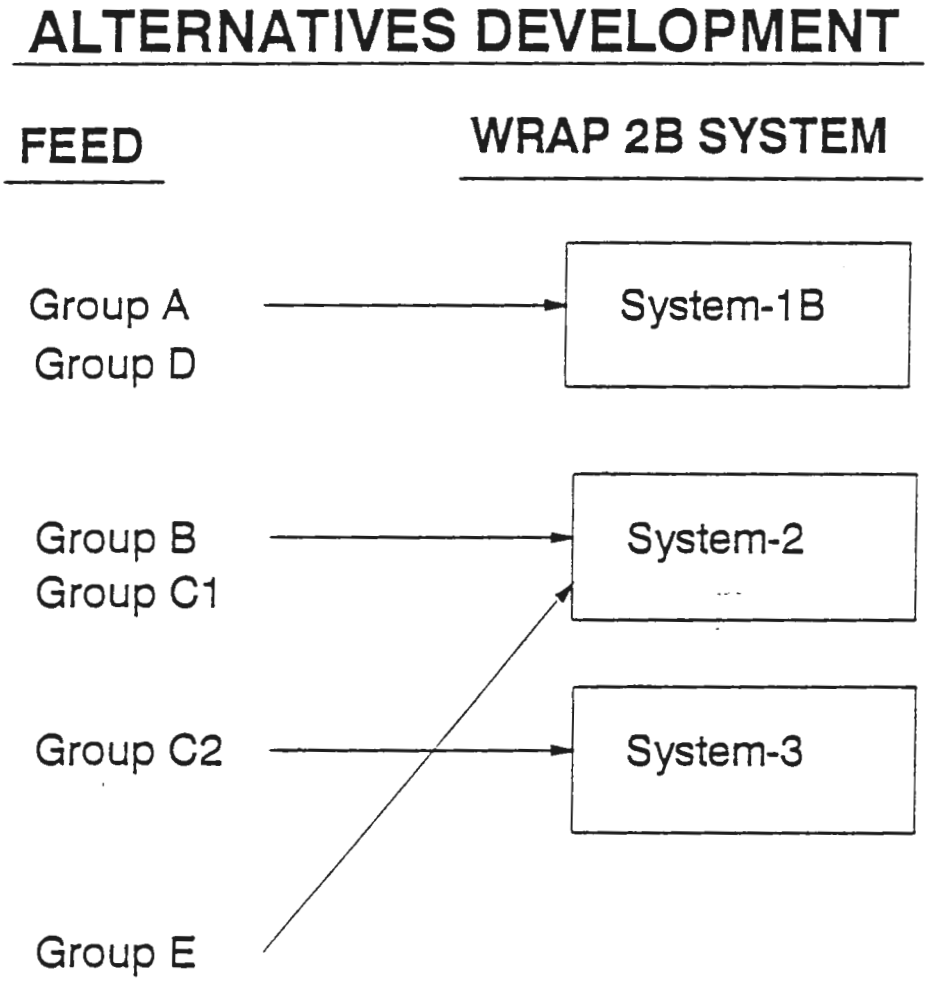

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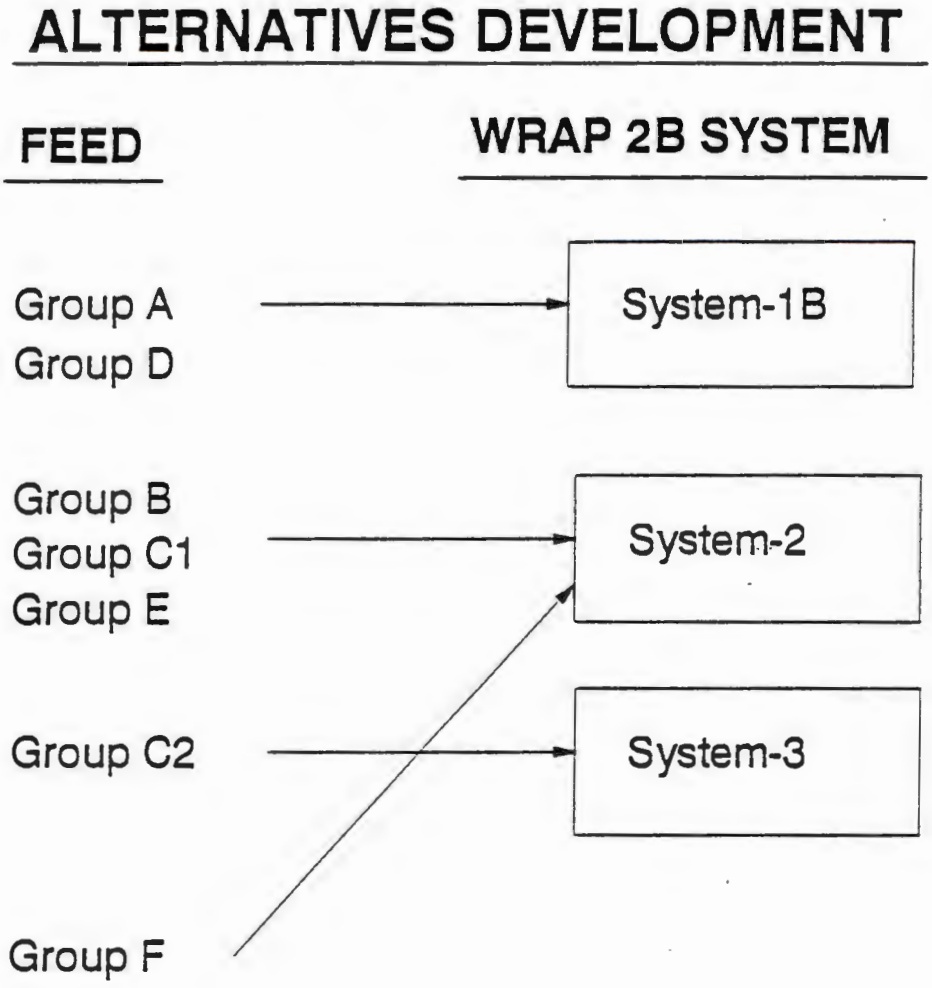

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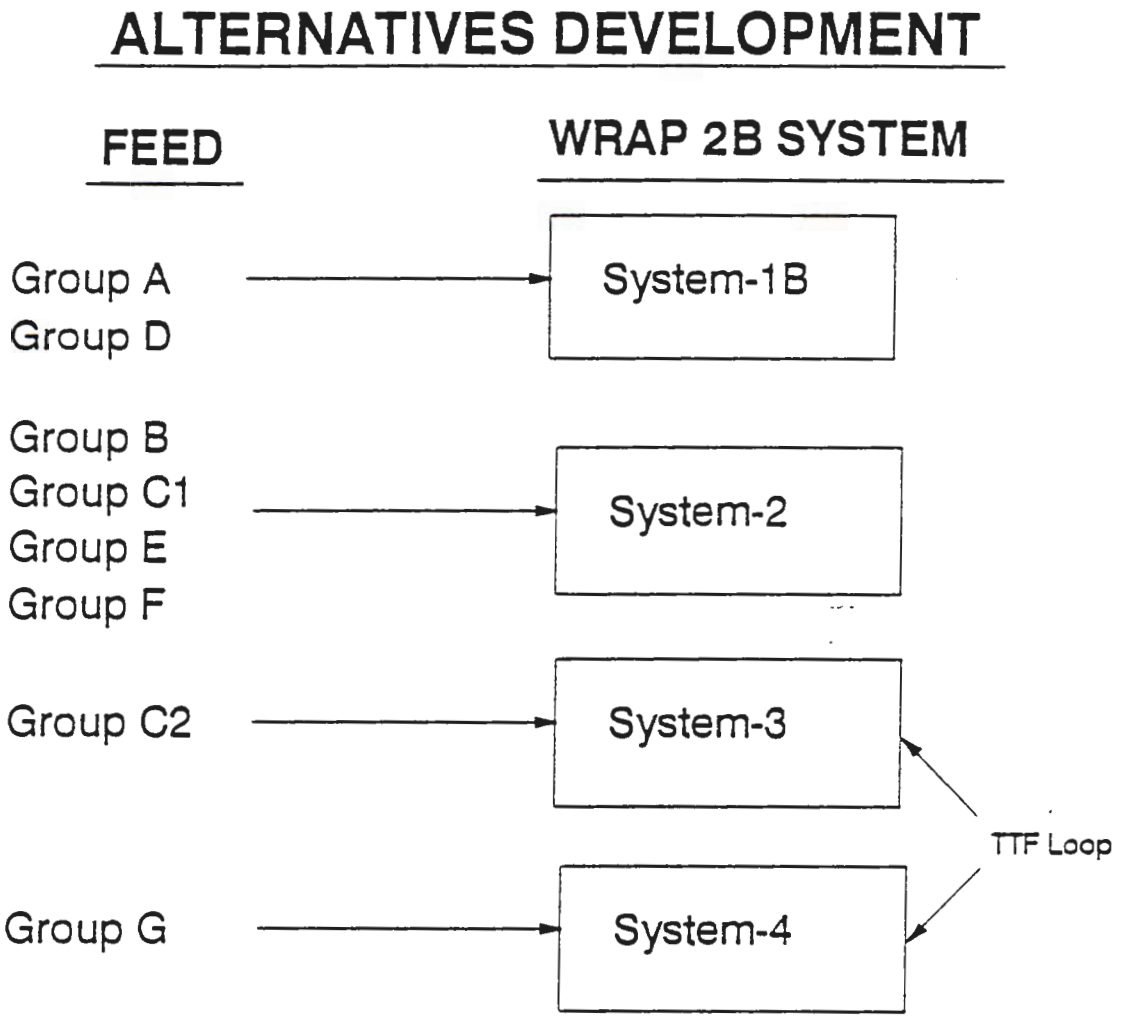

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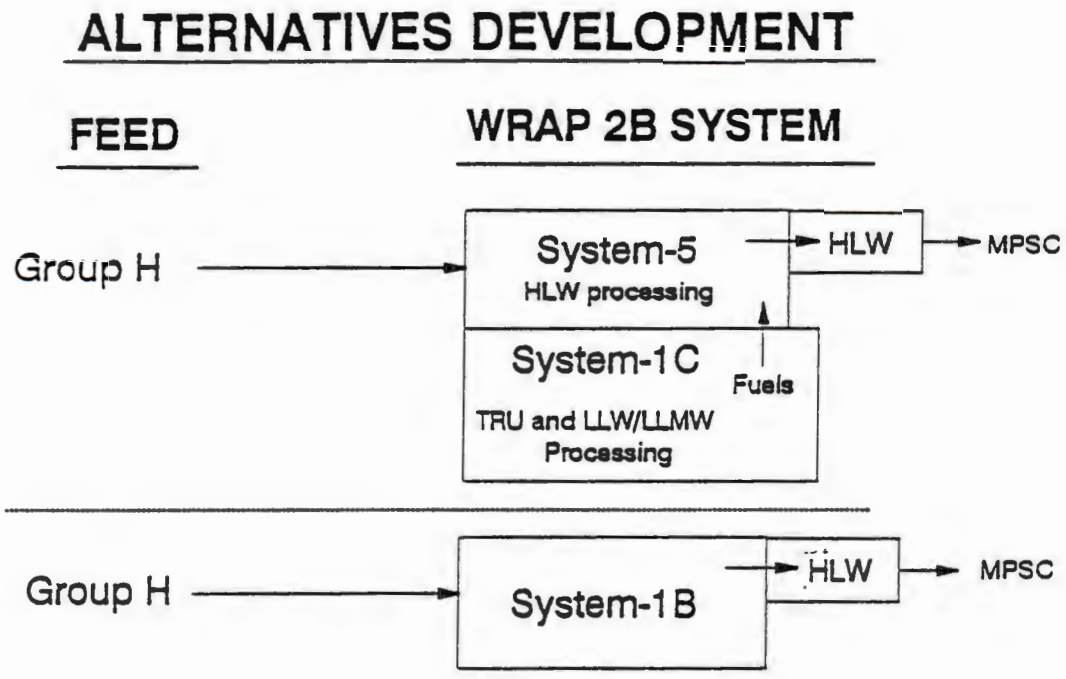

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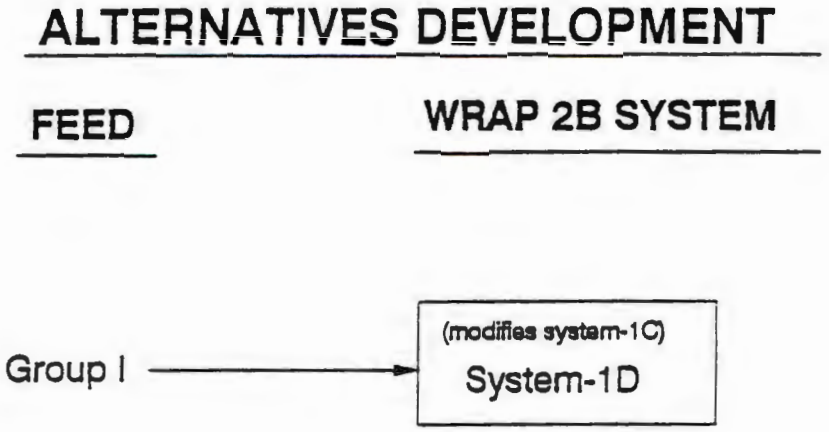

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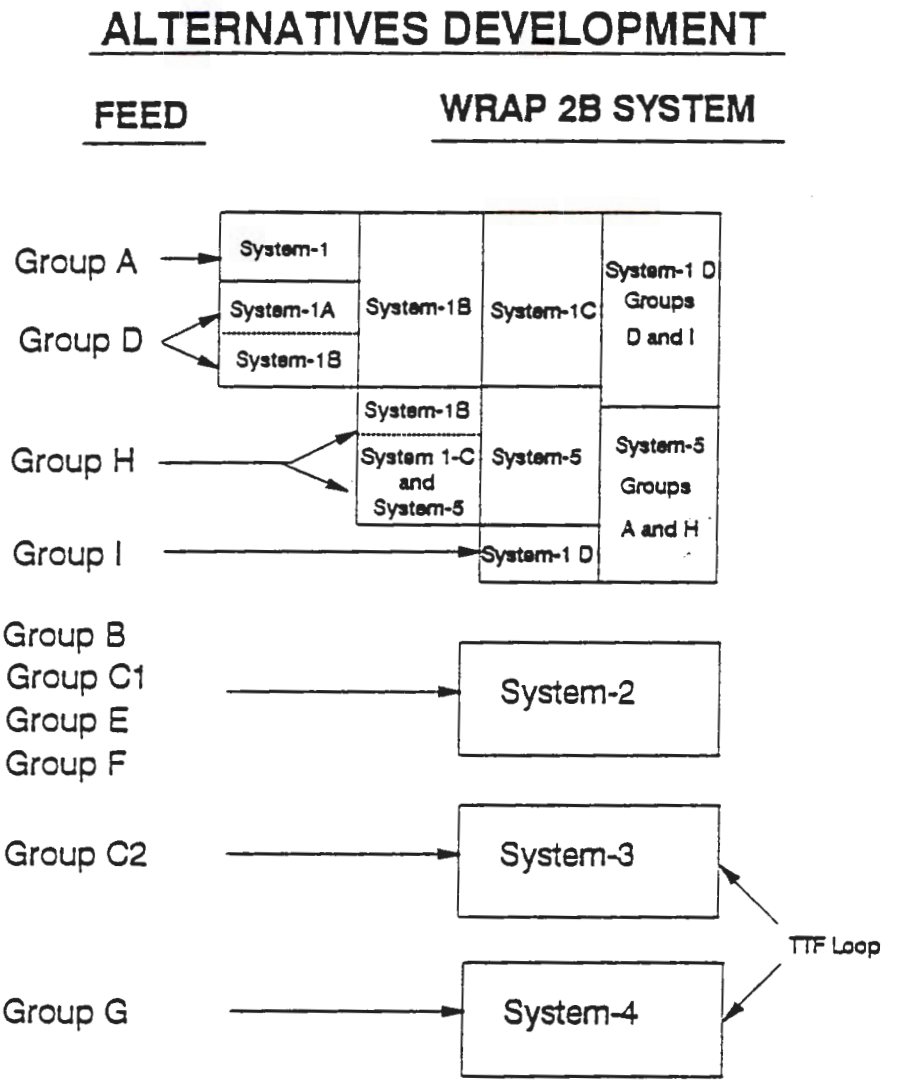

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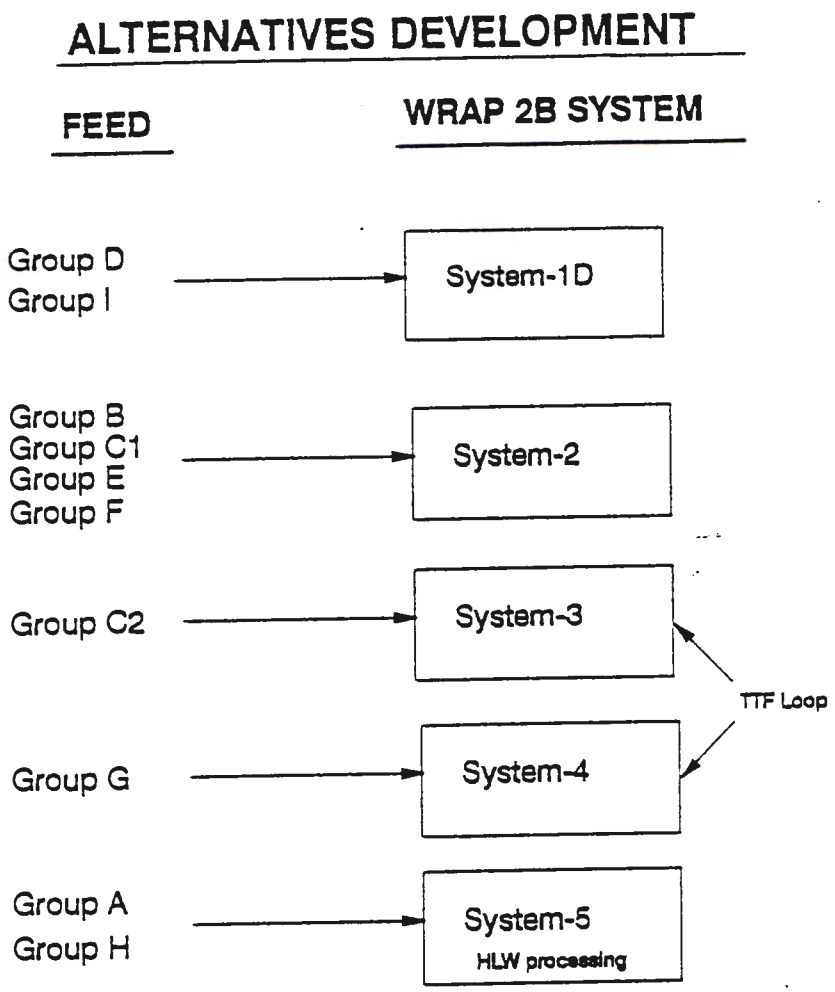

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