Appendix A

Waste Shipping Data

Appendix A
Waste Shipping Data

WASTE SHIPMENTS AROUND THE EXCAVATION AREA

Graphite

GENERATOR	TYPE	CONTAINER_	CONTAINER_	SHIPMENT_K	Drums/ Shipment	
776	Type V, LGW	1	55-gal drum(s)	RFODOWSR106/14/68810140	1	
776	LGW	15	55-gal drum(s)	RFODOWSR106/17/68101030	15	=Ship **B**
776	LGW	21	55-gal drum(s)	RFODOWSR106/18/68102020	21	=Ship A

EMPTY Drums

GENERATOR	TYPE	CONTAINER_	CONTAINER_	SHIPMENT_K	Drums/ Shipment	
746	Type I, Type V	54	boxed 55-gal drum(s)	RFODOWSR105/14/6881000	54	
746	Type I, Type V	53	boxed 55-gal drum(s)	RFODOWSR105/20/6880000	53	
746	Type I, Type V	53	boxed 55-gal drum(s)	RFODOWSR106/04/6881000	53	
746	Type I, Type V	54	boxed 55-gal drum(s)	RFODOWSR106/05/6880000	54	
746	Type I, Type V	54	boxed 55-gal drum(s)	RFODOWSR106/05/6881000	54	
746	Type I, Type V	54	boxed 55-gal drum(s)	RFODOWSR106/06/6880000	54	
746	Type I, Type V	57	boxed 55-gal drum(s)	RFODOWSR106/17/68101030	57	=Ship B

Combustibles

GENERATOR	TYPE	CONTAINER_	CONTAINER_	SHIPMENT_K	Drums/ Shipment	
742	Type I	9	55-gal drum(s)	RFODOWSR105/14/6881000	10	
744	Type I	1	55-gal drum(s)	RFODOWSR105/14/6881000		
771	Type I, Type V	5	55-gal drum(s)	RFODOWSR105/20/6880000	7	
123	Type I, Type V	1	55-gal drum(s)	RFODOWSR105/20/6880000		
771	Type I, Type V	1	boxed 55-gal drum(s)	RFODOWSR105/20/6880000		
776	Type I, Type V	12	55-gal drum(s)	RFODOWSR106/04/6881000	14	
771	Type I	1	55-gal drum(s)	RFODOWSR106/04/6881000		
771	Type I, Type V	1	boxed 55-gal drum(s)	RFODOWSR106/04/6881000		
771	Type I, Type V	10	55-gal drum(s)	RFODOWSR106/05/6881000	13	
776	Type I, Type V	3	55-gal drum(s)	RFODOWSR106/05/6881000		
771	Type I, Type V	12	55-gal drum(s)	RFODOWSR106/06/6880000	16	
559	Type I, Type V	4	55-gal drum(s)	RFODOWSR106/06/6880000		
unk	Type I, Type V	54	boxed 55-gal drum(s)	RFODOWSR106/14/68810140	69	
771	Type I, Type V	14	55-gal drum(s)	RFODOWSR106/14/68810140		
779	Type I, Type V	1	55-gal drum(s)	RFODOWSR106/14/68810140		
unk	Type I, Type V	57	boxed 55-gal drum(s)	RFODOWSR106/18/68102020	66	
771	Type I	8	55-gal drum(s)	RFODOWSR106/18/68102020		=Ship A
776	Type I, LGW	1	55-gal drum(s)	RFODOWSR106/18/68102020		

Non-Combustibles

GENERATOR	TYPE	CONTAINER_	CONTAINER_	SHIPMENT_K	Drums/ Shipment	
776	Type I, Type V	3	55-gal drum(s)	RFODOWSR105/20/6880000	3	
771	Type I, Type V	8	55-gal drum(s)	RFODOWSR106/04/6881000	11	
771	Type V	3	55-gal drum(s)	RFODOWSR106/04/6881000		
771	Type I, Type V	23	55-gal drum(s)	RFODOWSR106/05/6880000	24	
746	Type V	1	55-gal drum(s)	RFODOWSR106/05/6880000		
771	Type V	8	55-gal drum(s)	RFODOWSR106/05/6881000	12	
742	Type V	2	55-gal drum(s)	RFODOWSR106/05/6881000		
746	Type V	2	55-gal drum(s)	RFODOWSR106/05/6881000		
771	Type V	6	55-gal drum(s)	RFODOWSR106/06/6880000	6	
771	Type V	8	55-gal drum(s)	RFODOWSR106/14/68810140	8	
771	Type I, Type V	61	55-gal drum(s)	RFODOWSR106/17/68101030	61	=Ship **B**
771	Type I, Type V	45	55-gal drum(s)	RFODOWSR106/18/68102020	45	=Ship A

WASTE SHIPMENTS AROUND THE EXCAVATION AREA

741 Sludge

GENERATOR	TYPE	CONTAINER_	CONTAINER_	SHIPMENT_K	Drums/ Shipment
741	Type IV	52	55-gal drum(s)	RFODOWSR106/14/68810140	52
741	Type IV	3	55-gal drum(s)	RFODOWSR106/18/68102020	3

742 Sludge

GENERATOR	TYPE	CONTAINER_	CONTAINER_	SHIPMENT_K	Drums/ Shipment
742	Type IV	13	55-gal drum(s)	RFODOWSR105/14/6881000	22
742	Type I	9	55-gal drum(s)	RFODOWSR105/14/6881000	
742	Type IV	6	55-gal drum(s)	RFODOWSR105/20/6880000	6
742	Type V	2	55-gal drum(s)	RFODOWSR106/05/6881000	3
742	Type IV	1	55-gal drum(s)	RFODOWSR106/05/6881000	
742	Type IV	2	55-gal drum(s)	RFODOWSR106/06/6880000	2

743 Sludge

GENERATOR	TYPE	CONTAINER_	CONTAINER_	SHIPMENT_K	Drums/ Shipment
743	Type IV	41	55-gal drum(s)	RFODOWSR105/14/6881000	41
743	Type IV	51	55-gal drum(s)	RFODOWSR105/20/6880000	51
743	Type IV	52	55-gal drum(s)	RFODOWSR106/04/6881000	52
743	Type IV	50	55-gal drum(s)	RFODOWSR106/05/6880000	50
743	Type IV	49	55-gal drum(s)	RFODOWSR106/05/6881000	49
743	Type IV	52	55-gal drum(s)	RFODOWSR106/06/6880000	52

745 Sludge

GENERATOR	TYPE	CONTAINER_	CONTAINER_	SHIPMENT_K	Drums/ Shipment
745	Type IV	12	55-gal drum(s)	RFODOWSR105/14/6881000	12
745	Type IV	10	55-gal drum(s)	RFODOWSR105/20/6880000	10
745	Type IV	2	55-gal drum(s)	RFODOWSR106/05/6880000	2
745	Type IV	1	55-gal drum(s)	RFODOWSR106/05/6881000	1

NOMENCLATURE

GENERATOR

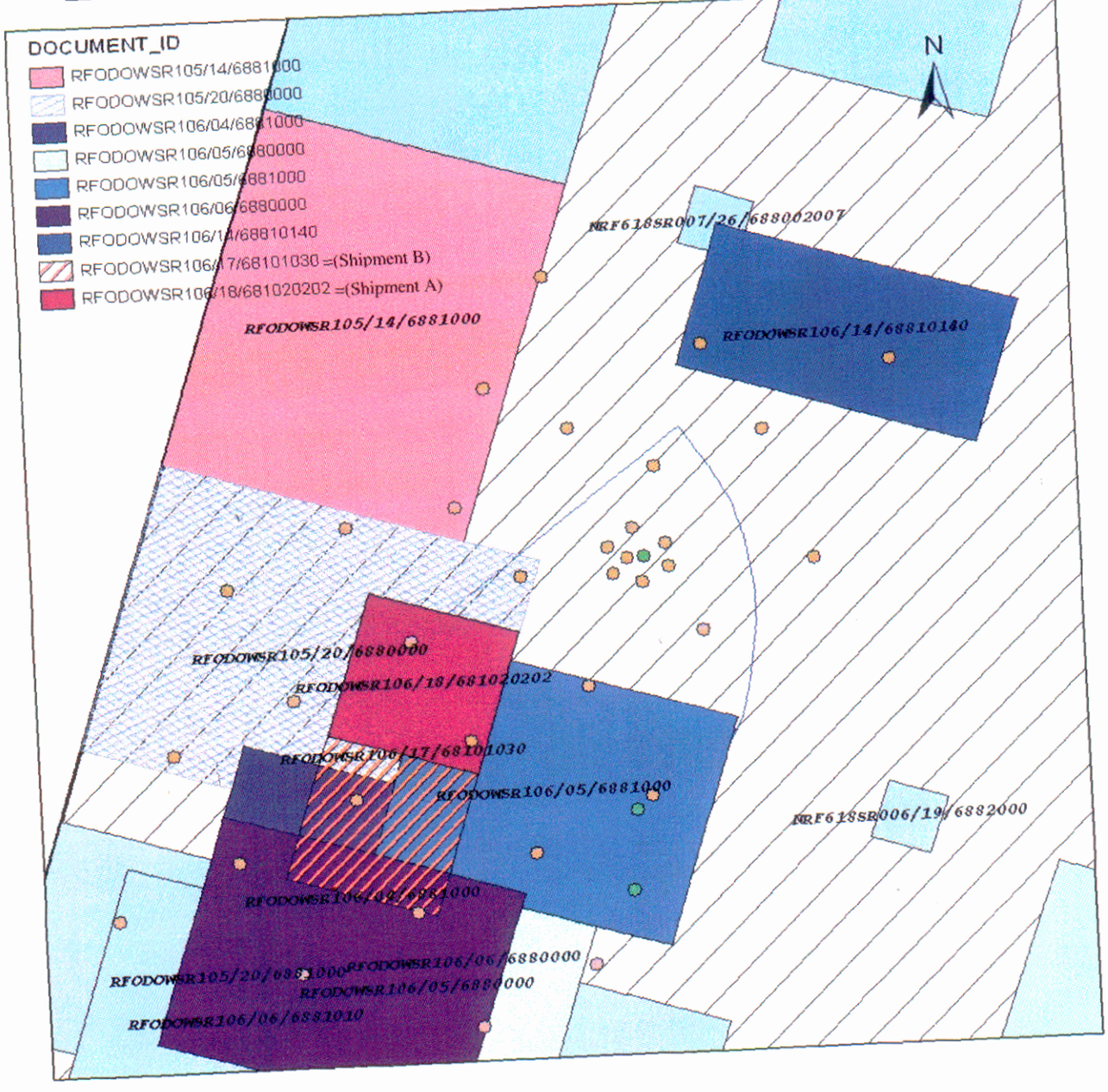
Building numbers	Primary Functions	Major Wastes Generated
771	Pu Chemical Recycle and Am-241 recovery	Graphite, Ion-exchange Resins, Glass, Filter Pads, Wet and Dry Combustibles
776	Foundry, Machining, Rolling and Forming	Plutonium, Beryllium, High Enriched Uranium (HEU), Depleted Uranium (D-38)
123	Health Physics and Medical Facilities	Bioassay and Medical Wastes (radioactively contaminated)
746	Empty Drums	Empty Drums

Sludges from building 774	Primary Functions	Major Wastes Generated
741 sludge	First Stage Water Treatment	Pu, Am, Hydrated Oxides of Fe, Mg, Si: sludge 50-70% water
742 sludge	Second Stage Water Treatment	Pu, Am, Hydrated Oxides of Fe, Mg, Si: 50-70% water (lower activity than first
743 sludge	Organic Sludges	CCl4, Regal Oil, 111TCA, TCE, PCE, Oil Dry
745sludge	Evaporator Salts – Nitrate Sludges	NaNO3, KNO3, paper, rags, gloves, etc.

TYPE

Waste Type. Solid waste produced at the Rocky Flats
Type I – Combustibles – paper, rags, wood, etc.
Type IV– Sludges from co-precipitation treatment
Type V – Non-combustibles – scrap metal, brick, etc.
LGW - Line generated waste - Graphite
Type V, LGW - Graphite

Map of Historical Shipment with Shipment Numbers

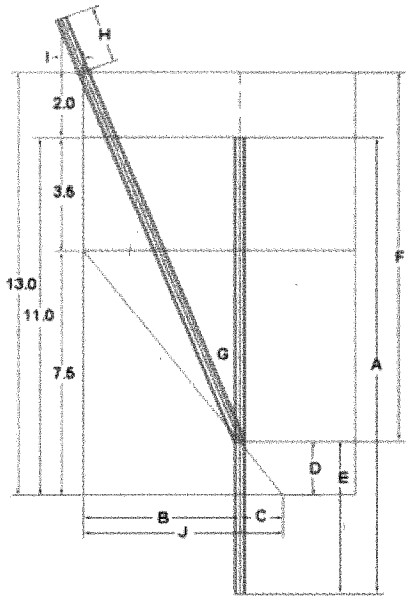


Appendix B

Probe Table

Probe Table

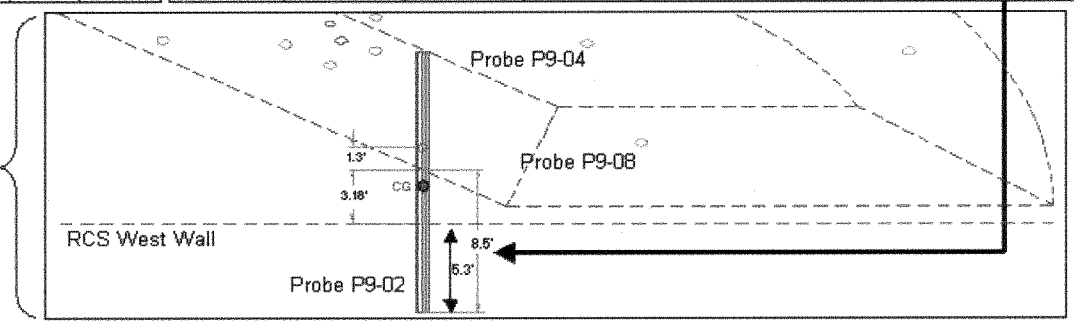
Floor Height =	2.0 ft
Depth to Underburden =	11.0 ft
Waste Layer Thickness =	7.5 ft
Angle of Repose =	52.0 deg
Width of Repose =	5.9 ft



Probe ID	Depth	A	B Wall Distance	C Base in Repose	D Repose Height	E Lift to Clear	F Surface Height	G Tilt Angle	H Extension	I Lateral Extension
			Lateral distance from probe center line to nearest wall	Lateral distance from probe center line to lower edge of respose	Height of repose surface (@ probe penetration) above underburden surface	Height to lift probe to clear repose	Height from probe, at repose surface, to RCS floor	Angle of probe, if pivoted to nearest wall (vertical is zero)	Extension of probe beyond nearest floor	Lateral extension of probe beyond nearest floor
P9-22	12'4"	12.3	0.9	5.0	6.4	7.7	6.6	7.6	5.6	0.7
P9-20	12'4"	12.3	4.6	1.3	1.7	3.0	11.3	21.9	0.1	0.0
P9-20-01	13'9"	13.8	4.8	1.0	1.3	4.1	11.7	22.5	1.1	0.4
P9-20-02	12'4"	12.3	3.2	2.7	3.5	4.8	9.5	18.3	2.3	0.7
P9-20-03	12'2"	12.2	3.2	2.6	3.4	4.5	9.6	18.6	2.0	0.6
P9-20-04	12'6"	12.5	5.4	0.4	0.6	2.1	12.4	23.5	-1.1	-0.4
P9-20-05	12'0"	12.0	6.0	-0.1	0.0	1.0	13.0	24.7	-2.3	-1.0
P9-20-06	12'3"	12.3	6.5	-0.6	0.0	1.3	13.0	26.4	-2.3	-1.0
VP (P9-20)			5.2	0.7						
P9-02	15'6"	15.5	1.1	4.8	6.1	10.6	6.9	9.0	8.5	1.3
P9-03	11'6"	11.5	4.0	1.9	2.4	2.9	10.6	20.6	0.2	0.1
▲ P9-04	16'6"	16.5	9.7	-3.8	0.0	5.5	13.0	36.6	0.3	0.2
▲ P9-08	13'6"	13.5	3.8	2.1	2.7	5.2	10.3	20.1	2.5	0.9
P9-09	11'6"	11.5	1.9	4.0	5.1	5.6	7.9	13.4	3.4	0.8
P9-10	9'6"	9.5	2.7	3.2	4.1	2.6	8.9	16.6	0.2	0.1
VP (P9-09)			2.1	3.8						
	ft, in	ft	ft	ft	ft	ft	ft	deg	ft	ft
* Nearest RCS West Wall										
P920 cluster laying along fan radius, towards excavator.										
P9-20	12'4"	12.3	11.6	1.3	1.7	3.0	11.3	45.5	-3.9	-2.8
P9-20-01	13'9"	13.8	10.4	1.0	1.3	4.1	11.7	41.8	-1.9	-1.3
P9-20-02	12'4"	12.3	10.6	2.7	3.5	4.8	9.5	48.0	-1.9	-1.4
P9-02 falling directly towards confinement wall (Distance from shoring wall to confinement wall is 3.18').										
P9-02	15'6"	15.5	1.3	4.8	6.1	10.6	6.9	10.8	8.5	1.6

Probe P9-02 Worst Case Scenario:

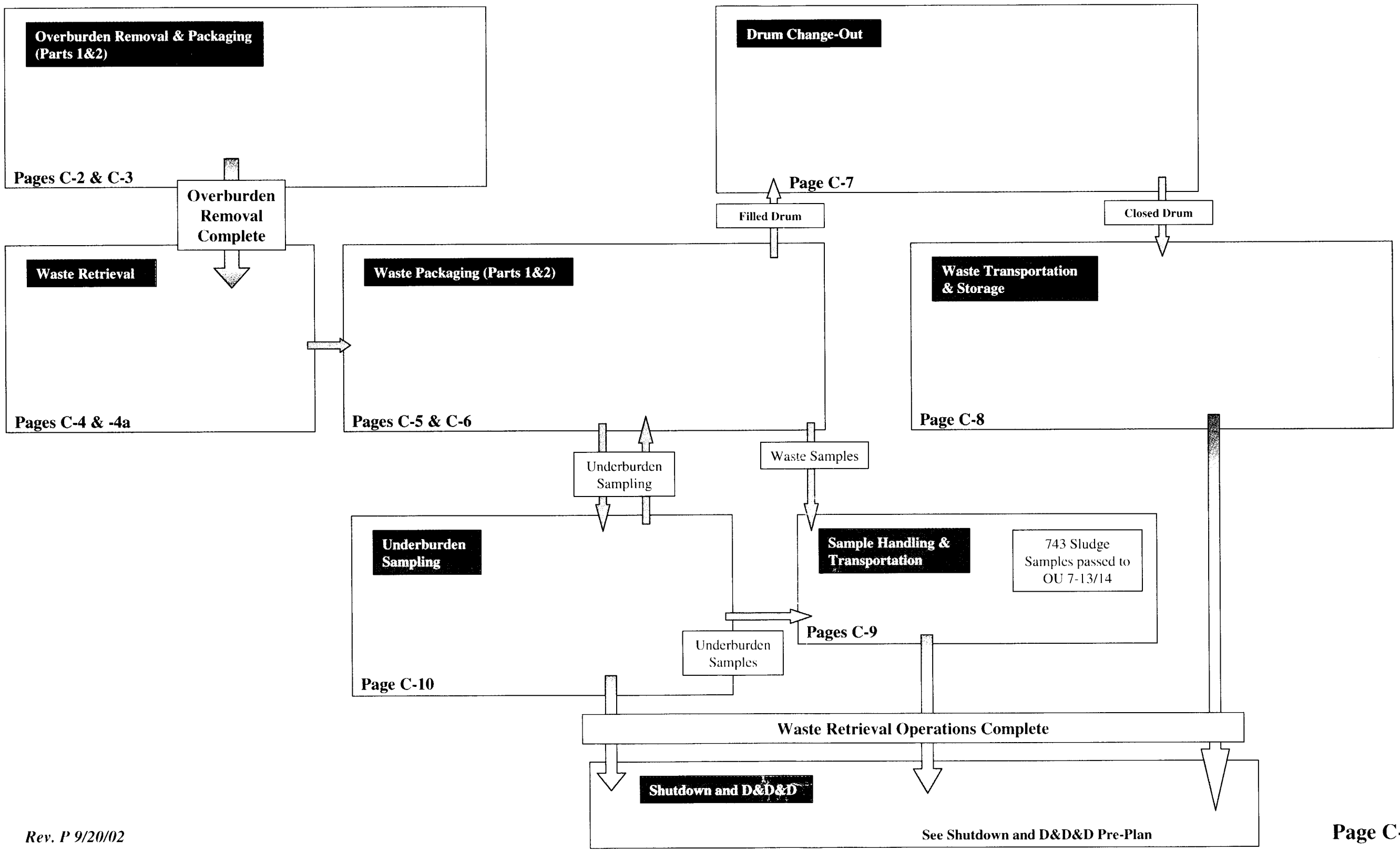
P9-02 is lifted out of waste repose and dropped in place. P9-02 falls directly towards the RCS west wall and hits the RCS floor. Due to P9-02's center of gravity (CG) being above the RCS floor, the probe attempts to lay perpendicular to the floor. Hence, probe P9-02 penetrates the west RCS wall by 5.3-



Appendix C

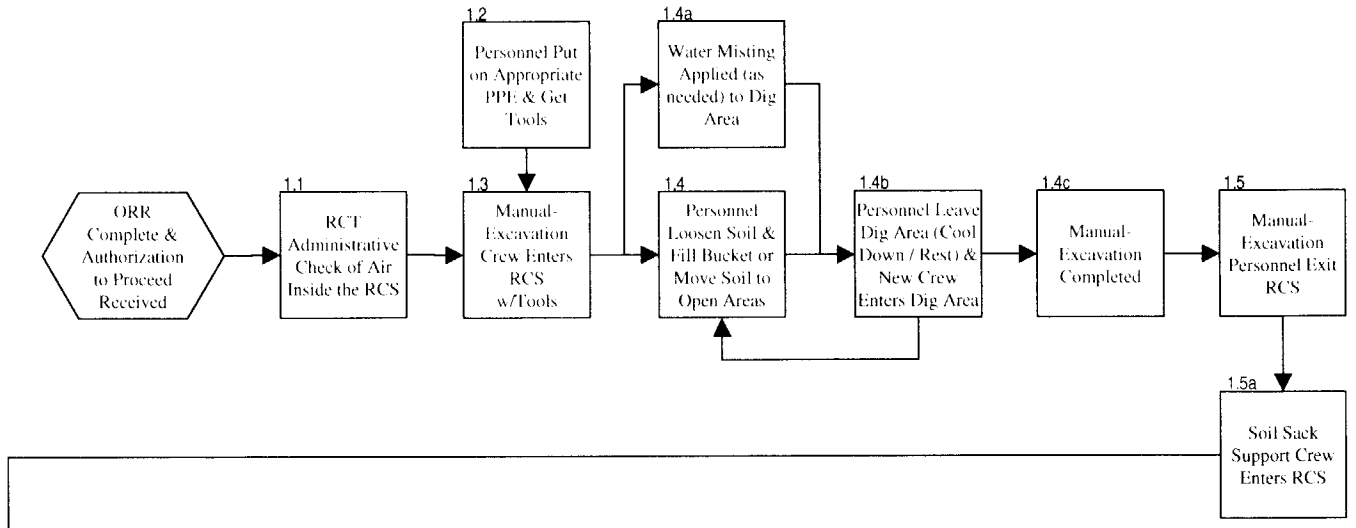
Process Logic Diagrams

Process Overview

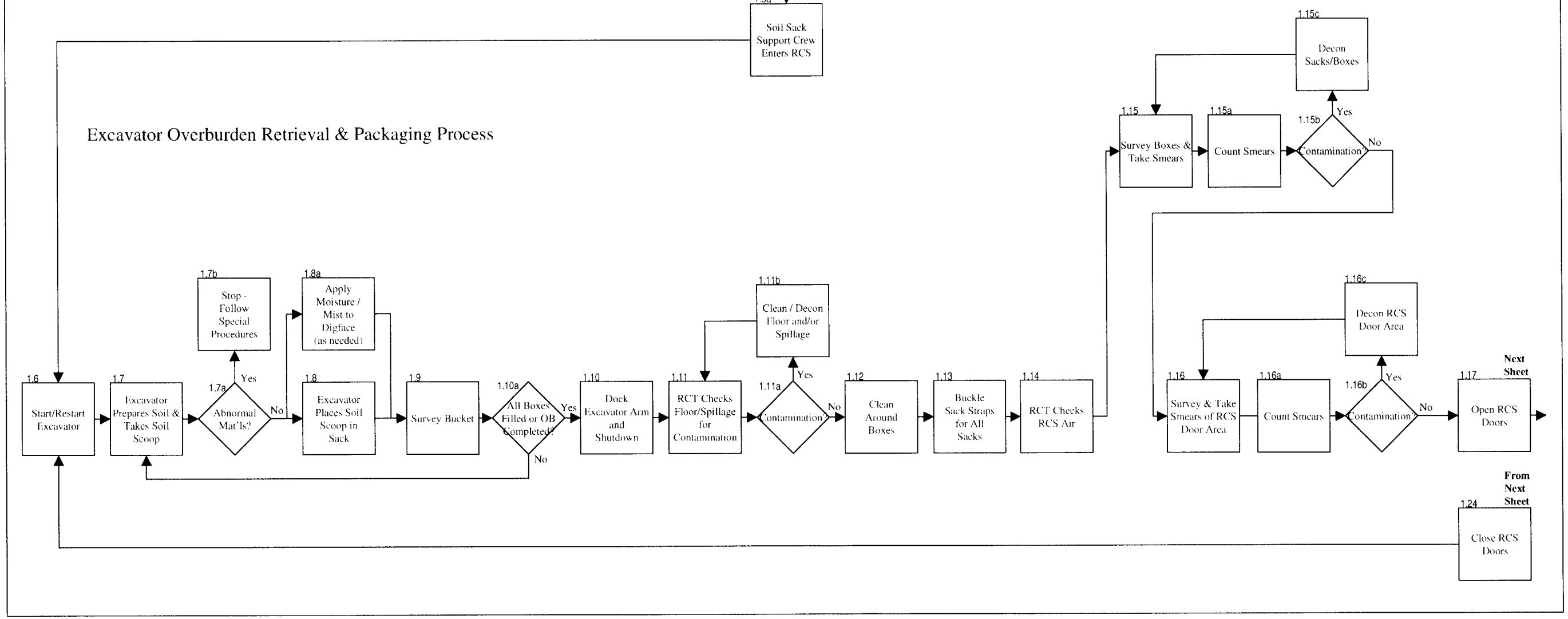


Overburden Removal & Packaging (Part 1)

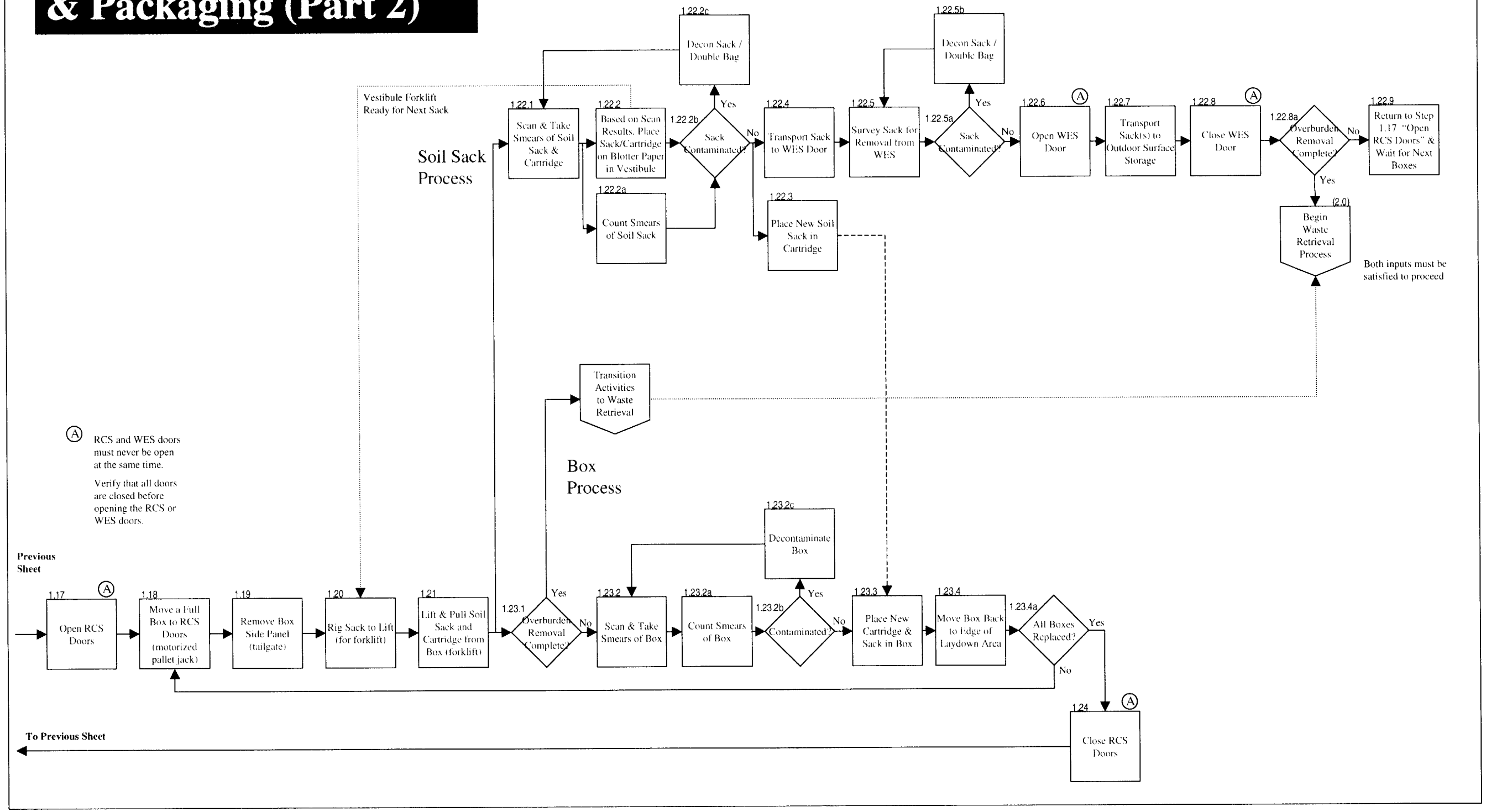
Overburden Manual-Excavation Process



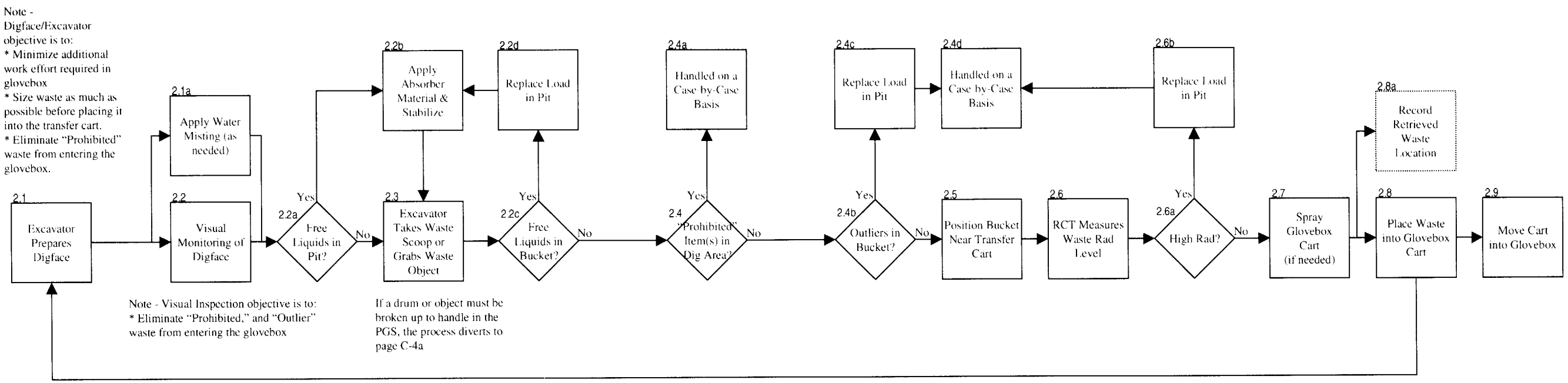
Excavator Overburden Retrieval & Packaging Process



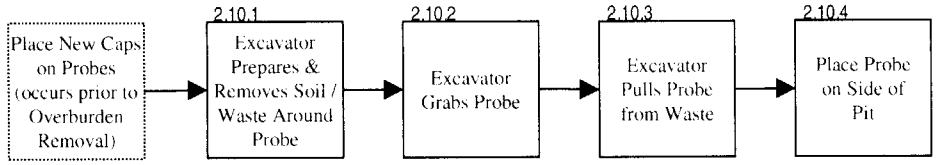
Overburden Removal & Packaging (Part 2)



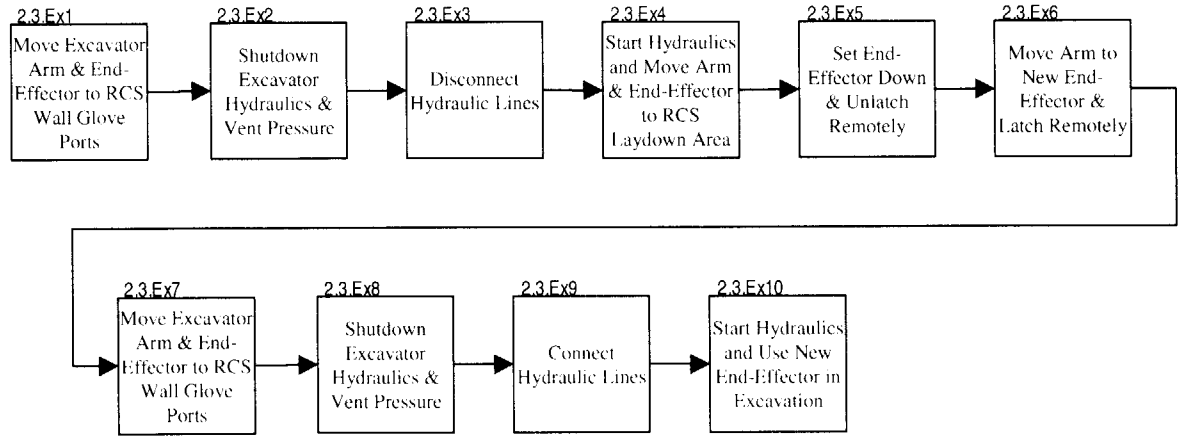
Waste Retrieval



Probe Relocation Process



End-Effector Exchange Process

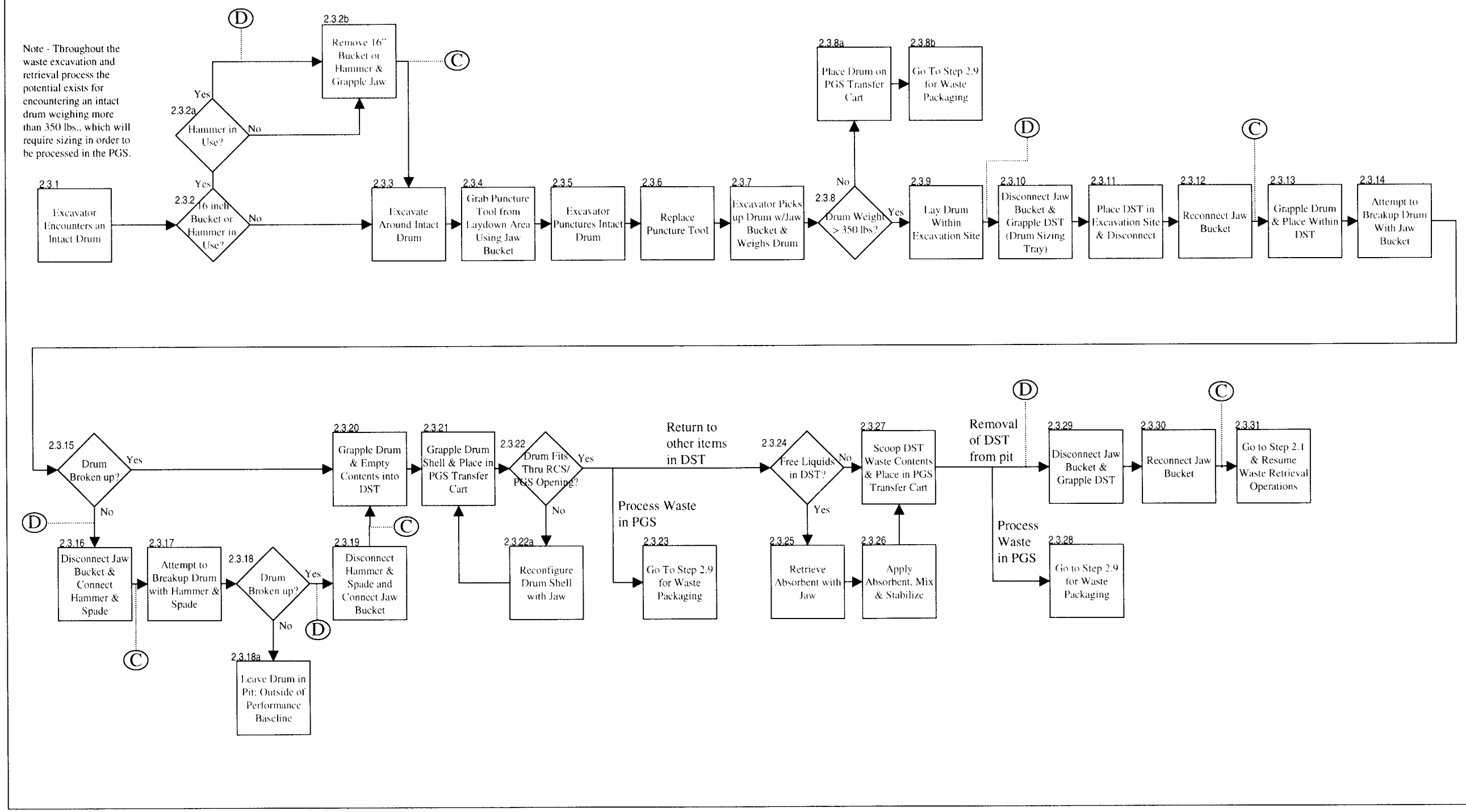


Drum Breakup

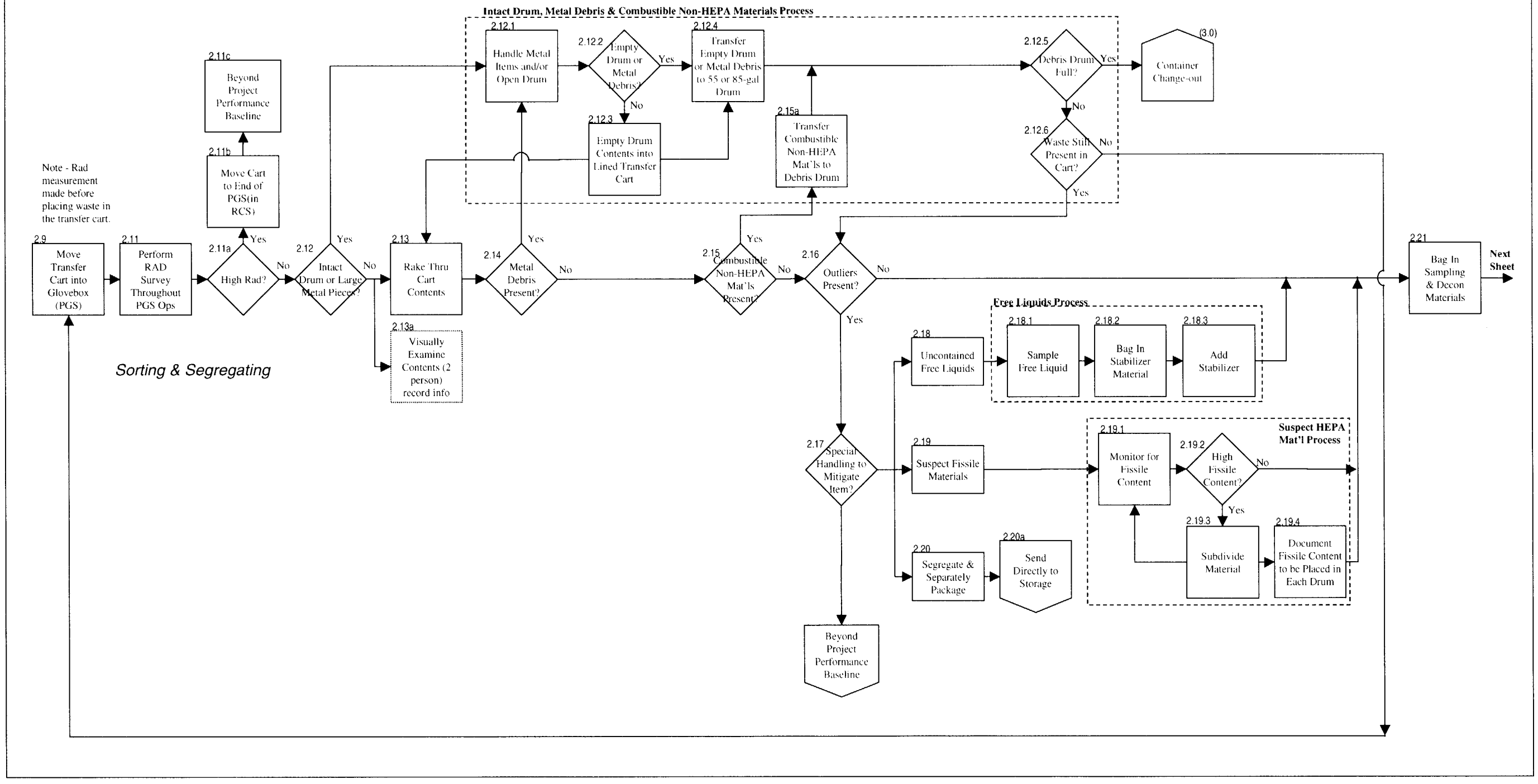
Ⓓ Move Excavator Arm to RCS Wall Glove Port & Disconnect Hydraulics (Steps 2.3.Ex)

Ⓒ Move Excavator Arm to RCS Wall Glove Port & Connect Hydraulics (Steps 2.3.Ex)

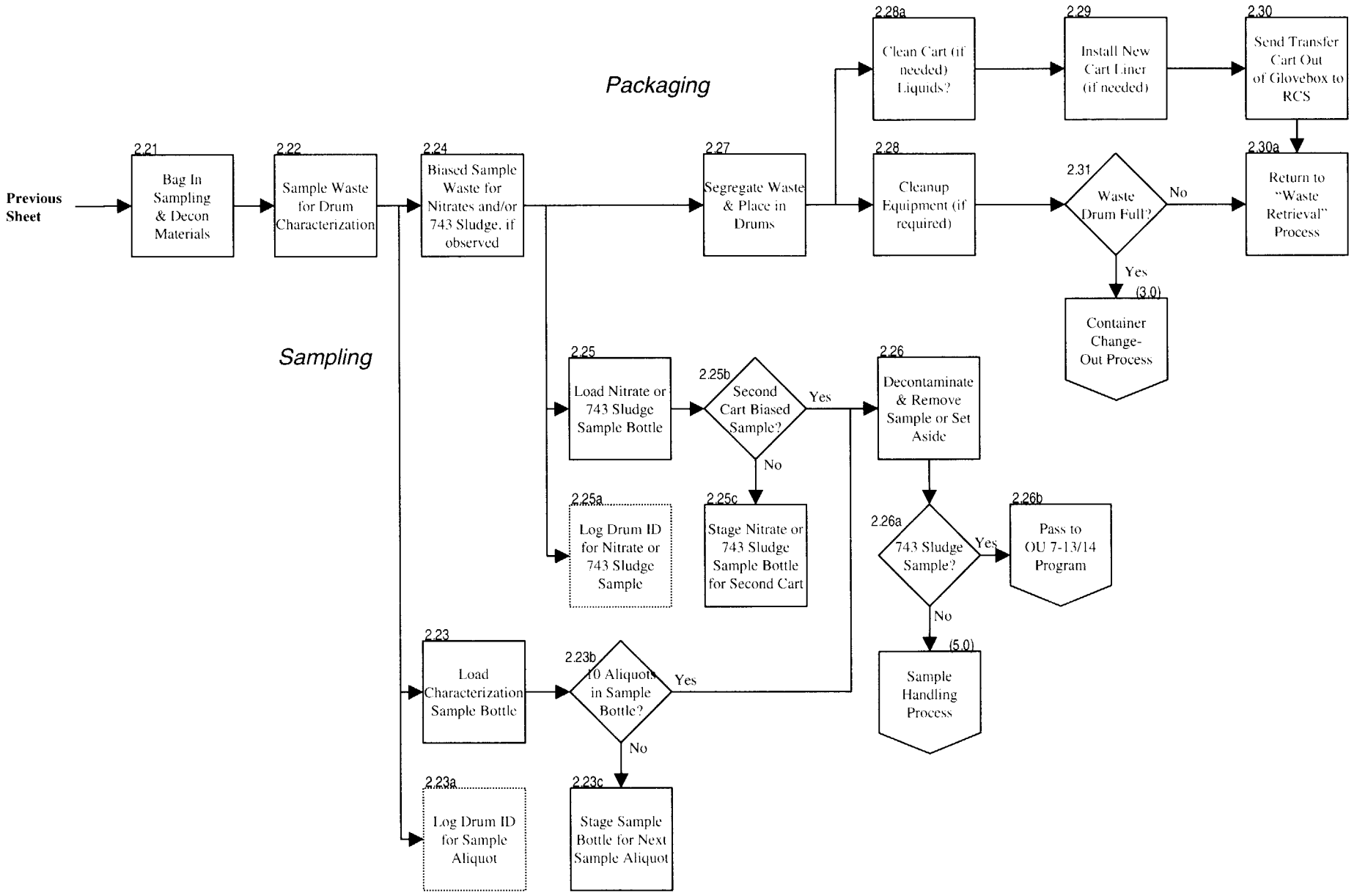
Note - Throughout the waste excavation and retrieval process the potential exists for encountering an intact drum weighing more than 350 lbs., which will require sizing in order to be processed in the PGS.



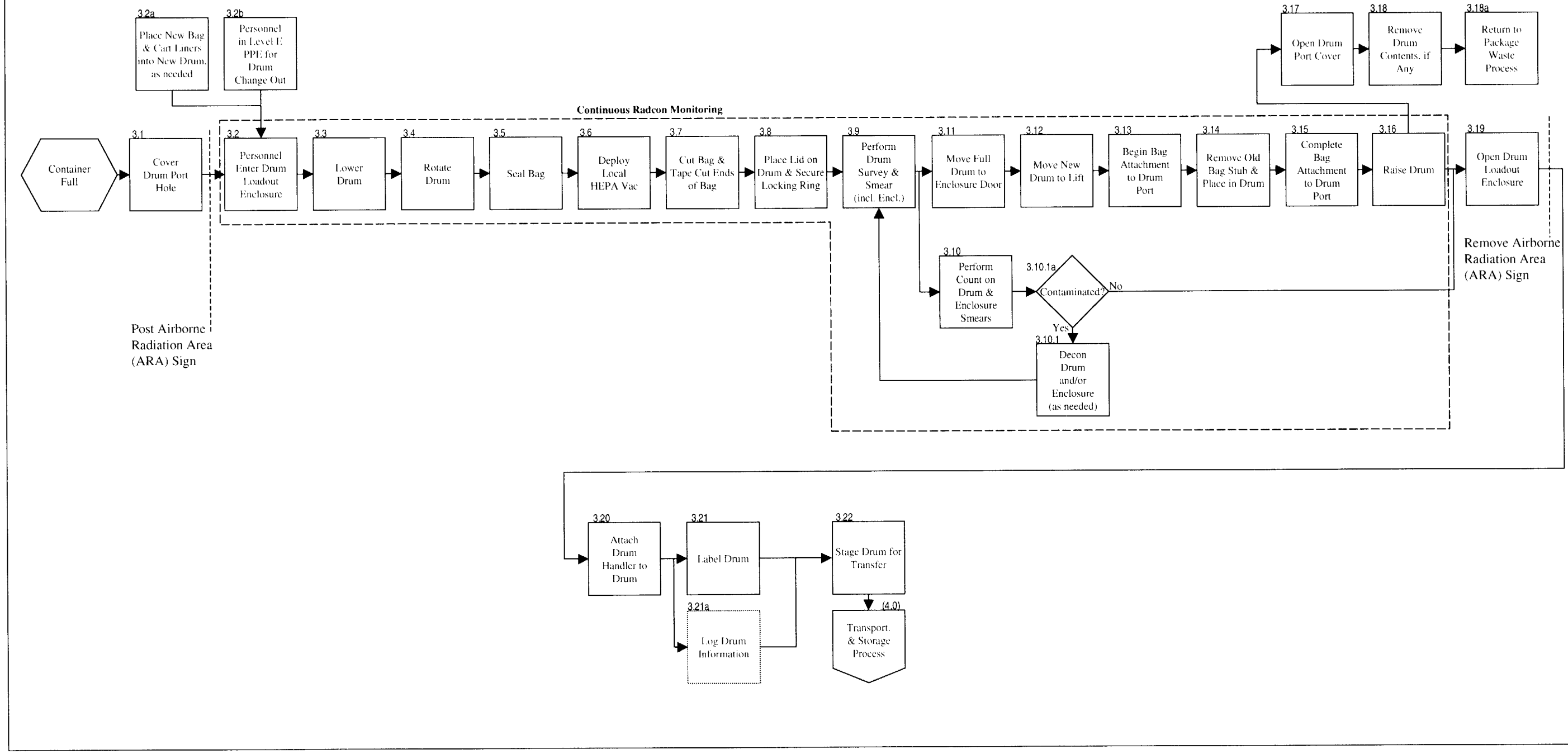
Waste Packaging (Part 1)



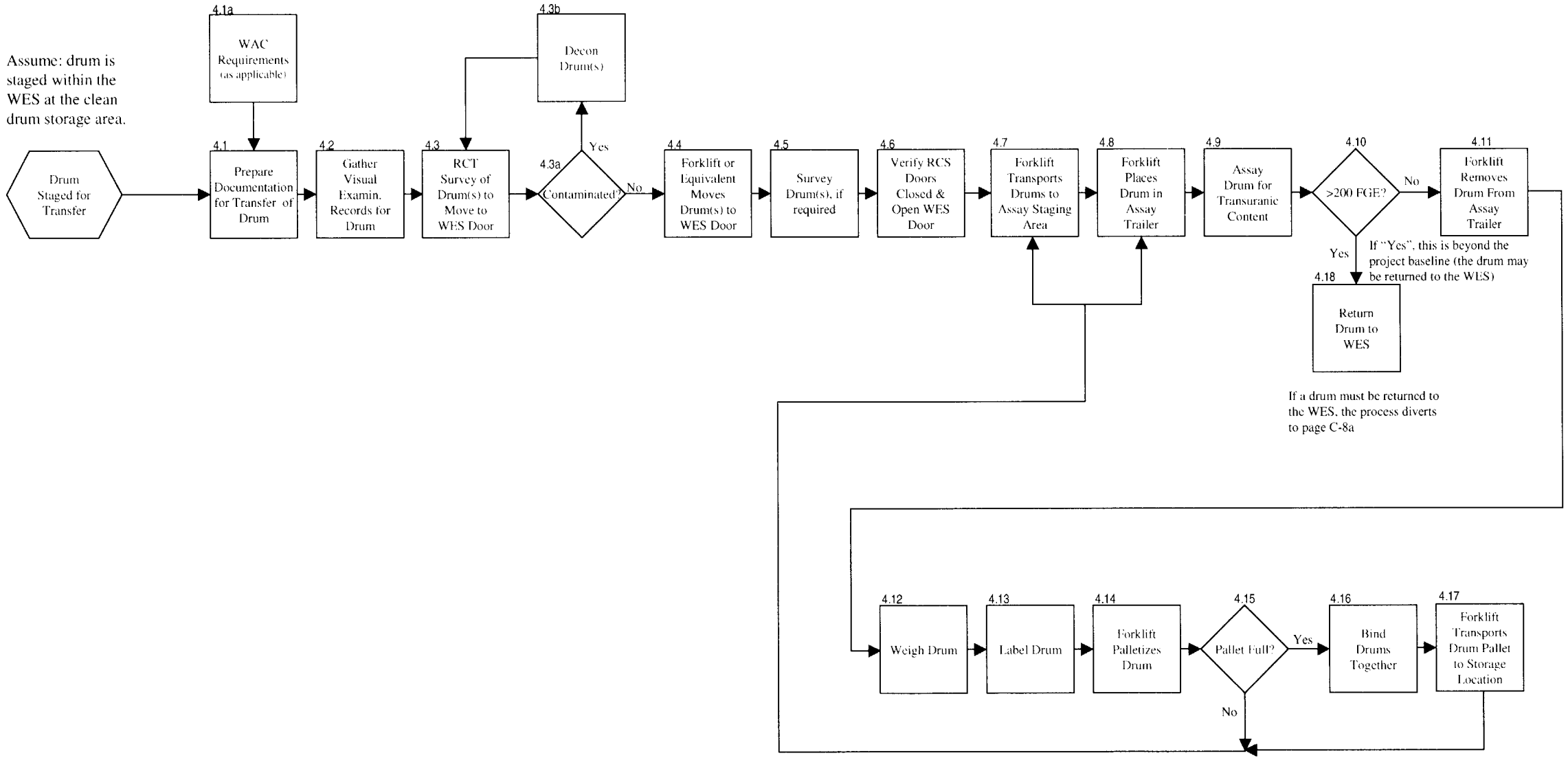
Waste Packaging (Part 2)



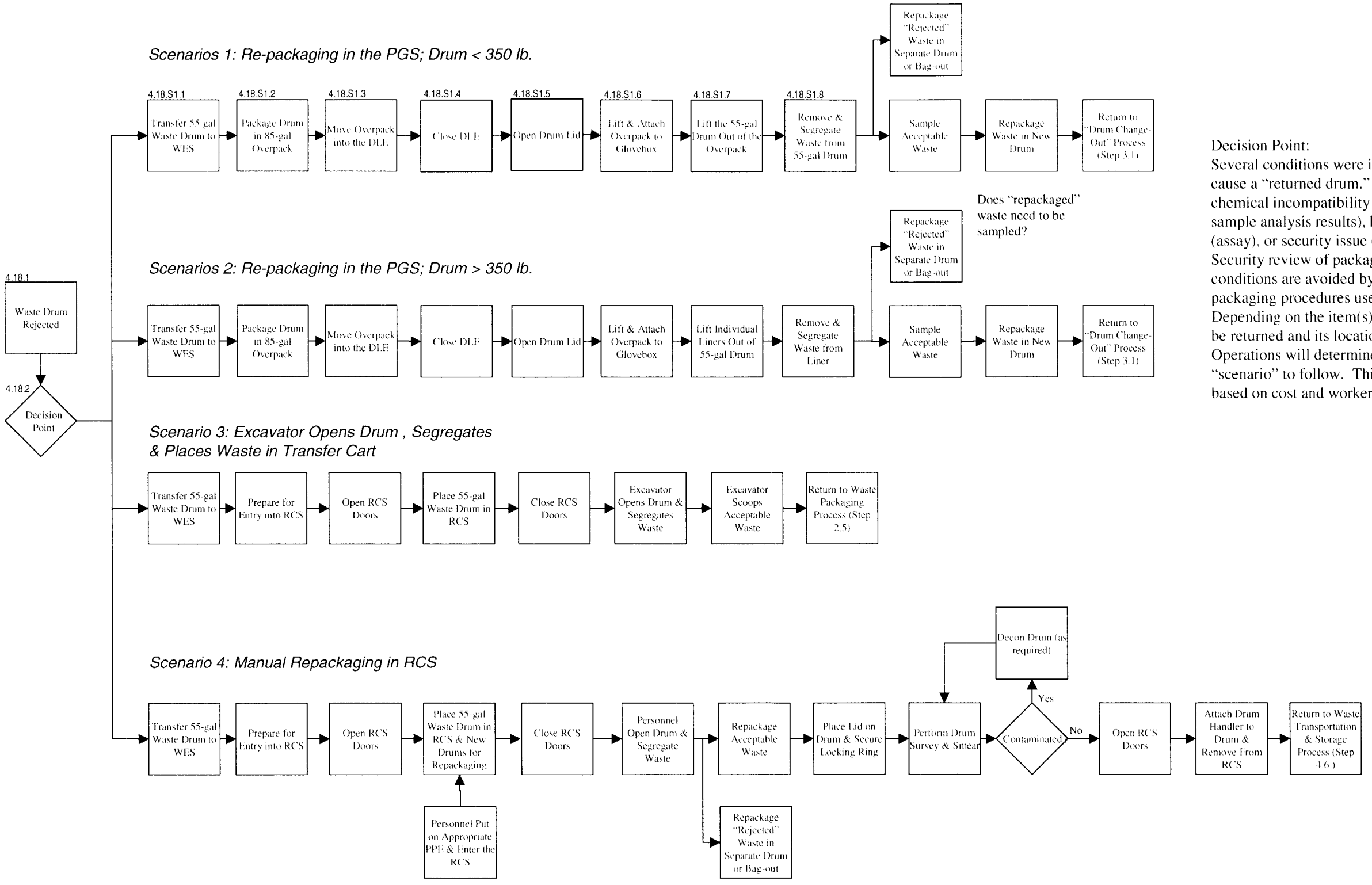
Drum Change-Out



Waste Transportation & Storage



Return Drum Scenarios

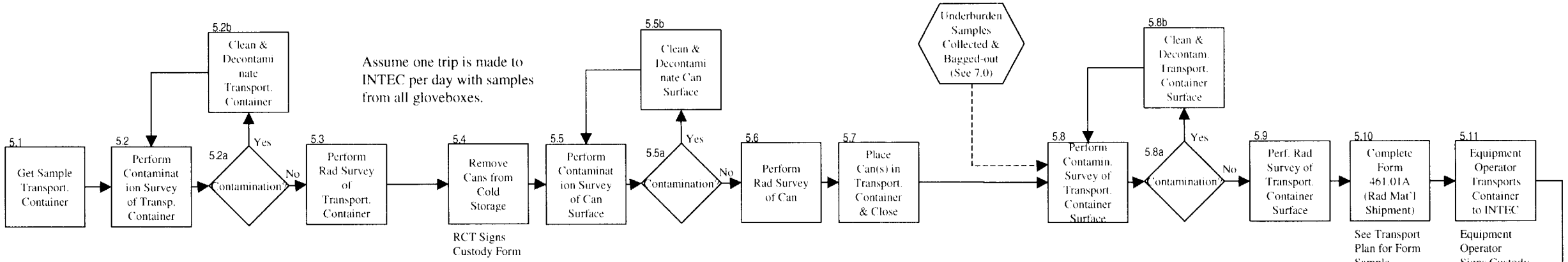


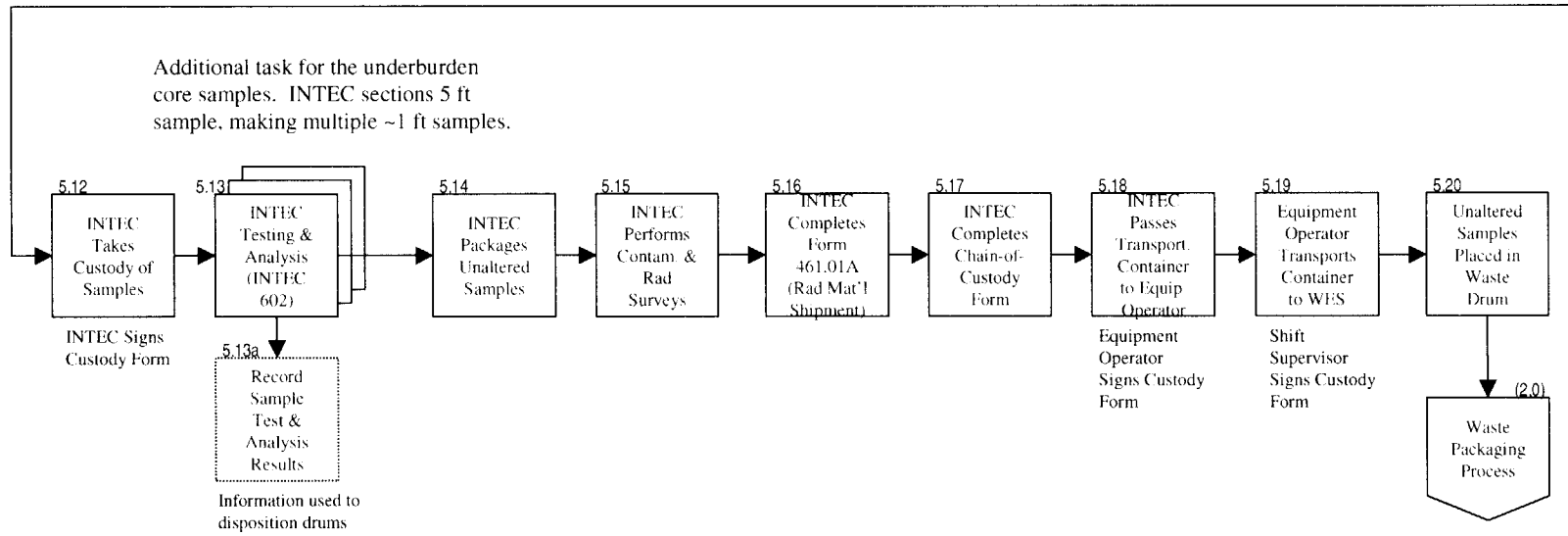
Decision Point:
Several conditions were identified that would cause a "returned drum." These included chemical incompatibility (as identified from sample analysis results), high fissile content (assay), or security issue (as identified by Security review of packaging videos). These conditions are avoided by screening and packaging procedures used in the glovebox. Depending on the item(s) causing the drum to be returned and its location within the drum, Operations will determine the appropriate "scenario" to follow. This decision will be based on cost and worker health and safety.

Sample Handling & Transportation

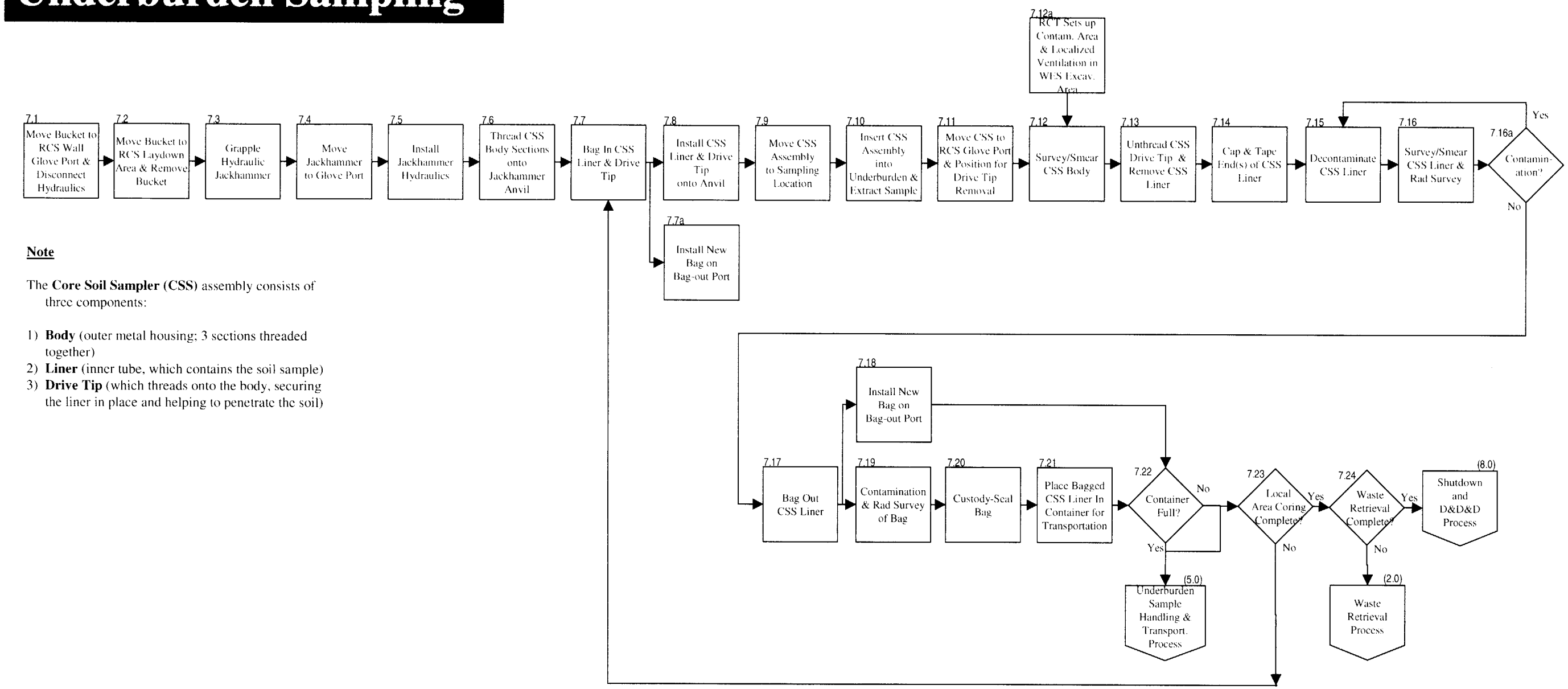
Process assumes:
- 10 aliquots (1 sub-aliquot per cart) taken and composited in one sample container and designated as one sample.
- Sample containers placed in alpha can (i.e., French can) for removal from Glovebox.
- Samples transported approximately once a day from the WES

Underburden samples join the Sample Handling & Transportation Process at this point. These samples have been packaged for transport to INTEC (see step 7.22 of the Underburden Sampling Process, page C-10)





Underburden Sampling



Note

The **Core Soil Sampler (CSS)** assembly consists of three components:

1) **Body** (outer metal housing; 3 sections threaded together)
2) **Liner** (inner tube, which contains the soil sample)
3) **Drive Tip** (which threads onto the body, securing the liner in place and helping to penetrate the soil)

Appendix D

OU 7-10 Glovebox Excavator Method Project
Process Flow Diagrams

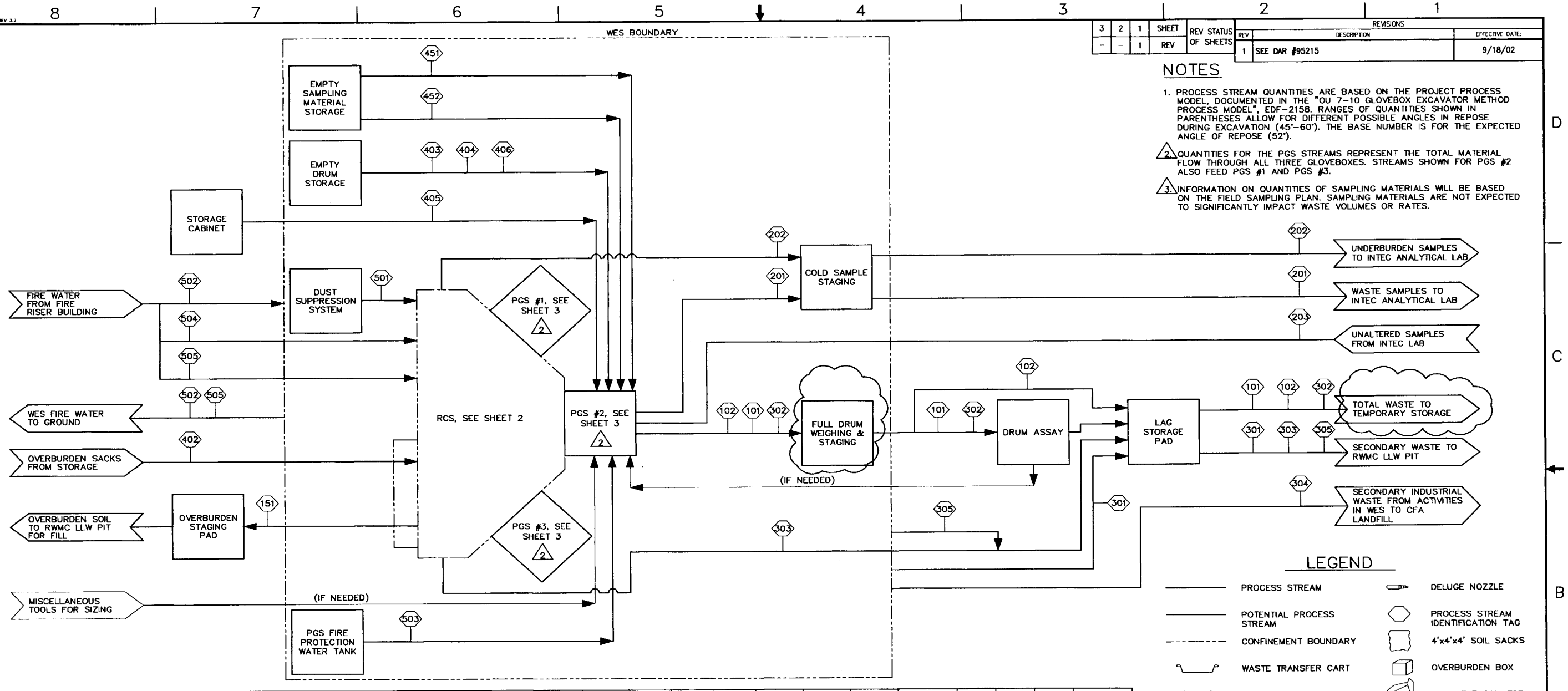
3	2	1	SHEET
–	–	1	REV

REV STATUS OF SHEETS

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE
1	SEE DAR #95215	9/18/02

NOTES

1. PROCESS STREAM QUANTITIES ARE BASED ON THE PROJECT PROCESS MODEL, DOCUMENTED IN THE "OU 7-10 GLOVEBOX EXCAVATOR METHOD PROCESS MODEL", EDF-2158. RANGES OF QUANTITIES SHOWN IN PARENTHESES ALLOW FOR DIFFERENT POSSIBLE ANGLES IN REPOSE DURING EXCAVATION (45°-60°). THE BASE NUMBER IS FOR THE EXPECTED ANGLE OF REPOSE (52°).
2. QUANTITIES FOR THE PGS STREAMS REPRESENT THE TOTAL MATERIAL FLOW THROUGH ALL THREE GLOVEBOXES. STREAMS SHOWN FOR PGS #2 ALSO FEED PGS #1 AND PGS #3.
3. INFORMATION ON QUANTITIES OF SAMPLING MATERIALS WILL BE BASED ON THE FIELD SAMPLING PLAN. SAMPLING MATERIALS ARE NOT EXPECTED TO SIGNIFICANTLY IMPACT WASTE VOLUMES OR RATES.



LEGEND

- PROCESS STREAM
- POTENTIAL PROCESS STREAM
- CONFINEMENT BOUNDARY
- WASTE TRANSFER CART
- TRAY
- DELUGE NOZZLE
- PROCESS STREAM IDENTIFICATION TAG
- 4'x4'x4' SOIL SACKS
- OVERBURDEN BOX
- REMOTE EXCAVATOR

PROCESS STREAM	101	102	151	201	202	203	301	302	303	304	305	402	403	404	405	406	451	452	501	502	503	504	505
DESCRIPTION	PIT WASTE – 55 GAL DRUM	PIT WASTE – 85 GAL DRUM	OVER-BURDEN SOIL IN SACK	SAMPLE – PIT WASTE	SAMPLE – UNDER-BURDEN	RETURNED WASTE SAMPLES	WES SEC WASTE	PGS SEC MTRU WASTE	SEC WASTE FROM OB REMOVAL	NON-RAD SEC WASTE	WES RAD SURVEY WASTE	OVER-BURDEN SOIL SACK	55 GAL DRUM ASSY	85 GAL DRUM ASSY	GLOVE-BOX MATL	WASTE TARP TO LINE CART	EMPTY SAMPLE BOTTLE	SAMPLING SPOONS, ETC	DUST SUPPRESSION WATER	FIRE WATER WES	FIRE WATER PGS	FIRE WATER RCS	FIRE WATER RCS NOZZLES
CUBIC FEET / 12 HOUR SHIFT	---	---	160	---	---	---	21.3	4.9	---	0.7	---	---	---	---	---	---	---	---	---	---	---	---	---
DRUMS / 12 HOUR SHIFT	14	1.2	---	---	---	---	3	0.7	---	---	---	---	14	1.2	---	---	---	---	---	---	---	---	---
UNITS / 12 HOUR SHIFT	---	---	3	2.5	---	---	---	---	---	---	---	3	---	---	AR	28	2.5	3	---	---	---	---	---
GALLONS/HOUR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.5	30,000	1,500	18,000	30,000
GALLONS, MAXIMUM	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	500	60,000	750	36,000	60,000
CUBIC YARDS, TOTAL	---	---	66	---	---	---	30	6.9	---	1	---	---	---	---	---	---	---	---	---	---	---	---	---
DRUMS, TOTAL	536	44	---	---	---	---	116	27	1	4	1	---	536	44	---	---	---	---	---	---	---	---	---
UNITS, TOTAL	---	---	48	94	6	UNK	---	---	---	---	---	48	---	---	AR	1,083	94	SEE NOTE 3	---	---	---	---	---

SUBCONTRACT NO. NA
REQUESTER: SA DAVIES
DESIGN: S WALSH
DRAWN: TB UMPHLETTE
PROJECT NO. 021052
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO. 93348
EFFECTIVE DATE: 07/10/2002

INEEL — Idaho National Engineering & Environmental Laboratory, LOCKHEED MARTIN IDAHO, LLC

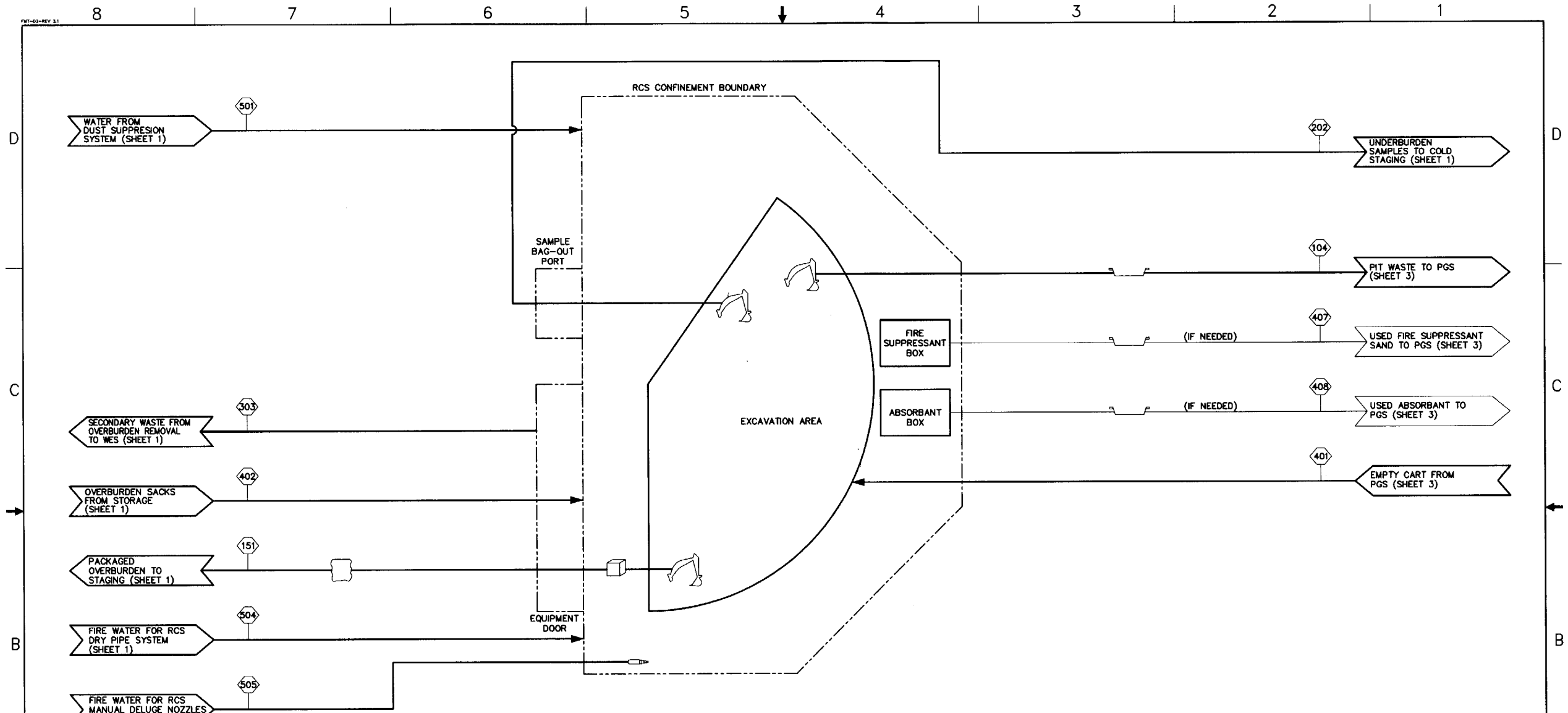
OU 7-10
GLOVEBOX EXCAVATOR METHOD PROJECT

PROCESS FLOW DIAGRAMS AND LEGEND

SIZE D | CAGE CODE 01MF3 | INDUSTRY CODE NUMBER: AREA 098 | TYPE 0671 | CL 38 | ORIG 090 | DWG-522048 | REV 1
SCALE: NONE | SHEET 1 OF 3

PROFESSIONAL ENGINEER REGISTERED STATE OF IDAHO STEPHANIE WALSH

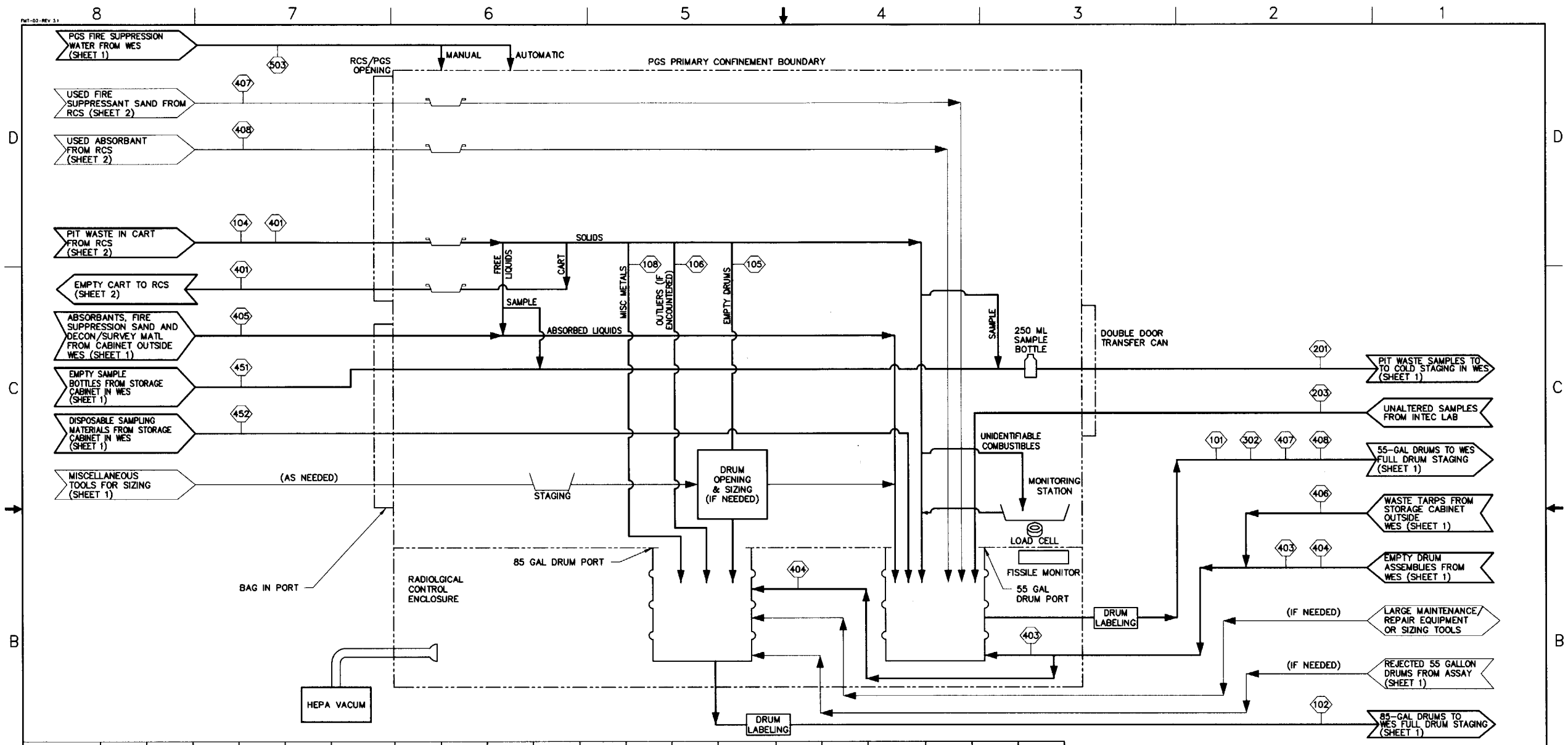
File: 522048-1.dwg Path: G:\GLOVEBOX\detail drawings\ ID: JAM4 Layout Name: Layout1 PrintDate: 09/18/02 - 10:40 A.M.



PROCESS STREAM	104	151	202	303	401	402	407	408	501	504	505
DESCRIPTION	TOTAL PIT WASTE	OVERBURDEN SOIL IN SACK	SAMPLE – UNDER-BURDEN	SEC WASTE FROM OB REMOVAL	WASTE TRANSFER CART	OVERBURDEN SOIL SACK	MgO_2 SAND	EXFOLIATED VERMICULITE	DUST SUPPRESSION WATER	FIRE WATER RCS	FIRE WATER RCS NOZZLES
CUBIC FEET / 12 HOUR SHIFT	55.5	160	---	---	---	---	---	---	---	---	---
DRUMS / 12 HOUR SHIFT	15.2	---	---	---	---	---	---	---	---	---	---
UNITS / 12 HOUR SHIFT	---	3	---	---	28	3	---	---	---	---	---
GALLONS/HOUR	---	---	---	---	---	---	---	---	8.5	18,000	30,000
GALLONS, MAXIMUM	---	---	---	---	---	---	---	---	500	36,000	60,000
CUBIC YARDS, TOTAL	79 (66–92)	66	---	---	---	---	---	---	---	---	---
DRUMS, TOTAL	580	---	---	1	---	---	---	---	---	---	---
UNITS, TOTAL	---	48	6	---	---	48	2–3 CUBIC FT	2–3 CUBIC FT	---	---	---

SIZE	CAGE CODE	INDEX CODE NUMBER					REV
		AREA	TYPE	CL	ORIG		
D	01MF3	098	0671	38	090	DWG-522048	
SCALE: NONE						SHEET 2	

File: 52204802.dwg ID: UMPHTB Layout Name: Layout1
Path: J:\Process Flow Diagram Date: 07/09/02 – 4:11 P.M.



PROCESS STREAM	101	102	104	105	106	108	201	202	203	302	401	403	404	405	406	407	408	451	452	503
DESCRIPTION	PIT WASTE – 55 GAL DRUM	PIT WASTE – 85 GAL DRUM	TOTAL PIT WASTE	EMPTY COOLANT DRUM	OUTLIER WASTE	MISC NON-COMBUSTIBLES	SAMPLE – PIT WASTE	SAMPLE – UNDER-BURDEN	RETURNED WASTE SAMPLES	PGS SEC MTRU WASTE	WASTE TRANSFER CART	55 GAL DRUM ASSEMBLY	85 GAL DRUM ASSEMBLY	GLOVEBOX MATERIALS	WASTE TARP TO LINE CART	MgO_2 SAND	EXFOLIATED VERMICULITE	EMPTY SAMPLE BOTTLE	SAMPLING SPOONS, ETC	FIRE WATER FOR PGS
CUBIC FEET / 12 HOUR SHIFT	---	---	55.5	---	---	---	---	---	---	4.9	---	---	---	---	---	---	---	---	---	---
DRUMS / 12 HOUR SHIFT	14	1.2	15.2	---	---	---	---	---	---	0.7	---	14	1.2	---	---	---	---	---	---	---
UNITS / 12 HOUR SHIFT	---	---	---	---	---	---	2.5	---	---	---	28	---	---	AR	28	---	---	2.5	3	---
GALLONS/HOUR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1500
GALLONS, MAXIMUM	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	750
CUBIC YARDS, TOTAL	---	---	79 (66–92)	---	---	---	---	---	---	6.9	---	---	---	---	---	---	---	---	---	---
DRUMS, TOTAL	536	44	580	97	---	5	---	---	---	27	---	536	44	---	---	---	---	---	---	---
UNITS, TOTAL	---	---	---	---	12	---	94	6	UNK	---	---	---	---	AR	1,083	2–3 CUBIC FT	2–3 CUBIC FT	94	SEE NOTE 1	---

SIZE D | CAGE CODE 01MF3 | INDEX CODE NUMBER: AREA 098, TYPE 0671, CL 38, DRG 090 | DWG- 522048 | REV
SCALE: NONE | SHEET 3

File: 52204803.dwg ID: UMPHTB Layout Name: Layout1
Path: J:\Process Flow Diagram Date: 07/09/02 – 4:11 P.M.