Attachment 51 – Appendix 11.0

Laboratory Building
Index

Attachment 51 – Appendix 11.1
Laboratory Building
Process Flow Diagrams

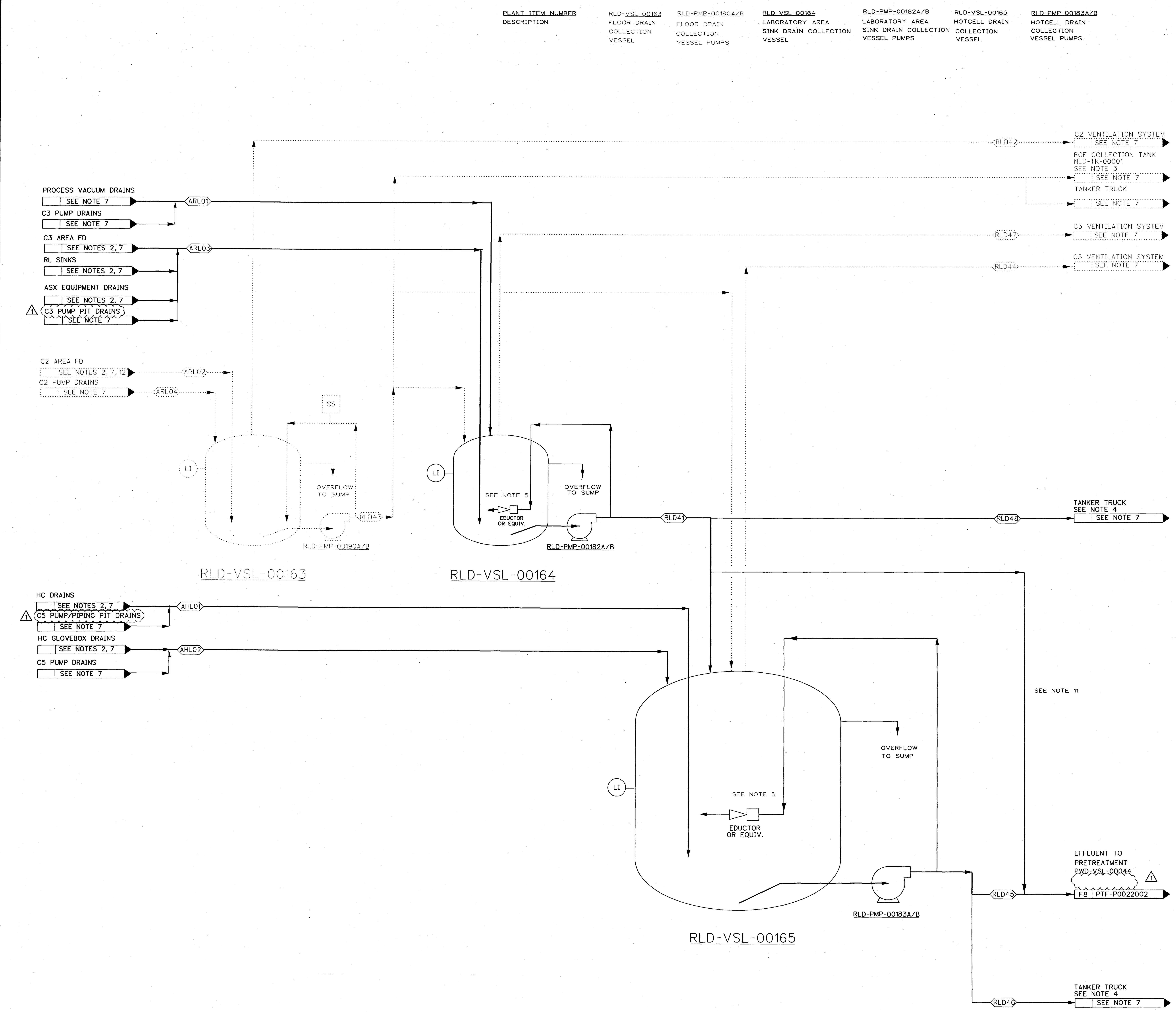
Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

Attachment 51 – Appendix 11.1
Laboratory Building
Process Flow Diagrams

The following drawings have been incorporated into Appendix 11.1 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing/Document	**Description**
24590-LAB-M5-V17T-P0029, Rev 1	Process Flow Diagram (RLD System)
RESERVED	RESERVED



NOTES:

1. SEE DRAWING 24590-WTP-M5-V17T-P0001 FOR SYMBOLS AND LEGEND.
2. ABBREVIATIONS:
   - ASX AUTOSAMPLING SYSTEM
   - FD FLOOR DRAINS
   - RL RADIOLOGICAL LABORATORIES
   - SS SAMPLE STATION
   - HC HOTCELL
3. NON-RADIOACTIVE, NON-DANGEROUS PROCESS EFFLUENT ONLY.
4. FOR "COLD COMMISSIONING" ONLY. TEMPORARY FILTERS WILL BE USED AS NEEDED. FLOW WILL BE ZERO DURING "HOT COMMISSIONING".
5. EQUIPPED WITH INTERNAL WASH RINGS FOR CLEANING.
6. (DELETED)
7. LINES CONNECT WITH SYSTEMS THAT DO NOT HAVE PFDS.
8. CONTENTS OF THIS DOCUMENT ARE DANGEROUS WASTE PERMIT AFFECTING
9. (DELETED)
10. (DELETED)
11. FUTURE CONNECTION
12. EFFLUENTS FROM SAFETY SHOWER EQUIPMENT AND EYEWASH WILL BE INDIRECTLY DRAINED TO RLD-VSL-000163 THROUGH THE C2 FLOOR DRAINS.
13. (DELETED)
14. (DELETED)
15. (DELETED)
16. (DELETED)
17. THE PORTIONS OF THIS DRAWING SHOWN IN PHANTOM ARE CONSIDERED NON-PERMIT AFFECTING AND ARE NOT SUBJECT TO THE REGULATORY REQUIREMENTS OF THE WAC CODE FOR THE DANGEROUS WASTE PERMIT TO THE EXTENT THAT THOSE PORTIONS DO NOT IMPACT DANGEROUS WASTE AREAS/OPERATIONS.

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIAL AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
1	DELETE EFFLUENT ROUTE TO PWD-VSL-00033	NW	AA	SA	KW	1/31/05
0	ISSUED FOR PERMITTING USE	AM	DD	SA	KW	03/08/04

REVISION HISTORY

ISSUED BY RPP-WTP PDC	PROJECT No.	24590
	SITE	HANFORD
	AREA	200E
ISSUE STAMP	BUILDING No.	60

	BY	DATE
ORIGINATOR	AJA MARCHESON	03/08/04
CHECKER	DAVID DODD	03/08/04
APPROVER	KRIS WALVEKAR	03/08/04
REVIEWER	SURAJIT AMRIT	03/08/04

CONTENT APPLICABLE TO ALARA? [X] YES [ ] NO
ADR NO. N/A REV: N/A

RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

WTP ANALYTICAL LABORATORY PROCESS FLOW DIAGRAM RADIOACTIVE LIQUID DISPOSAL

SCALE:
24590-LAB-M5-V17T-P0029 REV 1

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

01/27/2005 12:44:06 PM

R10462146

PLOTTED BY: newilkin
C:\Work\dms06004\24590-LAB-M5-V17T-P0029.dgn

FORM E_SDN.DGN 02/2003

Attachment 51 – Appendix 11.2
Laboratory Building
Piping and Instrumentation Diagrams

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

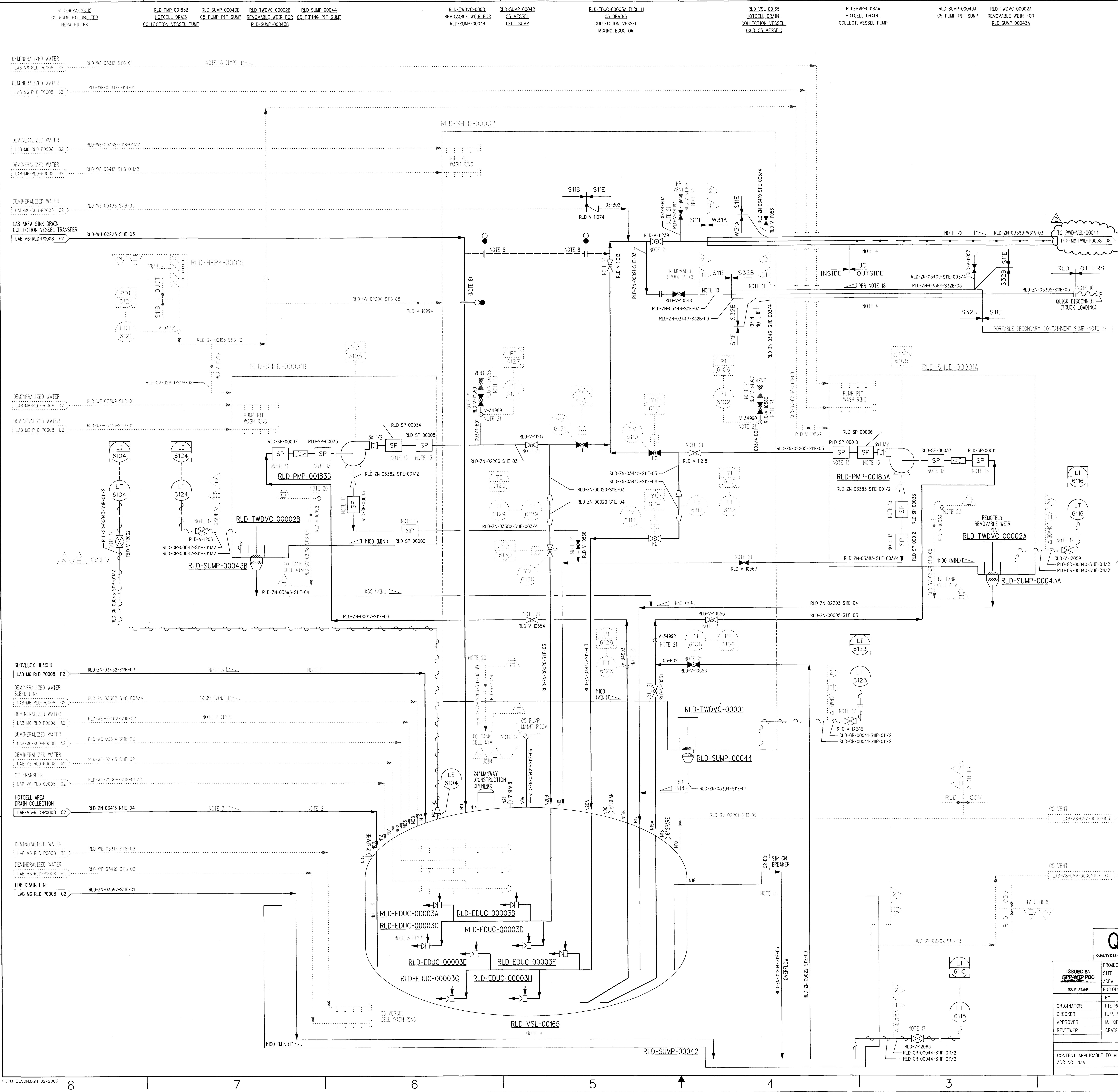
Attachment 51 – Appendix 11.2

Laboratory Building
Piping and Instrumentation Diagrams

The following drawings have been incorporated into Appendix 11.2 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing/Document	Description
24590-LAB-M6-RLD-P0001, Rev 2	Piping & Instrument Diagram Radioactive Liquid Waste Disposal System - C5 Collection and Transfer
24590-LAB-M6-RLD-P0002, Rev 1	Piping & Instrument Diagram Radioactive Liquid Waste Disposal System – C3 Collection & Transfer
24590-LAB-M6-RLD-P0006, Rev 1	Piping & Instrument Diagram Radioactive Liquid Waste Disposal System C3 Rad Lab Collection
24590-LAB-M6-RLD-P0007, Rev 1	Piping & Instrument Diagram Radioactive Liquid Waste Disposal System – C3 Collection & Leak Detection
24590-LAB-M6-RLD-P0008, Rev 1	Piping & Instrument Diagram Radioactive Liquid Waste Disposal System – C5 Collection & Leak Detection
RESERVED	RESERVED

24590-LAB-M6-RLD-P0001



NOTES:

1. SEE DRAWINGS 24590-WTP-M6-50-P0001 THROUGH 24590-WTP-M6-50-P0006 FOR GENERAL NOTES, SYMBOLS AND LEGEND.
2. LONG RADIUS ELBOWS AND SMOOTH FITTINGS SHALL BE USED IN DRAIN COLLECTION PIPING. 3D BENDS OR GREATER ARE PREFERRED TO BUTTWELD ELBOW FITTINGS IN ALL PIPING, WHENEVER PRACTICAL AND PERMITTED BY SPECIFICATION.
3. SLOPE C5 COLLECTION HEADERS 1/8 INCH PER FOOT AS PRACTICAL WITH A MINIMUM OF 1/16 INCH PER FOOT (1:192 SLOPE).
4. TRANSFER PIPING SHOWN SHALL BE DOUBLE-WALL TYPE WHEN NOT PROVIDED WITH SECONDARY CONTAINMENT AND LEAK DETECTION. EXTERIOR SURFACE MATERIALS OF DOUBLE-WALL PIPE ENDCAPS AND CONTAINMENT PIPING EXPOSED TO PUMP AND VALVE PIT ATMOSPHERES SHALL BE THE SAME AS THE PIT LINER MATERIAL.
5. VESSEL MIXING TO BE PROVIDED BY EIGHT TANK MIXING EDUCTORS. CONFIGURATION DETAILS TO BE DEVELOPED WITH VESSEL VENDOR.
6. THE DIP TUBE FOR NOZZLE N03 SHALL HAVE 1/2" DIA. ROUND HOLES. HOLES SHALL BE IN A PATTERN OF SIX ROWS. HOLES SHALL BE APPROXIMATELY 2" APART (CENTER-TO-CENTER) AND BE STAGGERED BETWEEN ADJACENT ROWS.
7. PROVIDE EMERGENCY MANUAL PUMP SHUTOFF SWITCH IN AREA.
8. POTENTIAL BYPASS SPOOL ROUTE (SPOOL AND SPECTACLE BLIND FLANGE WILL BE INSTALLED IF NEEDED).
9. ALL SYSTEMS AND COMPONENTS SHOWN ON THIS DRAWING ARE COMMERCIAL MATERIAL AND SEISMIC CATEGORY IV, UNLESS OTHERWISE INDICATED. VESSEL SHALL BE ADDITIONAL PROTECTION CLASS (APC), COMMERCIAL MATERIAL (CM), AND SEISMIC CATEGORY III (SC-III). COLLARS OR SLEEVES FOR PIPING ENTERING THE CELL OR PIT CONFINEMENT BOUNDARY SHALL BE QL-2 AND SC-III. THE PIT SHIELD PLATES SHALL BE QL-2 AND SC-III. THE PIT-TO-CELL VENTS ARE ADDITIONAL PROTECTION CLASS (APC).
10. HOSE CONNECTION TO BE REMOVED AND PIPING TO BE BLANKED OFF AFTER COLD COMMISSIONING.
11. DOUBLE-WALL PIPE DRAINS TO PIPE PIT FOR INTERSTITIAL LEAKAGE COLLECTION AND MONITORING.
12. PROVISION FOR FUTURE USE. FLOOR SHIELD PLUG TO BE PROVIDED.
13. PROVIDE GRAYLOC TYPE CONNECTORS OR EQUAL FOR PUMP SUCTION, DISCHARGE, AND DRAIN LINES.
14. DELETED
15. CONTENTS OF THIS DRAWING (DOCUMENT) ARE DANGEROUS WASTE PERMIT AFFECTING.
16. ITS EQUIPMENT AND COMPONENTS CANNOT BE PROCURED WITHOUT PRIOR AUTHORIZATION FROM DOE/ORP OR AN AUTHORIZED PSAR.
17. RADAR GUIDE IS TO BE ROUTED TO TRANSMITTER. A FULL PORT BALL VALVE IS REQUIRED FOR ISOLATION PURPOSES AT TRANSMITTER END OF GUIDE TUBE.
18. UNLESS OTHERWISE INDICATED ON THE DRAWING, LINES SHALL BE SELF-DRAINING AND ARRANGED WITH FALLS SO THAT FLUIDS DRAIN TO VESSELS OR INTO LINES THAT CAN BE DRAINED. THESE LINES IN CELLS OR PITS SHALL HAVE A MINIMUM SLOPE OF 1:120. LINES EXTERNAL TO CELL OR PIT AREAS SHALL HAVE A MINIMUM SLOPE OF 1:250.
19. IT IS ACCEPTABLE TO USE LOW POINT DRAINS FOR NON-REGULATED SERVICE LINES LOCATED OUTSIDE OF VESSEL CELLS WHEN DRAINAGE TO A VESSEL IS IMPRACTICAL.
20. PROVIDE MESH SCREEN, (*3 MESH 0.080 IN DIA WIRE, 316SS), TACK WELDED TO INLET OF VENT PIPE INSIDE PIT.
21. VALVE NOT IN THE PIPING SPECIFICATION. DATASHEET TO PROVIDE DETAILED INFORMATION PERTAINING TO THIS VALVE.
22. REFER TO INTERFACING DRAWING FOR MINIMUM SLOPE REQUIREMENTS.
23. DELETED
24. THE PORTIONS OF THIS DRAWING SHOWN IN PHANTOM ARE CONSIDERED NON-PERMIT AFFECTING AND ARE NOT SUBJECT TO THE REGULATORY REQUIREMENTS OF THE WAC CODE FOR THE DANGEROUS WASTE PERMIT TO THE EXTENT THAT THOSE PORTIONS DO NOT IMPACT DANGEROUS WASTE AREAS/OPERATIONS.

REFERENCES:

1. DELETED

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIALS AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

EXPIRES 6-30-06 — 3/18/05

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
2	ISSUED FOR PERMITTING USE					3/21/05
1	ISSUED FOR PERMITTING USE	PM	RPH	CMK	WK	11/03/04
0	ISSUED FOR PERMITTING USE	PM	RPH	CK	MH	03/04/04

REVISION HISTORY

Q — QUALITY DESIGNATOR

ISSUED BY RPP-WTP PDC — ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	60

	BY	DATE
ORIGINATOR	PIETRO MARTINELLI	03/04/04
CHECKER	R. P. HILLS	03/04/04
APPROVER	M. HOFFMANN	03/05/04
REVIEWER	CRAIG KELLER	03/04/04

RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

P&ID - LAB RADIOACTIVE LIQUID WASTE DISPOSAL SYSTEM C5 COLLECTION AND TRANSFER

CONTENT APPLICABLE TO ALARA? [X] YES [ ] NO
ADR NO. N/A — REV. N/A

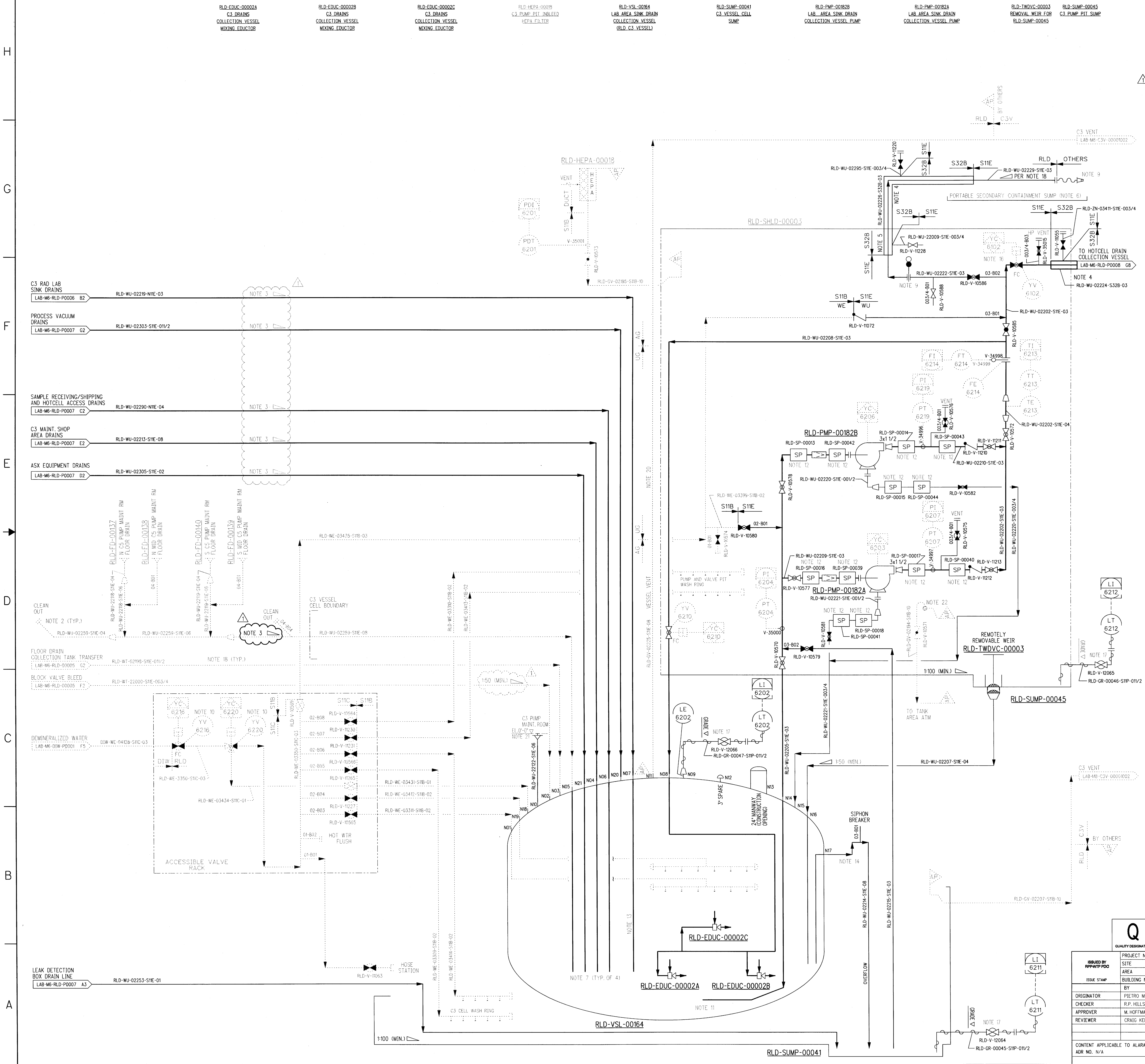
SCALE: NONE — 24590-LAB-M6-RLD-P0001 — REV 2

"E" SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

FORM E_SDN.DGN 02/2003

03/17/2005 08:00:19 AM

PLOTTED BY: tdsomes



NOTES:

1. SEE DRAWINGS 24590-WTP-M6-50-P0001 THROUGH 24590-WTP-M6-50-P0006 FOR GENERAL NOTES, SYMBOLS AND LEGEND.
2. LONG RADIUS ELBOWS AND SMOOTH FITTINGS SHALL BE USED IN DRAIN COLLECTION PIPING. 3D BENDS OR GREATER ARE PREFERRED TO BUTTWELD ELBOW FITTINGS IN ALL PIPING, WHENEVER PRACTICAL AND PERMITTED BY SPECIFICATION.
3. SLOPE C3 COLLECTION HEADERS 1/8 INCH PER FOOT AS PRACTICAL WITH A MINIMUM OF 1/16 INCH PER FOOT (1:192 SLOPE). △1
4. TRANSFER PIPING SHOWN SHALL BE DOUBLE-WALL TYPE WHEN NOT PROVIDED WITH SECONDARY CONTAINMENT AND LEAK DETECTION. EXTERIOR SURFACE MATERIALS OF DOUBLE-WALL PIPE ENDCAPS AND CONTAINMENT PIPING EXPOSED TO PUMP AND VALVE PIT ATMOSPHERE SHALL BE THE SAME AS THE PIT LINER MATERIAL.
5. ENCASEMENT PIPE GRAVITY DRAINS TO PUMP PIT FOR INTERSTITIAL LEAK COLLECTION AND MONITORING.
6. PROVIDE EMERGENCY MANUAL PUMP SHUTOFF SWITCH IN AREA
7. PROVIDE ENGINEERED "WEEP-HOLES" (2 INCH DIA. MAX. EACH) ABOVE VESSEL OVERFLOW LEVEL FOR COMBINED VESSEL VENT FLOW RATE OF 500 CFM.
8. ALL SYSTEMS AND COMPONENTS SHOWN ON THIS DRAWING ARE COMMERCIAL MATERIAL AND SEISMIC CATEGORY IV, UNLESS OTHERWISE INDICATED.
9. HOSE CONNECTION TO BE REMOVED AND PIPING TO BE BLANKED OFF AFTER COLD COMMISSIONING.
10. INTERLOCK TO CLOSE VALVE ON VESSEL RLD-VSL-00164 HIGH LEVEL.
11. THREE EDUCTORS TO BE MOUNTED ON HEADER LOCATED APROXIMATELY ONE FOOT FROM BOTTOM OF THE VESSEL. TWO END EDUCTORS TO BE DIRECTED 30 DEG UPWARD FROM HORIZONTAL AND POINTED IN OPPOSITE DIRECTIONS. THIRD EDUCTOR TO BE LOCATED MIDWAY BETWEEN THE OTHER TWO EDUCTORS AND POINTED 30 DEG DOWNWARD FROM THE HORIZONTAL.
12. PROVIDE GRAYLOC TYPE CONNECTORS OR EQUAL FOR PUMP SUCTION, DISCHARGE, AND DRAIN LINES.
13. DIP TUBE FOR NOZZLE NO. 7 SHALL HAVE 1/2" DIA ROUND HOLES ON TWO SIDES OF THE PIPE, SPACED APPROXIMATELY 3" APART (CENTER-TO-CENTER) OVER THE ENTIRE LENGTH INSIDE VESSEL.
14. DELETED
15. CONTENTS OF THIS DRAWING (DOCUMENT) ARE DANGEROUS WASTE PERMIT AFFECTING.
16. INTERLOCK TO CLOSE VALVE ON VESSEL RLD-VSL-00165 HIGH LEVEL.
17. RADAR GUIDE IS TO BE ROUTED TO TRANSMITTER. A FULL PORT BALL VALVE IS REQUIRED FOR ISOLATION PURPOSE AT TRANSMITTER END OF GUIDE TUBE.
18. UNLESS OTHERWISE INDICATED ON THE DRAWING, LINES SHALL BE SELF-DRAINING AND ARRANGED WITH FALLS SO THAT FLUIDS DRAIN TO VESSELS OR INTO LINES THAT CAN BE DRAINED. THESE LINES IN CELLS OR PITS SHALL HAVE A MINIMUM SLOPE OF 1:120. LINES EXTERNAL TO CELL OR PIT AREAS SHALL HAVE A MINIMUM SLOPE OF 1:250.
19. IT IS ACCEPTABLE TO USE LOW POINT DRAINS FOR NON-REGULATED SERVICE LINES LOCATED OUTSIDE OF VESSEL CELLS WHEN DRAINAGE TO A VESSEL IS IMPRACTICAL.
20. PIPE SHALL BE COATED FOR UNDERGROUND SERVICE PER SPECIFICATION 24590-WTP-3PB-P000-TS11E, PIPING MATERIAL CLASSIFICATION PIPE CLASS S11E, GENERAL NOTES FOR CLASS.
21. PROVISION FOR FUTURE USE. FLOOR SHIELD PLUG TO BE PROVIDED.
22. PROVIDE MESH SCREEN, (#3 MESH 0.080 IN DIA WIRE, 316SS), TACK WELDED TO INLET OF VENT PIPE INSIDE PIT.
23. THE PORTIONS OF THIS DRAWING SHOWN IN PHANTOM ARE CONSIDERED NON-PERMIT AFFECTING AND ARE NOT SUBJECT TO THE REGULATORY REQUIREMENTS OF THE WAC CODE FOR THE DANGEROUS WASTE PERMIT TO THE EXTENT THAT THOSE PORTIONS DO NOT IMPACT DANGEROUS WASTE AREAS/OPERATIONS.

REFERENCES:

1. DELETED

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIALS AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
1	ISSUED FOR PERMITTING USE	(signed)	(signed)	(signed)	(signed)	11/3/04
0	ISSUED FOR PERMITTING USE	PM	RPH	CK	MH	03/05/04

REVISION HISTORY

Q
QUALITY DESIGNATOR

ISSUED BY RPP-WTP PDC
ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	60

BECHTEL
RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

	BY	DATE
ORIGINATOR	PIETRO MARTINELLI	03/04/04
CHECKER	R.P. HILLS	03/05/04
APPROVER	M. HOFFMANN	03/04/04
REVIEWER	CRAIG KELLER	03/04/04

CONTENT APPLICABLE TO ALARA? [X] YES [ ] NO
ADR NO. N/A REV:

P&ID - LAB RADIOACTIVE LIQUID WASTE DISPOSAL SYSTEM - C3 COLLECTION & TRANSFER

SCALE: NONE | 24590-LAB-M6-RLD-P0002 | REV 1

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

11/03/2004 10:46:52 AM

PLOTTED BY: tdbarnes
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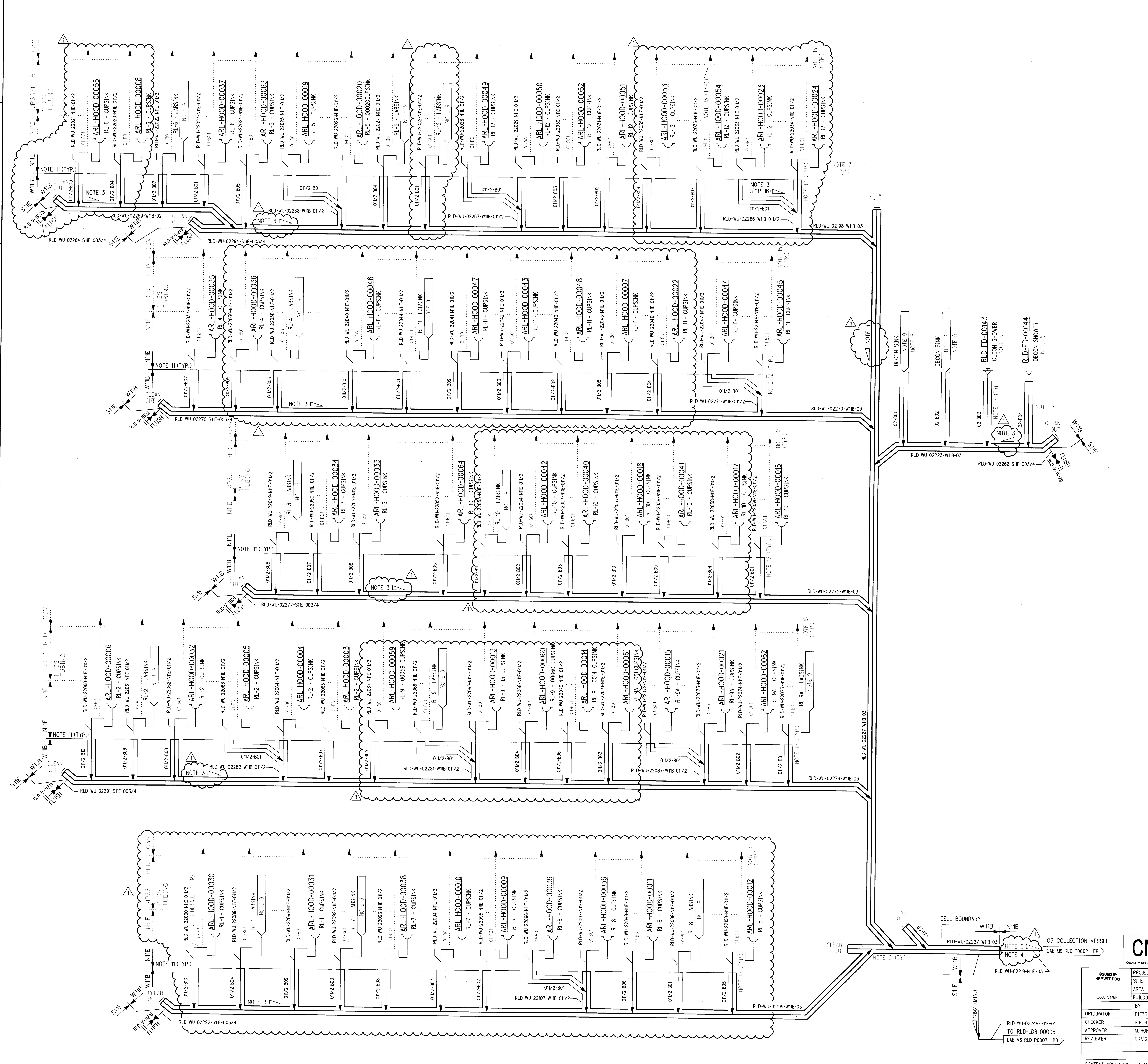
FORM E_SDN.DGN 02/2003

11.3.04

R10409710



NOTES:

1. SEE DRAWINGS 24590-WTP-M6-50-P0001 THROUGH 24590-WTP-M6-50-P0006 FOR GENERAL NOTES, SYMBOLS AND LEGEND.
2. LONG RADIUS ELBOWS AND SMOOTH FITTINGS TO BE USED IN DRAIN COLLECTION PIPING. 3D BENDS OR GREATER ARE PREFERRED TO BUTTWELD ELBOW FITTINGS IN ALL PIPING, WHENEVER PRACTICAL AND PERMITTED BY SPECIFICATION.
3. SLOPE C3 COLLECTION HEADERS 1/8 INCH PER FOOT AS PRACTICAL WITH A MINIMUM OF 1/16 INCH PER FOOT (1:192 SLOPE).
4. ALL PROCESS DRAIN COLLECTION PIPING SHOWN SHALL BE DOUBLE-WALL TYPE WHEN NOT PROVIDED WITH SECONDARY CONTAINMENT AND LEAK DETECTION. CARBON STEEL PORTIONS OF CONTAINMENT PIPING LOCATED ABOVE THE STAINLESS STEEL LINER AND EXPOSED TO EFFLUENT VESSEL CELL ATMOSPHERE SHALL BE COATED IN ACCORDANCE WITH SPECIFICATION 24590-WTP-3PS-AFPS-T0001, APPENDIX D, COATING SCHEDULE ITEM 3.90, SYSTEM CODE D.
5. PLUGGED WHEN NOT IN USE TO MINIMIZE CASCADE OF AIR INFLOW AND SATISFY DRAIN TRAP REQUIREMENTS OF NFPA 801-1998, SECTION 3-10.3.
6. ALL SYSTEMS AND COMPONENTS SHOWN ON THIS DRAWING ARE COMMERCIAL MATERIAL AND SEISMIC CATEGORY IV.
7. ALL P-TRAPS AND LOOP SEALS SHOWN ON THIS DRAWING SHALL BE ACCESSIBLE AND MAINTAINABLE (I.E., CAPABLE OF REPLACEMENT). LOOP PRIMING SHALL BE DONE ADMINISTRATIVELY.
8. DELETED.
9. LINE FROM SYSTEM THAT DOES NOT HAVE A P&ID.
10. CONTENTS OF THIS DRAWING (DOCUMENT) ARE DANGEROUS WASTE PERMIT AFFECTING.
11. AN UNDER SINK SECONDARY CONTAINMENT PAN WILL DIRECT POTENTIAL LEAKAGE TO THE ANNULAR SPACE OF THE DOUBLE-WALL PIPE FOR LEAK COLLECTION AND DETECTION. DRAIN PAN CONNECTION SHALL ALLOW FOR PERIODIC PNEUMATIC TESTING OF THE PIPE JACKET AND ALLOW FOR FLUSHING OF THE ANNULAR SPACE IN THE EVENT OF A LEAK.
12. COAT EXPOSED CARBON STEEL JACKET PER SPECIFICATION 24590-WTP-3PS-AFPS-T0001, APPENDIX D, COATING SCHEDULE ITEM 3.90, SYSTEM CODE D.
13. UNLESS OTHERWISE INDICATED ON THE DRAWING, LINES SHALL BE SELF-DRAINING AND ARRANGED WITH FALLS SO THAT FLUIDS DRAIN TO VESSELS OR INTO LINES THAT CAN BE DRAINED. THESE LINES IN CELLS OR PITS SHALL HAVE A MINIMUM SLOPE OF 1:120. LINES EXTERNAL TO CELL OR PIT AREAS SHALL HAVE A MINIMUM SLOPE OF 1:250.
14. IT IS ACCEPTABLE TO USE LOW POINT DRAINS FOR NON-REGULATED SERVICE LINES LOCATED OUTSIDE OF VESSEL CELLS WHEN DRAINAGE TO A VESSEL IS IMPRACTICAL.
15. SEE NOTE 3 ON 24590-LAB-M8-C3V-00002 FOR 1 1/2" NPT TAP PROVIDED BY HVAC SUB CONTRACTOR.
16. THE PORTIONS OF THIS DRAWING SHOWN IN PHANTOM ARE CONSIDERED NON-PERMIT AFFECTING AND ARE NOT SUBJECT TO THE REGULATORY REQUIREMENTS OF THE WAC CODE FOR THE DANGEROUS WASTE PERMIT TO THE EXTENT THAT THOSE PORTIONS DO NOT IMPACT DANGEROUS WASTE AREAS/OPERATIONS.

REFERENCES:

1. DELETED

EXPIRES: 11-11-05

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIALS AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
1	ISSUED FOR PERMITTING USE					11/3/04
0	ISSUED FOR PERMITTING USE	PM	RPH	CK	MH	03/05/04

REVISION HISTORY

CM (QUALITY DESIGNATOR)

PROJECT No.	24590	
SITE	HANFORD	
AREA	200E	
BUILDING No.	60	
	BY	DATE
ORIGINATOR	PIETRO MARTINELLI	03/04/04
CHECKER	R.P. HILLS	03/04/04
APPROVER	M. HOFFMANN	03/05/04
REVIEWER	CRAIG KELLER	03/04/04

RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

P&ID - LAB
RADIOACTIVE LIQUID WASTE DISPOSAL SYSTEM
C3 RAD LAB COLLECTION

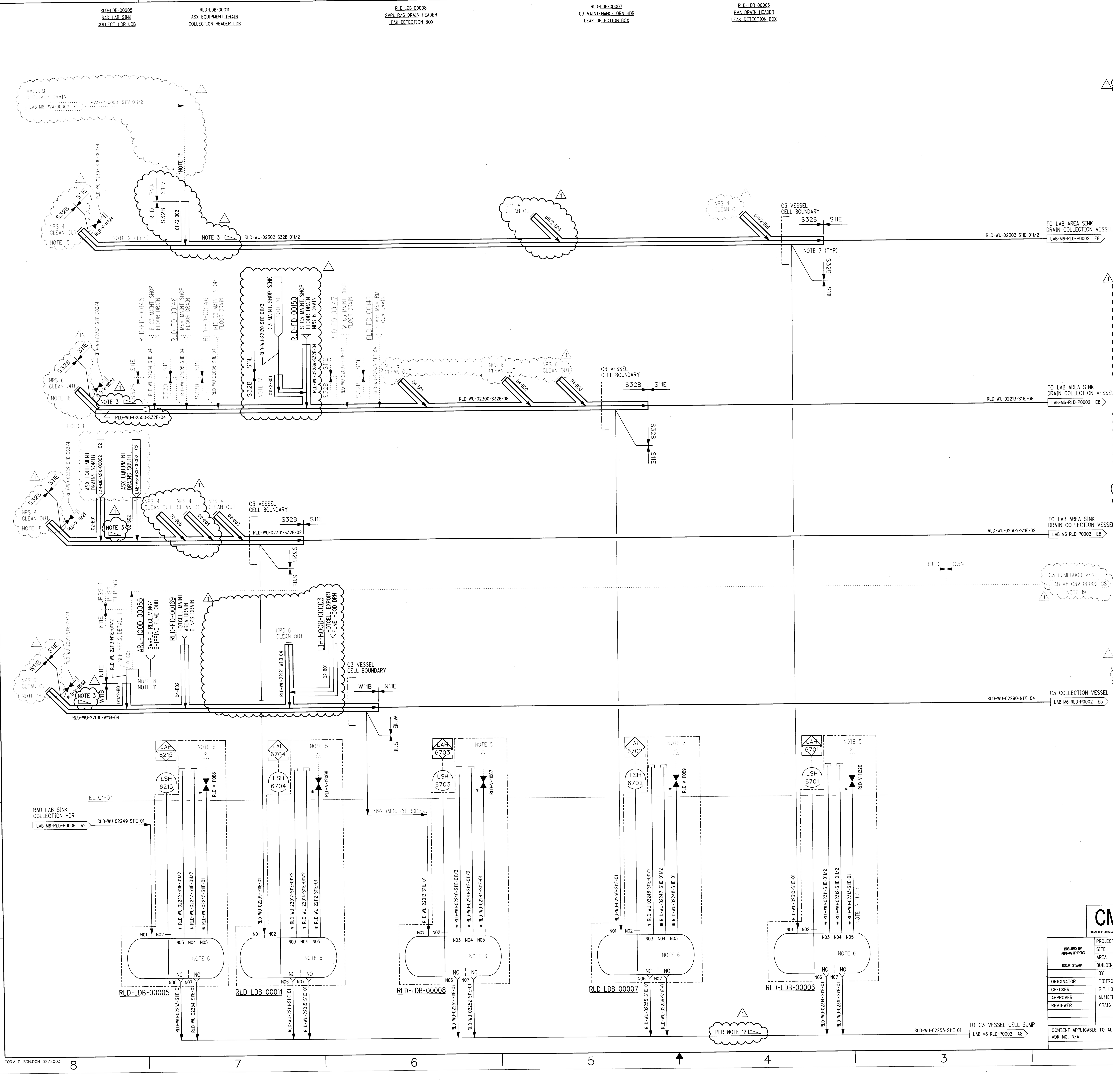
CONTENT APPLICABLE TO ALARA? [X] YES [ ] NO
ADR NO. N/A REV:

SCALE: NONE | 24590-LAB-M6-RLD-P0006 | REV 1

"E" SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

11/03/2004 10:46:53

FORM E_SDN.DGN 02/2003



NOTES:

1. SEE DRAWINGS 24590-WTP-M6-50-P0001 THROUGH 24590-WTP-M6-50-P0006 FOR GENERAL NOTES, SYMBOLS AND LEGEND.
2. LONG RADIUS ELBOWS AND SMOOTH FITTINGS TO BE USED IN DRAIN COLLECTION PIPING. 3D BENDS OR GREATER ARE PREFERRED TO BUTTWELD ELBOW FITTINGS IN ALL PIPING, WHENEVER PRACTICAL AND PERMITTED BY SPECIFICATION.
3. SLOPE C3 COLLECTION HEADERS 1/8 INCH PER FOOT AS PRACTICAL WITH A MINIMUM OF 1/16 INCH PER FOOT (1:192 SLOPE).
4. ALL SYSTEMS AND COMPONENTS SHOWN ON THIS DRAWING ARE COMMERCIAL MATERIAL AND SEISMIC CATEGORY IV.
5. QUICK CONNECTION IS PROVIDED FOR PNEUMATIC TESTING OF THE LEAK DETECTION BOX AND THE PIPE JACKET.
6. OVERFLOW AND DRAIN PLUGS OPERATED REMOTELY VIA RODS THAT EXTEND UP TO GRADE ELEVATION (0'-0"). DRAIN PLUG INSTALLED IN THE CLOSED POSITION TO CREATE A DETECTABLE LEVEL. UPON LEVEL DETECTION, THE PLUG IS LIFTED TO DRAIN THE LEAK DETECTION BOX. THE OVERFLOW PLUG IS NORMALLY OPEN FOR OVERFLOW PROTECTION. BOTH PLUGS WILL BE CLOSED FOR PNEUMATIC TESTING.
7. ALL PROCESS DRAIN COLLECTION PIPING SHOWN SHALL BE DOUBLE-WALL TYPE WHEN NOT PROVIDED WITH SECONDARY CONTAINMENT AND LEAK DETECTION. CARBON STEEL PORTIONS OF CONTAINMENT PIPING LOCATED ABOVE THE STAINLESS STEEL LINER AND EXPOSED TO EFFLUENT VESSEL CELL ATMOSPHERE SHALL BE COATED IN ACCORDANCE WITH SPECIFICATION 24590-WTP-3PS-AFPS-T0001, APPENDIX D, COATING SCHEDULE ITEM 3.90, SYSTEM CODE D.
8. P-TRAPS SHALL BE ACCESSIBLE AND MAINTAINABLE (I.E. CAPABLE OF REPLACEMENT). LOOP PRIMING SHALL BE DONE ADMINISTRATIVELY.
9. CONTENTS OF THIS DRAWING (DOCUMENT) ARE DANGEROUS WASTE PERMIT AFFECTING.
10. LINE FROM/TO SYSTEM THAT DOES NOT HAVE A P&ID.
11. AN UNDER SINK DRAIN PAN WILL DIRECT POTENTIAL LEAKAGE TO ANNULAR REGION OF DOUBLE-WALL PIPE FOR LEAKAGE COLLECTION AND MONITORING. DRAIN PAN CONNECTION SHALL PERMIT PERIODIC PNEUMATIC TESTING OF THE CONTAINMENT PIPING AND THE FLUSHING OF THE ANNULAR REGION IN THE EVENT OF LEAKAGE.
12. UNLESS OTHERWISE INDICATED ON THE DRAWING, LINES SHALL BE SELF-DRAINING AND ARRANGED WITH FALLS SO THAT FLUIDS DRAIN TO VESSELS OR INTO LINES THAT CAN BE DRAINED. THESE LINES IN CELLS OR PITS SHALL HAVE A MINIMUM SLOPE OF 1:120. LINES EXTERNAL TO CELL OR PIT AREAS SHALL HAVE A MINIMUM SLOPE OF 1:250.
13. DELETED
14. DELETED
15. SECONDARY CONTAINMENT ABOVE THE FLOOR SLAB SHALL BE PROVIDED BY A LEAK COLLECTION PAN OR BY A BERMED AREA COVERED BY A SPECIAL PROTECTIVE COATING.
16. VENDOR DESIGNED AND SUPPLIED ITEMS IDENTIFIED WITH AN "*".
17. PROVIDE A RECESSED PLUG-PLATE AT DOUBLE-/SINGLE-WALL TRANSITION FOR PERIODIC PNEUMATIC TESTING OF THE PIPE JACKET AND ALLOW FOR FLUSHING OF THE ANNULAR SPACE IN THE EVENT OF A LEAK.
18. DEAD LEGS OF THE DOUBLE-WALL C3 DRAIN COLLECTION HEADERS THAT CANNOT BE FLUSHED SHALL BE SUBJECT TO VISUAL INSPECTION OF LEVEL D CLEANLINESS PRIOR TO FINAL FIELD FIT-UP AND ASSEMBLY.
19. SEE NOTE 3 ON 24590-LAB-M8-C3V-00002 FOR 1 1/2" NPT TAP PROVIDED BY HVAC SUB-CONTRACTOR.
20. REVISED/ADDED/DELETED:
    - A) DELETED
    - B) CLARIFIED WHERE NOTE 8 AND NOTE 11 APPLY.
    - C) ADDED NPS OF RLD-FD-00150 AND RLD-FD-00169.
    - D) CLARIFIED NOTE 3 AND NOTE 6 REQUIREMENTS
    - E) CLARIFIED FUMEHOOD VENTILATION INTERFACE
    - F) CLARIFIED CELL BOUNDARY DESCRIPTION
    - G) REVISED LDB COLLECTION LINE SLOPE REQUIREMENTS
    - H) DELETED NON-APPLICABLE NOTE 13.
21. THE PORTIONS OF THIS DRAWING SHOWN IN PHANTOM ARE CONSIDERED NON-PERMIT AFFECTING AND ARE NOT SUBJECT TO THE REGULATORY REQUIREMENTS OF THE WAC CODE FOR THE DANGEROUS WASTE PERMIT TO THE EXTENT THAT THOSE PORTIONS DO NOT IMPACT DANGEROUS WASTE AREAS/OPERATIONS.

REFERENCES:

1. DELETED
2. DELETED

HOLDS/OPEN ITEMS:

1. DELETED

EXPIRES: 11-11-05

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIALS AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

CM
QUALITY DESIGNATOR

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
1	ISSUED FOR PERMITTING USE	RLJ	RPH	ck	MH	11/3/04
0	ISSUED FOR PERMITTING USE	PM	RPH	CK	MH	03/05/04

REVISION HISTORY

PROJECT No.	24590	
SITE	HANFORD	
AREA	200E	
BUILDING No.	60	
	BY	DATE
ORIGINATOR	PIETRO MARTINELLI	03/04/04
CHECKER	R.P. HILLS	03/04/04
APPROVER	M. HOFFMANN	03/05/04
REVIEWER	CRAIG KELLER	03/04/04

ISSUED BY RPP-WTP PDC
ISSUE STAMP

RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

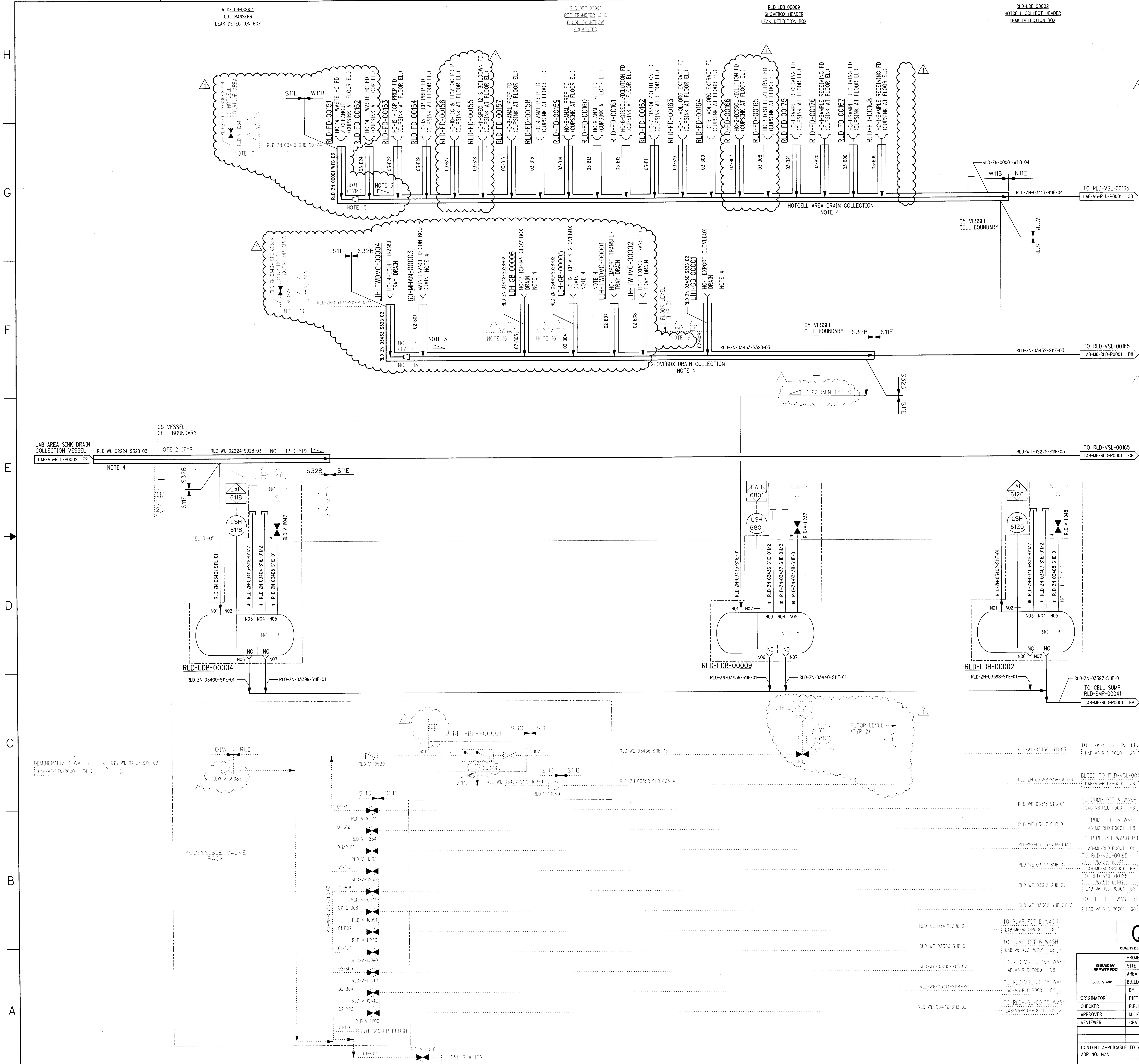
P&ID - LAB RADIOACTIVE LIQUID WASTE DISPOSAL SYSTEM - C3 COLLECTION & LEAK DETECTION

CONTENT APPLICABLE TO ALARA? [X] YES [ ] NO
ADR NO. N/A REV:

SCALE: NONE
24590-LAB-M6-RLD-P0007
REV 1

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

11/03/2004 10:46:53 AM



NOTES:

1. SEE DRAWINGS 24590-WTP-M6-50-P0001 THROUGH 24590-WTP-M6-50-P0006 FOR GENERAL NOTES, SYMBOLS AND LEGEND.
2. LONG RADIUS ELBOWS AND SMOOTH FITTINGS TO BE USED IN DRAIN COLLECTION PIPING. 3D BENDS OR GREATER ARE PREFERRED TO BUTTWELD ELBOW FITTINGS IN ALL PIPING, WHENEVER PRACTICAL AND PERMITTED BY SPECIFICATION.
3. SLOPE C5 COLLECTION HEADERS 1/8 INCH PER FOOT AS PRACTICAL WITH A MINIMUM OF 1/16 INCH PER FOOT (1:192 SLOPE).
4. ALL PROCESS DRAIN COLLECTION PIPING SHOWN SHALL BE DOUBLE-WALL TYPE WHEN NOT PROVIDED WITH SECONDARY CONTAINMENT AND LEAK DETECTION. CARBON STEEL PORTIONS OF CONTAINMENT PIPING LOCATED ABOVE THE STAINLESS STEEL LINER AND EXPOSED TO EFFLUENT VESSEL CELL ATMOSPHERE SHALL BE COATED IN ACCORDANCE WITH SPECIFICATION 24590-WTP-3PS-AFPS-T0001, APPENDIX D, COATING SCHEDULE ITEM 3.90, SYSTEM CODE D.
5. ALL SYSTEMS AND COMPONENTS SHOWN ON THIS DRAWING ARE COMMERCIAL MATERIAL AND SEISMIC CATEGORY IV, UNLESS OTHERWISE INDICATED.
6. DELETED.
7. QUICK CONNECTION IS PROVIDED FOR PNEUMATIC TESTING OF THE LEAK DETECTION BOX AND THE PIPE JACKET.
8. OVERFLOW AND DRAIN PLUGS OPERATED REMOTELY VIA RODS THAT EXTEND UP TO GRADE ELEVATION (0'-0") THROUGH PIPE SLEEVES. DRAIN PLUG INSTALLED IN THE CLOSED POSITION TO CREATE A DETECTABLE LEVEL. UPON LEVEL DETECTION, THE PLUG IS LIFTED TO DRAIN THE LEAK DETECTION BOX. THE OVERFLOW PLUG IS NORMALLY OPEN FOR OVERFLOW PROTECTION. BOTH PLUGS WILL BE CLOSED FOR PNEUMATIC TESTING.
9. INTERLOCK TO CLOSE ON VESSEL RLD-VSL-00165 HIGH LEVEL.
10. DELETED
11. CONTENTS OF THIS DRAWING (DOCUMENT) ARE DANGEROUS WASTE PERMIT AFFECTING.
12. UNLESS OTHERWISE INDICATED ON THE DRAWING, LINES SHALL BE SELF-DRAINING AND ARRANGED WITH FALLS SO THAT FLUIDS DRAIN TO VESSELS OR INTO LINES THAT CAN BE DRAINED. THESE LINES IN CELLS OR PITS SHALL HAVE A MINIMUM SLOPE OF 1:120. LINES EXTERNAL TO CELL OR PIT AREAS SHALL HAVE A MINIMUM SLOPE OF 1:250.
13. IT IS ACCEPTABLE TO USE LOW POINT DRAINS FOR NON-REGULATED SERVICE LINES LOCATED OUTSIDE OF VESSEL CELLS WHEN DRAINAGE TO A VESSEL IS IMPRACTICAL.
14. VENDOR DESIGNED AND SUPPLIED ITEMS IDENTIFIED WITH AN "*".
15. DEAD LEGS OF THE DOUBLE-WALL C5 DRAIN COLLECTION HEADER THAT CANNOT BE FLUSHED SHALL BE SUBJECT TO VISUAL INSPECTION OF LEVEL D CLEANLINESS PRIOR TO FINAL FIELD FIT-UP AND ASSEMBLY.
16. LOCATE TRANSITION FIELD WELD INSIDE CONCRETE OF ITS STRUCTURES.
17. LOCATE VALVE AS CLOSE AS PRACTICAL TO FLOOR LEVEL TO MINIMIZE THE AMOUNT OF PIPING EXTERNAL TO THE C5 PIPE PIT.
18. THE PORTIONS OF THIS DRAWING SHOWN IN PHANTOM ARE CONSIDERED NON-PERMIT AFFECTING AND ARE NOT SUBJECT TO THE REGULATORY REQUIREMENTS OF THE WAC CODE FOR THE DANGEROUS WASTE PERMIT TO THE EXTENT THAT THOSE PORTIONS DO NOT IMPACT DANGEROUS WASTE AREAS/OPERATIONS.

REFERENCES:

1. DELETED

HOLDS:

1. DELETED.

EXPIRES: 11-11-05

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIALS AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
1	ISSUED FOR PERMITTING USE	[signature]	RPH	[signature]	[signature]	11/3/04
0	ISSUED FOR PERMITTING USE	PM	RPH	CK	MH	03/05/04

REVISION HISTORY

Q
QUALITY DESIGNATOR

ISSUED BY RPP-WTP PDC
ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	60

	BY	DATE
ORIGINATOR	PIETRO MARTINELLI	03/04/04
CHECKER	R.P. HILLS	03/04/04
APPROVER	M. HOFFMANN	03/05/04
REVIEWER	CRAIG KELLER	03/04/04

CONTENT APPLICABLE TO ALARA? [X] YES [ ] NO
ADR NO. N/A REV:

BECHTEL
RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

P&ID - LAB RADIOACTIVE LIQUID WASTE DISPOSAL SYSTEM - C5 COLLECTION & LEAK DETECTION

SCALE: NTS
24590-LAB-M6-RLD-P0008
REV 1

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

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PLOTTED BY: tdbarnes
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FORM E_SDN.DGN 02/2003

11-3-04

R10409707

Attachment 51 – Appendix 11.4
Laboratory Building
General Arrangement Drawings

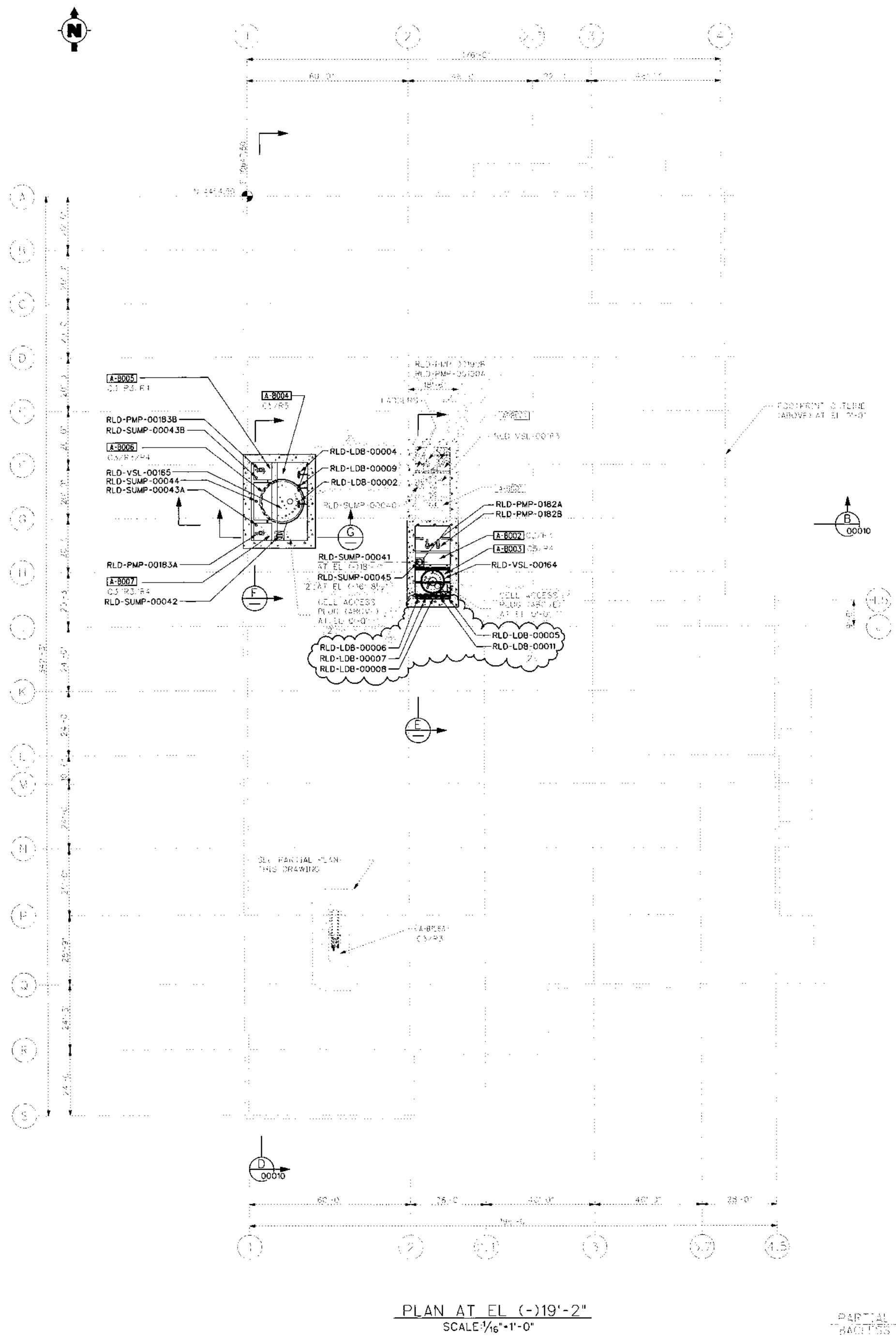
Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

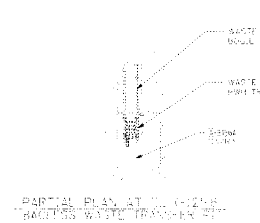
Attachment 51 – Appendix 11.4
Laboratory Building
General Arrangement Drawings

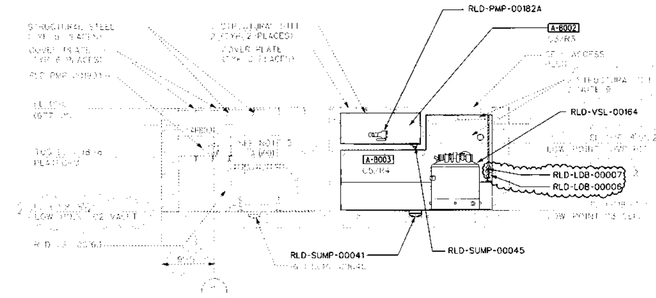
The following drawings have been incorporated into Appendix 11.4 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing/Document	**Description**
24590-LAB-P1-60-P0007, Rev 2	General Arrangement Plan at El. -19'-2" and Sections E-E, F-F, G-G
24590-LAB-P1-60-P0008, Rev 2	General Arrangement Plan at El. 0'-0"
24590-LAB-P1-60-P0010, Rev 1	General Arrangement Sections A-A, B-B, C-C, D-D
RESERVED	RESERVED

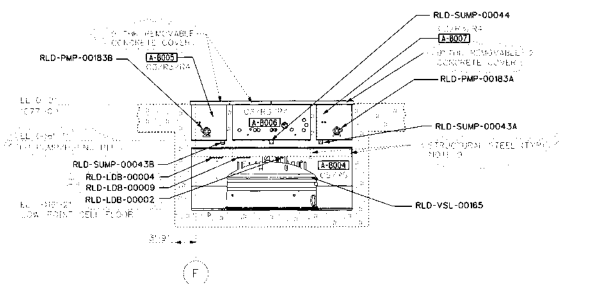


PLAN AT EL (-)19'-2"
SCALE 1/16"=1'-0"

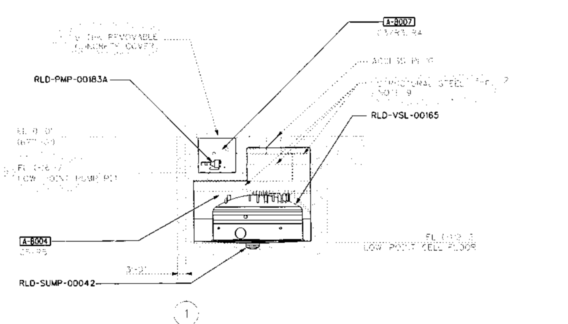




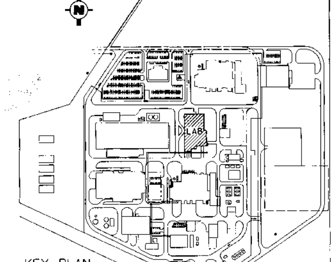
SECTION E
SCALE: 1/8" = 1'-0"



SECTION F
SCALE: 1/8" = 1'-0"



SECTION G
SCALE: 1/8" = 1'-0"



KEY PLAN
NOT TO SCALE

NOTES:

4. **CONTENTS OF THIS DOCUMENT ARE DANGEROUS WASTE PERMIT AFFECTING.**

6. **ADD 9 x LEAK DETECTION BOXES RLD-LDB-00002/00009 INCL. & RLD-LDB-00011.**

7. **ADJUST E/W ORDER OF 5 LEAK DETECTION BOXES IN C3 CELL.**

10. THE PORTIONS OF THIS DRAWING SHOWN IN PHANTOM ARE CONSIDERED NON-PERMIT AFFECTING AND ARE NOT SUBJECT TO THE REGULATORY REQUIREMENTS OF THE WAC CODE FOR THE DANGEROUS WASTE PERMIT TO THE EXTENT THAT THOSE PORTIONS DO NOT IMPACT DANGEROUS WASTE AREAS/OPERATIONS.

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIAL AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

REFERENCE DRAWINGS	
DWG NO	TITLE
24590-BOF-P1-50-T0001	RPP - WTP PLOT PLAN
24590-LAB-P1-60-P0008	ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT EL 0'-0"
24590-LAB-P1-60-P0010	ANALYTICAL LABORATORY GENERAL ARRANGEMENT SECTIONS A-A, B-B, C-C & D-D
[illegible]	ANALYTICAL LABORATORY ARCHITECTURAL ROOM FINISH SCHEDULE
[illegible]	ANALYTICAL LABORATORY ARCHITECTURAL ROOM FINISH SCHEDULE

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
2	ISSUED FOR PERMITTING USE	RWM	RLH	WTM	[illegible]	8/26/04
1	ISSUED FOR PERMITTING USE	KAC	RLH	WTM	KW	10/28/03
0	ISSUED FOR PERMITTING USE	DKD	RLH	WTM	KW	02/13/03

REVISION HISTORY

Q
QUALITY DESIGNATOR

PROJECT No.	24590	
SITE	HANFORD	
AREA	200E	
BUILDING No.	60	
	BY	DATE
ORIGINATOR	DK DIXON	02/13/03
CHECKER	RL HENDERSON	02/13/03
APPROVER	WT MYERS	02/13/03
REVIEWER	K WALVEKAR	02/13/03

CONTENT APPLICABLE TO ALARA? [X] YES [ ] NO
ADR NO. N/A REV: N/A

RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT EL (-)19'-2" SECTIONS E-E, F-F & G-G

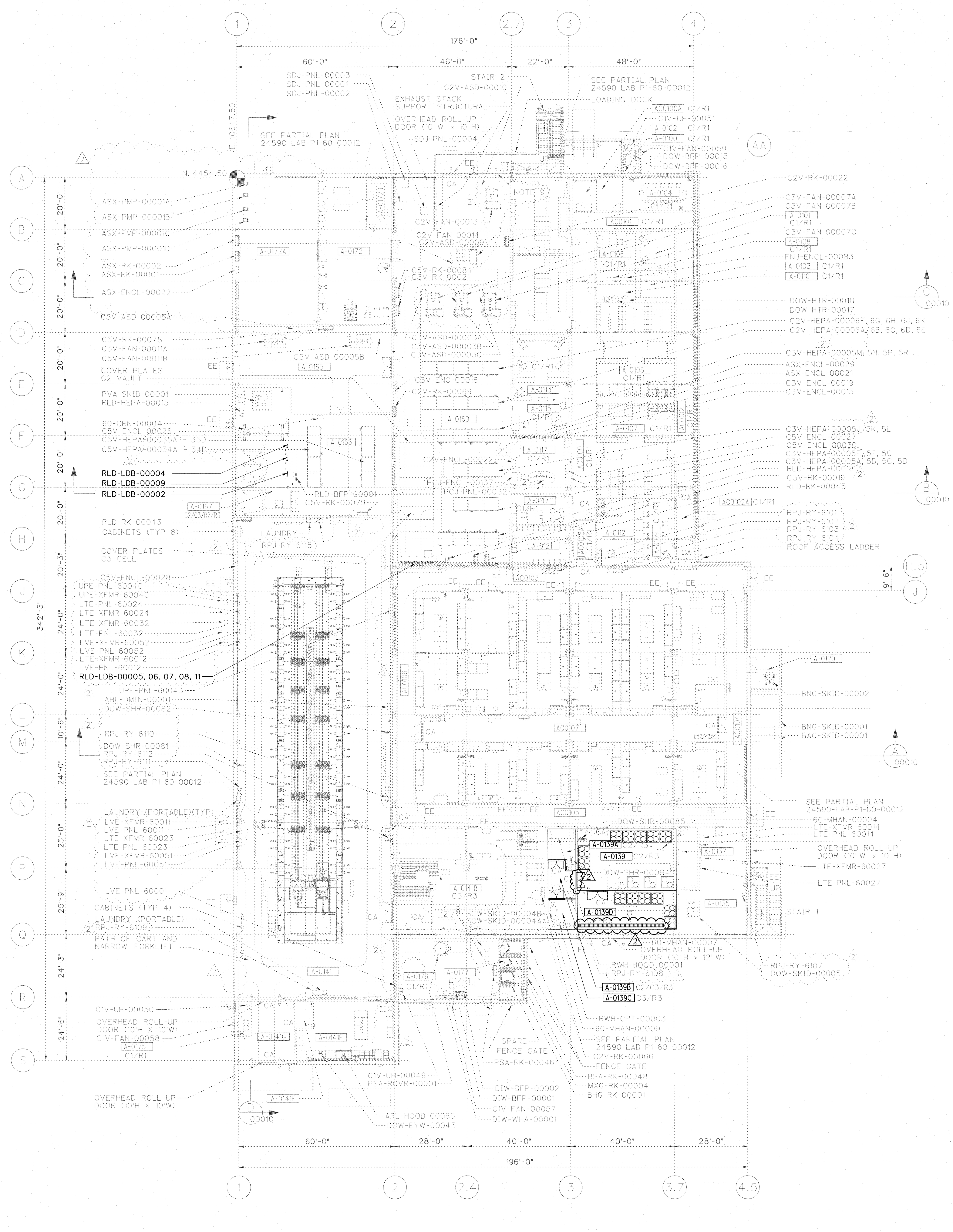
SCALE: AS NOTED
24590-LAB-P1-60-P0007
REV 2

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

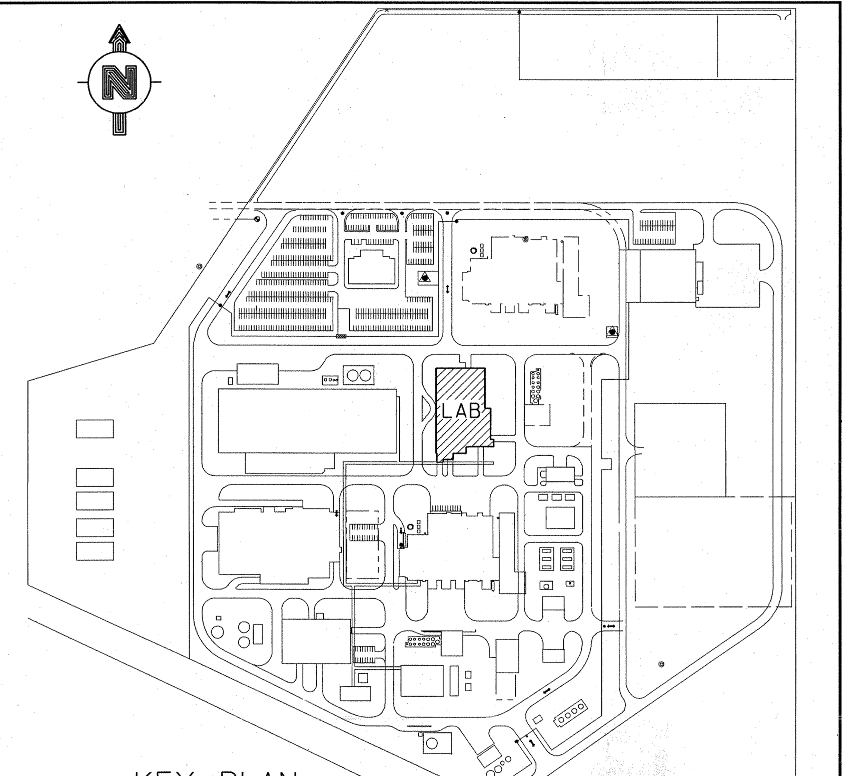
08/26/2004 08:44:18 AM

EXPIRES: 07/09/06

PLOTTED BY: rwmorgan



PLAN AT EL 0'-0"



KEY PLAN
NOT TO SCALE

NOTES:

1. REFER TO DRAWING 24590-LAB-P1-60-P0010 SECTION "A" FOR CONVERSIONS FROM LAB FACILITY ELEVATIONS TO SITE ELEVATIONS.(LAB FACILITY ELEVATION 0'-0" = SITE ELEVATION 677'-0" MSL).
2. FOR SITE REFERENCE SEE PLOT PLAN DRAWING 24590-BOF-P1-50-00001.
3. FOR LEGEND SEE DRAWING 24590-LAB-P1-60-P0007
4. **CONTENTS OF THIS DOCUMENT ARE DANGEROUS WASTE PERMIT AFFECTING**
5. ALL OPERATING AREAS ARE DESIGNATED C2/R2 UNLESS NOTED OTHERWISE.
6. FOR ROOM NUMBERS AND DESCRIPTION, SEE DRAWINGS 24590-LAB-A5-A19T-05200001, 24590-LAB-A5-A19T-05200002.
7. DELETED
8. DELETED
9. REMOVABLE SIDING PANELS FOR EQUIPMENT REPLACEMENT - C2V-FAN-00013/C2V-ASD-00010.
10. REVISE DRUM SKID TO CORRECT OVERLAP IN ROOM A-0139D.

    REVISE FAN/ASD EQUIPMENT AND LOCATIONS IN ROOM A-0160.

    REVISE C5 PUMP PIT/PIPING PIT COVERS.

    RELOCATE FOLLOWING EQUIPMENT/LABELS:

LVE-XFMR-60052	LTE-PNL-60032
LVE-PNL-60052	LTE-XFMR-60012
UPE-XFMR-60040	LTE-PNL-60012
UPE-PNL-60040	LVE-XFMR-60011
LTE-XFMR-60024	LVE-PNL-60011
LTE-PNL-60024	LTE-XFMR-60023
LVE-PNL-60051	LTE-PNL-60023
RLD-LDB-00005	LVE-XFMR-60051
RLD-LDB-00006	LVE-PNL-60001
RLD-LDB-00007	ASX-PMP-00001A
RLD-LDB-00008	ASX-PMP-00001B
RLD-LDB-00011	ASX-PMP-00001C
LTE-XFMR-60032	ASX-PMP-00001D
ASX-RK-00001	ASX-RK-00002
ASX-ENCL-00022	DOW-SHR-00082
DOW-SHR-00081	

    ADD FOLLOWING EQUIPMENT/LABELS:

SCW-SKID-00004A	DIW-BFP-00002
SCW-SKID-00004B	DIW-BFP-00001
DOW-SKID-00005	DIW-WHA-00001
C2V-RK-00066	RPJ-RY-6112
RPJ-RY-6101	RPJ-RY-6115
RPJ-RY-6102	PCJ-ENCL-00137
RPJ-RY-6103	RPJ-RY-6109
RPJ-RY-6104	RPJ-RY-6110
RPJ-RY-6107	RPJ-RY-6111
RPJ-RY-6108	

    DELETE FOLLOWING EQUIPMENT/LABELS:

DOW-SKID-00001	C5V-ENCL-00025
SCW-PMP-00029	FNJ-ENCL-00082
ASJ-CNSL-00001	
PCM-001	
RLD-SHLD-00001A/00001B/00002 (TOTAL 3)	
C3 FILTER (TYP) (TOTAL 4)	

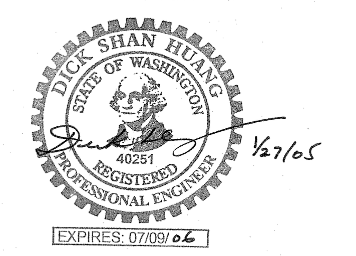
    REMOVE HOLD 1

    REVISE CABINETS IN ROOM A-0141F.

    UPDATE HEPA FILTER LABELS TO REFLECT FIVE DIGIT NUMERICAL COMPONENT NUMBER. PREVIOUS ISSUE REFLECTED A INCORRECT FOUR DIGIT NUMBER.

    INCORPORATED DCN 24590-LAB-P1N-60-00019.

11. THE PORTIONS OF THIS DRAWING SHOWN IN PHANTOM ARE CONSIDERED NON-PERMIT AFFECTING AND ARE NOT SUBJECT TO THE REGULATORY REQUIREMENTS OF THE WAC CODE FOR THE DANGEROUS WASTE PERMIT TO THE EXTENT THAT THOSE PORTIONS DO NOT IMPACT DANGEROUS WASTE AREAS/OPERATIONS.



REFERENCE DRAWINGS

DWG NO	TITLE
24590-BOF-P1-50-00001	RPP - WTP PLOT PLAN
24590-LAB-P1-60-P0007	ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT EL. (-)19'-2" SECTIONS E-E, F-F, G-G
24590-LAB-P1-60-00009	ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT EL. 17'-0"
24590-LAB-P1-60-P0010	ANALYTICAL LABORATORY GENERAL ARRANGEMENT SECTIONS A-A, B-B, C-C & D-D
24590-LAB-P1-60-00011	ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT ROOF
24590-LAB-P1-60-00012	ANALYTICAL LABORATORY GENERAL ARRANGEMENT PARTIAL PLANS AT EL. 0'-0"
24590-LAB-A5-A19T-05200001	ANALYTICAL LABORATORY ARCHITECTURAL ROOM FINISH SCHEDULE
24590-LAB-A5-A19T-05200002	ANALYTICAL LABORATORY ARCHITECTURAL ROOM FINISH SCHEDULE

REVISION HISTORY

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
2	ISSUED FOR PERMITTING USE	RWM	KKC	PR	[illegible]	1/26/05
1	ISSUED FOR PERMITTING USE	RWM	KCK	WTM	KRW	7/29/04
0	ISSUED FOR PERMITTING USE	KAC	RLH	WTM	KRW	10-28-03

Q
QUALITY DESIGNATOR

ISSUED BY RPP-WTP PDC
ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	60

	BY	DATE
ORIGINATOR	KA CRISPIN	10/27/03
CHECKER	RL HENDERSON	10/27/03
APPROVER	K WALVEKAR	10/28/03
REVIEWER	WT MYERS	10/27/03

CONTENT APPLICABLE TO ALARA? [X] YES [ ] NO
ADR NO. NA REV:

BECHTEL
RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT EL 0'-0"

SCALE: 1/16"=1'-0"
24590-LAB-P1-60-P0008
REV 2

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

R10461837

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PLOTTED BY: rwmorgan
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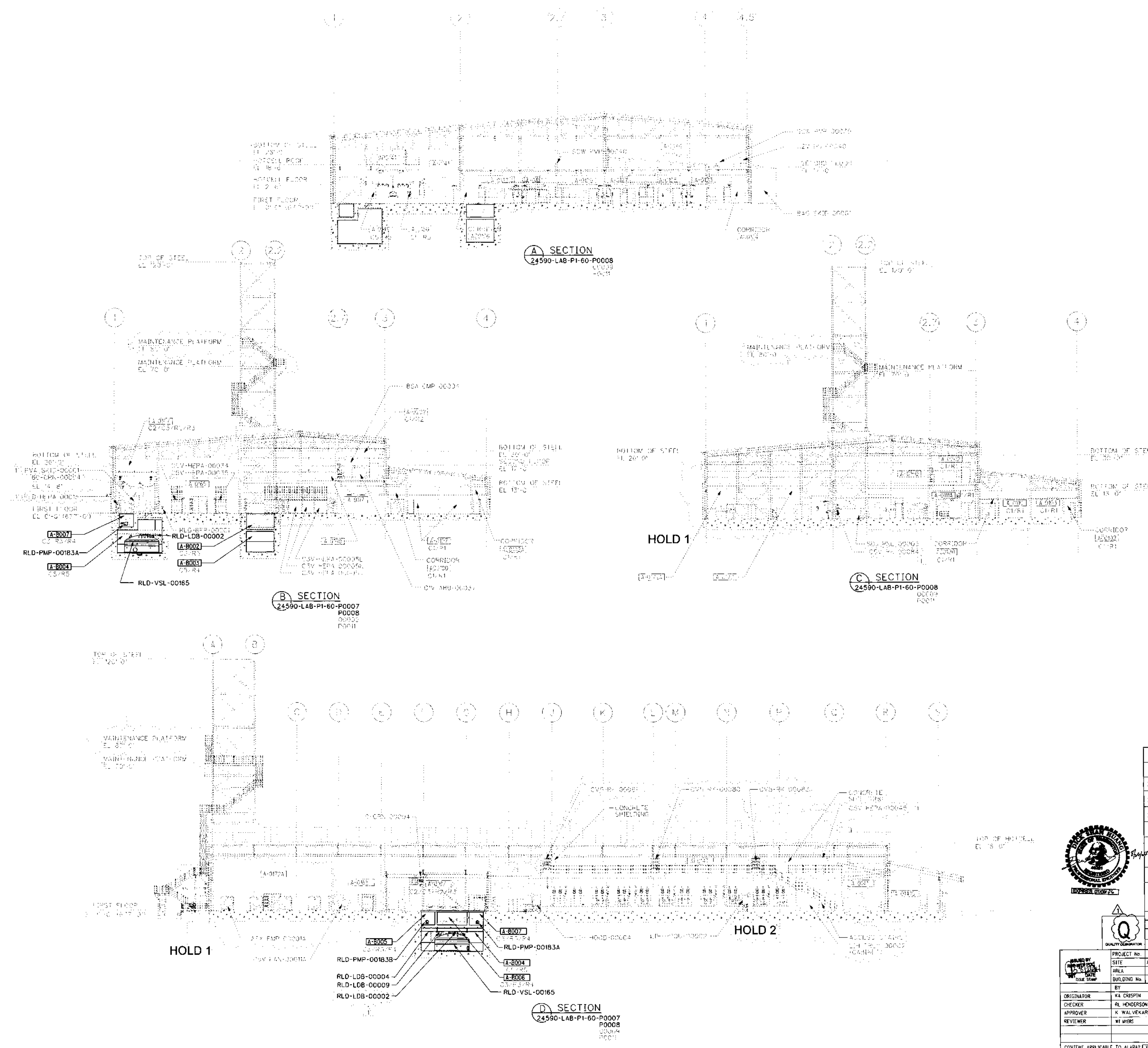


NOTES:

1. FOR SITE REFERENCE SEE PLOT PLAN DRAWING 24590-BOF-P1-50-00001.
2. ALL OPERATING AREAS ARE DESIGNATED C2/R2 UNLESS NOTED OTHERWISE.
3. CONTENTS OF THIS DOCUMENT ARE DANGEROUS WASTE AFFECTING.
4. FOR LEGEND SEE DRAWING 24590-LAB-P1-60-P0010.
5. FOR ROOM NUMBERS AND DESCRIPTION, SEE DRAWINGS 24590-LAB-AS [illegible] 24590-LAB-AS [illegible]
6. ADD ADDITIONAL MAINTENANCE PLATFORM TO EXHAUST STACK AT EL. 80'0".
   [illegible]
   [illegible]
   DELETE HOTCELL ROOF LADDER AND HOTCELL ACCESS STAIRS.
   [illegible]
   [illegible]
   ADD ROOM NO. [illegible] TO AREA OVER HOTCELL.
   CHANGED [illegible] -00002 TO C5V-PA-00084.
   CHANGED QUALITY DESIGNATOR FROM PV TO Q.
   ADD LABEL FOR RLD-LDB-00002.
   CHANGED THE CLOUD AND LABEL ORIENTATION FOR HOLD 1.
7. THE PORTIONS OF THIS DRAWING SHOWN IN PHANTOM ARE CONSIDERED NON-PERMIT AFFECTING AND ARE NOT SUBJECT TO THE REGULATORY REQUIREMENTS OF THE WAC CODE FOR THE DANGEROUS WASTE PERMIT TO THE EXTENT THAT THOSE PORTIONS DO NOT IMPACT DANGEROUS WASTE AREAS/OPERATIONS.

HOLDS:

1. HOLD PENDING RECEIPT OF VENDOR INFORMATION FOR EQUIPMENT IN SYSTEMS ASX AND PVA.
2. HOLD PENDING RECEIPT OF VENDOR INFORMATION FOR LASER ABLATION.

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIAL AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

REFERENCE DRAWINGS

DWG NO	TITLE
24590-BOF-P1-50-00001	RPP - WTP PLOT PLAN
24590-LAB-P1-60-P0007	ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT EL. (-)19'-2" SECTIONS E-E, F-F & G-G
24590-LAB-P1-60-P0008	ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT EL. 0'-0"
24590-LAB-P1-60-P0009	ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT [illegible]
24590-LAB-P1-60-[illegible]	ANALYTICAL LABORATORY GENERAL ARRANGEMENT PLAN AT ROOF
24590-LAB-AS-ARP-05200001	ANALYTICAL LABORATORY ARCHITECTURAL ROOM FINISH SCHEDULE
24590-LAB-AS-ARP-05200002	ANALYTICAL LABORATORY ARCHITECTURAL ROOM FINISH SCHEDULE

REVISION HISTORY

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
1	ISSUED FOR PERMITTING USE	RWH	RLH	[signature]	[signature]	8/26/04
0	ISSUED FOR PERMITTING USE	KAC	RLH	WTM	KW	10/29/03

QUALITY DESIGNATOR: Q

EXPIRES 07/09/06

PROJECT No.	24590	
SITE	HANFORD	
AREA	200E	
BUILDING No.	200A	
	BY	DATE
ORIGINATOR	KA CRISPIN	10/27/03
CHECKER	RL HENDERSON	10/28/03
APPROVER	K WALVEKAR	10/29/03
REVIEWER	WT MYERS	10/28/03

CONTENT APPLICABLE TO ALARA? [X] YES [ ] NO
ADR NO. N/A REV:

RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

ANALYTICAL LABORATORY GENERAL ARRANGEMENT SECTIONS A-A, B-B, C-C & D-D

SCALE: 1/16"=1'-0"

24590-LAB-P1-60-P0010 REV 1

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

08/26/2004 08:52:34 AM

PLOTTED BY: rwmorgan

R10365931

Attachment 51 – Appendix 11.5
Laboratory Building
Civil, Structural, and Architectural Criteria and Typical Design Details

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

Attachment 51 – Appendix 11.5
Laboratory Building
Civil, Structural, and Architectural Criteria and Typical Design Details

The following drawings have been incorporated into Appendix 11.5 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing/Document	**Description**
24590-LAB-PER-M-02-002, Rev 2	Sump Data for LAB Facility
RESERVED	RESERVED

R10363840

ISSUED BY
RPP-WTP PDC
INIT 8/20/04 DATE

Document title: **Sump Data for LAB Facility**

Contract number: DE-AC27-01RV14136

Department: LAB Mechanical Systems

Author(s): P. Martinelli

Principal author signature: Pietro Martinelli

Document number: 24590-LAB-PER-M-02-002, Rev 2

Checked by: R. P. Hills

Checker signature: R. P. Hills

Date of issue: 8/18/04

Issue status: Issued for Permitting Use

Approved by: M. Hoffmann

Approver's position: Mechanical Systems Manager

Approver signature:

MARK W. HOFFMANN
STATE OF WASHINGTON
0030952
REGISTERED PROFESSIONAL ENGINEER
EXPIRES 12/10/04
8/18/04

This bound document contains a total of 9 sheets

River Protection Project
Waste Treatment Plant
2435 Stevens Center Place
Richland, WA 99352
United States of America
Tel: 509 371 2000

Notice

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

History Sheet

Rev	Date	Reason for revision	Revised by
0	8/13/03	Issued for Permitting Use	P. Martinelli
1	3/09/04	Re-Issued for Permitting Use	P. Martinelli
2	8/18/04	Issued for Permitting Use	P. Martinelli

Contents

Tables

1 Introduction

The Washington Administrative Code, WAC 173-303, requires the use of secondary containment for systems that contain dangerous waste. This document provides a brief description of the secondary containment sumps for the C3 and C5 effluent vessel cells, and the pump and piping pits of the River Protection Project – Hanford Tank Waste Treatment and Immobilization Plant (WTP), Analytical Laboratory (LAB) facility. These sumps are listed in Table 1. Drains associated with these sumps are an extension of the secondary containment system and are described in Table 2.

2 Applicable Documents

WAC 173-303. *Dangerous Waste Regulations.* Washington Administrative Code.

3 Description

3.1 Effluent Vessel Cell Sumps

There are two dangerous waste sumps located in the dangerous waste vessel cells of the LAB facility. The first sump is located in the C3 effluent vessel cell (A-B003). It is part of the secondary containment system for the laboratory area sink drain collection vessel, RLD-VSL-00164. Throughout the balance of this sump data document, it will be referred to as the C3 cell sump (RLD-SUMP-00041). The second sump is located in the C5 effluent vessel cell (A-B004). It is part of the secondary containment system for the hotcell drain collection vessel, RLD-VSL-00165. Throughout the balance of this sump data document, it will be referred to as the C5 cell sump (RLD-SUMP-00042). Both sumps are of a dry-type design.

3.1.1 C3 Cell Sump (RLD-SUMP-00041)

The top of the C3 cell sump is located in the C3 effluent vessel cell (A-B003) at top-of-concrete (TOC) elevation (–) 18 ft-7 in. The cell is lined with stainless steel for secondary containment. The sump is of stainless steel construction and interfaces with the cell liner to form an integral boundary. The slope of the cell floor diverts any effluents towards the sump. The sump is 30 inches nominal diameter and approximately 13 inches deep. The sump is made from a piece of nominal pipe size (NPS 30) standard-wall pipe (or an equivalent rolled plate) and a 30-in diameter, standard-wall, pipe cap (or equivalent ellipsoidal-head section) and has a nominal volume of 30 gallons. The sump is equipped with radar level detection. Furthermore, the sump is emptied by pump RLD-PMP-00182A or 00182B into vessel RLD-VSL-00165, hotcell drain collection vessel (C5 vessel), located in room A-B004, or emptied into RLD-VSL-00164, lab area sink drain collection vessel (C3 vessel), located in room A-B003. There are no embedded drain lines in the sump that form an extension of the secondary containment boundary.

3.1.2 C5 Cell Sump (RLD-SUMP-00042)

The top of the C5 cell sump is located in the C5 effluent vessel cell (A-B004) at TOC elevation (–) 19 ft-2 in. The sump is similar to the one described in section 3.1.1 above. The sump is equipped with radar level detection and is emptied via pumps RLD-PMP-00183A or RLD-PMP-00183B into the plant wash vessel, PWD-VSL-00044, in the Pretreatment Facility through a buried, double-pipe (duplex) transfer line or emptied into vessel RLD-VSL-00165, hotcell drain collection vessel (C5 vessel) in room A-B004.

3.2 Pump and Piping Pit Sumps

There are four dangerous waste sumps located in the pump and piping pits of the LAB facility. One sump is located in the C3 pump pit (A-B002). It is part of the secondary containment system for the laboratory area sink drain collection vessel, RLD-VSL-00164 (C3 vessel). Throughout the balance of this sump data document, it will be referred to as the C3 pump pit sump (RLD-SUMP-00045).

The other three sumps are enumerated below:

Room Name	Room Number	Sump Name	Sump Number
C5 Pump Pit (South)	A-B007	C5 Pump Pit Sump	RLD-SUMP-00043A
C5 Piping Pit	A-B006	C5 Piping Pit Sump	RLD-SUMP-00044
C5 Pump Pit (North)	A-B005	C5 Pump Pit Sump	RLD-SUMP-00043B

These sumps are part of the secondary containment system for the hotcell drain collection vessel, RLD-VSL-00165 (C5 vessel). Throughout the balance of this sump data document, they will be referred to by the aforementioned sump names and numbers.

All four sumps are of a dry-type design.

3.2.1 C3 Pump Pit Sump (RLD-SUMP-00045)

The bottom of the C3 pump pit sump is located in the C3 pump pit (A-B002) at TOC elevation (-) 6 ft-8 1/2 in. The pit is lined with stainless steel for secondary containment and ease of decontamination prior to anticipated maintenance activities in the area. The liner on the floor of the pit consists of several sloped plates that direct potential leakage and washwater (during maintenance) to a drain located at the lowest point in the pit. The sump is formed by a rectangular depression in the liner around the drain. Hence, the sump is an integral part of the pit liner.

The sump drain includes a removable weir and instrumentation to provide both leak detection capabilities and the ability to completely empty the sump. With the weir installed, a detectable level is formed in the sump to allow the radar detector to sense potential leaks. Persistent leakage spills over the weir and returns to the laboratory area sink drain collection vessel, RLD-VSL-00164 (C3 vessel). In the event that leakage is detected, an operator manually removes the weir from the sump via an extended drive spindle and allows the sump to drain. The operator then diagnoses the source of the leak. The weir may also be removed during maintenance to preclude the accumulation of a residual volume of washwater in the sump.

As in the case of the cell sumps, level detection for the pit sump is accomplished using the radar level measurement leak-detection method. The volume of the sump is equal to the volume created by the depression in the liner in the vicinity of the drain and the height of the weir. This volume is limited to a maximum value of 2.4 gallons in order to be able to detect a design basis leak of 0.1 gal/h in 24 hours. Moreover, a stainless steel pipe directs weir overflow and sump drainage to the laboratory area sink drain collection vessel, RLD-VSL-00164 (C3 vessel). Flow to this vessel is by gravity.

The drain line from the C3 pump pit sump is located entirely within the C3 effluent vessel cell (A-B003). Hence, secondary containment and leak detection for this drain line is provided by the C3 effluent vessel cell and the associated radar leak detection system.

3.2.2 C5 Pump Pit Sumps (RLD-SUMP-00043A and RLD-SUMP-00043B) and C5 Piping Pit Sump (RLD-SUMP-00044)

The bottom of the C5 pump pit sumps (RLD-SUMP-0043A and RLD-SUMP-00043B) and C5 piping pit sump (RLD-SUMP-00044) are located in their respective pit at TOC elevation (-) 6 ft-7 in. The design of each of these three sumps is similar to the one described in section 3.2.1 above. The primary difference is that all three sumps drain to RLD-VSL-00165, hotcell drain collection vessel (C5 vessel) via a common drainline. The drain line from the two C5 pump pit sumps and the one C5 piping pit sump is located entirely within the C5 effluent vessel cell (A-B004). Hence, secondary containment and leak detection for this drain line is provided by the C5 effluent vessel cell and the associated radar leak detection system.

Table 1 Analytical Laboratory Sump Data

Index No.	Sump PIN	LAB Room Number & TOC Elevation	Nominal Sump Capacity (in US Gallons)	Sump Type	Sump Dimensions	Piping and Instrumentation Diagram Number (24590-LAB-M6-)	Leak Detection Type	Material of Fabrication
1	RLD-SUMP-00041	A-B003 (-) 18 ft-7 in. (top)	30	Dry	30 in. dia. x approx. 13 in. deep [NPS 30 standard-wall pipe (or equivalent plate) and 30-in dia., standard-wall pipe cap (or equivalent ellipsoidal-head section)]	RLD-P0002	Radar	Stainless Steel UNS N08367 (6% Mo)
2	RLD-SUMP-00042	A-B004 (-) 19 ft-2 in. (top)	30	Dry	30 in. dia. x approx. 13 in. deep [NPS 30 standard-wall pipe (or equivalent plate) and 30-in dia., standard-wall pipe cap (or equivalent ellipsoidal-head section)]	RLD-P0001	Radar	Stainless Steel UNS N08367 (6% Mo)
3	RLD-SUMP-00043A	A-B007 (-) 6 ft-7 in. (bottom)	1.40	Dry	Volume formed by a local depression in the liner 1.5 ft x 3.0 ft x height of a 1/2-in. weir.	RLD-P0001	Radar	Stainless Steel (SS 304L or higher grade)
4	RLD-SUMP-00043B	A-B005 (-) 6 ft-7 in. (bottom)	1.40	Dry	Volume formed by a local depression in the liner 1.5 ft x 3.0 ft x height of a 1/2-in. weir.	RLD-P0001	Radar	Stainless Steel (SS 304L or higher grade)
5	RLD-SUMP-00044	A-B006 (-) 6 ft-7 in. (bottom)	1.56	Dry	Volume formed by a local depression in the liner 2.0 ft x 2.5 ft x height of a 1/2-in. weir.	RLD-P0001	Radar	Stainless Steel (SS 304L or higher grade)
6	RLD-SUMP-00045	A-B002 (-) 6 ft-8 1/2 in. (bottom)	1.56	Dry	Volume formed by a local depression in the liner 2.0 ft x 2.5 ft x height of a 1/2-in. weir.	RLD-P0002	Radar	Stainless Steel (SS 304L or higher grade)

Table 2 Analytical Laboratory Sump Drain Data

Index Number	Sump Drain Line & Sump Number	LAB Room Number & Name	Nominal Drain Line Capacity (US gal/min)	Drain Line Size (nominal pipe size)	Piping and Instrumentation Diagram Number (24590-LAB-M6-)	Leak Detection Type	Material of Fabrication
1	RLD-WU-02207-S11E-04, RLD-SUMP-00045	A-B003, C3 Effluent Vessel Cell	86	4	RLD-P0002	Not Applicable	Stainless Steel 316L
2	RLD-ZN-02203-S11E-04, RLD-SUMP-00043A (common line)	A-B004, C5 Effluent Vessel Cell	86	4	RLD-P0001	Not Applicable	Stainless Steel 316L
3	RLD-ZN-03393-S11E-04, RLD-SUMP-00043B	A-B004, C5 Effluent Vessel Cell	86	4	RLD-P0001	Not Applicable	Stainless Steel 316L
4	RLD-ZN-03394-S11E-04, RLD-SUMP-00044	A-B004, C5 Effluent Vessel Cell	86	4	RLD-P0001	Not Applicable	Stainless Steel 316L

Attachment 51 – Appendix 11.6
Laboratory Building
Mechanical Drawings

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

Attachment 51 – Appendix 11.6
Laboratory Building
Mechanical Drawings

The following drawings have been incorporated into Appendix 11.6 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing/Document	**Description**
24590-LAB-MVD-RLD-P0164, Rev 1	Mechanical Data Sheet for RLD-VSL-00164
24590-LAB-MVD-RLD-P0165, Rev 1	Mechanical Data Sheet for RLD-VSL-00165
24590-LAB-MV-RLD-P0001, Rev 0	Equipment Assembly Drawing for RLD-VSL-00164
24590-LAB-MV-RLD-P0003, Rev 0	Equipment Drawing for RLD-VSL-00165
RESERVED	RESERVED

BECHTEL	**MECHANICAL DATA SHEET: VESSEL**	**PLANT ITEM No.** *24590-LAB-MV-RLD-VSL-00164*

Project	***RPP-WTP***	P&ID	***24590-LAB-M6-RLD-P0002***
Project No:	***24590***	Process Data Sheet.	***N/A***
Project Site:	***Hanford***	Vessel Drawing	***24590-LAB-MV-RLD-P0001***
Description:	***Lab Area Sink Drain Collection Vessel***		

Reference Data

ISSUED BY RPP-WTP PDC

Charge Vessels (Tag Numbers)	***None***
Pulsejet Mixers / Agitators (Tag Numbers)	***None***
RFDs/Pumps (Tag Numbers)	***None***

Design Data

Quality Level		***Commercial Grade***	Fabrication Specs	***24590-WTP-3PS-MV00-TP001***		
Seismic Category		***SC-III***	Design Code	***ASME Sec VIII Div 1***		
Service/Contents		***Radioactive Liquid Drain***	Code Stamp	***Yes***		
Design Specific Gravity		***1.02***	NB Registration	***Yes***		
Maximum Operating Volume	gal	***2740 (Note 5)***	Weights (lbs)	Empty	Operating	Test
Total Volume	gal	***3180 (Note 5)***	Estimated	***7200***	***28110***	***33910***
			Actual **			

Inside Diameter	inch	***102***			Wind Design	***Not Required***	
Length/Height (TL-TL)	inch	***69***			Snow Design	***Not Required***	
		Vessel Operating	Vessel Design	Coil/Jacket Design	Seismic Design	***24590-WTP-3PS-FB01-T0001 & 24590-WTP-3PS-MV00-TP002***	
Internal Pressure	psig	***0***	***15***	***N/A***	Seismic Base Moment **	ft*lb	
External Pressure	psig	***0.15***	***7***	***N/A***	Postweld Heat Treatment	***Not Required***	
Temperature	°F	***78***	***240***	***N/A***	Corrosion Allowance	Inch	***0.04***
Min. Design Metal Temp.	°F	***-20***			Hydrostatic Test Pressure **	psig	

Note: Please note that source, special nuclear and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the U.S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

MARK W. HOFFMANN STATE OF WASHINGTON 0030952 REGISTERED PROFESSIONAL ENGINEER
3/28/05
EXPIRES 12/10/06

This Bound Document Contains a total of 2 sheets.

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	REVIEWER	APPROVER
1	3/28/05	Issued for Permitting Use				
0	3/5/04	Issued for Permitting Use	K. Brightman	M, Arulampalam	C. Slater	M. Hoffmann

R10523241

Materials of Construction

Component	Material	Minimum Thickness / Size	Containment
Top Head	***UNS N08367***	***See Drawing***	***Auxiliary***
Shell	***UNS N08367***	***See Drawing***	***Primary***
Bottom Head	***UNS N08367***	***See Drawing***	***Primary***
Support (Skirt)	***SA-240-304 (Carbon Content Max 0.030%)***	**	***N/A***
Jacket/Coils/Half-Pipe Jacket	***N/A***	***N/A***	***N/A***
Internals	***UNS N08367***	***See Drawing***	***Secondary***
Pipe	***UNS N08367, SB622-N10276/N06022, Note 4*** (1)	***See Drawing***	***See Note-1***
Forgings/ Bar stock	***UNS N08367***	***See Drawing***	***As Note-1 for Nozzle Necks***
Bolting/Gaskets	***None***	***N/A***	***N/A***

Miscellaneous Data

Orientation	***Vertical***	Support Type	***Skirt***
Insulation Function	***Not Applicable***	Insulation Material	***Not Applicable***
Insulation Thickness (inch)	***Not Applicable***	Weld Surface Finish	***De-scaled as laid***

Remarks

*** To be confirmed by Seller*

Note 1: Nozzle necks below maximum operating level are primary, others auxiliary.

Note 2: Design life is 40 years

Note 3: Deleted

Note 4: Material of construction for nozzle NO 7 and NO 6 shall be Hastelloy C22 or Hastelloy C-276 (1)

Note 5: Vessel volumes are approximates and do not account for manufacturing tolerances, nozzles, and displacement of internals.

Note 6: Revised design data (1)

Note 7: Contents of this document are Dangerous Waste Permit Affecting. (1)

BECHTEL	**MECHANICAL DATA SHEET: VESSEL**	**PLANT ITEM No.** *24590-LAB-MV-RLD-VSL-00165*

Project:	***RPP-WTP***	P&ID	***24590-LAB-M6-RLD-P0001***
Project No:	***24590***	Process Data Sheet:	***N/A***
Project Site:	***Hanford***	Vessel Drawing	***24590-LAB-MV-RLD-P0003***
Description:	***Hot Cell Drain Collection Vessel***		

ISSUED BY RPP-WTP PDC

Reference Data

Charge Vessels (Tag Numbers)	***None***
Pulsejet Mixers / Agitators (Tag Numbers)	***None***
RFDs/Pumps (Tag Numbers)	***None***

Design Data

Quality Level		***QL-2***	Fabrication Specs	***24590-WTP-3PS-MV00-TP001***		
Seismic Category		***SC-III***	Design Code	***ASME Sec VIII Div 1***		
Service/Contents		***Radioactive Liquid Drain***	Code Stamp	***Yes***		
Design Specific Gravity		***1.02***	NB Registration	***Yes***		
Maximum Operating Volume	gal	***6615 (Note 5)*** △1	Weights (lbs)	Empty	Operating	Test
Total Volume	gal	***9100 (Note 5)*** △1	Estimated	***21185***	***75014***	***97966***
			Actual **			

Inside Diameter	inch	***192***			Wind Design	***Not Required***	
Length/Height (TL-TL)**	inch	***27***			Snow Design	***Not Required***	
		Vessel Operating	Vessel Design	Coil/Jacket Design	Seismic Design	***24590-WTP-3PS-FB01-T0001 & 24590-WTP-3PS-MV00-TP002***	
Internal Pressure	psig	***0***	***15***	***N/A***	Seismic Base Moment **	ft*lb	
External Pressure	psig	***0.15***	***7***	***N/A***	Postweld Heat Treatment	***Not Required***	
Temperature	°F	***78***	***240***	***N/A***	Corrosion Allowance	Inch	***0.04***
Min. Design Metal Temp	°F	***-20***			Hydrostatic Test Pressure **	psig	

Note: Please note that source, special nuclear and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the U.S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

MARK W. HOFFMANN
STATE OF WASHINGTON
0030952
REGISTERED PROFESSIONAL ENGINEER
3/28/05
EXPIRES 12/10/06

This Bound Document Contains a total of 2 sheets.

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	REVIEWER	APPROVER
1	3/28/05	Issued for Permitting Use	[signature]	[signature]	[signature]	[signature]
0	3/1/04	Issued for Permitting Use	K. Brightman	M. Arulampalam	C. Slater	M. Hoffmann

R10523240

	MECHANICAL DATA SHEET: VESSEL	PLANT ITEM No. 24590-LAB-MV-RLD-VSL-00165

Materials of Construction

Component	Material	Minimum Thickness / Size	Containment
Top Head	***UNS N08367***	***See Drawing***	***Auxiliary***
Shell	***UNS N08367***	***See Drawing***	***Primary***
Bottom Head	***UNS N08367***	***See Drawing***	***Primary***
Support (Skirt)	***SA-240-304 (0.030% Carbon Max)***	**	***N/A***
Jacket/Coils/Half-Pipe Jacket	***N/A***	***N/A***	***N/A***
Internals	***UNS N08367***	***See Drawing***	***Secondary***
Pipe	***UNS N08367/ N06022/N10276, Note 4*** △1	***See Drawing***	***Note-1***
Forgings/ Bar stock	***UNS N08367***	***See Drawing***	***Note-1 for Nozzle Necks***
Bolting/Gaskets	***None***	***N/A***	***N/A***

Miscellaneous Data

Orientation	***Vertical***	Support Type	***Skirt***
Insulation Function	***Not Applicable***	Insulation Material	***Not Applicable***
Insulation Thickness (inch)	***Not Applicable***	Weld Surface Finish	***De-scaled as laid***

Remarks

*** To be confirmed by Seller*

Note 1: Nozzle necks below maximum operating level are primary, others auxiliary.

Note 2: Design life is 40 years

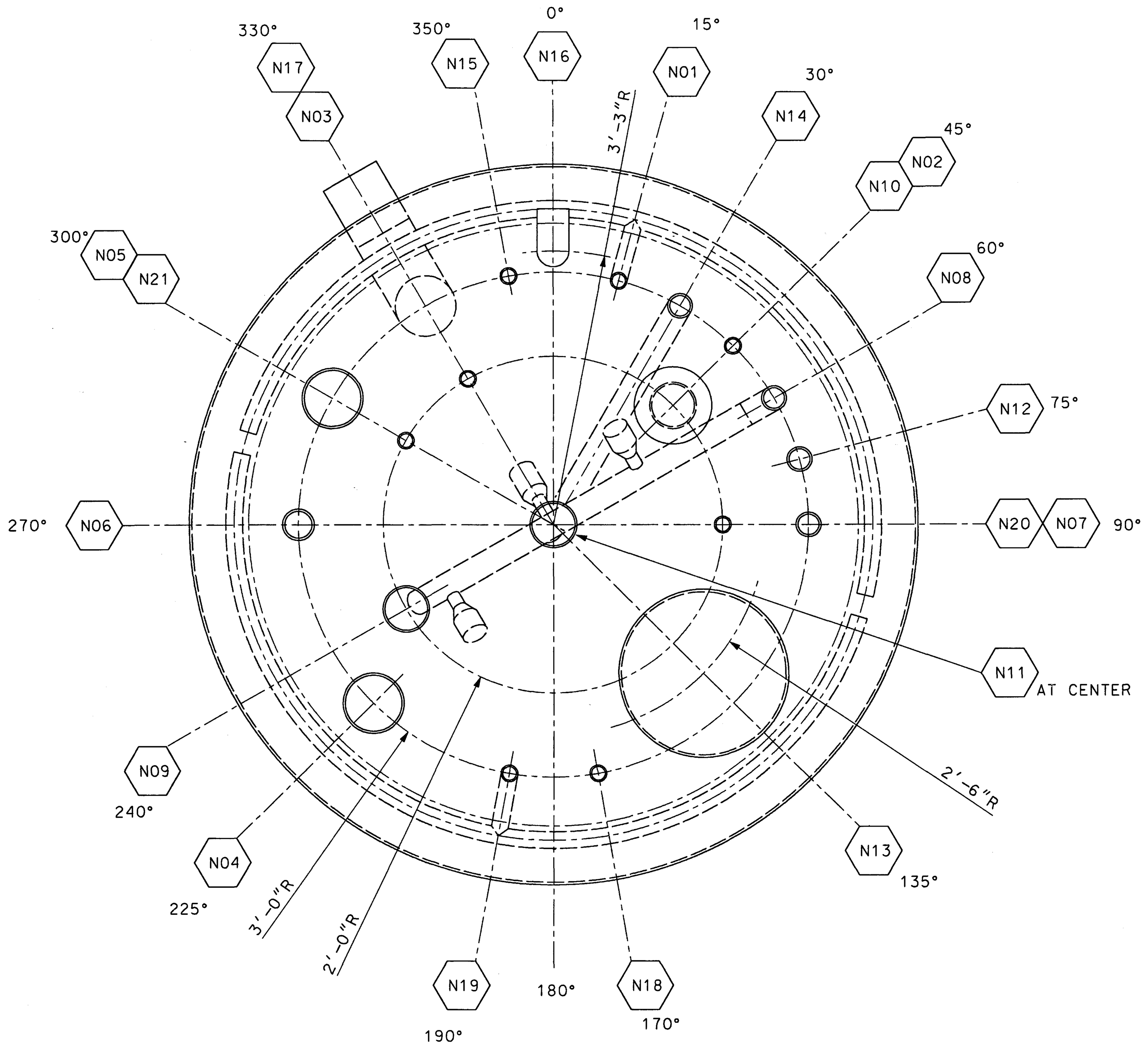
Note 3: Radiography 100% required on the primary confinement welds. △1

Note 4: Material of construction for nozzle NO. 3 and the dip pipe shall be alloy UNS N06022. △1

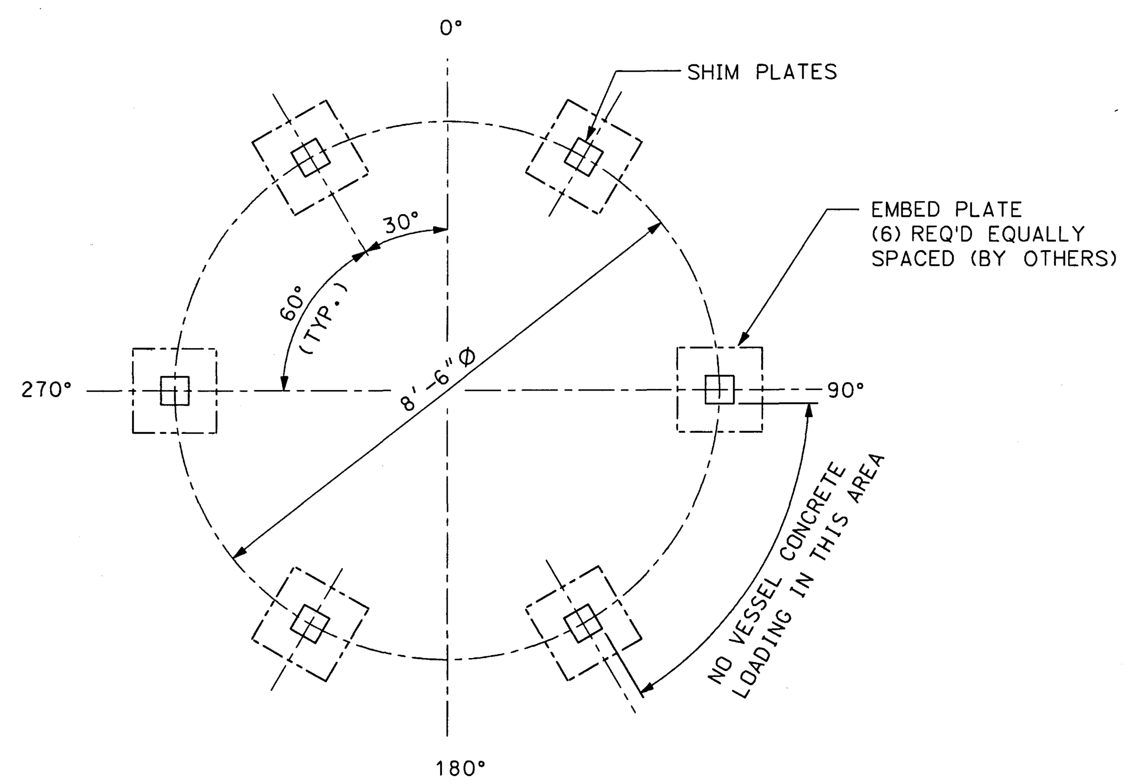
Note 5: Vessel volumes are approximates and do not account for manufacturing tolerances, nozzles, and displacement of internals.

Note 6: Quality level and seismic category designations on this datasheet reflect requirements beyond those stipulated by the vessel safety function

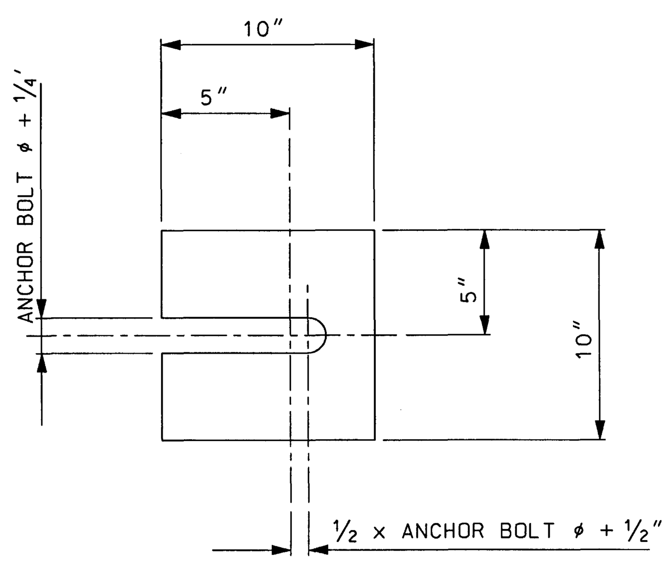
Note 7: Contents of this document are Dangerous Waste Permit Affecting.



PLAN

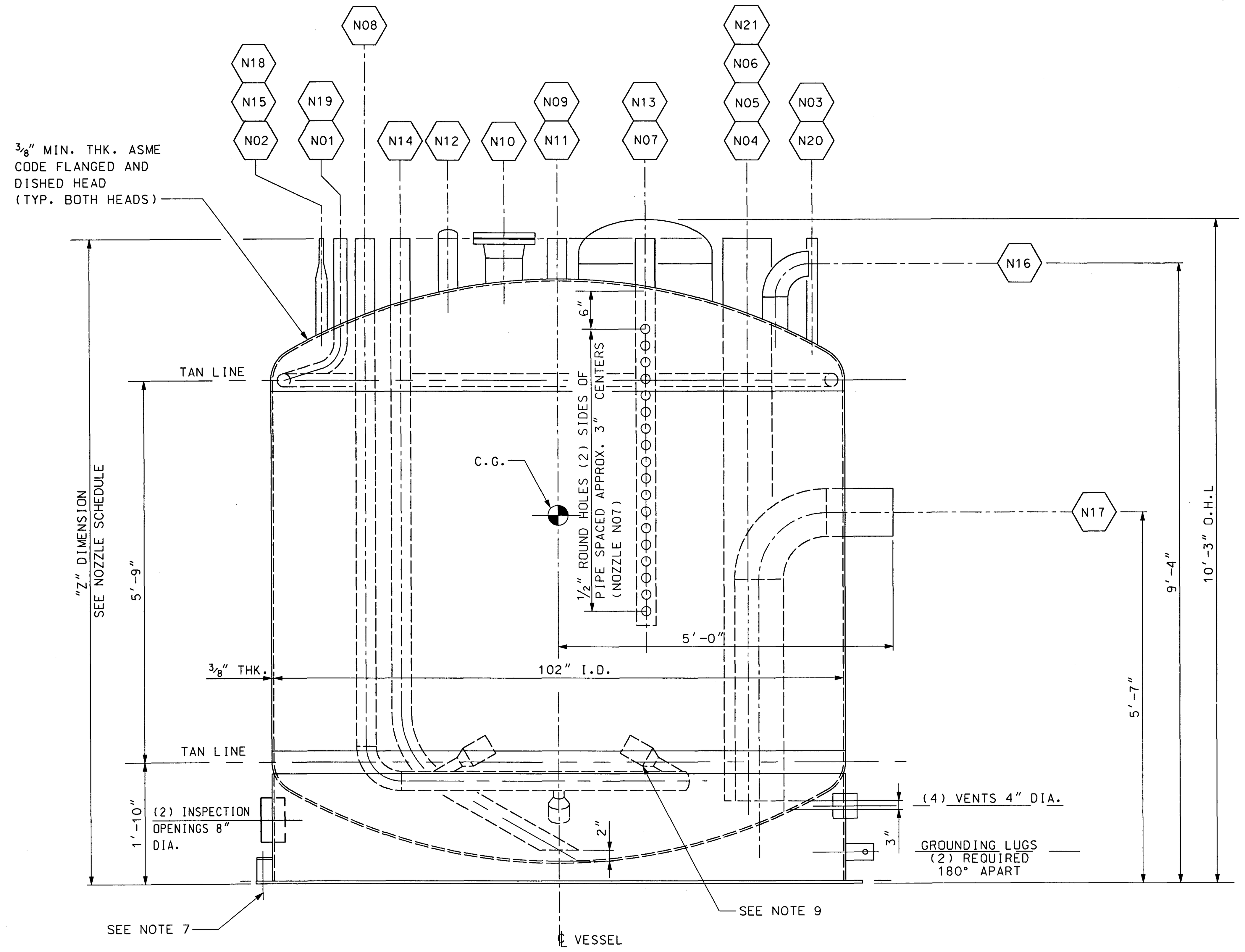


EMBED PLATE PLAN VIEW



SHIM PLATE DETAIL

(SEE NOTE 5)



ELEVATION

FOR TRUE ORIENTATION SEE PLAN

NOZZLE SCHEDULE							
NOZZLE NO.	SIZE	SCHEDULE/WALL	SERVICE/REMARKS	"Z" DIM	REF DWG/DET	CONN. PIPE SIZE/SCHED	WELD END PREP
N01	2"	80S	DIW SPRAY WATER	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 2	2" SCH. 40S	WTP J-BEVEL
N02	2" O.D.x 3/4"	SEE DETAIL	BLOCK VALVE BLEED	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 5	3/4" SCH. 40S	STANDARD
N03	1 1/2"	160S	C2 COLLECTION TANK TRANSFER	10'-0"	24590-WTP-MV-M59T-00016001 DETAIL 4	1 1/2" SCH 40S	WTP J-BEVEL
N04	8"	40S	C3 MAINT SHOP AREA DRAIN/DIP PIPE	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 4	8" SCH 10S	STANDARD
N05	8"	40S	C5 PUMP MAINT. ROOM DRAIN /DIP PIPE	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 4	8" SCH 10S	STANDARD
N06	4"	40S	HOT CELL ACCESS FLOOR DRAIN/DIP PIPE	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 4	4" SCH 10S	STANDARD
N07	3"	80S	DRAIN FROM RAD LABS/DIP PIPE	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 4	3" SCH. 10S	STANDARD
N08	3"	80S	PUMP RE-CIRCULATION/EDUCTORS	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 2	3" SCH. 40S	WTP J-BEVEL
N09	6"	40S	INSTRUMENTATION (RADAR)	10'-0"	24590-WTP-MV-M59T-00016003 DETAIL 24		STANDARD
N10	6"	40S	SPARE RFWN	9'-9"	24590-WTP-MV-M59T-00016001 DETAIL 8	BLIND FLANGE	———
N11	8"	40S	VENT	10'-2"	24590-WTP-MV-M59T-00016001 DETAIL 1	8" SCH. 10S	STANDARD
N12	3"	80S	SPARE W/ CAP	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 2	CAPPED	———
N13	24"	3/8" PLATE	MANWAY (CONSTRUCTION OPENING)	SHOWN	24590-WTP-MV-M59T-00017 DETAIL 1	CAPPED	———
N14	3"	80S	PUMP SUCTION WITH DIP PIPE	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 4	3" SCH. 40S	WTP J-BEVEL
N15	2" O.D. x 3/4"	SEE DETAIL	PUMP DRAIN	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 5	3/4" SCH. 40S	STANDARD
N16	4"	80S	PIT DRAIN WITH DIP PIPE	SHOWN	24590-WTP-MV-M59T-00016001 DETAIL 4	4" SCH. 40S	STANDARD
N17	8"	40S	OVER FLOW/DIP PIPE	SHOWN	24590-WTP-MV-M59T-00016001 DETAIL 4	8" SCH. 10S	STANDARD
N18	2" O.D.x 1"	SEE DETAIL	DEMIN WATER BLEED DRAIN	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 5	1" SCH. 40S	STANDARD
N19	2"	80S	DIW SPRAY WATER	9'-10"	24590-WTP-MV-M59T-00016001 DETAIL 2	2" SCH. 40S	WTP J-BEVEL
N20	1 1/2"	160S	PROCESS VACUUM DRAIN	10'-0"	24590-WTP-MV-M59T-00016001 DETAIL 4	1 1/2" SCH 40S	WTP J-BEVEL
N21	2"	160S	ASX BOTTLE STATION DRAIN/DIP PIPE	10'-0"	24590-WTP-MV-M59T-00016001 DETAIL 4	2" SCH 40S	WTP J-BEVEL

GENERAL NOTES

1. ALL THICKNESSES OR PIPE SCHEDULES SHOWN ON THE NOZZLE SCHEDULE ARE MINIMUM. SELLER TO CONFIRM THE ACTUAL WALL THICKNESS TO BE USED.
2. SELLER TO DESIGN BASE PLATE AND ANCHOR BOLT SIZE. MINIMUM ø 1 1/4".
3. SELLER TO DESIGN AND FURNISH TAILING LUG.
4. MIXING WILL BE ACCOMPLISHED WITH EDUCTORS.
5. SELLER SHALL PROVIDE SIX SHIM PACKS, 10" SQUARE IN 316 SS EACH CONSISTING OF:
   (2) 1/4" THICK PLATES
   (2) 1/8" THICK PLATES
   (2) 1/16" THICK PLATES
   THE SKIRT SHALL BE DESIGNED TO BE SUPPORTED BY THE SHIM PLATES SPACED AS SHOWN BY THE EMBED PLATE PLAN VIEW.
6. N04 AND N05 DIP PIPE SHALL HAVE 4 STAGGERED, 2-IN DIA. HOLES LOCATED ABOVE OVERFLOW LEVEL. SIMILARLY, N06 DIP PIPE SHALL HAVE 4 STAGGERED 1-IN DIA HOLES AND N21 SHALL HAVE 4 STAGGERED 1/2-IN DIA HOLES ABOVE OVERFLOW LEVEL.
7. SELLER SHALL SIZE ANCHOR BOLTS AND CHAIRS PER REFERENCE DRAWING 24590-WTP-MV-M59T-00026. BUYER SHALL PROVIDE AND WELD ANCHOR BOLTS TO A-240 316L PLATES EMBEDDED IN CONCRETE FLOOR. SELLER SHALL SIZE ANCHOR BOLTS USING MATERIAL PROPERTIES OF THE EMBEDDED STAINLESS STEEL 316L PLATE.
8. FOR DISTANCE OF DIP PIPES TO BOTTOM OF THE HEAD USE 2" CLEARANCE UNLESS OTHERWISE SPECIFIED.
9. TWO END TANK MIXING EDUCTORS (EST CORP., TYPE 468, 3/4-INCH OR EQUAL) TO BE DIRECTED 30 DEGREE UPWARD FROM HORIZONTAL AND POINTED IN OPPOSITE DIRECTIONS. THIRD EDUCTOR (EST CORP., TYPE 468, 3/8-INCH OR EQUAL) TO BE POINTED 30 DEGREE DOWNWARD FROM HORIZONTAL.
10. DELETED
11. CONTENTS OF THIS DOCUMENT (DRAWING) ARE DANGEROUS WASTE PERMIT AFFECTING.

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIAL AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

THIS DRAWING TO BE READ IN CONJUNCTION WITH THE MECHANICAL DATA SHEET NO 24590-LAB-MVD-RLD-P0164

REFERENCE DRAWINGS		
DWG NO	REV	TITLE
24590-LAB-M6-RLD-P0002	0	P&ID LAB RADIOACTIVE LIQUID WASTE DISPOSAL SYSTEM
24590-WTP-MV-M59T-00001	2	PRESSURE VESSEL TOLERANCES STANDARD DETAILS
24590-WTP-MV-M59T-00012	1	GROUNDING LUG STANDARD DETAILS
24590-WTP-MV-M59T-00017	1	VESSEL INSPECTION MANWAY STANDARD DETAILS
24590-WTP-MV-M59T-00018	1	VESSEL NAME PLATE STANDARD DETAILS
24590-WTP-MV-M59T-00026	1	ANCHOR BOLT CHAIR DETAILS FOR VERTICAL VESSEL
24590-WTP-MV-M59T-00016001	2	VESSEL CONNECTIONS STANDARD DETAILS SHEET 1 OF 3
24590-WTP-MV-M59T-00016003	0	VESSEL CONNECTION STANDARD DETAILS SHEET 3 OF 3
24590-WTP-MV-M59T-00009	1	LIFTING LUGS STANDARD DETAILS
24590-WTP-MV-M59T-00011	1	WASH RINGS STANDARD DETAILS

EXPIRES 12/15/03

R10223772

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
0	ISSUED FOR PERMITTING USE					12/18/03

REVISION HISTORY

CM QUALITY LEVEL

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	60

	BY	DATE
ORIGINATOR		12/2/03
CHECKER		12/1/03
APPROVER		12/18/03
REVIEWER		12/8/03

CONTENT APPLICABLE TO ALARA? YES NO

ADR NO. REV:

RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

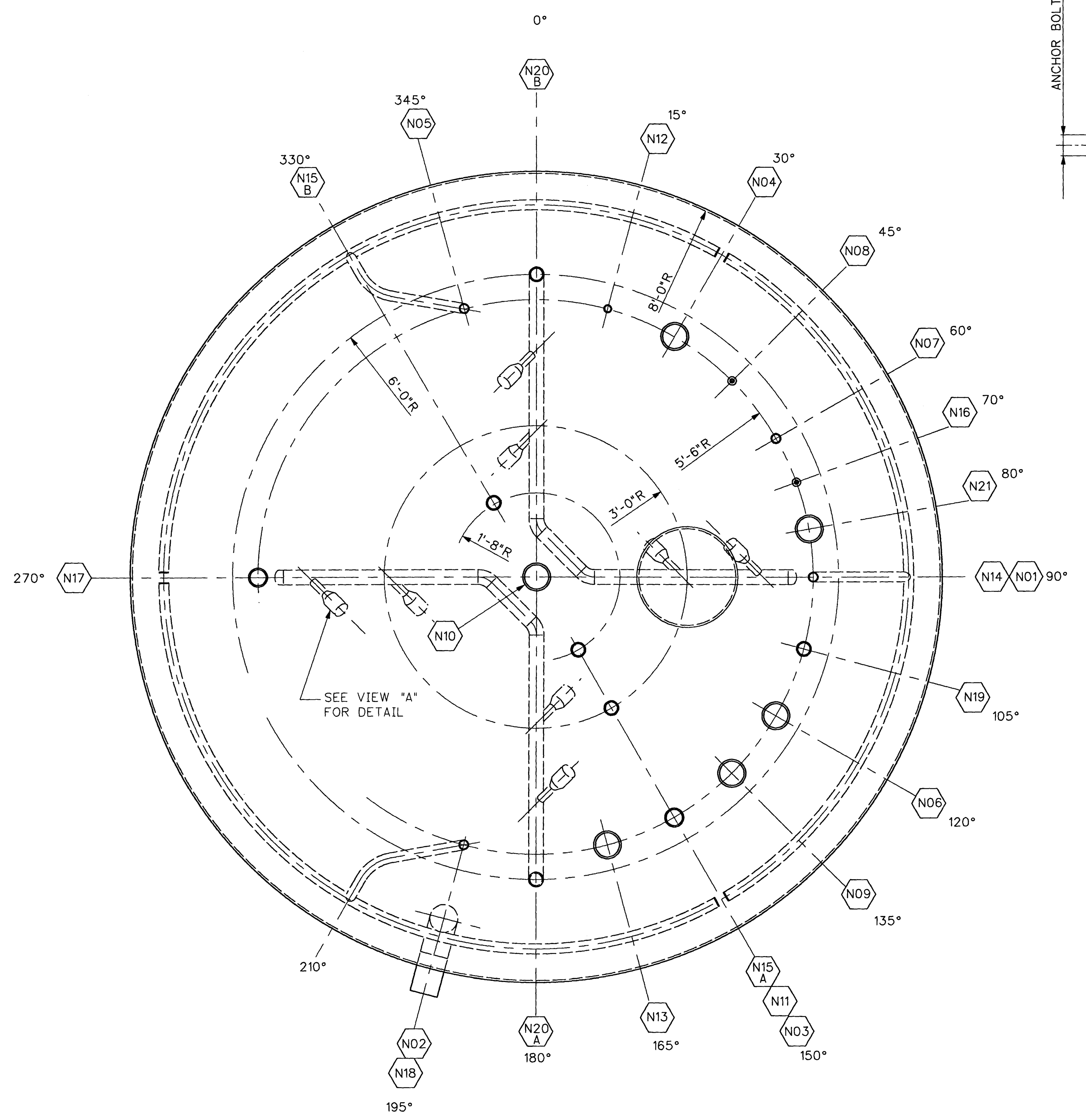
CONTRACT No: DE-AC27-01RV14136

EQUIPMENT ASSEMBLY LAB AREA SINK DRAIN COLLECTION VESSEL RLD-VSL-00164

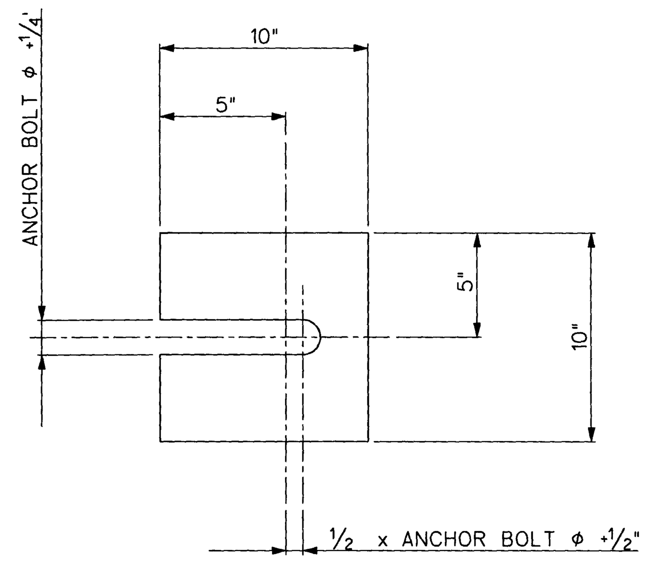
SCALE: NTS

24590-LAB-MV-RLD-P0001 REV 0

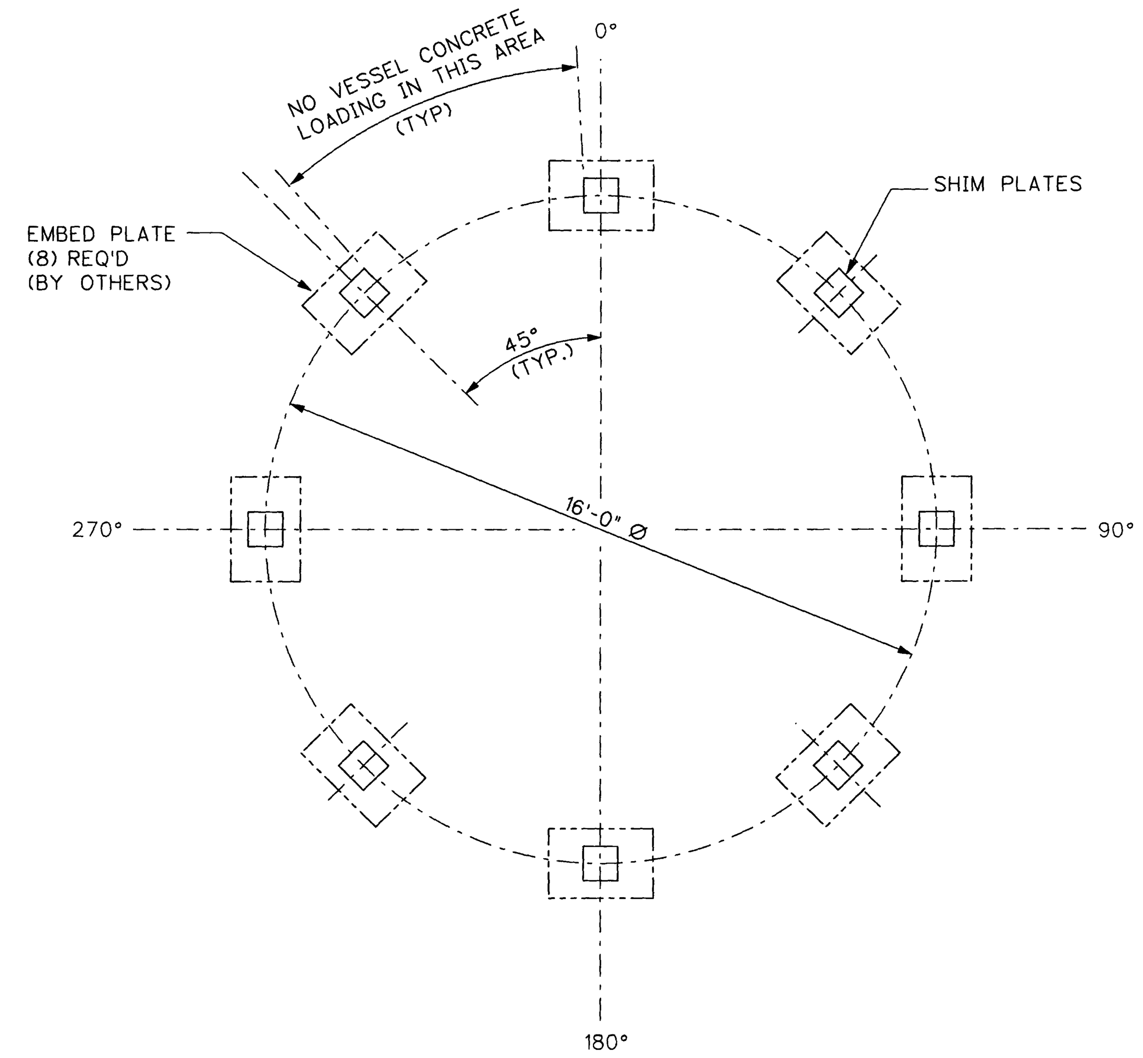
"E" SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED



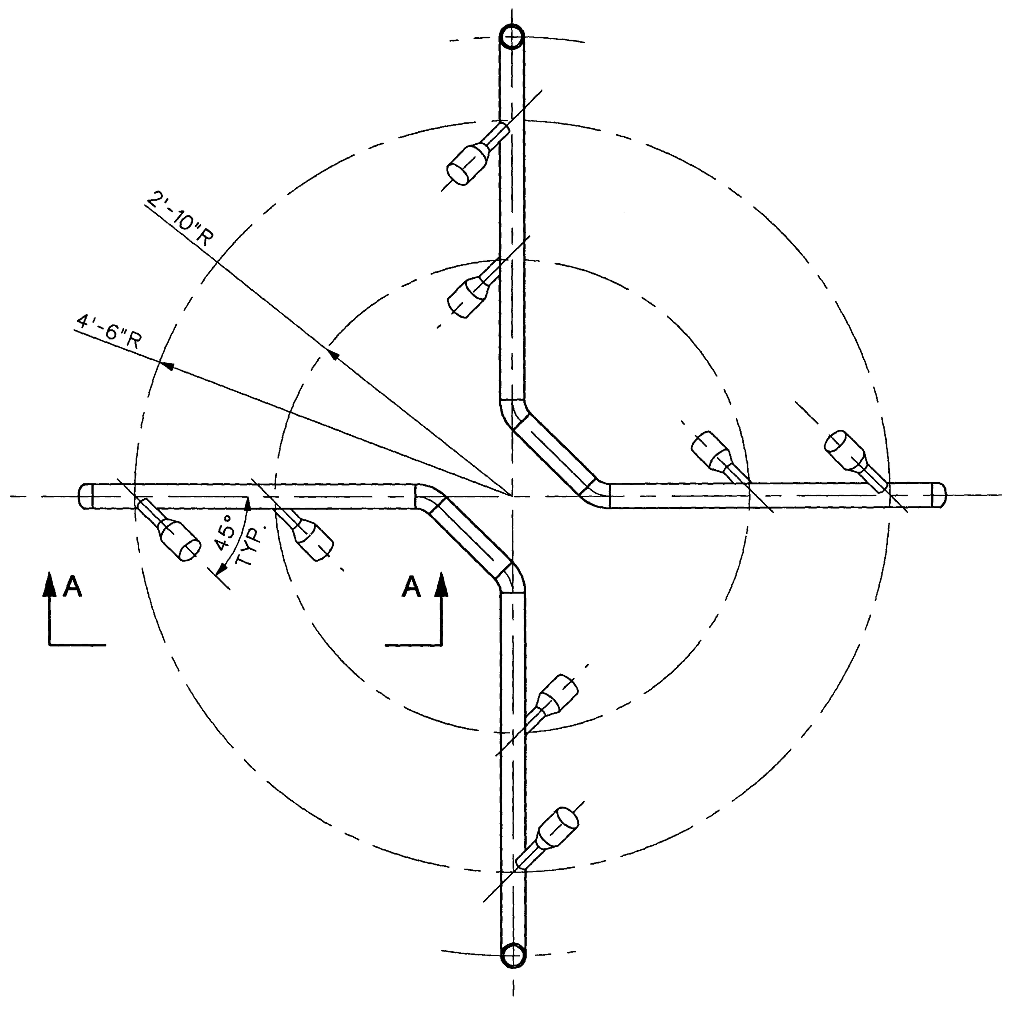
PLAN



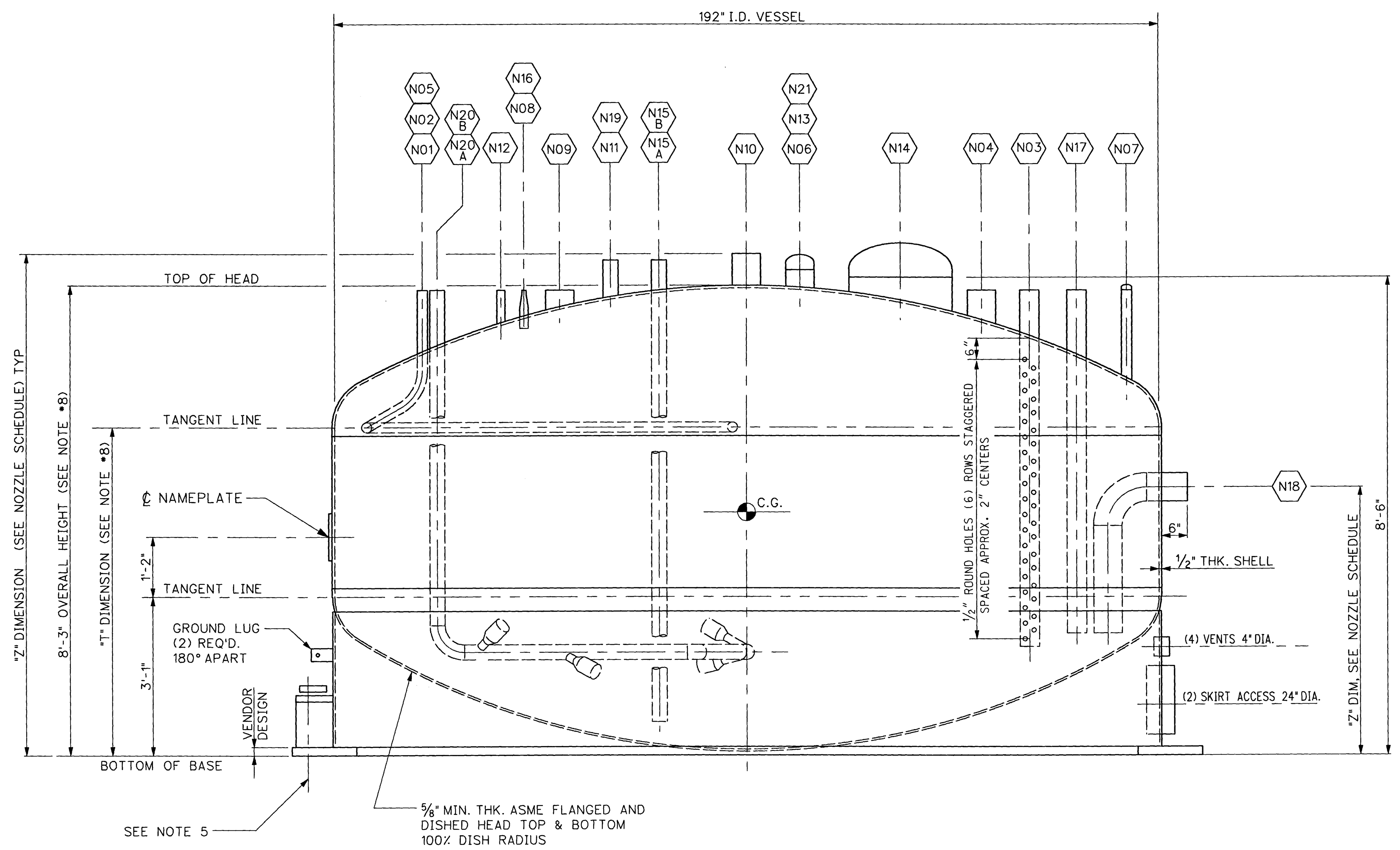
SHIM PLATE DETAIL
(SEE NOTE 5)



EMBED PLATE PLAN VIEW

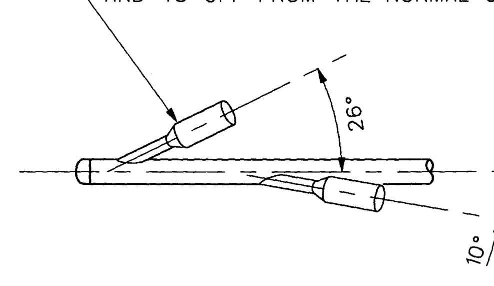


VIEW "A"
RECIRC/EDUCTORS



ELEVATION
FOR TRUE ORIENTATION SEE PLAN

PENBERTHY, INC. EDUCTOR MODEL CTE 1/2", QUANTITY (8), DIRECTED UPWARD/DOWNWARD @ 26° & 10° RESPECTIVELY, AND 45° OFF FROM THE NORMAL CENTERLINES.



SECTION "A"-"A"
TYP. @ (4) PLACES
EDUCTOR MANIFOLD SHALL BE 12" OR LESS ABOVE VESSEL LOW POINT

NOZZLE SCHEDULE							
NOZZLE	SIZE	SCHED/WALL	SERVICE/REMARKS	"Z" DIM	REF DWG/DET	CONN PIPE SIZE/SCHED	WELD END PREP
N01	2"	80S	WASH RING	8'-3"	24590-WTP-MV-M59T-00016001, DET. 3	2" SCH. 40S	WTP J-BEVEL
N02	2"	80S	WASH RING	8'-3"	24590-WTP-MV-M59T-00016001, DET. 3	2" SCH. 40S	WTP J-BEVEL
N03	4"	80S	HOTCELL DRAINS (DIP PIPE)	8'-3"	24590-WTP-MV-M59T-00016001, DET. 4	4" SCH. 10S	STANDARD
N04	6"	80S	LEVEL INSTRUMENTATION (RADAR)	--	24590-WTP-MV-M59T-00016003, DET. 24	N/A	STANDARD
N05	2"	80S	WASH RING	8'-3"	24590-WTP-MV-M59T-00016001, DET. 3	2" SCH. 40S	WTP J-BEVEL
N06	6"	80S	SPARE	8'-3"	24590-WTP-MV-M59T-00016001, DET. 2	CAPPED	--
N07	2"	80S	SPARE	8'-3"	24590-WTP-MV-M59T-00016001, DET. 2	CAPPED	--
N08	2"ODX3/4"		DEMIN WATER BLEED	8'-3"	24590-WTP-MV-M59T-00016001, DET. 5	3/4" SCH. 40S	STANDARD
N09	6"	80S	PROVISION FOR FUTURE USE	8'-3"	24590-WTP-MV-M59T-00016001, DET. 2	6" SCH. 10S	STANDARD
N10	6"	80S	VESSEL VENT	9'-3"	24590-WTP-MV-M59T-00016001, DET. 1	6" SCH. 10S	STANDARD
N11	3"	80S	LAB AREA SINK DRAIN VESSEL TRANSFER	9'-3"	24590-WTP-MV-M59T-00016001, DET. 2	3" SCH. 40S	WTP J-BEVEL
N12	1 1/2"	160S	C2 TRANSFER	8'-3"	24590-WTP-MV-M59T-00016001, DET. 2	1 1/2" SCH. 40S	WTP J-BEVEL
N13	6"	80S	SPARE	8'-3"	24590-WTP-MV-M59T-00016001, DET. 2	CAPPED	--
N14	24"	PLATE	MANWAY (CONSTRUCTION OPENING)	--	24590-WTP-MV-M59T-00017, DET. 1	CAPPED	--
N15A	3"	80S	PUMP SUCTION (DIP PIPE)	9'-3"	24590-WTP-MV-M59T-00016001, DET. 4	3" SCH. 40S	WTP J-BEVEL
N15B	3"	80S	PUMP SUCTION (DIP PIPE)	9'-3"	24590-WTP-MV-M59T-00016001, DET. 4	3" SCH. 40S	WTP J-BEVEL
N16	2"ODX3/4"		PUMP DRAINS	8'-3"	24590-WTP-MV-M59T-00016001, DET. 5	3/4" SCH. 40S	STANDARD
N17	4"	80S	PIT DRAIN HEADER (DIP PIPE)	8'-3"	24590-WTP-MV-M59T-00016001, DET. 4	4" SCH. 40S	WTP J-BEVEL
N18	6"	80S	OVERFLOW (DIP PIPE)	4'-5"	24590-WTP-MV-M59T-00016001, DET. 4	6" SCH. 10S	STANDARD
N19	3"	80S	GLOVE BOX HEADER	8'-3"	24590-WTP-MV-M59T-00016001, DET. 2	3" SCH. 40S	WTP J-BEVEL
N20A	3"	80S	RECIRC. / EDUCTORS	8'-3"	24590-WTP-MV-M59T-00016001, DET. 3	3" SCH. 40S	WTP J-BEVEL
N20B	3"	80S	RECIRC. / EDUCTORS	8'-3"	24590-WTP-MV-M59T-00016001, DET. 3	3" SCH. 40S	WTP J-BEVEL
N21	6"	80S	SPARE	8'-3"	24590-WTP-MV-M59T-00016001, DET. 2	CAPPED	--

GENERAL NOTES

1. ALL THICKNESSES OR PIPE SCHEDULES SHOWN ON THE NOZZLE SCHEDULE ARE MINIMUMS. SELLER TO CONFIRM THE ACTUAL WALL THICKNESS TO BE USED.
2. SELLER TO DESIGN BASE PLATE AND ANCHOR BOLT SIZE. MINIMUM ⌀ 1 1/4".
3. USE 2" BOTTOM HEAD CLEARANCE FOR DIP LEG.
4. MIXING WILL BE ACCOMPLISHED WITH EDUCTORS.
5. SELLER SHALL SIZE ANCHOR BOLTS AND CHAIRS PER REFERENCE DRAWING 24590-WTP-MV-M59T-00026. BUYER SHALL PROVIDE AND WELD ANCHOR BOLTS TO A-240 316L PLATES EMBEDDED IN CONCRETE FLOOR. SELLER SHALL SIZE ANCHORS BOLTS USING MATERIAL PROPERTIES OF THE EMBEDDED STAINLESS 316L PLATE.
6. SELLER SHALL PROVIDE EIGHT SHIM PACKS, 10" SQUARE IN 316 SS EACH CONSISTING OF:
   (2) 1/4" THICK PLATES
   (2) 1/8" THICK PLATES
   (2) 1/16" THICK PLATES.
   THE SKIRT SHALL BE DESIGNED TO BE SUPPORTED BY THE SHIM PLATES SPACED AS SHOWN BY THE EMBED PLATE PLAN VIEW.
7. DELETED
8. "T" DIMENSION MAY VARY BETWEEN 5'-4 1/8" MAXIMUM AND 5'-1 7/8" MINIMUM DEPENDING ON ACTUAL DEPTH OF TOP HEAD PROVIDED. IN ORDER TO MAINTAIN 8'-3" DIMENSION FROM UNDERSIDE BASE RING TO OUTSIDE OF TOP HEAD, THE 8'-3" DIMENSION SHALL HAVE A TOLERANCE OF ±3/8" IN LIEU OF A STACKED TOLERANCE PER THE REFERENCED TOLERANCE DRAWING.
9. DELETED
10. CONTENTS OF THIS DOCUMENT (DRAWING) ARE DANGEROUS WASTE PERMIT AFFECTING.
11. QUALITY DESIGNATIONS ON THIS DRAWING REFLECT REQUIREMENTS BEYOND THOSE STIPULATED BY THE VESSEL'S SAFETY FUNCTION.

PLEASE NOTE THAT SOURCE, SPECIAL NUCLEAR AND BYPRODUCT MATERIALS, AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954 (AEA), ARE REGULATED AT THE U.S. DEPARTMENT OF ENERGY (DOE) FACILITIES EXCLUSIVELY BY DOE ACTING PURSUANT TO ITS AEA AUTHORITY. DOE ASSERTS, THAT PURSUANT TO THE AEA, IT HAS SOLE AND EXCLUSIVE RESPONSIBILITY AND AUTHORITY TO REGULATE SOURCE, SPECIAL NUCLEAR, AND BYPRODUCT MATERIAL AT DOE-OWNED NUCLEAR FACILITIES. INFORMATION CONTAINED HEREIN ON RADIONUCLIDES IS PROVIDED FOR PROCESS DESCRIPTION PURPOSES ONLY.

VESSEL COMPONENT QUALITY LEVELS	
COMPONENTS	QUALITY LEVELS
MAIN VESSEL, SKIRT, NOZZLES	QL-2
ALL INTERNAL SUPPORTS	QL-2
LEVEL INSTRUMENTS	CM
EDUCTORS AND PIPING	CM
OTHER INSTRUMENTATION	CM
WASH RING AND PIPING	CM

THIS DRAWING TO BE READ IN CONJUNCTION WITH THE MECHANICAL DATA SHEET NO 24590-LAB-MVD-RLD-P0165

REFERENCE DRAWINGS		
DWG NO	REV	TITLE
24590-LAB-M6-RLD-P0001	0	P & ID- LAB RLD C5 COLLECTION AND TRANSFER
24590-WTP-MV-M59T-00001	2	PRESSURE VESSEL TOLERANCES STANDARD DETAILS
24590-WTP-MV-M59T-00012	1	GROUNDING LUG STANDARD DETAILS
24590-WTP-MV-M59T-00016001	2	VESSEL CONNECTIONS STANDARD DETAILS SHEET 1 OF 3
24590-WTP-MV-M59T-00016003	0	VESSEL CONNECTIONS STANDARD DETAILS SHEET 3 OF 3
24590-WTP-MV-M59T-00011	1	WASH RING STANDARD DETAILS USE DETAIL 1
24590-WTP-MV-M59T-00009	1	LIFTING LUGS STANDARD DETAILS
24590-WTP-MV-M59T-00017	1	VESSEL INSPECTION MANWAY STANDARD DETAILS
24590-WTP-MV-M59T-00018	1	NAME PLATE STANDARD DETAILS
24590-WTP-MV-M59T-00026	1	ANCHOR BOLT CHAIR DETAILS FOR VERTICAL VESSEL

MARK W. HOFFMANN
REGISTERED PROFESSIONAL ENGINEER
STATE OF WASHINGTON
EXPIRES 12/19/04
3/5/04

REVISION HISTORY						
REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
0	ISSUED FOR PERMITTING USE	[signature]	[signature]	[signature]	[signature]	3/5/04

Q
QUALITY LEVEL

ISSUED BY RPP-WTP PDC
INIT DATE
ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	60

	BY	DATE
ORIGINATOR	[signature]	3/3/04
CHECKER	[signature]	03/03/04
APPROVER	[signature]	3/5/04
REVIEWER	[signature]	3/3/04

CONTENT APPLICABLE TO ALARA? [XX] YES [ ] NO
ADR NO. N/A REV:

BECHTEL
RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
2435 STEVENS CENTER PLACE
RICHLAND, WA 99352

CONTRACT No: DE-AC27-01RV14136

EQUIPMENT ASSEMBLY ANALYTICAL LAB HOT CELL DRAIN COLLECTION VESSEL RLD-VSL-00165

SCALE: NTS
24590-LAB-MV-RLD-P0003
REV 0

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL CHANGES NOT PERMITTED

03/03/2004 08:43:55 AM
PLOTTED BY: jrwilli3
C:\Work\dms07427\LABMVRLDP0003.DGN

R10223773

FORM E_SDN.DGN 02/2003

Attachment 51 – Appendix 11.8
Laboratory Building
Engineering Calculations

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

Appendix 11.8
Laboratory Building
Engineering Calculations

The following drawings have been incorporated into Appendix 11.8 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing/Document	Description
24590-LAB-PER-M-02-001, Rev 0	Flooding Volume Calculations
24590-LAB-PER-M-04-0001, Rev 0	LAB Minimum Leak Rate Detection Capabilities for Leak Detection Boxes, Cell Sumps, and Pit Sumps
24590-LAB-PER-M-04-0002, Rev 0	LAB Waste Removal Capability for the Effluent Vessels Cells
RESERVED	RESERVED

BECHTEL

DOCUMENT INFORMATION

The following information is required when submitting a document to PDC for issuance.	**Correspondence (CCN) No:** ______ **Document No:** 24590-LAB-PER-M-02-001 **Rev:** 0

Project Information (Check Applicable Box)

- [ ] Balance of Facilities
- [ ] HLW Vitrification
- [x] Analytical Laboratory
- [ ] Across all areas
- [ ] Pretreatment
- [ ] LAW Vitrification
- [ ] External Interfaces

Document is applicable to ALARA (as determined by the originator)? [ ] Yes [x] No

Applicability to ALARA means that the item has the potential to affect doses, contamination levels, or releases to the environment. (See 24590-WTP-GPP-SRAD-002, *Application of ALARA in the Design Process*, sections 4.1 and 4.2 for more information.)

Subject code(s): ______ (for correspondence only)

ACTION ITEM INFORMATION (for correspondence other than meeting minutes)

Commitments: [ ] Yes [ ] No (if yes, brief description below)

Tracked by RITS

Commitment Owed to: ______ Due Date: ______

Actionee(s)

Tracked by PADC

Written Response Required: [ ] Yes [ ] No

Owed to: ______ Due Date: ______

This correspondence closes action on Correspondence Number ______

- [ ] Subcontract Files ______ Copies
- [ ] PAAA Coordinator MS14-4B
- [ ] Contains SENSITIVE Information

Additional Departmental Info (to facilitate keyword search)

Internal [ ] DNFSB [ ] ORP [ ] OSR [ ] WDOE [ ] WDOH [ ] Other ______

Special Instructions for PDC

Submitted to PDC w/o A Master Distribution Schedule
WJ 8/14/03

8/14/03 [x] Processed Data Entry [NA] Copied QA [ ] Scanned [ ] Filed

R10111633

Document title: **Flooding Volume for LAB Facility**

Contract number: DE-AC27-01RV14136

Department: LAB Mechanical Systems

Author(s): P. Martinelli

ISSUED BY RPP-WTP PDC 8/19/03 INIT DATE

Principal author signature: Pietro Martinelli

Document number: 24590-LAB-PER-M-02-001, Rev 0

Checked by: R. P. Hills

Checker signature: R. P. Hills

Date of issue: August 13, 2003

Issue status: Issued for Permitting Use

Approved by: M. Hoffmann

Approver's position: Mechanical Systems Manager

Approver signature:

MARK W. HOFFMANN STATE OF WASHINGTON 0030952 REGISTERED PROFESSIONAL ENGINEER

M.W. Hoffmann 8/13/03

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Notice

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

History Sheet

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Contents

Appendices

1 Introduction

The Washington Administrative Code, WAC 173-303, requires that secondary containment be designed and operated to contain 100% of the capacity of the largest tank within its boundary for tank systems that contain dangerous waste. This report discusses the assessment of the flooding volumes that are required to be contained for the River Protection Project – Waste Treatment Plant (WTP) analytical laboratory (LAB). The LAB has two dangerous waste vessels: the laboratory area sink drain collection vessel (RLD-VSL-00164) and the hotcell drain collection vessel (RLD-VSL-00165).

2 Applicable Documents

WAC 173-303. *Dangerous Waste Regulations.* Washington Administrative Code.

Publication #95-420, Guidance for Assessing Dangerous Waste Secondary Containment Systems, Washington Department of Ecology, September 1995.

3 Description

There are two dangerous waste vessels in the LAB. The first vessel, RLD-VSL-00164, laboratory area sink drain collection vessel, will hereafter be referred to as the C3 vessel (RLD-VSL-00164). The second vessel, RLD-VSL-00165, hotcell drain collection vessel, will hereafter be referred to as the C5 vessel (RLD-VSL-000165).

The C3 vessel (RLD-VSL-00164) collects, by gravity flow, effluents and other inflows from the radiological laboratory fumehood sinks, radiological laboratory sinks, maintenance area floor drains, pump maintenance room drains, hotcell maintenance access area floor drains, personnel decontamination showers and sinks, process vacuum system equipment drains, and a maintenance area sink. These sources of influent are all located at grade level. In addition, the C3 vessel (RLD-VSL-00164) receives liquid transfers from RLD-VSL-00163, floor drain collection vessel (C2 vessel), and sump drain flows from the C3 pump pit (A-B002). RLD-VSL-00164 is located at elevation (-) 18'-7". The vessel is located in a stainless steel lined, rectangular cell and is the only vessel in that cell. The cell is designated room A-B003, C3 effluent vessel cell.

The C5 vessel (RLD-VSL-000165) collects, by gravity flow, effluents and other inflows from laboratory hotcell floor drains, hotcell cupsinks, hotcell transfer drawer drains, hotcell transfer glovebox drains, autosampling system drains, and a maintenance decontamination glovebox drain. In addition, the vessel receives effluent transfers from the previously described C3 vessel (RLD-VSL-00164), liquid transfers from RLD-VSL-00163, floor drain collection vessel (C2 vessel), and sump drain flows from the C5 pump pits (A-B005 and A-B007) and C5 piping pit (A-B006). RLD-VSL-00165 is located at elevation (-)19'-2". It is housed in a stainless steel lined, rectangular cell and is the only vessel in that cell. The cell is designated room A-B004, C5 effluent vessel cell.

3.1 C3 Vessel Secondary Containment for LAB Facility

The C3 vessel (RLD-VSL-00164) is the only vessel in the respective cell. Flooding could occur in the cell if there is a failure of the vessel or a release of fire water that causes the vessel to overflow via its overflow nozzle. The worse of the two scenarios determines the required height of the stainless steel liner for the C3 effluent vessel cell.

The WTP design criteria for flooding due to a vessel failure is defined as either 110% of the maximum operating volume of the largest vessel in the cell or the total volume of the largest vessel, whichever is greater. The total volume is defined as the internal volume of the vessel, including the shell and both heads. In this case, there is only one vessel in the cell and its total volume of 3180 gal (425.1 ft^3) is the greater volume. This is the volume that is used for calculating the cell stainless steel liner height.

To conservatively calculate the available volume of the C3 cell where the flooding volume would be contained, the cross-sectional area of the vessel was subtracted from the cross-sectional area of the rectangular cell and the vessel was conservatively modeled as a straight cylinder over the entire flood height. In addition, an allotment was made for displacement due to piping, vessel supports, and other commodities that may be found in the cell. The required height of the liner is equal to the flooding volume divided by the available cross-sectional area of the cell compartment. Since the cell floor is sloped, the depth of the grout at the highest point in the cell is added to the liner height. The available volume below the grout height is conservatively ignored. The top of the stainless steel liner above the poured concrete floor required for a postulated vessel failure is 1.85 ft.

Collection of fire water discharges when the vessel is full and intact could also result in the flooding of the C3 effluent vessel cell. The C3 vessel (RLD-VSL-00164) collects effluents and other inflows from various sinks, cupsinks, and floor drains. Most of the cupsinks are located in independent fumehoods or gloveboxes that are independently sprinklered. Hence, they are not major influent sources. Similarly, the lab bench sinks are not major influent sources due to their small cross-sectional open area. Therefore, the sinks and cupsinks represent only small flooding volumes and are not considered further.

The flooding due to fire water entering the drain collection system through floor drains and overflowing the C3 vessel (RLD-VSL-00164) was estimated based on a sprinkler spray density of 0.17 gal/min·ft^2 (gallons per minute per square foot), a minimum design area of 3000 ft^2, and a sprinkler operating duration of 20 minutes. Thus, the total amount of fire water that is collected in the vessel and presumed to overflow into the cell is 10,200 gal (1363.5 ft^3). Moreover, the largest contained area of any room or compartment with floor drains is less than 2000 ft^2. Hence, the postulated overflow volume is deemed to be conservative.

Again, to conservatively calculate the available area of the cell where the flooding volume would be contained, the cross-sectional area of the vessel was subtracted from the cross-sectional area of the rectangular cell. The required height of the liner is equal to the flooding volume divided by the available cross-sectional area of the cell compartment, plus the grout height. As before, the available volume below the grout height is conservatively ignored. The top of the stainless steel liner above the poured concrete floor required for flooding due to a postulated fire water discharge is 5.06 ft (round to 5 ft-1 in.).

Based on selection of the worse of the two flooding scenarios, the minimum stainless steel liner height for the C3 effluent vessel cell is 5 ft-1 in. A derivation of the liner height calculation is provided in Appendix A.

3.2 C5 Vessel Secondary Containment for LAB Facility

The C5 vessel (RLD-VSL-00165) is the only vessel in the respective cell. Flooding could occur in the cell if there is a failure of the vessel or a release of fire water that causes the vessel to overflow via its overflow nozzle. The worse of the two scenarios determines the required height of the stainless steel liner for the C5 effluent vessel cell.

The flooding due to a vessel failure is defined by WTP as either 110% of the maximum operating volume of the largest vessel in the cell or the total volume of the largest vessel, whichever is greater. The total volume is defined as the internal volume of the vessel, including the shell and both heads. In this case, there is only one vessel in the cell and its total volume of 9100 gallons (1216.5 ft^3) is the greater volume. This is the volume that is used for calculating the cell stainless steel liner height.

To conservatively calculate the available area of the C5 cell where the flooding volume would be contained, the cross-sectional area of the vessel was subtracted from the cross-sectional area of the rectangular cell and the vessel was conservatively modeled as a straight cylinder over the entire flood height. In addition, an allotment was made for displacement due to piping, vessel supports, and other commodities that may be found in the cell. The required height of the liner is equal to the flooding volume divided by the available cross-sectional area of the cell compartment. Since the cell floor is sloped, the depth of the grout at the highest point in the cell is added to the liner height. The available volume below the grout height is conservatively ignored. The top of the stainless steel liner required above the poured concrete floor for a postulated vessel failure is 3.59 ft.

Collection of fire water discharges when the vessel is full and intact could also result in the flooding of the C5 effluent vessel cell. The C5 vessel (RLD-VSL-00165) collects effluents and other inflows from various cupsinks, floor drains, and specialty drains located within or around the hotcells, and in the C3 maintenance shop. Fire water that is discharged in areas where these inlets are located can enter the drain collection system and overflow the C5 vessel (RLD-VSL-00165).

The flooding due to fire water overflowing the C5 vessel (RLD-VSL-00165) was estimated based on a sprinkler spray density of 0.17 $gal/min \cdot ft^2$, a minimum design area of 3000 ft^2, and a sprinkler operating duration of 20 minutes. An operating area of 3000 ft^2 was deemed appropriate in this case because the steel partitions between cells are not massive enough to justify the existence of smaller, fire-affected areas. Thus, the total amount of fire water that is collected in the vessel and presumed to overflow into the cell is 10,200 gal (1363.5 ft^3).

Again, to conservatively calculate the available area of the cell were the flooding volume would be contained, the cross-sectional area of the vessel was subtracted from the cross-sectional area of the rectangular cell. The required height of the liner is equal to the flooding volume divided by the available cross-sectional area of the cell compartment, plus the grout height. As before, the available volume below the grout height is conservatively ignored. The top of the stainless steel liner above the poured concrete floor required for flooding due to a postulated fire water discharge is 3.97 ft (round to 4.0 ft).

Based on selection of the worse of the two flooding scenarios, the minimum stainless steel liner height for the C5 effluent vessel cell is 4.0 ft. A derivation of the liner height calculation is provided in Appendix B.

Appendix A

Calculation of Liner Height for RLD-VSL-00164 Cell

Calculation of Liner Height for RLD-VSL-00164 Cell

1. Objective

The purpose of this calculation is to size the height of the liner in the C3 effluent vessel cell (A-B003) at the (-)18'-7" elevation of the WTP analytical laboratory (for the C3 vessel, RLD-VSL-00164). The general arrangement of the cell is illustrated in drawing 24590-LAB-P1-60-P0007.

2. Inputs

The following input parameters and physical characteristics are used as input to this calculation.

- Vessel characteristics: 8'-6" (102.0 in.) diameter x 8'-7 9/16" (103.6 in.) height (flanged-and dished heads, top and bottom)
- Vessel volume: total volume = 3180 gal (425.1 ft^3), maximum operating volume = 2740 gal (366.3 ft^3)
- Cell dimensions: 27'-3" (long, north/south) x 13'-0" (wide, east/west) x 10'-0" (high)
- Duration of a fire water discharge is 20 minutes
- Fire sprinkler design criteria: The minimum spray density for laboratory process areas, including hotcell support rooms, laboratory suites and corridors, and mechanical rooms is 0.17 $gal/min{\cdot}ft^2$ over the minimum design area of 3000 ft^2
- Liner sizing criterion: The liner must be designed to contain either 110% of the maximum operating volume of the largest vessel in the cell or the total volume of the largest vessel, whichever is greater; and handle the volume of fire water from the fire protection system over the minimum design area for a period of 20 minutes (with the vessel full)

The characterization of the fire and fire sprinkler system is based on consultations with the WTP Fire Protection Engineer. The design criterion for the liner is based on a review of Washington Administrative Code requirements and referenced standards. The vessel volumes are conservative values.

3. Background

This calculation is being performed to support dangerous waste permit modifications for the analytical laboratory (LAB) facility.

4. Applicable Codes and Standards

WAC 173-303. *Dangerous Waste Regulations*. Washington Administrative Code.

Publication #95-420, Guidance for Assessing Dangerous Waste Secondary Containment Systems, Washington Department of Ecology, September 1995.

5. Methodology

This is a manual calculation that uses well-known and recognized handbook formulas. The general approach is to calculate the total volume of liquid that potentially enters the cell and divide that value by the net available floor area to obtain the flooding height in the cell.

Liquid can enter the cell if there is a failure of the vessel in the corresponding cell or a release of fire water that causes the vessel to overflow. For the vessel rupture cases, the total volume of the vessel in the corresponding cell is discharged to the cell. In contrast, for the fire water cases, liquid enters the drain collection system through floor drains located at various grade-level rooms throughout the analytical laboratory building and the collected liquid causes the vessel to overflow into the corresponding cell. The intact vessel is taken to be full at the start of the fire water discharge.

No credit is taken for any usable volume in the sloped portions of the cell (up to the maximum height of the grout).

6. Assumptions

The following assumptions are used in the calculation.

- For the case of a vessel spill, no credit is taken for any fluid volume that may remain in the vessel. This assumption is conservative.
- The outside diameter of the vessel is assumed to be 2 inches more than the internal diameter. This assumption is based on engineering judgment and is deemed to be conservative.
- The vessel is assumed to be sitting on the floor and to be a straight cylinder over the entire flood height. No credit was taken for the volume under the vessel or vessel head. This assumption is conservative.
- The volume displaced by the piping, vessel supports, and other unforeseen obstructions in the cell was assumed to equal 5% of the volume displaced by the vessel. This assumption is deemed to be conservative. There are very few pipes and other commodities located in the vessel cells.
- The use of a minimum design area of 3000 ft^2 is appropriate. Based on discussions with the WTP Fire Protection Engineer, the criteria for evaluating fire water spray discharge volumes based on this value is conservative and provides a credible upper bound for fire water discharges.
- The use of a minimum spray density of 0.17 $gal/min{\cdot}ft^2$ is appropriate. Based on discussions with the WTP Fire Protection Engineer, this value, in combination with the minimum design area and sprinkler discharge interval, yields a conservative fire water discharge volume.
- The floor of the vessel cell will be sloped 1% to direct potential leaks to the secondary containment sump.
- There are no fire sprinklers in the vessel cell itself. All fire water is collected in the vessel and it enters the cell via the vessel overflow nozzle.

- Volume displacements due to vessel internals are conservatively ignored.

7. Calculations

7.1 C3 Vessel (RLD-VSL-00164) Rupture Case

7.1.1 Vessel Characteristics

Vessel dimensions: 8'-6" (8.50 ft) diameter x 8'-7 9/16" (8.63 ft) height (flanged-and-dished heads, top and bottom)

110% of maximum operating volume: 1.1 x 2740 gal = 3014 gal

Total volume = 3180 gal (425.1 ft^3)

Therefore, flooding volume is equal to 3180 gal (425.1 ft^3)

7.1.2 Cell Characteristics

Cell dimensions: 27'-3" (long) x 13'-0" (wide) x 10'-0" (high)

Cell gross volume = 27.25 ft x 13.00 ft x 10.00 ft = 3543 ft^3 (26,500 gal)

Net cell area = gross area – vessel area (assume full-length straight cylinder) – A contingency of 5% of the vessel area was included to account for piping, vessel supports, etc.

For this evaluation, use a vessel diameter of 8.50 ft (internal diameter) + 0.167 ft (shell thickness)

Cell area = $[27.25\ ft*13.00\ ft] - [(1/4)*\pi*(8.50\ ft + 0.167\ ft)^2] - [0.05*(1/4)*\pi*(8.50\ ft + 0.167\ ft)^2]$

Cell area = $354.25\ ft^2 - 59.00\ ft^2 - 2.95\ ft^2 = 292.30\ ft^2$

7.1.3 Required Liner Height

Height = floodwater volume/cell area = $425.1\ ft^3/292.3\ ft^2 = 1.45$ ft

The cell floor is sloped 1% to direct potential leaks to the secondary containment sump. This contouring of the cell could potentially occupy available containment volume. The maximum height that can be occupied by the cell contours is equal to half the cell perimeter times the slope, or:

[27.25 ft + 13 ft] * 0.01 = 0.40 ft (4.8 in.)

Hence, the required height is: 1.45 ft + 0.40 ft = 1.85 ft

7.2 C3 Vessel (RLD-VSL-00164) Fire Water Case

7.2.1 Vessel Characteristics

The full vessel remains intact and overflows due to the incoming fire water influent.

7.2.2 Flood Water Characteristics

Floodwater = time of inflow * spray density * affected area

Therefore, flooding volume is equal to: 20 min * (0.17 gal/min·ft^2) * (3000 ft^2) = 10,200 gal (1363.5 ft^3)

7.2.3 Cell Characteristics

Cell dimensions: 27'-3" (long) x 13'-0" (wide) x 10'-0" (high)

From section 7.1 above, the net cell area = 292.30 ft^2

7.2.4 Required Liner Height

Height = floodwater volume/cell area = 1363.5 ft^3/292.3 ft^2 = 4.66 ft

From section 7.1 above, the height of the contour floor is 0.40 ft (4.8 in.)

Therefore, the required height of the liner is: 4.66 ft + 0.40 ft = 5.06 ft (rounded to 5 ft-1 in.)

8. Results and Conclusions

The required liner height is 5 ft-1 in.

9. References

Drawing 24590-LAB-P1-60-P0007, *Analytical Laboratory General Arrangement Plan At EL (–)19'-2" Sections E-E, F-F and G-G*, Rev 0.

10. Attachments

None

Appendix B

Calculation of Liner Height for RLD-VSL-00165 Cell

Calculation of Liner Height for RLD-VSL-00165 Cell

1. Objective

The purpose of this calculation is to size the height of the liner in the C5 effluent vessel cell (A-B004) at the (-)19'-2" elevation of the WTP analytical laboratory (for C5 vessel, RLD-VSL-00165). The general arrangement of the cell is illustrated in drawing 24590-LAB-P1-60-P0007.

2. Inputs

The following input parameters and physical characteristics are used as input to this calculation.

- Vessel characteristics: 16'-0" (192 in.) diameter x 8'-2" (98 in.) height (flanged-and dished heads, top and bottom)
- Vessel volume: total volume = 9100 gal (1216.5 ft^3), maximum operating volume = 6615 gal (884.3 ft^3)
- Cell dimensions: 29'-0" (long, north/south) x 21'-0" (wide, east/west) x 11'-2" in. (high)
- Duration of a fire water discharge is 20 min
- Fire sprinkler design criteria: The minimum spray density for laboratory process areas, including the hotcell and associated support rooms, is 0.17 gal/min·ft^2 over the minimum design area of 3000 ft^2
- Liner sizing criterion: The liner must be designed to contain either 110% of the maximum operating volume of the largest vessel in the cell or the total volume of the largest vessel, whichever is greater; and handle the volume of fire water from the fire protection system over the minimum design area for a period of 20 minutes (with the vessel full)

The characterization of the fire and fire sprinkler system is based on consultations with the WTP Fire Protection Engineer. The design criterion for the liner is based on a review of Washington Administrative Code requirements and referenced standards. The vessel volumes are conservative values.

3. Background

This calculation is being performed to support a dangerous waste permitting application for the WTP analytical laboratory (LAB) facility.

4. Applicable Codes and Standards

WAC 173-303. *Dangerous Waste Regulations*. Washington Administrative Code.

Publication #95-420, Guidance for Assessing Dangerous Waste Secondary Containment Systems, Washington Department of Ecology, September 1995.

5. Methodology

This is a manual calculation that uses well-known and recognized handbook formulas. The general approach is to calculate the total volume of liquid that potentially enters the cell and divide that value by the net available floor area to obtain the flood height in the cell.

Liquid can enter the cell if there is a failure of the vessel in the corresponding cell or a release of fire water that causes the vessel to overflow. For the vessel rupture cases, the total volume of the vessel in the corresponding cell is discharged to the cell. In contrast, for the fire water cases, liquid enters the drain collection system through floor drains located at various grade-level rooms throughout the analytical laboratory building and the collected liquid causes the vessel to overflow into the corresponding cell. The intact vessel is taken to be full at the start of the fire water discharge.

No credit is taken for any usable volume in the sloped portions of the cell (up to the maximum height of the grout).

6. Assumptions

The following assumptions are used in the calculation.

- For the case of a vessel spill, no credit is taken for any fluid volume that may remain in the vessel. This assumption is conservative.
- The outside diameter of the vessel is assumed to be 2 inches more than the internal diameter. This assumption is based on engineering judgment and is deemed to be conservative.
- The vessel is assumed to be sitting on the floor and to be a straight cylinder over the entire flood height. No credit was taken for the volume under the vessel or vessel head. This assumption is conservative.
- The volume displaced by the piping, vessel supports, and other unforeseen obstructions in the cell was assumed to equal 5% of the volume displaced by the vessel. This assumption is deemed to be conservative. There are very few pipes and other commodities located in the vessel cells.
- The use of a minimum design area of 3000 ft^2 is appropriate. Based on discussions with the WTP Fire Protection Engineer, the criteria for evaluating fire water spray discharge volumes based on this value is conservative and provides a credible upper bound for fire water discharges.
- The use of a minimum spray density of 0.17 $gal/min \cdot ft^2$ is appropriate. Based on discussions with the WTP Fire Protection Engineer, this value, in combination with the minimum design area and sprinkler discharge interval, yields a conservative fire water discharge volume.
- The floor of the vessel cell will be sloped 1% to direct potential leaks to the secondary containment sump.
- There are no fire sprinklers in the vessel cell itself. All fire water is collected in the vessel and it enters the cell via the vessel overflow nozzle.
- Volume displacements due to vessel internals are conservatively ignored.

7. Calculations

7.1 C5 Vessel (RLD-VSL-00165) Rupture Case

7.1.1 Vessel Characteristics

Vessel dimensions: 16'-0" diameter x 8'-2" (8.17 ft) height (flanged-and-dished heads, top and bottom)

110% of maximum operating volume: 1.1 x 6615 gal = 7277 gal

Total volume = 9100 gal (1216.5 ft^3)

Therefore, the flooding volume is equal to 9100 gal (1216.5 ft^3)

7.1.2 Cell Characteristics

Cell dimensions: 29'-0"(long) x 21'-0" (wide) x 11'-2" (high)

Cell gross volume = 29.00 ft x 21.00 ft x 11.17 ft = 6803 ft^3 (50,890 gal)

Net cell area = gross area – vessel area (assume full-length straight cylinder) – A 5% contingency of the vessel area was included to account for piping, vessel supports, etc.

For this evaluation, use a vessel diameter of 16.00 ft (internal diameter) + 0.167 ft (shell thickness)

Cell area = $[29.00 \text{ ft}*21.00 \text{ ft}] - [(1/4)*\pi*(16 \text{ ft} + 0.167 \text{ ft})^2] - [0.05 *(1/4)*\pi*(16 \text{ ft} + 0.167 \text{ ft})^2]$

Cell area = $609.00 \text{ ft}^2 - 205.28 \text{ ft}^2 - 10.26 \text{ ft}^2 = 393.46 \text{ ft}^2$

7.1.3 Required Liner Height

Height = floodwater volume/cell area = $1216.5 \text{ ft}^3/393.5 \text{ ft}^2 = 3.09$ ft

The cell floor is sloped 1% to direct potential leaks to the secondary containment sump. This contouring of the cell could potentially occupy available containment volume. The maximum height that can be occupied by the cell contours is equal to half the cell perimeter times the slope, or:

[29.00 ft + 21.00 ft] * 0.01 = 0.50 ft (6.0 in.)

Hence, the required height is: 3.09 ft + 0.50 ft = 3.59 ft

7.2 C5 Vessel (RLD-VSL-00165) Fire Water Case

7.2.1 Vessel Characteristics

The full vessel remains intact and overflows due to the incoming fire water influent.

7.2.2 Flood Water Characteristics

Flood water = time of inflow * spray density * affected area

Therefore, flooding volume is equal to: 20 min * (0.17 gal/min·ft^2) * (3000 ft^2) = 10,200 gal (1363.5 ft^3)

7.2.3 Cell Characteristics

Cell dimensions: 29'-0" (long) x 21'-0" (wide) x 11'-2" in. (high)

From section 7.1 above, the net cell area = 393.46 ft^2

7.2.4 Required Liner Height

Height = fire water volume/cell area = 1363.5 ft^3/393.5 ft^2 = 3.47 ft

From section 7.1 above, the height of the contour floor is 0.50 ft (6.0 in.)

Therefore, the required height of the liner is: 3.47 ft + 0.50 ft = 3.97 ft (rounded to 4.0 ft)

8. Results and Conclusions

The required liner height is 4.0 ft.

9. References

Drawing 24590-LAB-P1-60-P0007, *Analytical Laboratory General Arrangement Plan At EL (–)19'-2" Sections E-E, F-F, and G-G*, Rev 0.

10. Attachments

None

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History Sheet

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Contents

Acronyms

AEA	Atomic Energy Act of 1954
C3	Originally an identification of radiological contamination level potential (in the context of this report it identifies or describes subsystems or components associated with the RLD-VSL-00164 tank system)
C5	Originally an identification of radiological contamination level potential (in the context of this report it identifies or describes subsystems or components associated with the RLD-VSL-00165 tank system)
CCN	Correspondence Control Number
DOE	US Department of Energy
LAB	Analytical Laboratory Facility
LDB	Leak Detection Box
NPS	Nominal Pipe Size
PDC	WTP Project Archives & Document Control
PIN	Plant Item Number
WAC	Washington Administrative Code
WTP	River Protection Project - Waste Treatment Plant

1 Summary

The Analytical Laboratory (LAB) ancillary equipment piping and associated leak detection boxes (LDBs), effluent vessel cell sumps (cell sumps), and the pump and piping pit sumps (pit sumps) must satisfy the leak detection criteria of Dangerous Waste Permit Number WA7890008967, Permit Condition III.10.E.9.e.ii for secondary containment systems. This report evaluates the minimum leak rates that the LDBs, cell sumps, and pit sumps can detect within 24 hours. The LDBs and their associated instrumentation monitor regulated double-wall piping for signs of primary containment leakage. This piping has a minimum slope requirement of 1:192 (>0.5%) to ensure that leakage is properly directed towards the LDBs. Similarly, the cell sumps and pit sumps and their associated instrumentation monitors the effluent vessel cells, and pump and piping pits for indications of primary containment leakage. The floors in these areas have a minimum slope requirement of 1:100 to ensure that leakage is properly directed towards the sumps.

The minimum leak rates that can be detected within a 24-hour period are 0.05 gal/h for the LDBs (worst-case), 0.02 gal/h for the cell sumps, and 0.07 gal/h for the pit sumps. These values demonstrate compliance with the criterion established in Permit Condition III.10.E.9.e.ii for a leak detection capability of 0.1 gallons per hour within 24 hours. The minimum detectible leak rates are all based on the assumption that a leak occurs at the most remote location from the leak detection receptacle and its associated leak detection instrumentation.

The leak detection calculations identified three components that influence leak detection within 24 hours. These components are: 1) the volume associated with wetting of pipe and floor surfaces, 2) the volume associated with boundary layer flow, and 3) the minimum detectable fluid volume within an LDB or sump. The holdup volume required to wet the surface of the containment piping is dominant (75% of the total detection time) for the typical LDB case. This means that leak detection times for these events are dependent largely on the line length. For the cell sump and pit sump cases, the sump volume is dominant (67 and 93% of the total detection time, respectively). Considering the assumptions and inputs, the calculated minimum leak detection times are judged approximate and reasonable. In all cases within the LAB, the minimum detectable leak rate is well within the leak detection criterion identified in the Dangerous Waste Permit.

2 Objective

There are two dangerous waste vessels in the LAB. The first vessel, RLD-VSL-00164, the Laboratory Area Sink Drain Collection Vessel, will hereafter be referred to as the C3 Vessel (RLD-VSL-00164). The second vessel, RLD-VSL-00165, the Hotcell Drain Collection Vessel, will hereafter be referred to as the C5 Vessel (RLD-VSL-00165). The purpose of this report is to examine the minimum leak rate detection capabilities of the secondary containment features associated with these two tank systems.

The LAB LDBs, effluent vessel cell sumps (cell sumps), and the pump and piping pit sumps (pit sumps) and their associated instrumentation must satisfy the leak detection criteria of Dangerous Waste Permit Number WA7890008967, Permit Condition III.10.E.9.e.ii for secondary containment systems. This report evaluates the minimum leak rates that the LDBs, cell sumps, and pit sumps; and their associated instrumentation can detect within 24 hours.

The secondary containment design includes a number of features that influence leak detection:

- Instrumentation in the LDBs, cell sumps, and pit sumps that monitor for signs of primary containment leakage
- Sloping of piping, cell floors, and pit floors to direct leakage flow to central points for detection
- The geometry of the piping, cells, and pits.

This report examines these features to determine the minimum detectable leakage rate that can be detected by the LDBs, cell sumps, and pit sumps.

3 Description

The regulatory requirements for leak detection are contained in WAC 173-303-640, Tank Systems, Section 4, Containment and Detection of Releases (Ref. 1). The regulatory requirements are restated as follows:

> (b) "Secondary Containment systems must be:
>
> (ii) Capable of detecting and collecting releases and accumulated liquids until the collected material is removed."
>
> (c) "To meet the requirements of (b) of this subsection, secondary containment systems must be, at a minimum:
>
> (iii) Provided with a leak detection system that is designed and operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous waste or accumulated liquid in the secondary containment system within twenty-four hours, or at the earliest practicable time if the owner or operator can demonstrate to the department that the existing detection technologies or site conditions will not allow detection of a release within twenty-four hours."

In addition, the Waste Treatment Plant Dangerous Waste Permit (Ref. 2), Permit Condition III.10.E.9.e.ii requires submittal of:

> "Detailed plans and descriptions, demonstrating the leak detection system is operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous and/or mixed waste, or accumulated liquid in the secondary containment system within twenty-four (24) hours. Detection of a leak of at least 0.1 gallons per hour within twenty-four (24) hours is defined as being able to detect a leak within twenty-four (24) hours. Any exceptions to this criteria must be approved by Ecology [WAC 173-303-640(4)(c)(iii), WAC 173-303-806(4)(c)(vii)];"

4 Assumptions

Assumptions used in this evaluation of the LAB secondary containment piping and associated LDBs, cell sumps, and pit sumps, secondary containment system features, leak detection capabilities are enumerated in the succeeding subsections.

4.1 Design Input Assumptions

4.1.1 The vessel cell dimensions are summarized as follows:

C3 Effluent Vessel Cell (Rm No. A-B003): 13'-0" (east-west) x 27'-3" (north-south)
C5 Effluent Vessel Cell (Rm No. A-B004): 21'-0" (east-west) x 29'-0"(north-south).

4.1.2 The pump and piping pit dimensions are summarized as follows:

C3 Pump Pit (Rm No. A-B002): 13'-0" (east-west) x 14'-5 1/2" (north-south)
C5 Pump Pit (south)/(Rm No. A-B007): 6'-9" (east-west) x 6'-5" (north-south)
C5 Piping Pit (Rm No. A-B006): 6'-9" (east-west) x 14'-0" (north-south)
C5 Pump Pit (north)/Rm No. A-B005: 6'-9" (east-west) x 6'-5" (north-south).

4.1.3 All eight of the LAB LDBs are NPS 8, horizontal, Schedule 40 pipe, with an NPS 8 cap on either end. A detectable leakage volume is built up in an 11-inch segment of pipe, plus the cap, by a 2-in. high baffle located in the middle of the device.

4.1.4 The stainless steel liners in the vessel cells and the pump and piping pits are sloped at a minimum grade of 1:100 to direct potential leakage in these areas to the respective sump (Ref. 3 and 4).

4.1.5 The length of the longest run of regulated, double-wall pipe is defined by detailed isometric drawings. The longest length is approximately 220 ft, which is conservatively rounded to a length of 250 ft.

4.1.6 There is one sump in each vessel cell. The sump is 30 inches nominal diameter and approximately 13 inches deep. The sump is made from a piece of nominal pipe size (NPS 30) standard-wall pipe (or an equivalent rolled plate) and a 30-in diameter, standard-wall, pipe cap (or equivalent ellipsoidal-head section) – (Ref. 5).

4.1.7 There is one sump in each pump and piping pit. The sump is formed by a shallow rectangular depression in the liner around the drain for the pit. A removable weir around the drain hole allows formation of a detectable volume before excess leakage is directed back to its associated vessel. The sump dimensions are summarized below (Ref. 5):

C3 Pump Pit (RLD-SUMP-00042): [2'-0" x 2'-6" x 1/2"]
C5 Pump Pit, south (RLD-SUMP-00043A): [1'-6" x 3'-0" x 1/2"]
C5 Piping Pit (RLD-SUMP-000044): [2'-0" x 2'-6" x 1/2"]
C5 Pump Pit, north (RLD-SUMP-00043B: [1'-6" x 3'-0" x 1/2"].

4.1.8 Based on inspection of Ref. 3, 4, 6, 7, and 8, double-wall pipe sizes range from NPS 1 1/2 x 4 to NPS 8 x 10. Only the containment pipe for the drain collection header from the C3 Maintenance Shop Area is greater than NPS 6. This header corresponds to the NPS 8 x 10 case.

4.2 Evaluation Assumptions

4.2.1 The outer containment pipe of the double-wall piping system is either 316L stainless steel or carbon steel. Moreover, the vessel cell and pit walls are lined with 304L stainless steel liners. In either case, the dominant flow phenomena are the transient condition that is commonly referred to as "wetting" and laminar, steady-state flow. Wetting is assumed to be insensitive to surface roughness and laminar flow is not dependent on surface roughness.

4.2.2 The maximum discharge flow rate from a permit condition leak is assumed to be a constant 0.1 gal/h over the twenty-four hour period. Moreover, the minimum detectable leak rate determined in this evaluation is also assumed to be constant over the same period.

4.2.3 There are no obstructions to the liquid flow. However, holdup along the flow path (flow channel) will be considered. Holdup is defined as wetting of the surface.

Refer to Assumption 4.2.8 and Assumption 4.2.9 for discussion of wetting and transport flow.

4.2.4 The vessel cell and pit sumps have "radar-type" level detection instrumentation that can conservatively detect a minimum fluid level rise of 10 mm (0.39 in.) in the sumps when the liquid level is at the bottom of the wave-guide. The liquid level does not have to be inside the wave guide to achieve this accuracy.

4.2.5 The LDBs have "thermal dispersion" level detection instrumentation that can conservatively detect a minimum fluid level rise of 1/2 inch (12.7 mm) in the reservoir.

4.2.6 The leaking liquid has characteristics similar to water at a temperature of 100 °F. Moreover, the liquid does not contain solids and it does not foam in the sumps.

4.2.7 The leaking fluid does not evaporate while it is flowing towards the LDBs or sumps.

4.2.8 Steady-state flows in the annular-region of double-wall pipe and over liner surfaces can be modeled using equations derived from boundary layer theory for uniform flow down an inclined plane.

4.2.9 The wetting (or hold-up) factor is assumed to equal 0.32 fl. oz./ft (Ref. 9) and to be largely independent of slope, surface roughness, or other pipe or liner parameters. However, because this factor is an empirical value that was explicitly developed for NPS 6 pipe, the factor will be doubled for flow in pipes larger than NPS 6 and for flow over flat surfaces. This approach is deemed to be conservative.

4.2.10 The maximum distance from the leak to the vessel cell or pit sump is assumed equal to the diagonal formed by the width and length of the cell or pit. Raised equipment embeds allow leakage flows to travel with minimal obstruction of the direct flow path to the sump.

4.2.11 The curved head portion of the pipe cap section that is used for the cell sumps can be approximated by a 2:1 semi-ellipsoidal head.

4.2.12 The containment pipe for all double-wall pipe runs is assumed to be Schedule 40.

4.2.13 Level detection instruments will be properly installed and calibrated upon installation. Periodic, normal maintenance, and calibration will be performed on level instruments during operation of the facility; and the instruments will be maintained in an operable condition.

4.2.14 Based on a review of the 3-D Model and Ref. 10, the two longest runs of pipe are anticipated to be the C5 collection header from the C3 Maintenance Shop, Maintenance Decon Booth (60-MHAN-00003) and a C3 collection header from a lab sink or fumehood in the southeast corner of the Rad Lab Area. Both of these runs are estimated to be a little over 200 ft. For the purposes of this analysis, the latter case was assumed to be the longest run and determined to be approximately 220 ft. This length was conservatively rounded to 250 ft to ensure that both cases (both pipe runs) are conservatively bounded.

4.2.15 The level instrument response time (i.e., the time between the process reaching a specified level setpoint and the instrument responding to the process condition) is negligible for the purposes of this analysis.

4.2.16 The double-wall (co-axial) piping is assumed to have a minimum slope of 1/16 in. per foot (1:192 slope).

4.2.17 The diameter of the removal weir in the pit sumps is 7.00 in. (Ref. 11, Figure 8).

4.2.18 For spills in the vessel cells and pits, flows across the floors are assumed to be similar to flow in an open channel. The width of the channel is assumed to equal 10 times the depth of the channel. This assumption is not significant to the analysis because the travel distance is comparatively short (i.e., <36 ft).

5 Analysis

5.1 In-Slab Dangerous Waste Piping

In the LAB, there are a total of eight dangerous waste lines. These lines are all embedded in the building foundation slab. The lines are of a coaxial, double-wall construction. Pipe sizes range from NPS 1 1/2 x 4 to NPS 8 x 10. In general, the primary containment core pipe is two pipe sizes smaller than the containment pipe, and pipes are typically constructed of a C-22 hastalloy core pipe with a carbon steel containment pipe. For purposes of this evaluation, the containment pipe is assumed to be Schedule 40 in all cases. The length of the longest run of in-slab dangerous waste piping is 250 ft.

The in-slab dangerous waste lines have a minimum slope of 1/16 in. per foot (1:192 slope). These lines all slope towards a vessel cell. These cells are either the C3 Effluent Vessel Cell or the C5 Effluent Vessel Cell. LDBs are connected to the low point of the double-wall (coaxial) piping where it terminates in the vessel cells. The LDBs allow for the accumulation of a detectible volume of leakage while directing excess leakage to the associated vessel cell.

The in-slab dangerous waste piping is routed so that the containment pipe drains into its respective LDB in the event of a primary-containment, core-pipe leak. In each of the LDBs, there is a thermal-conductivity-type level instrument to detect potential leakage.

5.2 Effluent Vessel Cells

There are two effluent vessel cells in the LAB corresponding to the C3 Vessel and C5 Vessel, respectively. The C5 Vessel Cell is the larger of the two cells.

The floors and portions of the walls of the two effluent vessel cells have stainless liners for secondary containment. The liners are contoured to direct primary containment leakage to the respective cell sump. The minimum slope of the cell floors is 1:100. The maximum distance leakage must travel to reach a sump is approximately 36 ft.

The cell sumps allow for the accumulation of detectible volumes of leakage. In each of the sumps, there is a radar-type level instrument to detect potential leakage.

5.3 Pit Cells

There are four pump and piping pits in the LAB. One of these pits is associated with the C3 Vessel and the other three are associated with the C5 Vessel. The C3 Pump Pit is the largest of the four pits.

The floors and walls of the four pump and piping pits have stainless liners for secondary containment. The liners are contoured to direct primary containment leakage to the respective pit sump. The minimum slope of the pit floors is 1:100. The maximum distance leakage must travel to reach a sump is approximately 20 ft.

The pit sumps allow for the accumulation of detectible volumes of leakage while a removal weir within the sump allows excess leakage to be directed to the corresponding effluent vessel. In each of the sumps, there is a radar-type level instrument to detect potential leakage.

6 Detectable Leak Rates

The results of this evaluation are compiled in the table below based on the four limiting cases that are evaluated in Section 7, Bounding Calculations. This table demonstrates that the LAB secondary containment leak detection systems for the vessel cells, and pump and piping pits are capable of detecting leaks of 0.1 gal/h within 24 hours. The 0.1 gal/h value corresponds to the stipulated leakage identified in Permit Condition III.10.E.9.e.ii. Moreover, note that the leak rates are reported to only one-significant figure. This practice is consistent with the required accuracy.

The "24-hour Leak Rate Detected" value is the minimum continuous leak rate that can be detected within 24 hours. As discussed in Section 7, this rate is driven by three primary components: 1) the volume associated with wetting of pipe or floor surfaces, 2) the volume associated with boundary layer flow, and 3) the minimum detectable fluid volume within an LDB or sump. The first two components (the transit volumes) are combined in the table as "Max. Volume to Reach LDB or Sump." Note that the minimum detectable leak rate is dominated by the transit volume (i.e., the length of pipe) for the piping cases, while the sump detection volume is dominant for the cell sump and pit sump cases.

LAB Facility Leak Detection Capability

Description of Leak Detection Area	*LDB or Sump PIN*	*Max. Length of Travel to LDB or Sump, ft*	*Max. Volume to Reach LDB or Sump, US gal(1)*	*Leak Detection Device Description*	*Leak Detection Device Sensitivity*	*Max. Volume in LDB or Sump for Detection, US gal*	*Max. Total Volume for Detection, US gal*	*24-Hour Leak Rate Detected, gal/h*
Rad Lab Sink Collection Header	**RLD-LDB-00005**	**250**	**0.7607**	**Thermal Dispersion**	**0.5 in. max. liquid level**	**0.0767**	**0.8374**	**0.03**
Hotcell Collection Header	RLD-LDB-00002	---	---	Thermal Dispersion	0.5 in. max. liquid level	---	---	Use 0.03
C3 Transfer Line	RLD-LDB-00004	---	---	Thermal Dispersion	0.5 in. max. liquid level	---	---	Use 0.03
PVA Drain Header	RLD-LDB-00006	---	---	Thermal Dispersion	0.5 in. max. liquid level	---	---	Use 0.03
Sample Receiving/ Shipping Drain Header	RLD-LDB-00008	---	---	Thermal Dispersion	0.5 in. max. liquid level	---	---	Use 0.03
Glovebox Header	RLD-LDB-00009	---	---	Thermal Dispersion	0.5 in. max. liquid level	---	---	Use 0.03
ASX Equipment Drain Collection Header	RLD-LDB-00011	---	---	Thermal Dispersion	0.5 in. max. liquid level	---	---	Use 0.03
C3 Maintenance Drain Header	**RLD-LDB-00007**	**189**	**1.0638**	**Thermal Dispersion**	**0.5 in. max. liquid level**	**0.0767**	**1.1405**	**0.05**
C5 Vessel Cell, A-B004	**RLD-SUMP-00042**	**35.8**	**0.1862**	**Radar**	**± 10 mm liquid level**	**0.3797**	**0.5659**	**0.02**
C3 Vessel Cell, A-B003	RLD-SUMP-00041	---	---	Radar	± 10 mm liquid level	---	---	Use 0.02
C3 Pump Pit A-B003	**RLD-SUMP-00045**	**19.4**	**0.1038**	**Radar**	**± 10 mm liquid level**	**1.4752**	**1.5790**	**0.07**
C5 Pump Pit, A-B007	RLD-SUMP-00043A	---	---	Radar	± 10 mm liquid level	---	---	Use 0.07
C5 Pump Pit, A-B005	RLD-SUMP-00043B	---	---	Radar	± 10 mm liquid level	---	---	Use 0.07
C5 Piping Pit, A-B006	RLD-SUMP-00044	---	---	Radar	± 10 mm liquid level	---	---	Use 0.07

Note 1: This quantity is the sum of the volumes associated with "wetting" and boundary layer flow.

7 Bounding Calculations

7.1 Methodology

The analysis of minimum leak rate detection capabilities for the LDBs, cell sumps, and pits sumps; and their associated instrumentation involved the following steps:

1. An initial leakage rate was judiciously selected based on engineering judgment. This leakage rate was evaluated and refined through a series of iterations.

2. The amount of time required for the leakage to wet the flow path (flow channel) from the most-remote leakage location to its corresponding leak detection feature (e.g., a cell sump) was calculated. This is done using an experimentally determined value of wetting holdup of 0.32 fl. oz./ft (Ref. 9) and the following equation:

$$t = \frac{c\,L}{Q}$$

Where:

t = time, h
c = wetting factor, gal/ft
L = travel distance, ft
Q = leakage rate, gal/h.

3. The time delay required for the leakage to reach the leak detection volume was calculated using equations derived from boundary layer theory for uniform flow down an inclined plane.

The average velocity distribution from boundary layer theory is given in Ref. 12 (pp. 249 thru 251) as Equation 9.4b:

$$V = \frac{g\,S_o\,d^2}{3\,\upsilon}$$

Where:

V = average velocity, ft/s
g = gravitation constant, 32.17 ft/s^2
S_o = Slope of the incline, dimensionless
d = flow depth, ft
υ = kinematic viscosity, ft^2/s

Moreover, from continuity, flow rate is given by: $Q = A\,V$

Q = flow rate, ft^3/s
A = cross-sectional flow area, ft^2

Therefore, combining the latter two equations, the flow depth, *d*, can be found by solving the following relationship:

$$d = \sqrt{\frac{3\,\upsilon\,Q}{g\,S_o\,A}}$$

The cross-sectional flow area, *A*, is solved for based on the assumed flow rate and the physical constrains of the flow channel.

Returning to the original boundary layer equation:

$$V = \frac{g\,S_o\,d^2}{3\,\upsilon}$$

The time delay for the leakage to reach the LDBs is simply:

t = (h/3600 s)*(L/V)

Where:

t = time, h
V = average velocity, ft/s
L = travel distance, ft.

4. The amount of leakage required to obtain a detectible volume in a cell sump, pit sump, or LDB is determined using the physical dimensions and other characteristics of the LDBs or sumps.

5. The time required to obtain a detectible volume in a LDB, cell sump, or pit sump is calculated. The time required to obtain a detectable accumulation of leakage is simply the volume of the fluid at the minimum detectible level divided by the assumed leakage rate ($t = W/Q$).

   Where:

   t = time, h
   W = Volume (at minimum detectable level), gal
   Q = leakage rate, gal/h.

6. The time required to wet the flow channel (Step 2), the time required by the fluid to reach a LDB or sump based on boundary layer flow conditions (Step 5), and the time required to obtain a detectible volume (Step 5) were summed together. If the calculated time was significantly more or less than 24 hours, the iteration process was repeated with alternate assumptions of leakage rates until the calculations converge on a solution.

7.2 Bounding Calculation for LDBs on In-Slab Dangerous Waste Piping

The succeeding analysis determines the minimum leak rate that can be detected by the LDBs in a 24-hour period. The analysis evaluates a leak in the longest run of in-slab dangerous waste pipe.

7.2.1 Initial Minimum Detectible Leak Rate Assumption

Try an initial minimum detectible leakage rate that is equal to 1/3 of the 0.1 gal/h permit condition leak rate or 0.0333 gal/h.

7.2.2 Time Required to Wet the Outer Jacket of the Coaxial Pipe Flow Path

The maximum distance from any postulated leak to its respective LDB is obtained from Assumptions 4.1.5 and 4.2.14. Tallying the line lengths from the pipe cleanout upstream of the furthest drain to the LDB and conservatively treating straight-vertical drops as sloped segments, a travel distance of 217.32 ft is obtained. This value is consistent with the estimate of slightly more than 200 ft. Moreover, conservatively round the total to 250 ft.

The wetting factor is equal 0.32 fl. oz./ft (Assumption 4.2.9). Hence, the time required to wet the flow channel is given by:

$$t = \frac{c\,L}{Q}$$

Where the variables are defined in Section 7.1(2).

$$t_1 = \left(\frac{0.32\ fl.\,oz.}{ft}\right)\left(\frac{gal}{128\ fl.\,oz.}\right)\left(\frac{250\ ft}{1}\right)\left(\frac{h}{0.0333\ gal}\right) = 18.8\ h$$

7.2.3 Calculation of Leakage Travel Time to LDB

The time required for the leakage to travel from its point of origin to the LDB under boundary layer flow conditions is calculated by simultaneously solving the following sets of equations:

$$Q = VA$$ Section 7.1.3

$$d = \sqrt{\frac{3\,\upsilon\,V}{g\,S_o}}$$ Section 7.1.3

$$A = \frac{(\theta - \sin\theta)D^2}{8}$$ Ref. 13, pg. 168

$$d = D\sin^2\left(\frac{\theta}{4}\right)$$ Ref. 13, pg. 168

Where:

D = inside diameter of the encasement pipe. Based on Assumptions 4.1.8 and 4.2.12, the inside diameters of the containment pipe will vary as follows:

D = 4.026 in. (0.3355 ft) to 10.020 in. (0.8350 ft). Use the latter end of the range. The larger cross-sectional area will yield the lower velocities.

θ = the angle formed by the intersection of the fluid free surface and the wall of the pipe, and the centerline of the pipe, radians.

Q = 0.0333 gal/h (1.237 x 10^{-6} ft^3/s)

υ = kinematic viscosity of water @ 100 °F (Assumption 4.2.6), 7.37 x 10^{-6} ft^2/s (Ref. 12, pg. 513)
g = gravitation constant, 32.17 ft/s^2
S_o = Slope of the incline, 0.00521 (Assumption 4.2.16)

Using an equation processor as a tool to solve for these equations simultaneously, the equations converged on the following solution:

θ = 9.751 deg
d = 1.511 x 10^{-3} ft
V = 1.7302 x 10^{-2} ft/s
A = 7.150 x 10^{-5} ft^2

Thus, the travel delay for the leakage to reach the LDB is:

t_2= (h/3600 s)*(L/V)
= (h/3600 s)*(250 ft)*(s/1.7302 x 10^{-2} ft) = 4.0 h

7.2.4 Calculation of Leakage Volume Required for a Detectable LDB Level Change

Each of the eight LAB LDBs consists of a NPS 8, horizontal, Schedule 40 pipe, with a NPS 8 cap on either end. A detectable leakage volume is built up in an 11-inch segment of pipe, plus the cap, by a 2-in. high baffle located in the middle of the LDB (Input 4.1.3).

The detectable volume consists of the partial volume of the pipe, partial volume of the straight portion of the cap, plus the partial volume of the curved portion of the cap.

Solving the equations for the geometric properties of these sections for the volume needed to produce a minimum detectable level change of 0.5 in (0.0417 ft) [Assumption 4.2.5] yields a total required volume of 7.665 x 10^{-2} gal.

7.2.5 Time to Obtain a Detectible Volume in the LDB

The time required to obtain a detectible volume in a LDB is given by:

$$t_3 = \frac{W}{Q}$$

$t_3 = (7.665 \times 10^{-2}$ gal)*(h/0.0333 gal) = 2.3 h

7.2.6 Total LDB Detection Time and Minimum Detectible Flow Rates

The total detection time is the sum of the previously enumerated pipe wetting, boundary layer flow transport, and LDB filling delays:

$t = t_1 + t_2 + t_3$
t = 18.8 h + 4.0 h + 2.3 h = 25.1 h.

The resultant value is greater than 24 h. Therefore, the iterative process is repeated for successively larger leakage rates. The iteration process converged on a solution for a leakage rate of 0.0348 gal/h (say 0.03 gal/h) and a $\theta = 9.813$ deg, when the following detection times are obtained:

t = 17.9 h + 3.9 h + 2.2 h = 24.0 h.

The corresponding partial volumes required for detection are summarized as follows:

$W = W_1 + W_2 + W_3$

W = (0.32 fl. oz./ft)*(250 ft)*(gal/128 fl. oz.) + (0.0348 gal)*(3.9 h) + 0.0767 gal
= 0.6250 gal + 0.1357 gal + 0.0767 gal = 0.8374 gal

7.2.7 Additional Study of the Drain Collection Line from the C3 Maintenance Shop

Because of concerns regarding the ability of the wetting factor to pipe that is larger than NPS 6, the case of the Drain Collection Line from the C3 Maintenance Shop is re-evaluated further in greater detail to confirm that the previous calculations are in fact bounding. When these calculations are re-run for an actual travel length, L = 189 ft and a wetting factor c = 0.64 fl. oz./ft (twice the empirically-determined value), the 24-hour minimum detectible leakage rate is 0.0475 gal/h (round to 0.05 gal/h) and following results are obtained:

$t = t_1 + t_2 + t_3$
t = 19.9 h + 2.5 h + 1.6 h = 24.0 h.

The corresponding partial volumes required for detection are summarized as follows:

$W = W_1 + W_2 + W_3$

W = (0.64 fl. oz./ft)*(189 ft)*(gal/128 fl. oz.) + (0.0475 gal)*(2.5 h) + 0.0767 gal
= 0.9450 gal + 0.1188 gal + 0.0767 gal = 1.1405 gal

7.3 Vessel Cell Sumps

The succeeding analysis determines the minimum leakage rate that can be detected by the C3 and C5 vessel cell sumps in a 24-hour period.

7.3.1 Initial Minimum Detectible Leak Rate Assumption

Try an initial minimum detectible leakage rate that is equal to 1/5th of the 0.1 gal/h permit condition leak rate or 0.020 gal/h.

7.3.2 Time Required to Wet the Cell Liner Flow Path

The longest distance from a leak to the associated cell sump is conservatively equal to the diagonal formed by the width and the length of the cell (Assumption 4.2.10). Based on Assumption 4.1.1, the bounding case occurs in the C5 Vessel Cell. This distance is equal to the following:

$$L = \sqrt{(21.00\text{ ft})^2 + (29.00\text{ ft})^2}$$

$$L = 35.81\text{ ft}$$

The wetting factor is equal 0.32 fl. oz./ft (Assumption 4.2.9). Double this value to account for uncertainty in the validity of this parameter to flow over a flat surface. Hence, the time required to wet the flow channel is given by:

$$t = \frac{c\,L}{Q}$$

Where the variables are defined in Section 7.1(2).

$$t_1 = \left(\frac{0.64\ fl.\,oz.}{ft}\right)\left(\frac{gal}{128\ fl.\,oz.}\right)\left(\frac{35.81\ ft}{1}\right)\left(\frac{h}{0.020\ gal}\right) = 9.0\ h$$

7.3.3 Calculation of Leakage Travel Time to Cell Sump

The time required for the leakage to travel from its point of origin to the cell sump under boundary layer flow conditions is calculated by simultaneously solving the following sets of equations:

$$d = \sqrt{\frac{3\,\upsilon\,Q}{g\,S_o\,A}}$$ Assumption 4.2.8

and

$A = d*z$, where d = flow depth, ft; and z = the flow width = $10*d$, ft Assumption 4.2.18

Solving for d:

$$d = \left[\frac{3\,\upsilon\,Q}{10\,g\,S_o}\right]^{0.25}$$ Assumption 4.2.8

Where:

d = flow depth, ft
υ = kinematic viscosity of water @ 100 °F (Assumption 4.2.6), 7.37 x 10^{-6} ft^2/s (Ref. 12, pg. 513)
g = gravitation constant, 32.17 ft/s^2
S_o = Slope of the incline, 0.01 (Input 4.1.4)
Q = leakage flow rate, 0.020 gal/h (7.427 x 10^{-7} ft^3/s)

d = [(3/10)*(7.37 x 10^{-6} ft^2/s)*(7.427 x 10^{-7} ft^3/s)*(s^2/32.17 ft)*(1/0.010)]^0.25

d = 0.00150 ft

The average flow velocity is given by:

$$V = \frac{g\, S_o\, d^2}{3\,\upsilon}$$

V = (32.17 ft/s^2)*(0.010)*(0.00150 ft)^2*(1/3)*(1/7.37 x 10^{-6} ft^2/s)
= 0.0327 ft/s

Thus, the travel delay for the leakage to reach the vessel cell sump is:

t_l = (h/3600 s)*(L/V)
= (h/3600 s)*(35.81 ft)*(s/0.0327 ft) = 0.3 h

7.3.4 Calculation of Leakage Volume Required for a Detectable Cell Sump Level Change

The curved head portion of the pipe cap that is used for the cell sump can be approximated by a 2:1 semi-ellipsoidal head (Assumption 4.2.11). The cap is NPS 30 (Assumption 4.1.6).

The partial volume of the cap at various levels is thus given by the following equation (Ref. 14, Appendix D):

$$W_p = \pi\, D H_b^2 \left[1 - \frac{4H_b}{3D}\right]$$

Where:

W_p = Partial volume (from the bottom of the cap to a height H_b)

and where:

D = Diameter of the cap, 29.250 in. (Assumption 4.1.6)

H_b = Height of the fluid in the curved portion of the head and $H_{b\,max}$ = 0.25D or 7.3 in.

Radar-type level detection instrumentation is capable of detecting a level rise of 10 mm (0.39 in.) (Assumption 4.2.4). To account for any uncertainties associated with wave guide positioning and rangeability of the curved bottom of the sump, conservatively use a detectible level change of 1 in. (25.4 mm). Solving the previous equation to obtain a volume change corresponding to a 1 in. rise in level:

$$W_p = \pi \cdot (29.250\text{ in.}) \cdot (1.0\text{ in.})^2 \left[1 - \frac{4\,(1.0\text{ in.})}{3\,(29.250\text{ in.})} \right]$$

$W_p = 87.70\text{ in.}^3$ (0.3797 gal)

7.3.5 Time to Obtain a Detectible Volume in a Vessel Cell Sump

The time required to obtain a detectible volume in a cell sump is given by:

$$t_3 = \frac{W}{Q}$$

t_3 = (0.3797 gal)*(h/0.020 gal) = 19.0 h

7.3.6 Total Vessel Cell Detection Time and Minimum Detectible Flow Rates

The total detection time is the sum of the previously enumerated floor wetting, boundary layer flow transport, and cell sump filling delays:

$t = t_1 + t_2 + t_3$
t = 9.0 h + 0.3 h + 19.0 h = 28.3 h.

The resultant value is greater than 24 h. Therefore, the iterative process is repeated for successively larger leakage rates. The iteration process converged on a solution for a leakage rate of 0.0236 gal/h (say 0.02 gal/h) when the following detection times are obtained:

t = 7.6 h + 0.3 h + 16.1 h = 24.0 h.

The corresponding partial volumes required for detection are summarized as follows:

$W = W_1 + W_2 + W_3$

W = (0.64 fl. oz./ft)*(35.81 ft)*(gal/128 fl. oz.) + (0.0236 gal)*(0.3 h) + 0.3797 gal
= 0.1791 gal + 0.0071 gal + 0.3797 gal = 0.5659 gal

7.4 Pit Sumps

The succeeding analysis determines the minimum leak rate that can be detected in the C3 Pump Pit, the C5 pump pits, or C5 Piping Pit in a 24-hour period.

7.4.1 Initial Minimum Detectible Leak Rate Assumption

Try an initial minimum detectible leakage rate that is equal to two-thirds of the 0.1 gal/h permit condition leak rate or 0.067 gal/h.

7.4.2 Time Required to Wet the Pit Liner Flow Path

The longest distance from a leak to the associated pit sump is conservatively equal to the diagonal formed by the width and the length of the pit (Assumption 4.2.10). Based on Assumption 4.1.3, the bounding case occurs in the C3 Pump Pit. This distance is equal to the following:

$$L = \sqrt{(13.00\ \text{ft})^2 + (14.46\ \text{ft})^2}$$

$$L = 19.44\ \text{ft}$$

The wetting factor is equal 0.32 fl. oz./ft (Assumption 4.2.9). Double this value to account for uncertainty in the validity of this parameter to flow over a flat surface. Hence, the time required to wet the flow channel is given by:

$$t = \frac{c\,L}{Q}$$

Where the variables are defined in Section 7.1(2).

$$t_1 = \left(\frac{0.64\ fl.\,oz.}{ft}\right)\left(\frac{gal}{128\ fl.\,oz.}\right)\left(\frac{19.44\ ft}{1}\right)\left(\frac{h}{0.067\ gal}\right) = 1.5\ h$$

7.4.3 Calculation of Leakage Travel Time to Pit Sump

The time required for the leakage to travel from its point of origin to its respective pit sump under boundary layer flow conditions is calculated by simultaneously solving the following sets of equations:

$$d = \sqrt{\frac{3\,\upsilon\,Q}{g\,S_o\,A}}$$ Assumption 4.2.8

and

$A = d*z$, where d = flow depth, ft; and z = the flow width = 10*d, ft — Assumption 4.2.18

Solving for d:

$$d = \left[\frac{3\,\upsilon\,Q}{10\,g\,S_o}\right]^{0.25}$$ Assumption 4.2.8

Where:

d = flow depth, ft
υ = kinematic viscosity of water @ 100 °F (Assumption 4.2.6), 7.37 x 10^{-6} ft^2/s (Ref. 12, pg.513)
g = gravitation constant, 32.17 ft/s^2
S_o = Slope of the incline, 0.01 (Assumption 4.1.4)
Q = leakage flow rate, 0.067 gal/h (2.488 x 10^{-6} ft^3/s)

d = [(3/10)*(7.37 x 10^{-6} ft^2/s)*(2.488 x 10^{-6} ft^3/s)*(s^2/32.17 ft)*(1/0.010)]^0.25

d = 0.00203 ft

The average flow velocity is given by:

$$V = \frac{g\, S_o\, d^2}{3\,\upsilon}$$

V = (32.17 ft/s^2)*(0.010)*(0.00203 ft)^2*(1/3)*(1/7.37 x 10^{-6} ft^2/s)
= 0.05996 ft/s

Thus, the travel delay for the leakage to reach the vessel cell sump is:

t_2= (h/3600 s)*(L/V)
= (h/3600 s)*(19.44 ft)*(s/0.05996 ft) = 0.1 h

7.4.4 Calculation of Leakage Volume Required for a Detectable Pit Sump Level Change

Based on inspection of Assumption 4.2.8, the two largest pit sumps are in the C3 Pump Pit or the C5 Piping Pit. These sumps are identical in size. The partial volume of the sump at various levels is thus given by the following:

W_g = 2.00 ft x 2.5 ft x (144 $in.^2/ft^2$) x (gal/231 $in.^3$) x H = (3.1169 gal/in.) x H

Where, H = height of the liquid in the sump in inches.

Similarly, based on Assumption 4.2.17, the partial volume displaced by the removal weir inside the sumps is equal to a straight cylinder with a diameter of 7.00 in. Therefore, the partial volume displaced by the weir at various levels is given by the following:

W_w = (1/4) x (π) x (7.00 in.)^2 x (gal/231 $in.^3$) x H = (0.1666 gal/in.) x H

Radar-type level detection instrumentation is capable of detecting a level rise of 10 mm (0.39 in.) (Assumption 4.2.4). To account for any potential uncertainties associated with rangeability, conservatively use a detectible level change of 1/2 in. (12.7 mm). Solving the previous equation to obtain a volume change corresponding to a 1/2 in. rise in level:

$W_h = W_g - W_w$ = (3.1169 gal/in. - 0.1666 gal/in.) * (0.50 in) = 1.4752 gal

7.4.5 Time to Obtain a Detectible Volume in a Pit Sump

The time required to obtain a detectible volume in a cell sump is given by:

$$t_3 = \frac{W}{Q}$$

t_3 = (1.4752 gal)*(h/0.067 gal) = 22.0 h

7.4.6 Total Pit Sump Detection Time and Minimum Detectible Flow Rates

The total detection time is the sum of the previously enumerated floor wetting, boundary layer flow transport, and pit sump filling delays:

$$t = t_1 + t_2 + t_3$$
$$t = 1.5\text{ h} + 0.1\text{ h} + 22.0\text{ h} = 23.6\text{ h}.$$

The resultant value is slightly less than 24 h. Therefore, the iterative process is repeated for successively smaller leakage rates. The iteration process converged on a solution for a leakage rate of 0.0658 gal/h (say 0.07 gal/h) when the following detection times are obtained:

$$t = 1.5\text{ h} + 0.1\text{ h} + 22.4\text{ h} = 24.0\text{ h}.$$

The corresponding partial volumes required for detection are summarized as follows:

$$W = W_1 + W_2 + W_3$$

W = (0.64 fl. oz./ft)*(19.44 ft)*(gal/128 fl. oz.) + (0.0658 gal)*(0.1 h) + 1.4752 gal
= 0.0972 gal + 0.0066 gal + 1.4752 gal = 1.5790 gal

8 References

1. WAC 173-303, *Dangerous Waste Regulations*, Washington Administrative Code

2. Permit Number WA7890008967, *Dangerous Waste Portion of the Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous, Waste,* Chapter 10 and Attachment 51, "Waste Treatment and Immobilization Plant".

3. 24590-LAB-M6-RLD-P0001, P&ID-LAB Radioactive Liquid Waste Disposal System C5 Collection and Transfer, Rev. 1.

4. 24590-LAB-M6-RLD-P0002, P&ID-LAB Radioactive Liquid Waste Disposal System C3 Collection & Transfer, Rev. 1.

5. 24590-LAB-PER-M-02-002, Sump Data for LAB Facility, Rev. 2.

6. 24590-LAB-M6-RLD-P0006, P&ID-LAB Radioactive Liquid Waste Disposal System C3 Rad Lab Collection, Rev. 1.

7. 24590-LAB-M6-RLD-P0007, P&ID-LAB Radioactive Liquid Waste Disposal System C3 Collection & Leak Detection, Rev. 1.

8. 24590-LAB-M6-RLD-P0008, P&ID-LAB Radioactive Liquid Waste Disposal System C5 Collection & Leak Detection, Rev. 1.

9. J.R. Collins, Calculation W314-P-039, "*Encasement Leak Detection*", Rev. 0, Fluor Daniel Northwest, October 19, 1998 (available from WTP PDC under CCN #093156).

10. 24590-LAB-P1-60-P0008, Analytical Laboratory General Arrangement Plan at EL. 0'-0", Rev. 1.

11. 24590-WTP-PER-CSA-02-001, Secondary Containment Design, Rev. 6.

12. Roberson, John A. and Clayton T. Crow, *Engineering Fluid Mechanics*, Houghton Mifflin Co., Boston, MA, 1975.

13. Blevins, Robert D., *Applied Fluid Dynamics Handbook*, Van Nostrand Reinhold Co., 135 West 50th St., New York, NY 10020 (1984).

14. Moss, D., *Pressure Vessel Design Manual*, Gulf Publishing Co., Houston, TX (1987).

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Notice

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

History Sheet

Rev	Date	Reason for revision	Revised by
0	11-02-04	Issued For Permitting Use	P. Martinelli

Contents

Acronyms

AEA	Atomic Energy Act of 1954
C3	Originally an identification of radiological contamination level potential (in the context of this report it identifies or describes subsystems or components associated with the RLD-VSL-00164 tank system)
C5	Originally an identification of radiological contamination level potential (in the context of this report it identifies or describes subsystems or components associated with the RLD-VSL-00165 tank system)
DOE	US Department of Energy
LAB	Analytical Laboratory Facility
LDB	Leak Detection Box
NPS	Nominal Pipe Size
PIN	Plant Item Number
TDH	Total Dynamic Head
WAC	Washington Administrative Code

1 Summary

The Analytical Laboratory (LAB) effluent vessel cells (cells) must satisfy the waste removal criteria of Dangerous Waste Permit Number WA7890008967, Permit Condition III.10.E.9.e.iii for secondary containment systems. This report evaluates the capability for removing, within 24 hours, spills, leaked waste, and other liquids that may accumulate in the effluent vessel cells.

The effluent vessel cells are stainless steel lined. The liners are contoured to direct liquids to dry sumps in the cells. The cells and cell sumps are emptied by self-priming, centrifugal mechanical pumps that can transfer accumulated liquids to dangerous waste process vessels for storage and subsequent processing.

Calculations of waste removal capability verified that the containment area waste removal capacity for the C3 Effluent Vessel Cell (Room A-B003) is 2.4 hours. Similarly, the waste removal capacity for the C5 Effluent Vessel Cell (Room A-B004) is 3.1 hours. These values are well within the 24-hour period required by the regulations and stipulated by Permit Condition III.10.E.9.e.iii. The calculated values are based on consideration of the maximum operating volume of a single vessel in its respective cell, plus the maximum anticipated volume of firewater that is postulated to accumulate in these cells.

2 Objective

There are two dangerous waste vessels in the Analytical Laboratory (LAB). The first vessel, RLD-VSL-00164, the Laboratory Area Sink Drain Collection Vessel, will hereafter be referred to as the C3 Vessel. The second vessel, RLD-VSL-00165, the Hotcell Drain Collection Vessel, will hereafter be referred to as the C5 Vessel. The purpose of this report is to confirm the waste removal capabilities for the effluent vessel cell sumps associated with these two tank systems.

The C3 Effluent Vessel Cell (Room A-B003) and the C5 Effluent Vessel Cell (Room A-B004) must satisfy Dangerous Waste Permit Number WA7890008967, Permit Condition III.10.E.9.e.iii criteria for waste removal from secondary containment systems (Ref. 1 & 2). This report evaluates the capability for removing, within 24 hours, spills, leaked waste, and other liquids that may accumulate in the effluent vessel cells. The report examines sources and volumes of liquids that may accumulate in the cells, discusses provisions for the removal of accumulated liquids, and confirms the capability to remove accumulated liquids from the cells within 24 hours.

Excluded from the scope of this report are the dangerous waste lines that are embedded in the building foundation slab and the associated leak detection boxes (LDBs), and the pump and piping pit sumps. The LDBs are designed to direct excess leakage from the dangerous waste lines to their corresponding effluent vessel cell. Similarly, the pump and piping pit sumps are designed to direct excess leakage from the associated pit area to the corresponding effluent vessel.

3 Description

The Waste Treatment Plant Dangerous Waste Permit (Ref. 2), Permit Condition III.10.E.9.e.iii requires submittal of:

> "Detailed operational plans and descriptions, demonstrating that spilled or leaked waste and accumulated liquids can be removed from the secondary containment system within twenty-four (24) hours [WAC 173-303-806(4)(c)(vii)].

This report confirms that the LAB waste removal capabilities satisfy these requirements.

4 Assumptions

Assumptions used in this evaluation of the Analytical Laboratory (LAB) effluent vessel cell waste removal capabilities are enumerated in the succeeding subsections.

4.1 Fire water discharges are based on a spray density of 0.17 gal/min·ft^2 over a "minimum design area" of 3000 ft^2 for a discharge duration of 20 minutes (Ref. 3)

4.2 The total dynamic head (TDH) requirements for the transfer of liquids from the C3 vessel cell sump to the C5 vessel are provided by current project design calculations.

4.3 The pump performance characteristics (i.e., pump curve data) for Pump RLD-PMP-00182A and B are given by the proposal documents of the selected pump vendor.

4.4 The TDH requirements for the transfer of liquids from the C5 vessel cell sump to PWD-VSL-00044 in the Pretreatment Facility (PTF) can be estimated from existing project design calculations. Minor elevation differences between the bottom of the C5 Vessel considered in the existing calculations and the bottom of the C5 effluent vessel sump are addressed herein.

4.5 The pump performance characteristics (i.e., pump curve data) for Pump RLD-PMP-00183A are given by the proposal documents of the selected pump vendor.

4.6 LAB dangerous waste inventories are sufficiently small compared to the liquid volumes that are routinely handled by the PTF Facility that there are no practical limits on when or how much waste can be transferred. Moreover, delays due to intermediate transfers between the C3 and C5 Vessels can be ignored for purposes of this evaluation. The C3 and C5 Vessel transfer capacities are comparable.

4.7 Operator response times needed for the manual alignment of valves and pump priming are ignored for the purposes of this evaluation. The cell liners are sized to accommodate 100% of the vessel volume or 20 minutes of firewater flow. In any event, prior to drawing suction from the effluent vessel cell sumps (cell sumps), the pump suction valves need to be re-aligned in order to draw suction from the cell sumps and the pumps may need to prime themselves prior to achieving rated flow capacities.

5 Analysis

5.1 C3 Effluent Vessel Cell (Room A-B003)

The C3 Effluent Vessel Cell houses the C3 Vessel. There are no other dangerous waste vessels in the cell. The cell is lined with stainless steel for secondary containment. The slope of the cell liner diverts effluents or other liquids towards the C3 Cell Sump (RLD-SUMP-00041). The sump is 30 inches nominal diameter and approximately 13 inches deep. The sump is made from a piece of nominal pipe size (NPS 30) standard-wall pipe (or an equivalent rolled plate) and a 30-in diameter, standard-wall, pipe cap (or equivalent ellipsoidal-head section) and has a nominal volume of 30 gallons. The sump is emptied by pump RLD-PMP-00182A or 00182B into the C5 Vessel, located in Room A-B004, or emptied into the C3 vessel, located in Room A-B003. For major breaches of the primary containment or major firewater discharges to the cell, accumulated liquids are contained by the combined volumes of the sump and the lined portions of the cell. Under these circumstances, the accumulated liquids will be removed from the cell and be transferred to the C5 Vessel for subsequent storage, transfer, and processing. The bounding calculations consider three potential scenarios: (1) removal of the breached-vessel contents from the cell, (2) removal of firewater overflow discharges from the cell, and (3) removal of all accumulated liquids from the vessel and the associated cell.

5.2 C5 Effluent Vessel Cell (Room A-B004)

The C5 Effluent Vessel Cell is similar to the one described in section 5.1 above. The associated sump, C5 Cell Sump (RLD-SUMP-00042), is emptied via pump RLD-PMP-00183A into the Plant Wash Vessel, PWD-VSL-00044, in the PTF Facility, through a buried, double-walled (duplex) transfer line or emptied into the C5 vessel in Room A-B004. For major breaches of the primary containment or major firewater discharges to the cell, the accumulated liquids will be removed from the cell and transferred to PWD-VSL-00044 (the PT Plant Wash Vessel) for subsequent storage and processing. The bounding calculations consider the same three waste removal scenarios described previously.

6 Sump Removal Rates

The results of this evaluation are compiled in the table below based on the two cases that are evaluated in Section 7, Bounding Calculations. The table demonstrates that the C3 Effluent Vessel Cell [and the associated C3 Cell Sump (RLD-SUMP-00041)] and the C5 Effluent Vessel Cell [and the associated C5 Cell Sump (RLD-SUMP-00042)] have sufficient emptying capacity to remove spills, leaks, or other accumulated liquids from their respective effluent vessel cells within 24 hours. The 24-hour criterion corresponds to the requirement in Permit Condition III.10.E.9.e.iii.

Analytical Laboratory Facility
Waste Removal Capacity Over 24 Hours

Containment Area Room Number	Sump PIN	Sump Waste Removal Capacity, (US gal/h)	Largest Vessel in Containment Area [1] (Vessel Number and Maximum Operating Volume)	Largest Vessel Waste Removal Capacity, h	Fire Water Volume. (US gal)	Fire Water Removal Capacity, h	Total Containment Area Waste Removal Capacity, h
A-B003	RLD-SUMP-0041	5400	RLD-VSL-00164 2740 US gal	0.5	10,200	1.9	2.4
A-B004	RLD-SUMP-0042	5400	RLD-VSL-00165 6615 US gal	1.2	10,200	1.9	3.1

Note 1: There is only one dangerous waste vessel in either containment area.

7 Bounding Calculations

There are two effluent vessel cells in the LAB that are used for tank system containment. These two cells are associated with the respective C3 Vessel and C5 Vessel and are identified as follows:

- C3 effluent vessel cell, Room A-B003 — C3 Cell Sump (RLD-SUMP-00041)
- C5 effluent vessel cell, Room A-B004 — C5 Cell Sump (RLD-SUMP-00042)

This calculation examines the waste removal capabilities from these areas and the associated cell sump.

7.1 C3 Effluent Vessel Cell, Room A-B003

The C3 Effluent Vessel Cell contains the C3 Vessel. Leak collection and detection for the C3 Effluent Vessel Cell is provided by RLD-SUMP-00041 and the associated level instrumentation. The sump is emptied by either pump RLD-PMP-00182A or RLD-PMP-00182B.

There are no fire suppression sprinklers in the C3 Effluent Vessel Cell. All firewater postulated to accumulate in the cell originates from other areas of the facility.

The liquid volumes of interest that must be removed from the area are the following (Ref. 3):

- Maximum Operating Volume of the C3 Vessel: 2740 gal
- Maximum Firewater Volume: 20 min * (0.17 gal/min·ft^2) * (3000 ft^2) = 10,200 gal (Assumption 4.1)
- Total Containment Area Volume: 2740 gal + 10,200 = 12,940 gal

Based on inspection of the system design calculations, the total dynamic head (TDH) @ 74 gal/min needed to pump the C3 vessel cell sump to the C5 Vessel is approximately 12.4 ft-H_2O (Assumption 4.2). Based on a review of the pump curve furnished by the selected supplier with its pump proposal (Assumption 4.5), the pumps will runout at over 150 gal/min at this condition. Therefore, the piping system is expected to be throttled during this mode of operation to limit the flow rate to a reasonable value. From the pump curve, a value of 100 gal/min is deemed reasonable. As a check, per Ref. 4, pg. B-14, the corresponding fluid velocity through a NPS 3, Sch. 40 pipe is only about 4 ft/s. This value is well within the pipe-sizing limits. Hence, a sump waste removal capacity of 100 gal/min would be reasonable. However, for conservatism, use a value of 90 gal/min or 5400 gal/h.

The "largest vessel waste removal capacity", the "fire water volume", and the "total containment area waste removal capacity" are thus the following, respectively:

- Maximum Operating Volume: 2740 gal * (min/90 gal) * (h/60 min) = 0.5 h
- Maximum Firewater Volume: 10,200 gal * (min/90 gal) * (h/60 min) = 1.9 h
- Total Containment Area Volume: 12,940 gal * (min/90 gal) * (h/60 min) = 2.4 h.

7.2 C5 Effluent Vessel Cell, Room A-B004

The C5 Effluent Vessel Cell contains the C5 Vessel. Leak collection and detection for the C5 Effluent Vessel Cell is provided by RLD-SUMP-00042 and the associated level instrumentation. The sump is emptied by pump RLD-PMP-00183A.

There are no fire suppression sprinklers in the C5 Effluent Vessel Cell. All firewater postulated to accumulate in the cell originates from other areas of the facility.

The liquid volumes of interest that must be removed from the area are the following (Ref. 3):

- Maximum Operating Volume of the C5 Vessel: 6615 gal
- Maximum Firewater Volume: 20 min * (0.17 gal/min·ft^2) * (3000 ft^2) = 10,200 gal (Assumption 4.1)
- Total Containment Area Volume: 6615 gal + 10,200 gal = 16,815 gal (round to 16,820 gal)

Based on inspection of system design calculations, the TDH @ 60 gal/min needed to pump the C5 Vessel to the PTF Plant Wash Vessel (PWD-VSL-00044) is approximately 78.3 ft-H_2O (Assumption 4.4). The TDH requirement for transfers from the C5 effluent vessel sump to PTF Vessel PWD-VSL-00044 is 2 to 3 ft-H_2O more.

Per system design calculations, the system curve for this mode of operation is estimated using the following equation:

$$H = \left(\frac{15.5\ ft \cdot H_2 0}{(60\ gpm)^2} \right) Q^2 + 62.79\ ft \cdot H_2 O$$

Q, gpm	H, ft-H_2O
40	70
60	78
80	90
85	94
90	98
95	102
100	**106** ~ Pump Intersection
105	110
110	115
120	125

Superimposing these points onto the pump performance curve, the operating point (i.e., the intersection of the pump curve and the system curve) is approximately 100 gal/min and 106 ft-H_2O. These values define the expected output of the pump. The actual flow is anticipated to be modestly less because the system curve is based on discharge from the C5 Vessel, rather than the C5 effluent vessel sump. Again, per Ref. 4, pg. B-14, the corresponding fluid velocity through a NPS 3, Sch. 40 pipe is only about 4 ft/s. This value is well within the pipe-sizing limits and a flow of 100 gal/min would be reasonable. However, for conservatism, use a value of 90 gal/min or 5400 gal/h.

The "largest vessel waste removal capacity", the "fire water volume", and the "total containment area waste removal capacity" are thus the following, respectively:

- Maximum Operating Volume: 6615 gal * (min/90 gal) * (h/60 min) = 1.2 h
- Maximum Firewater Volume: 10,200 gal * (min/90 gal) * (h/60 min) = 1.9 h
- Total Containment Area Volume: 16,820 gal * (min/90 gal) * (h/60 min) = 3.1 h.

8 References

1. WAC 173-303, *Dangerous Waste Regulations*, Washington Administrative Code.

2. Permit Number WA7890008967, *Dangerous Waste Portion of the Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous, Waste,* Chapter 10 and Attachment 51, "Waste Treatment and Immobilization Plant".

3. 24590-LAB-PER-M-02-001, Flooding Volumes for LAB Facility, Rev. 0.

4. Crane, *Flow of Fluid Through Valves, Fittings, and Pipe*, Crane Co., 300 Park Ave., New York, NY 10022, 21st Printing (1982).

Attachment 51 – Appendix 11.9
Laboratory Building
Material Selection Documentation

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

Appendix 11.9
Laboratory Building
Material Selection Documentation

The following drawings have been incorporated into Appendix 11.9 and can be viewed at the Ecology Richland Office. See Appendix 7.9 for material selection documentation common to the Pretreatment, LAW, HLW, and Laboratory buildings. **New drawings are in bold lettering.**

Drawing/Document	**Description**
24590-LAB-N1D-RLD-P0002, Rev 1	Material Selection Data Sheet for RLD-VSL-00164
24590-LAB-N1D-RLD-P0003, Rev 1	Material Selection Data Sheet for RLD-VSL-00165
RESERVED	RESERVED

24590-LAB-N1D-RLD-P0002
Rev. 1

PLANT ITEM MATERIAL SELECTION DATA SHEET

R10672006

ISSUED BY RPP-WTP PDC

RLD-VSL-00164 (LAB)
Lab Area Sink Drain Collection Vessel (RLD C3 Vessel)

- Design Temperature (°F)(max/min): 240/-20
- Design Pressure (psig) (max/min): 15/7
- Location: Lab

Operating conditions as stated on attached Material Selection Data Sheet

Options Considered:

- Vessel contains contaminated liquid effluent at normal operating temperatures less than 92°F.
- Mixing will be provided by pumps and eductors. Solid accumulation at bottom of vessel is anticipated. Wash rings are available for flushing.
- Dilute acid is available for cleaning vessel internals.

Materials Considered:

Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00		X
316L (S31603)	1.18		X
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: UNS N08367 or N08926

Recommended Corrosion Allowance: 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance)

Process & Operations Limitations:

- Develop flushing/rinsing procedure

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1	4/18/06	Issued for Permitting Use	[signature]	[signature]	[signature]
0	3/4/04	Issued for Permitting Use	DLA	JRD	APR

PLANT ITEM MATERIAL SELECTION DATA SHEET

Corrosion Considerations:

a General Corrosion
In this vessel, the normal pH conditions and temperatures are such that 316L stainless steel would be acceptable if no chlorides are present. However, because of the of expected halide concentration, a 6% Mo alloy will be necessary.

Conclusion:
A 6% Mo alloy is recommended.

b Pitting Corrosion
Chloride is known to cause pitting in acid and neutral solutions. Under the stated conditions, for temperature and pH, a 6% Mo alloy or better is needed.

Conclusion:
Localized corrosion, such as pitting, is common and would be a serious concern at the expected halide levels. Under the stated conditions, 6% Mo is recommended.

c End Grain Corrosion
End grain corrosion only occurs in metal with exposed end grains and in highly oxidizing acid conditions.

Conclusion:
Not likely in this system.

d Stress Corrosion Cracking
The exact amount of chloride required to cause stress corrosion cracking is unknown. In part this is because the amount varies with temperature, metal sensitization, and the environment. But it is also unknown because chloride tends to concentrate under heat transfer conditions, by evaporation, and electrochemically during a corrosion process. Hence, even as little as 10 ppm can lead to cracking under some conditions. Generally, as seen in Sedriks (1996) and Davis (1987), stress corrosion cracking does not usually occur below about 140 °F. With the maximum fluid temperature stated at 92 °F and with a large concentration of chlorides, 316L is not recommended. A more resistant alloy such as 6% Mo alloys or better will be needed.

Conclusion:
A 6% Mo alloy or better is recommended.

e Crevice Corrosion
Non-negligible amounts of solids are expected to accumulate at the bottom of the vessel. With the proposed operating conditions, 304L and 316L are not acceptable. A 6% Mo alloy or better is recommended. In addition, see Pitting.

Conclusion:
A resistant alloy such as a 6% Mo is recommended.

f Corrosion at Welds
Other than pitting or crevice corrosion, corrosion at welds is not considered a problem in the proposed environment.

Conclusion:
Weld corrosion is not considered a problem for this system.

g Microbiologically Induced Corrosion (MIC)
The proposed operating conditions are suitable for microbial growth. However, liquids received should either be treated or DIW so the possibility of infection is small.

Conclusion:
MIC is not considered a problem.

h Fatigue/Corrosion Fatigue
Not expected to be a concern.

Conclusions
Not believed to be a concern.

i Vapor Phase Corrosion
Vapor phase corrosion is not expected to be a concern.

Conclusion:
Not a concern.

PLANT ITEM MATERIAL SELECTION DATA SHEET

j Erosion
Velocities within the vessel are expected to be small. Erosion allowance of 0.004 inch for components with low solids content (< 2 wt%) at low velocities is based on 24590-WTP-RPT-M-04-0008.

Conclusion:
Not a concern.

k Galling of Moving Surfaces
Not applicable.

Conclusion:
Not applicable.

l Fretting/Wear
No contacting surfaces expected.

Conclusion:
Not applicable.

m Galvanic Corrosion
No dissimilar metals are present.

Conclusion:
Not applicable.

n Cavitation
None expected.

Conclusion:
Not a concern.

o Creep
The temperatures are too low to be a concern for metallic vessels.

Conclusion:
Not applicable.

PLANT ITEM MATERIAL SELECTION DATA SHEET

References:

1. 24590-LAB-MVC-RLD-00002, Rev. A, *Material Selection Data Sheet*
2. 24590-WTP-RPT-M-04-0008, Rev. 2, *Evaluation Of Stainless Steel Wear Rates In WTP Waste Streams At Low Velocities*
3. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
4. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158

Bibliography:

1. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
2. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
3. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
4. Koch, GH, 1995, *Localized Corrosion in Halides Other Than Chlorides*, MTI Pub No. 41, Materials Technology Institute of the Chemical Process Industries, Inc, St Louis, MO 63141
5. Phull, BS, WL Mathay, & RW Ross, 2000, *Corrosion Resistance of Duplex and 4-6% Mo-Containing Stainless Steels in FGD Scrubber Absorber Slurry Environments*, Presented at Corrosion 2000, Orlando, FL, March 26-31, 2000, NACE International, Houston TX 77218.
6. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
7. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084

PLANT ITEM MATERIAL SELECTION DATA SHEET

OPERATING CONDITIONS

Materials Selection Data

Component (Name/ID) Radioactive Liquid Disposal Vessel (24590-LAB-MV-RLD-VSL-00164)
System RLD

Operations

Chemicals	Unit	Cold Startup	Normal Operation	Standby/Idle	Cleaning	Accident
		Note 1		Note 2		
Aluminum	g/l		1.51E-02			
Bromide	g/l		3.44E-06			
Chloride	g/l		1.88E+00			
Fluoride	g/l		1.62E-01			
Hydroxide	g/l		1.47E-01			
Iron	g/l		4.80E-03			
Nitrate	g/l		1.98E+00			
Nitrite	g/l		6.89E-03			
Phosphate	g/l		2.26E-03			
TOC✝	g/l		1.99E-01			
Sulfate	g/l		3.79E-01			
Undissolved solids	g/l		See comments (1)			
Particle size/hardness	µm (##)		NA			
Other ($NaMnO_4$, Hg, etc)	g/l		3.88E-06 (Hg)			
Carbonate	g/l		7.12E+00			
pH	-		6 to 8			
Dose rate -- β/γ (inside)	Rad		See comments (2)			
Temperature	°F		See comments (3)			
Velocity	fps		NA			
Vibration			NA			
Time of exposure	#		NA			

\# - % of total; ## - use Mho scale

Based on Calc. No. 24590-LAB-MVC-RLD-00002, Rev. A

Notes:
Note 1: Assume same as normal operations minus radionuclides.
Note 2: Same as normal operation.

Comments:
(1) Total Solids accumulation per month at the bottom of the C3 vessel (RLD-VSL-00164) = 0.20 in.
(2) Activity in C3 vessel: 137-Cs: 1.10E-07 Ci/gal and 90-Sr: 2.52E-06 Ci/gal.
(3) The minimum, normal, and maximum fluid temperatures will be approximately 50°F, 78°F, and 92°F, respectively.

☐ Black Cell

✝ List expected organic species: Potassium hydrogen phthalate, Ammonium hydrogen oxalate, Ethanol, Glacial acetic acid, Chloramine-T

☐ Flushing

Use maximum of 2 significant figures

PLANT ITEM MATERIAL SELECTION DATA SHEET

R10664181

RLD-VSL-00165 (LAB)
Hotcell Drain Collection Vessel

ISSUED BY
RPP-WTP PDC

- Design Temperature (°F)(max/min): 240/-20
- Design Pressure (psig) (max/min): 15/7
- Location: Lab

Contents of this document are Dangerous Waste Permit affecting

Operating conditions as stated on attached Material Selection Data Sheet

Options Considered:

- Vessel contains contaminated liquid effluent at normal operating temperatures less than 92°F.
- Mixing will be provided by pumps and eductors. Solid accumulation at bottom of vessel is anticipated. Wash rings are available for flushing.
- Dilute acid is available for cleaning vessel internals.

Materials Considered:

Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00		X
316L (S31603)	1.18		X
6% Mo (N08367/ N08925/N08926)	7.64	X	
Alloy C-276 (N10276)	~ 10	X	
Alloy C-22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: UNS N08367, N08925 or N08926 (6% Mo alloys) or better

Recommended Corrosion Allowance: 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance)

Process & Operations Limitations:

- Develop flushing/rinsing procedure

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REGISTERED
PROFESSIONAL ENGINEER
1/12/06
EXPIRES: 12/07/07

Please note that source, special nuclear and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the U.S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

This bound document contains a total of 5 sheets.

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0	3/14/04	Issued for Permitting Use	DLA	JRD	APR
REV	**DATE**	**REASON FOR REVISION**	**PREPARER**	**CHECKER**	**APPROVER**

PLANT ITEM MATERIAL SELECTION DATA SHEET

Corrosion Considerations:

a General Corrosion
In this vessel, the normal pH conditions and temperatures are such that 316L stainless steel would be acceptable if no chlorides are present. However, because of the expected halide concentration, a 6% Mo alloy is recommended.

Conclusion:
A 6% Mo alloy is recommended.

b Pitting Corrosion
Chloride is known to cause pitting in acid and neutral solutions. At the lower end of the stated pH range, with the expected halide concentrations, 316L is a marginal choice. A 6% Mo alloy or better is needed.

Conclusion:
Localized corrosion, such as pitting, is common and would be a concern at the expected halide levels. Under the stated conditions, a 6% Mo alloy is the minimum recommended.

c End Grain Corrosion
End grain corrosion only occurs in metal with exposed end grains and in highly oxidizing acid conditions.

Conclusion:
Not likely in this system.

d Stress Corrosion Cracking
The exact amount of chloride required to cause stress corrosion cracking is unknown. In part this is because the amount varies with temperature, metal sensitization, and the environment. But it is also unknown because chloride tends to concentrate under heat transfer conditions, by evaporation, and electrochemically during a corrosion process. Hence, even as little as 10 ppm can lead to cracking under some conditions. Generally, as seen in Sedriks (1996) and Davis (1987), stress corrosion cracking does not usually occur below about 140°F. With the maximum fluid temperature stated at 92 °F and with a large concentration of chlorides, 316L is not recommended. A more resistant alloy such as 6% Mo alloys or better will be needed.

Conclusion:
A 6% Mo alloy or better is recommended.

e Crevice Corrosion
Non-negligible amounts of solids are expected to accumulate at the bottom of the vessel. With the proposed operating conditions, 304L and 316L are not acceptable. A 6% Mo alloy or better is recommended. In addition, see Pitting.

Conclusion:
A resistant alloy such as a 6% Mo is recommended.

f Corrosion at Welds
Other than pitting or crevice corrosion, corrosion at welds is not considered a problem in the proposed environment. 6% Mo alloys must be welded with a high molybdenum filler metal such as NiCrMo-3.

Conclusion:
Weld corrosion is not considered a problem for this system.

g Microbiologically Induced Corrosion (MIC)
The proposed operating conditions are suitable for microbial growth. However, liquids received should either be treated or DIW so the possibility of infection is small.

Conclusion:
MIC is not considered a problem.

h Fatigue/Corrosion Fatigue
Not expected to be a concern.

Conclusions
Not believed to be a concern.

i Vapor Phase Corrosion
Vapor phase corrosion is not expected to be a concern.

Conclusion:
Not a concern.

PLANT ITEM MATERIAL SELECTION DATA SHEET

j Erosion
Velocities within the vessel are expected to be low. Erosion allowance of 0.004 inch for components with low solids content (< 2 wt%) at low velocities is based on 24590-WTP-RPT-M-04-0008.

Conclusion:
Not a concern.

k Galling of Moving Surfaces
Not applicable.

Conclusion:
Not applicable.

l Fretting/Wear
No contacting surfaces expected.

Conclusion:
Not applicable.

m Galvanic Corrosion
No dissimilar metals are present.

Conclusion:
Not applicable.

n Cavitation
None expected.

Conclusion:
Not a concern.

o Creep
The temperatures are too low to be a concern for metallic vessels.

Conclusion:
Not applicable.

p Inadvertent Addition of Nitric Acid
Higher chloride contents and higher temperatures usually require higher alloy materials. Nitrate ions inhibit the pitting and crevice corrosion of stainless alloys. Furthermore, nitric acid passivates these alloys; therefore, lower pH values brought about by increases in the nitric acid content of process fluid will not cause higher corrosion rates for these alloys. The upset condition that was most likely to occur is lowering of the pH of the vessel content by inadvertent addition of 0.5 M nitric acid. Lowering of pH may make a chloride-containing solution more likely to cause pitting of stainless alloys. Increasing the nitric acid content of the process fluid adds more of the pitting-inhibiting nitrate ion to the process fluid. In addition, adding the nitric acid solution to the stream will dilute the chloride content of the process fluid.

Conclusion:
The recommended materials will be able to withstand a plausible inadvertent addition of 0.5 M nitric acid.

PLANT ITEM MATERIAL SELECTION DATA SHEET

References:

1. 24590-LAB-MVC-RLD-00003, Rev. A, *Material Selection Data Sheet*
2. 24590-WTP-RPT-M-04-0008, Rev. 2, *Evaluation Of Stainless Steel Wear Rates In WTP Waste Streams At Low Velocities*
3. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
4. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158

Bibliography:

1. 24590-LAB-3YD-RLD-00001, *System Description for the Radioactive Liquid Waste Disposal System (RLD) for the Analytical Laboratory.*
2. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
3. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
4. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
5. Koch, GH, 1995, *Localized Corrosion in Halides Other Than Chlorides*, MTI Pub No. 41, Materials Technology Institute of the Chemical Process Industries, Inc, St Louis, MO 63141
6. Phull, BS, WL Mathay, & RW Ross, 2000, *Corrosion Resistance of Duplex and 4-6% Mo-Containing Stainless Steels in FGD Scrubber Absorber Slurry Environments*, Presented at Corrosion 2000, Orlando, FL, March 26-31, 2000, NACE International, Houston TX 77218.
7. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
8. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084

PLANT ITEM MATERIAL SELECTION DATA SHEET

OPERATING CONDITIONS

BY: Budhi N. Kapoor
DATE: 04/16/2003
SUBJECT: Process and Materials Selection Data for Hotcell Drain Collection Vessel (RLD-VSL-00165)

CALCULATION SHEET

PROJECT: RPP-WTP
JOB NO: 24590
CALC NO: 24590-LAB-MVC-RLD-00003
SHEET REV: A
SHEET NO: 11 BNK 4/21/03

Materials Selection Data

Document No 24590-LAB-MVC-RLD-00003, Rev A

Component (Name/ID) Radioactive Liquid Disposal Vessel (24590-LAB-MV-RLD-VSL-00165)

System RLD-VSL-00165

Fabrication/Construction	
Material	
Heat treatment	
Mechanical treatment	
Surface finish	
Cleaning	
Marking	
Corrosion allowance	

Transportation	
Protection	

External Environment	
Chemistry	
Relative Humidity	

Operations						
Chemicals	Unit	Cold Startup	Normal Operation*	Standby/Idle	Cleaning	Accident
		Note 1		Note 2		
Aluminum	g/l		1.71E-02			
Bromide	g/l		1.65E-06			
Chloride	g/l		9.17E-01			
Fluoride	g/l		1.22E-01			
Hydroxide	g/l		1.83E-01			
Iron	g/l		8.42E-03			
Nitrate	g/l		1.08E+00			
Nitrite	g/l		9.86E-03			
Phosphate	g/l		1.82E-03			
TOC'	g/l		9.56E-02			
Sulfate	g/l		1.90E-01			
Undissolved solids	g/l		See comments (1)			
Particle size/hardness	µm (##)		NA			
Other ($NaMnO_4$, Hg, etc)	g/l		1.49E-05 (Hg)			
Carbonate	g/l		3.41E+00			
pH	-		6 to 8			
Dose rate, α, β/γ (inside)	Rad		See comments (2)			
Temperature	°F		See comments (3)			
Velocity	fps		NA			
Vibration			NA			
Time of exposure	#		NA			

* Based on Calc. No. 24590-LAB-MVC-RLD-00003, Rev A

\# - % of total; ## - use Mho scale

Assumptions:

Remarks:

Notes
Note 1: Assume same as normal operations minus radionuclides
Not 2: Same as normal operation

Comments:
(1) Total Solids accumulation per month at the bottom of the C5 vessel (RLD-VSL-00165) = 0.20 in
(2) Activity in C3 vessel: 137-Cs: 1.62E-03 Ci/gal and 90-Sr: 1.80E-03 Ci/gal
(3) The minimum, normal, and maximum fluid temperatures will be approximately 50°F, 78°F, and 92°F, respectively.

Prepared by: B. Kapoor BNK Checked by: S. Rueff Approved by: Abdul Dada
Dates 4/17/03 SMR 4-17-03 AD 4/22/03

☐ Black Cell

' List expected organic species. Potassium hydrogen phthalate, Ammonium hydrogen oxalate, Ethanol, Glacial acetic acid, Chloramine-T

☐ Flushing

* Use maximum of 2 significant figures

Attachment 51 – Appendix 11.10
Laboratory Building
Critical Systems Equipment/Instrument List

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

Appendix 11.10
Laboratory Building
Critical Systems Equipment/Instrument List

The following drawings have been incorporated into Appendix 11.10 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing/Document	**Description**
	Analytical Laboratory Below Grade Room & Equipment Room List
RESERVED	RESERVED

Analytical Laboratory Below Grade Room and Equipment List

Room Number	Room Description	Equipment Number	Equipment Description
A-B002	C3 Pump Pit	RLD-PMP-00182A	Lab Area Sink Drain Collection Vessel Pump (C3 Vessel)
		RLD-PMP-00182B	Lab Area Sink Drain Collection Vessel Pump (C3 Vessel)
		RLD-SUMP-00045	C3 Pump Pit Sump
A-B003	C3 Effleunt Vessel Cell	RLD-VSL-00164	Lab Area Sink Drain Collection Vessel
	(Lab Area Sink Drain Collection Vessel Cell)	RLD-SUMP-00041	C3 Vessel Cell Sump
		RLD-LDB-00005	Rad Lab Sink Drain Collection Header Leak Detection Box
		RLD-LDB-00006	PVA Drain Header Leak Detection Box
		RLD-LDB-00007	C3 Maintenance Drain Header Leak Detection Box
		RLD-LDB-00008	Sample Receipt Sink Drain Collection Header Leak Detection Box
		RLD-LDB-00011	ASX Equipment Drain Collection Header Leak Detection Box
A-B004	C5 Effluent Vessel Cell	RLD-VSL-00165	Hot Cell Drain Collection Vessel (C5 Vessel)
	(Lab Area Sink Drain Collection Vessel Cell)	RLD-SUMP-00042	C5 Vessel Cell Sump
		RLD-LDB-00002	Hotcell Drain Collection Header Leak Detection Box
		RLD-LDB-00004	C3 Transfer Line Header Cell Leak Detection Box
		RLD-LDB-00009	Glovebox Header Leak Detection Box
A-B005	C5 Pump Pit	RLD-PMP-00183B	Hotcell Drain Collection Vessel Pump
		RLD-SUMP-00043B	C5 Pump Pit Sump
A-B006	C5 Piping Pit	RLD-SUMP-00044	C5 Piping Pit Sump

Analytical Laboratory Below Grade Room and Equipment List

A-B007	C5 Pump Pit	RLD-PMP-00183A	Hotcell Drain Collection Vessel Pump
		RLD-SUMP-00043A	C5 Pump Pit Sump

3/19/04

Attachment 51 – Appendix 11.11
Laboratory Building
IQRPE Reports

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

Appendix 11.11
Laboratory Building
IQRPE Reports

The following drawings have been incorporated into Appendix 11.11 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing/Document	**Description**
24590-CM-HC4-HXYG-00138-01-16, Rev 00B	IQRPE Integrity Assessment Report for Below Grade Level Secondary Containment
24590-CM-HC4-HXYG-00138-01-00020, Rev 00A	IQRPE Integrity Assessment Report for RLD-VSL-00164 and RLD-VSL-00165
24590-CM-HC4-HXYG-00138-02-00016, Rev 00A	IQRPE Integrity Assessment Report for El. 0 RLD Ancillary Equipment
RESERVED	RESERVED

Attachment 51 – Appendix 11.10
Laboratory Building
Critical Systems Equipment/Instrument List

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

Analytical Laboratory Below Grade Room and Equipment List

Room Number	Room Description	Equipment Number	Equipment Description
A-B002	C3 Pump Pit	RLD-PMP-00182A	Lab Area Sink Drain Collection Vessel Pump (C3 Vessel)
		RLD-PMP-00182B	Lab Area Sink Drain Collection Vessel Pump (C3 Vessel)
		RLD-SUMP-00045	C3 Pump Pit Sump
A-B003	C3 Effleunt Vessel Cell	RLD-VSL-00164	Lab Area Sink Drain Collection Vessel
	(Lab Area Sink Drain Collection Vessel Cell)	RLD-SUMP-00041	C3 Vessel Cell Sump
		RLD-LDB-00005	Rad Lab Sink Drain Collection Header Leak Detection Box
		RLD-LDB-00006	PVA Drain Header Leak Detection Box
		RLD-LDB-00007	C3 Maintenance Drain Header Leak Detection Box
		RLD-LDB-00008	Sample Receipt Sink Drain Collection Header Leak Detection Box
		RLD-LDB-00011	ASX Equipment Drain Collection Header Leak Detection Box
A-B004	C5 Effluent Vessel Cell	RLD-VSL-00165	Hot Cell Drain Collection Vessel (C5 Vessel)
	(Lab Area Sink Drain Collection Vessel Cell)	RLD-SUMP-00042	C5 Vessel Cell Sump
		RLD-LDB-00002	Hotcell Drain Collection Header Leak Detection Box
		RLD-LDB-00004	C3 Transfer Line Header Cell Leak Detection Box
		RLD-LDB-00009	Glovebox Header Leak Detection Box
A-B005	C5 Pump Pit	RLD-PMP-00183B	Hotcell Drain Collection Vessel Pump
		RLD-SUMP-00043B	C5 Pump Pit Sump
A-B006	C5 Piping Pit	RLD-SUMP-00044	C5 Piping Pit Sump

Analytical Laboratory Below Grade Room and Equipment List

A-B007	C5 Pump Pit	RLD-PMP-00183A	Hotcell Drain Collection Vessel Pump
		RLD-SUMP-00043A	C5 Pump Pit Sump

3/19/04

Attachment 51 – Appendix 11.13
Laboratory Building
Instrument Control Logic and Narrative Descriptions

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.

Appendix 11.13
Laboratory Building
Instrument Control Logic and Narrative Descriptions

The following drawings have been incorporated into Appendix 11.13 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing/Document Number	**Description**
24590-LAB-PER-J-03-001, Rev 0	System Logic Description for Laboratory RLD System
RESERVED	RESERVED

R10222898

Document title: **System Logic Description for Analytical Laboratory - Radioactive Liquid Waste System**

ISSUED BY RPP-WTP PDC
INIT DATE

Contract number: DE-AC27-01RV14136

Department: Controls and Instrumentation

Author(s): A Pfeif

Principal author signature: Anne M. Pfeif

Document number: 24590-LAB-PER-J-03-001, Rev 0

Checked by: H McAdams

Checker signature:

Date of issue: 5 March 2004

Issue status: Issued for Permitting Use

Approved by: S Anderson

Approver's position: C&I Discipline Engineering Manager

Approver signature: Stephen E. Anderson

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Notice

Please note that source, special nuclear, and byproduct materials, as defined in the *Atomic Energy Act of 1954* (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

History Sheet

Rev	Date	Reason for revision	Revised by
0	6 October 2003	Issued for Permitting Use	A Pfeif

Contents

Figures

Acronyms and Abbreviations

AEA	*Atomic Energy Act of 1954*
DOE	US Department of Energy
LAB	analytical laboratory
LOL	lower operating limit
P&ID	piping and instrumentation diagram
RLD	radioactive liquid waste disposal
UOL	upper operating limit
WTP	Hanford Tank Waste Treatment and Immobilization Plant

Glossary

acquire	Acquire is a command under batch control that reserves a group of equipment for a particular batch control operation.
batch	Batch is the material that is being produced or that has been produced by a single execution of a batch process.
batch control	Batch control refers to control activities and control functions that provide an ordered set of processing activities to complete a batch process.
batch process	A batch process is a process that leads to the production of finite quantities of material by subjecting quantities of input materials to an ordered set of processing activities over a finite period of time using one or more pieces of equipment.
control system	Control system refers to electronic processors that perform regulatory and logic control functions necessary for normal plant operation.
exception handling	Exception handling refers to those functions that deal with plant or process contingencies and other events that occur outside the normal or desired behavior of batch control.
lower operating limit (LOL)	A vessel low-level set point used to stop a transfer-out batch operation from a vessel under normal plant operations.
release	Release is a command under batch control that opens up a group of equipment for any batch control to acquire.
upper operating limit (UOL)	A vessel high-level setpoint used to stop a transfer-in batch operation to a vessel under normal plant operation.

1 Introduction

This document describes the instrument control logic for tank and ancillary equipment in the radioactive liquid waste disposal (RLD) system within the analytical laboratory (LAB) associated with dangerous waste management.

2 Applicable Documents

24590-LAB-M6-RLD-P0001, *P&ID-LAB Radioactive Liquid Waste Disposal System - C5 Collection and Transfer.*

24590-LAB-M6-RLD-P0002, *P&ID-LAB Radioactive Liquid Waste Disposal System - C3 Collection & Transfer.*

24590-LAB-M6-RLD-P0006, *P&ID-LAB Radioactive Liquid Waste Disposal System - C3 Rad Lab Collection.*

24590-LAB-M6-RLD-P0007, *P&ID-LAB Radioactive Liquid Waste Disposal System - C3 Collection & Leak Detection.*

24590-LAB-M6-RLD-P0008, *P&ID-LAB Radioactive Liquid Waste Disposal System - C5 Collection & Leak Detection.*

24590-WTP-M6-50-P0001, *P&ID Symbols and Legend Sheet 1 of 6.*

24590-WTP-M6-50-P0002, *P&ID Symbols and Legend Sheet 2 of 6.*

24590-WTP-M6-50-P0003, *P&ID Symbols and Legend Sheet 3 of 6.*

24590-WTP-M6-50-P0004, *P&ID Symbols and Legend Sheet 4 of 6.*

24590-WTP-M6-50-P0005, *P&ID Symbols and Legend Sheet 5 of 6.*

24590-WTP-M6-50-P0006, *P&ID Symbols and Legend Sheet 6 of 6.*

24590-WTP-PER-J-02-001, *Leak Detection - Sump Level Measurement in Secondary Containment Systems.*

3 Description

The tank and ancillary equipment associated with dangerous waste management within the RLD system are the following:

- Hotcell drain collection vessel (C5 vessel, RLD-VSL-00165), piping, and cell sump (RLD-SUMP-00042)

- Lab area sink drain collection vessel (C3 vessel, RLD-VSL-00164), piping, and cell sump (RLD-SUMP-00041)
- C5 pump pit and C5 piping pit sumps (RLD-SUMP-00043A, RLD-SUMP-00043B, and RLD-SUMP-00044, respectively)
- C3 pump pit sump (RLD-SUMP-00045)
- Leak detection boxes (RLD-LDB-00002, RLD-LDB-00004 through RLD-LDB-00009, and RLD-LDB-00011)

3.1 Hotcell Drain Collection Vessel

The hotcell drain collection vessel (RLD-VSL-00165) receives effluent from hotcell glovebox drains, hotcell cupsinks, hotcell transfer drawers, the master-slave manipulator decontamination glovebox, hotcell sample drop station, and the hotcell drain collection vessel pump pits and valve pit sumps. Effluents from the lab area sink drain collection vessel (RLD-VSL-00164) and the floor drain collection vessel (RLD-VSL-00163) are also transferred to the hotcell drain collection vessel (RLD-VSL-00165). For waste management reliability, batch controlled transfers into RLD-VSL-00165 are limited by the control system to one transfer in or out at a time by the batch control mechanism of acquiring and releasing. Once acquired, no other batch control operation will be able to coordinate activities with the hotcell drain collection vessel (RLD-VSL-00165) until it is released.

When the vessel is available to receive effluent, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic that will return the equipment associated with the transfer to a safe state. During normal operation, the batch transfer sequence is stopped by the control system when any of the following are true:

- The level in the hotcell drain collection vessel (RLD-VSL-00165) reaches its upper operating limit (UOL)
- The level of the sending equipment reaches its lower operating limit (LOL).

When the UOL of the hotcell drain collection vessel (RLD-VSL-00165) is reached, the control system will notify an operator through the plant control system interface that the hotcell drain collection vessel (RLD-VSL-00165) is ready to transfer its contents. The operator will then initiate the transfer-out sequence within the control system. Once initiated, the control system verifies that instruments, utilities, and equipment associated with the transfer are within operational parameters and remain as such throughout the transfer. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic that will return the equipment associated with the transfer to a safe state. During normal operation, the batch transfer sequence will end when any of the following are true:

- The level in the hotcell drain collection vessel (RLD-VSL-00165) reaches its LOL
- The level of the receiving equipment reaches its UOL (during routine operations, pretreatment plant wash vessel, PWD-VSL-00044 or the pretreatment ultimate overflow vessel, PWD-VSL-00033, which receives transfer line flushes).

When the level is no longer within the normal operating range due to an abnormality, interlocks and alarms within the control system help prevent an overflow condition. Figure 1 shows the interlocks and alarms for the level instrument associated with the hotcell drain collection vessel (RLD-VSL-00165). At the high-alarm setpoint, an alarm is generated and all dedicated controlled feeds are isolated. Isolation occurs by stopping the motive force, closing valves, or a combination of both.

3.2 Radiological Laboratory Area Sink Drain Collection Vessel

The radiological laboratory (referred to in this document as the lab) area sink drain collection vessel (RLD-VSL-00164) receives effluent from the lab sinks, the lab fume hood sinks, decontamination showers and sinks, autosampling system equipment drains, the receiving and shipping area, process vacuum equipment, other floor drains throughout the LAB, and the C3 pump pit sump (RLD-SUMP-00045). Effluents from the floor drain collection vessel (RLD-VSL-00163) are also transferred to the lab area sink drain collection vessel (RLD-VSL-00164). For waste management reliability, batch controlled transfers into RLD-VSL-00164 are limited by the control system to one transfer in or out at a time by the batch control mechanism of acquiring and releasing. Once acquired, no other batch control operation will be able to coordinate activities with the lab area sink drain collection vessel (RLD-VSL-00164) until it is released.

When the vessel is available to receive effluent, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic that will return the equipment associated with the transfer to a safe state. During normal operation, the batch transfer sequence is stopped by the control system when any of the following are true:

- The level in the lab area sink drain collection vessel (RLD-VSL-00164) reaches its UOL
- The level of the sending equipment reaches its LOL.

When the UOL of the lab area sink drain collection vessel (RLD-VSL-00164) is reached, the control system will notify an operator through the plant control system interface that the lab area sink drain collection vessel is ready to transfer its contents. The operator will then initiate the transfer-out sequence within the control system. Once initiated, the control system verifies that instruments, utilities, and equipment associated with the transfer are within operational parameters and remain as such throughout the transfer. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic that will return the equipment associated with the transfer to a safe state. During normal operation, the batch transfer sequence will end when any of the following are true:

- The level in the lab area sink drain collection vessel (RLD-VSL-00164) reaches its LOL
- The level of the receiving equipment reaches its UOL.

When the level is no longer within the normal operating range due to an abnormality, interlocks along with alarms within the control system help prevent an overflow condition. Figure 2 shows the interlocks and alarms for the level instrument associated with the lab area sink drain collection vessel (RLD-VSL-00164). At the high-alarm setpoint, an alarm is generated and all dedicated controlled feeds are isolated. Isolation occurs by stopping the motive force, closing valves, or a combination of both.

3.3 Cell and Equipment Sumps

The LAB has two different types of sumps: pit (equipment) and cell sumps. All of the sumps are maintained dry. A general description of radar level detection in sumps can be found in 24590-WTP-PER-J-02-001, *Leak Detection - Sump Level Measurement in Secondary Containment Systems*, section 3.2.

Upon detection of a high liquid level in a cell sump, the control system alarms at which point the operator must take the necessary action to diagnose the source of the leakage and empty the cell sump. Figure 3 shows the alarms for the level instrument associated with the C5 vessel cell sump (RLD-SUMP-00042), which also serves as a typical method of operation for the C3 vessel cell sump (RLD-SUMP-00041).

The pit sumps are self-emptying and automatically drain back to their respective vessel. Upon detection of a high liquid level in a pit sump, the control system alarms at which point the operator removes the weir from the sump and diagnoses the source of the leakage. Figure 4 shows the alarms for the level instrument associated with one of the C5 pump pit sumps (RLD-SUMP-00043A), which serves as a typical method of operation for all pit sumps in the LAB.

The hotcell drain collection vessel (RLD-VSL-00165) and the lab area sink drain collection vessel (RLD-VSL-00164) have their own set of sumps. The sumps for the hotcell drain collection vessel (RLD-VSL-00165) are the C5 vessel cell sump (RLD-SUMP-00042), the C5 pump pit sumps (RLD-SUMP-00043A and RLD-SUMP-00043B), and the C5 piping pit sump (RLD-SUMP-00044). In the event of a level detection in the C5 vessel cell sump, the operator routes the liquid to the pretreatment plant wash vessel (PWD-VSL-00044). The sumps for the lab area sink drain collection vessel (RLD-VSL-00164) are the C3 vessel cell sump (RLD-SUMP-00041) and the C3 pump pit sump (RLD-SUMP-00045). In the event of a level detection in the C3 vessel cell sump, the operator routes the liquid to the hotcell drain collection vessel (RLD-VSL-00165).

3.4 Leak Detection Boxes

The LAB has leak detection boxes on the headers draining into the hotcell drain collection vessel (RLD-VSL-00165) and the lab area sink drain collection vessel (RLD-VSL-00164). The leak detection boxes are designed to detect a leak in the interior wall of the double-walled piping. Each box is installed with a drain plug in the closed position to create a detectable level. Upon detection of a level, the control system alarms at which point the operator lifts the plug to drain the leak detection box. An overflow plug installed in the open position prevents overfill of the leak detection box until it can be drained. The leak detection boxes for the C3 drain collection headers drain to the C3 vessel cell sump (RLD-SUMP-00042). Similarly, the leak detection boxes for the C5 drain collection headers and the C3 transfer line for the lab area sink drain collection vessel (RLD-VSL-00164) drain to the C5 vessel cell sump (RLD-SUMP-00041). Figure 5 shows the alarm for the level instrument associated with one of the C3 transfer leak detection box (RLD-LDB-00004), which serves as a typical method of operation for all leak detection boxes in the LAB.

Figure 1 Level Measurement for Hotcell Drain Collection Vessel (RLD-VSL-00165)

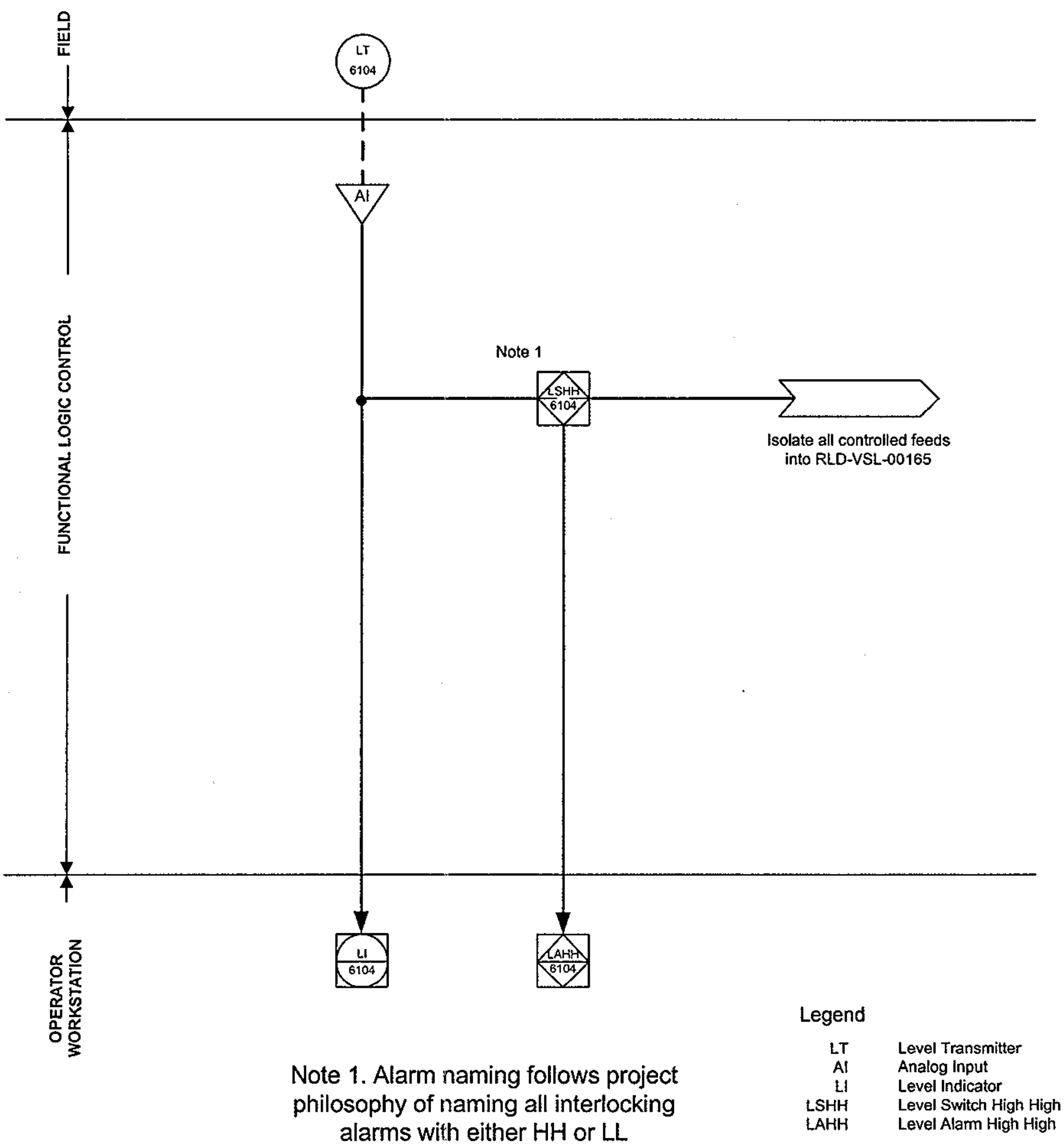
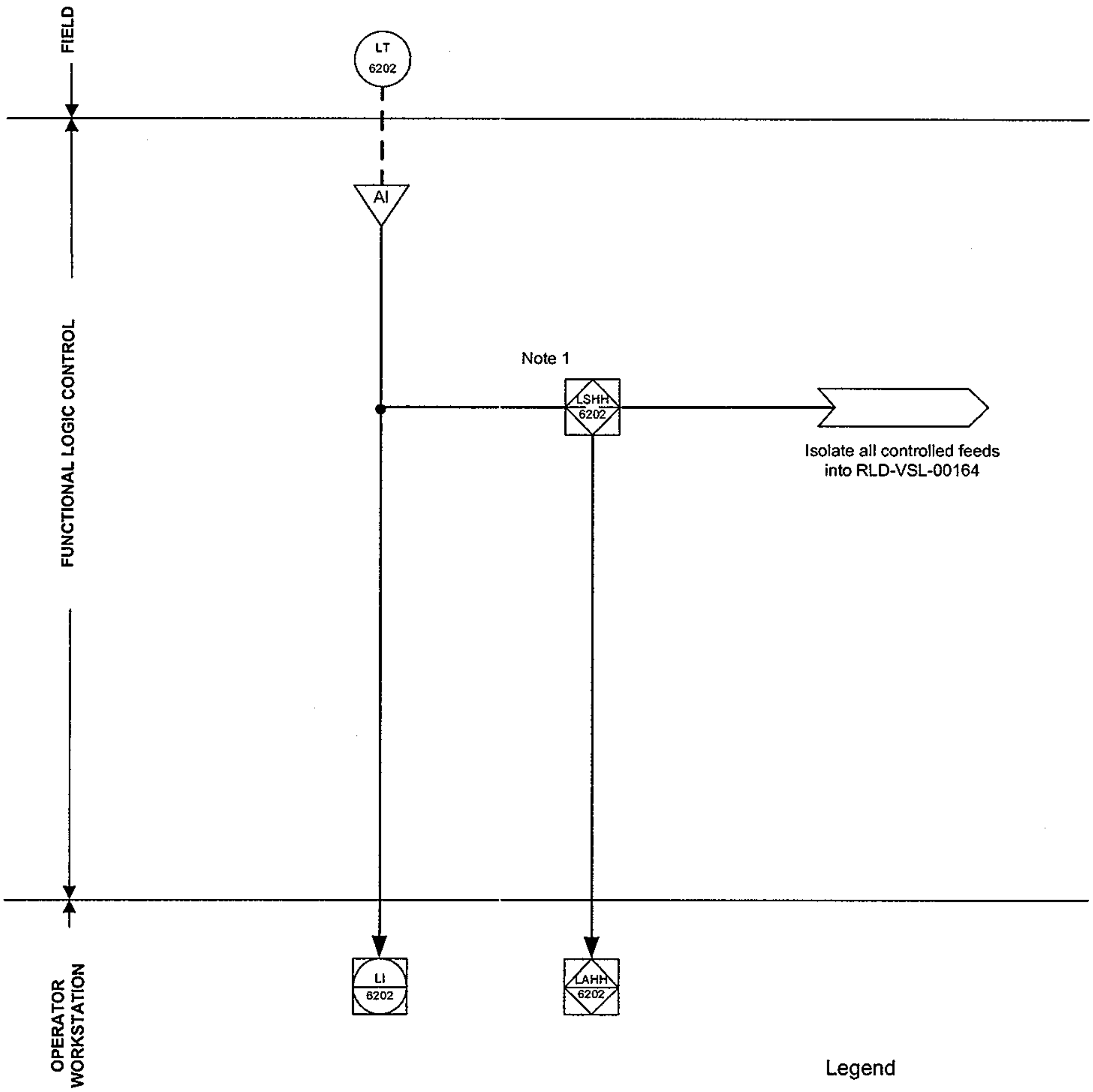


Figure 2 Level Measurement for Lab Area Sink Drain Collection Vessel (RLD-VSL-00164)



Note 1. Alarm naming follows project philosophy of naming all interlocking alarms with either HH or LL

Legend

LT	Level Transmitter
AI	Analog Input
LI	Level Indicator
LSHH	Level Switch High High
LAHH	Level Alarm High High

Figure 3 Level Measurement for Typical Cell Sump (C5 Vessel Cell Sump, RLD-SUMP-00042)

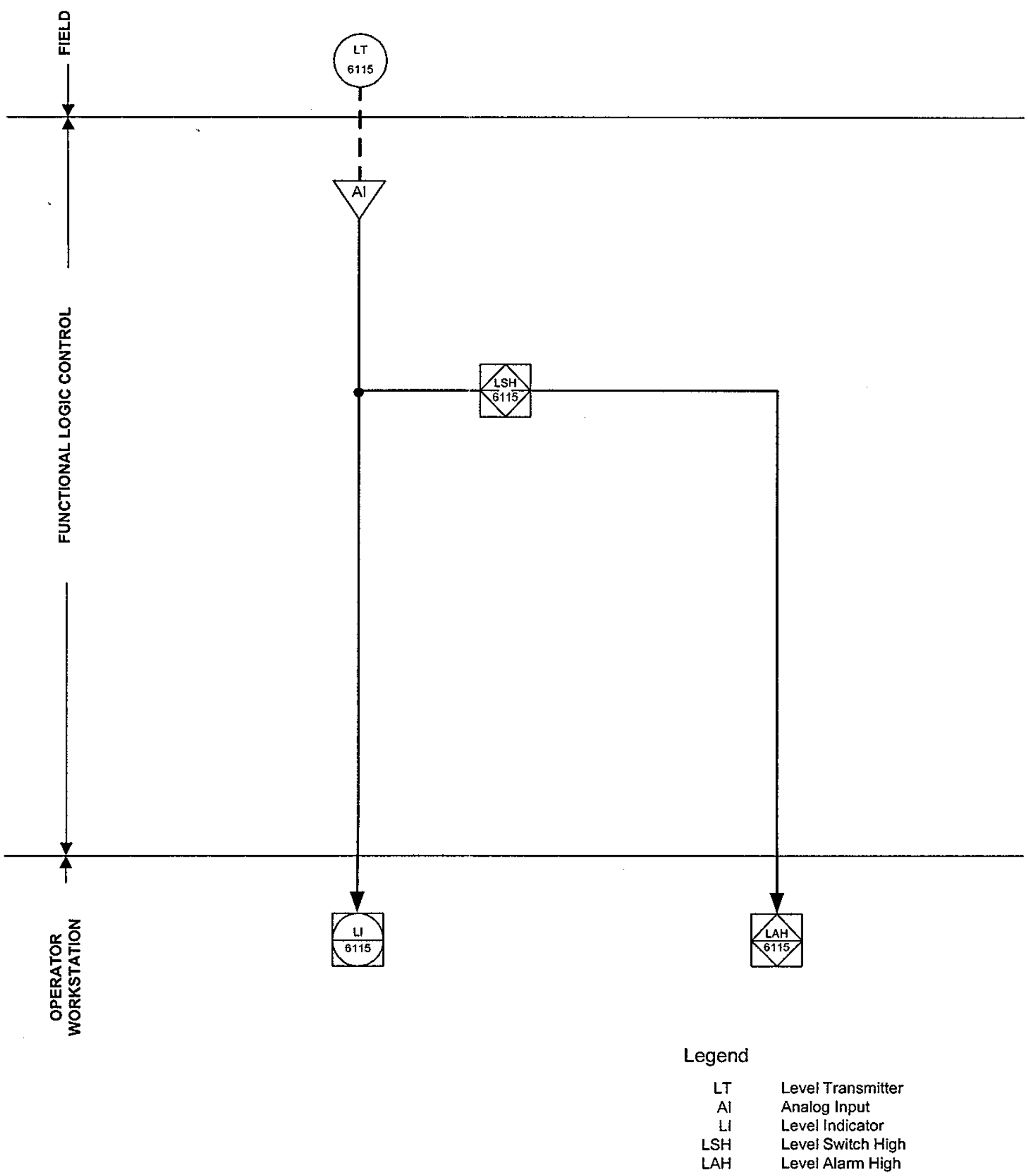
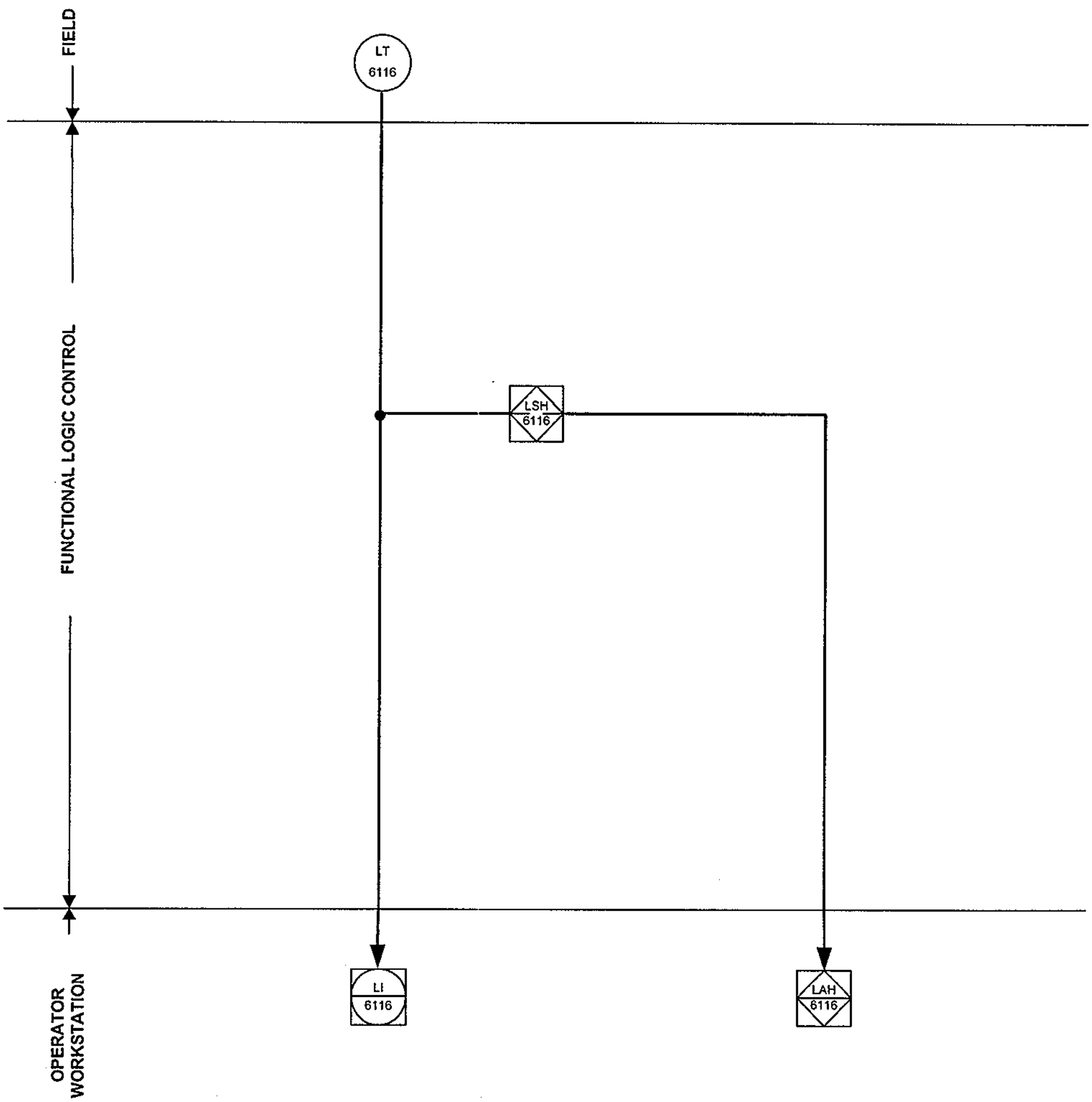


Figure 4 Level Detection for Typical Pit Sump (C5 Pump Pit Sump, RLD-SUMP-00043A)



Legend

LT	Level Transmitter
AI	Analog Input
LI	Level Indicator
LSH	Level Switch High
LAH	Level Alarm High

Figure 5 Level Detection for Typical Leak Detection Box (C3 Transfer Line Leak Detection Box, RLD-LDB-00004)