IDAHO
DEPARTMENT OF ENVIRONMENTAL QUALITY

PARTIAL PERMIT FOR HWMA STORAGE and TREATMENT

for the

LIQUID WASTE MANAGEMENT SYSTEM at the IDAHO NUCLEAR TECHNOLOGY & ENGINEERING CENTER

on the

IDAHO NATIONAL LABORATORY

EPA ID NO. ID4890008952

Revision Date: September 5, 2019

Book 1 of 4

PERMIT

PERMIT -
INTRODUCTION
through ACRONYMS

Permittee: Department of Energy (DOE) and DOE-Designated Contractors, Idaho National Laboratory, Idaho Nuclear Technology and Engineering Center (INTEC) Permit Number: EPA ID# ID4890008952

INTRODUCTION AND SIGNATURE PAGE

Pursuant to the Idaho Hazardous Waste Management Act of 1983 (HWMA), as amended, Idaho Code §§ 39-4401 *et seq*., and the "*Rules and Standards for Hazardous Waste*," as amended, IDAPA 58.01.05.000 et seq., specifically IDAPA 58.01.05.012 [40 CFR § 270.1(c)(4)], a Partial-Permit (for less than the entire facility) is hereby issued to the United States Department of Energy (DOE) and DOE-designated contractor (see Permit Definitions), hereinafter called the Permittee, to operate a Hazardous Waste Storage and Treatment Facility at the Idaho Nuclear Technology and Engineering Center (INTEC), located at the Idaho National Laboratory (INL), which is located in Butte County, Idaho.

The Permittee shall comply with all of the terms and conditions of this Partial-Permit (Permit) and Attachments 1 through 9 of this Permit. The Permittee shall comply with all applicable state regulations, including IDAPA 58.01.05.004 through 58.01.05.013 [40 Code of Federal Regulations (CFR), Parts 124,260 through 266, 268, and 270], and as specified in this Permit.

Applicable state regulations are those which are in effect on the date of final administrative disposition of this Permit and any self-implementing statutory provisions and related regulations which, according to the requirements of the Hazardous and Solid Waste Amendments (HSWA), are automatically applicable to the Permittee's hazardous waste management activities, notwithstanding the conditions of this Permit.

This Permit is based upon the administrative record, as required by IDAPA 58.01.05.013 [40 CFR § 124.9]. The Permittee's failure (in the Application or during the permit-issuance process) to fully disclose all relevant facts or the Permittee's misrepresentation of any relevant facts, at any time, shall be grounds for the termination or modification of this Permit, and/or initiation of an enforcement action, including criminal proceedings. The Permittee must inform the Director of the Idaho Department of Environmental Quality (DEQ), hereinafter referred to as "Director," of any deviation from the permit conditions or changes in the information on which the Application is based, which would affect the Permittee's ability to comply or actual compliance with the Director shall enforce all conditions of this Permit, which are designated in this Permit as state requirements. Any challenges of any permit condition that concern requirements shall be appealed to the Director, in accordance with IDAPA 58.01.05.996 and the Idaho Department of Environmental Quality Rules and Regulations 58.05.03.000 et seq., "Rules Governing Contested Cases and Declaratory Rulings."

The United States Environmental Protection Agency (EPA) shall maintain an oversight role of the state-authorized program and in such capacity, shall enforce any permit condition based on state requirements, if, in the EPA's judgment, the Director should fail to enforce that permit condition. Any challenges to the EPA-enforced condition shall be appealed to EPA, in accordance with 40 CFR § 124.19.

This Permit is effective as of November 20, 2014 and shall remain in effect until November 20, 2024 unless, in accordance with IDAPA 58.01.05.012, the Permit is revoked and reissued [40 CFR § 270.43], or continued [40 CFR § 270.51].

_____
Date

_____
Curt Fransen, Director
Department of Environmental Quality

TABLE OF CONTENTS

INTRODUCTION AND SIGNATURE PAGE 1
TABLE OF CONTENTS 3
LIST OF ATTACHMENTS 6
LIST OF PERMIT APPENDICES 7
DEFINITIONS 9
ACRONYMS AND ABBREVIATIONS 12
MODULE I - STANDARD PERMIT CONDITIONS 15
I.A. EFFECT OF PERMIT 15
I.B. ENFORCEABILITY 15
I.C. OTHER AUTHORITY 16
I.D. PERMIT ACTIONS 16
I.E. SEVERABILITY 16
I.F. DUTIES TO COMPLY 17
I.G. DUTY TO REAPPLY 17
I.H. PARTIAL PERMIT EXPIRATION 17
I.I. CONTINUATION OF EXPIRING PERMIT 17
I.J. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE 18
I.K. DUTY TO MITIGATE 18
I.L. PROPER OPERATION AND MAINTENANCE 18
I.M. DUTY TO PROVIDE INFORMATION 18
I.N. INSPECTION AND ENTRY 18
I.O. MONITORING AND RECORDS 19
I.P. REPORTING PLANNED CHANGES 20
I.Q. REPORTING ANTICIPATED NONCOMPLIANCE 20
I.R. CERTIFICATION OF CONSTRUCTION OR MODIFICATION 20
I.S. TRANSFER OF PERMIT 21
I.T. REPORTING 21
I.U. OTHER NONCOMPLIANCE 22
I.V. OTHER INFORMATION 23
I.W. SIGNATORY REQUIREMENT 23
I.X. CONFIDENTIAL INFORMATION 23
I.Y. REPORTS, NOTIFICATIONS, AND SUBMISSIONS 23
I.Z. DOCUMENTS TO BE MAINTAINED AT THE FACILITY 24
MODULE II - GENERAL FACILITY CONDITIONS 25
II.A. DESIGN AND OPERATION OF FACILITY 25
II.B. RECEIPT OF OFF-SITE WASTE 25
II.C. WASTE ANALYSIS PLAN 25
II.D. SECURITY 26
II.E. INSPECTION PLAN 26
II.F. TRAINING PLAN 27
II.G. PREPAREDNESS AND PREVENTION 27

II.H. CONTINGENCY PLAN 28
II.I. MANIFEST SYSTEM 29
II.J. RECORD KEEPING AND REPORTING 29
II.K. CLOSURE 31
II.L. EQUIVALENT MATERIALS/INFORMATION 32
II.M. AIR EMISSION STANDARDS FOR PROCESS VENTS 33
II.N. FINANCIAL ASSURANCE FOR FACILITY CLOSURE 35
II.O. LIABILITY INSURANCE FOR SUDDEN ACCIDENTAL OCCURRENCES 35
II.P. COMPLIANCE SCHEDULE 35
II.Q. RISK ANALYSIS VALIDATION 36

MODULE III - CONTAINER STORAGE 37

III.A. PERMITTED CONTAINER STORAGE 37
III.B. PERMITTED AND PROHIBITED WASTES IN THE CONTAINER STORAGE AREAS 37
III.C. CONDITION OF CONTAINERS 37
III.D. COMPATIBILITY OF WASTE WITH CONTAINERS 37
III.E. MANAGEMENT OF CONTAINERS 37
III.F. INSPECTIONS 39
III.G. RECORDKEEPING 39
III.H. CLOSURE 39

MODULE IV - STORAGE IN TANKS 39

IV.A. TANK STORAGE 39
IV.B. PERMITTED AND PROHIBITED WASTES IN THE INTEC LIQUID WASTE MANAGEMENT SYSTEM UNITS 60
IV.C. SECONDARY CONTAINMENT AND CONTAINMENT SYSTEM SUMPS 61
IV.D. TANK SYSTEM OPERATING CONDITIONS 63
IV.E. INSPECTION SCHEDULES AND PROCEDURES 69
IV.F. IGNITABLE OR REACTIVE WASTES 70
IV.G. INCOMPATIBLE WASTE 70

MODULE V - TREATMENT IN TANKS 71

V.A. SOLIDS SETTLING, CHEMICAL ADDITION, WASTE BLENDING AND PH ADJUSTMENT 71
V.B. PERMITTED/PROHIBITED WASTE TO BE TREATED 72
V.C. RECORD KEEPING 72

MODULE VI - MISCELLANEOUS TREATMENT 74

VI.A. TREATMENT BY DISTILLATION, EVAPORATION, OR STEAM REFORMING 74
VI.B. PERMITTED AND PROHIBITED WASTE 74
VI.C. OPERATING CONDITIONS 76
VI.D. INSPECTIONS 81
VI.E. RECORD KEEPING AND REPORTING 81
VI.F. START OF STEAM REFORMER OPERATIONS 83
VI.G. CLOSURE 83

MODULE VII -WASTE PILES 84

VII.A. PERMITTED WASTE PILE STORAGE AREAS 84
VII.B. DESIGN AND OPERATING REQUIREMENTS 84
VII.C. PERMITTED AND PROHIBITED WASTES IN THE WASTE PILE STORAGE AREAS 84
VII.D. IGNITABLE OR REACTIVE WASTES 84

VII.E. INCOMPATIBLE WASTES..... 84
VII.F. INSPECTION SCHEDULES AND PROCEDURES..... 84
VII.G. RECORDKEEPING..... 85
VII.H. CLOSURE..... 85
MODULE VIII - CORRECTIVE ACTION..... 86

LIST OF ATTACHMENTS

The following documents are excerpts from the Permittee's Administrative Record, i.e., HWMA Permit Application, supplemental reports, and other documents contained in the Department's supporting file for the draft Permit. The listed documents are hereby incorporated, in their entirety, by reference into this Permit. The Director, as deemed necessary, modified specific language in the Attachments. These modifications are described in the Permit Conditions (Modules I through VI) and, thereby, supersede the language of the original attachment. If the language of the Permit conflicts with either the attachments or the original application, the language in the Permit shall prevail. These incorporated Attachments are enforceable conditions of this Permit, as modified by the specific permit condition(s).

ATTACHMENT 1 FACILITY DESCRIPTION, consisting of:

A. Part A
B. Section B – Facility Description
C. Section D – Process Information, including Preliminary Risk Assessment

ATTACHMENT 2 WASTE ANALYSIS PLAN, consisting of:

Section C – Waste Characteristics

ATTACHMENT 3 SECURITY

Section F-1 – Security

ATTACHMENT 4 INSPECTION SCHEDULE

Section F-2 – Inspection Schedule and Appendices F-1 through F-6

ATTACHMENT 5 TRAINING PLAN

Section H – Personnel Training

ATTACHMENT 6 PREPAREDNESS & PREVENTION

Sections F-3, F-4, and F-5 – Procedures to Prevent Hazards

ATTACHMENT 7 CONTINGENCY PLAN

Section G – Preparedness, Prevention, and Contingency Plan

ATTACHMENT 8 CLOSURE PLANS

Section I – Closure Plan

ATTACHMENT 9 PERMIT MODIFICATION

Permit Revision Log

LIST OF PERMIT APPENDICES

APPENDIX I – DRAWING LIST

Includes the following drawings:
Sheet 057807, Sheet 057808, Sheet 057812, Sheet 103171, Sheet 103180, Sheet 103530, Sheet 103544, Sheet 132358, Sheet 132359, Sheet 132361, Sheet 132376, Sheet 132377, Sheet 132378, Sheet 132379, Sheet 132380, Sheet 132381, Sheet 132382, Sheet 132383, Sheet 132390, Sheet 132391, Sheet 132392, Sheet 132393, Sheet 132394, Sheet 132395, Sheet 132396, Sheet 132397, Sheet 132444, Sheet 132445, Sheet 132446, Sheet 132466, Sheet 133376, Sheet 134619, Sheet 134620, Sheet 134621, Sheet 134622, Sheet 134623, Sheet 134624, Sheet 155069, Sheet 155070, Sheet 158768, Sheet 162748, Sheet 176263, Sheet 176265, Sheet 176301, Sheet 347791, Sheet 347796, Sheet 347798, Sheet 369374, Sheet 370862, Sheet 370863, Sheet 370864, Sheet 370865, Sheet 370866, Sheet 370867, Sheet 383716, Sheet 400814, Sheet 400815, Sheet 632451, Sheet 632452, Sheet 632483, Sheet 632484, Sheet 632340, Sheet 632503, Sheet 632504, Sheet 632512, Sheet 632513, Sheet 632830, Sheet 632831

See pages ii to vi, Appendix I for the revision number and description of these drawings.

APPENDIX II – DIAGRAM LIST

Includes the following diagrams:
Sheet 057498, Sheet 057499, Sheet 094276, Sheet 096156, Sheet 103308, Sheet 103589, Sheet 133400, Sheet 133401, Sheet 133402, Sheet 133406, Sheet 133407, Sheet 133408, Sheet 133409, Sheet 133410, Sheet 133411, Sheet 133412, Sheet 133413, Sheet 133417, Sheet 133418, Sheet 133420, Sheet 133423, Sheet 133424, Sheet 133425, Sheet 133426, Sheet 133427, Sheet 133428, Sheet 134251, Sheet 176274, Sheet 176275, Sheet 179009, Sheet 347791, Sheet 356596, Sheet 368921, Sheet 368922, Sheet 368923, Sheet 368924, Sheet 368925, Sheet 368926, Sheet 368927, Sheet 368928, Sheet 368929, Sheet 368930, Sheet 368931, Sheet 632359, Sheet 632750, Sheet 632752, Sheet 632753, Sheet 632754, Sheet 632757, Sheet 632758, Sheet 632759, Sheet 632779, Sheet 632780, Sheet 632792, Sheet 632793, Sheet 632797, Sheet 632798, Sheet 632799, Sheet 632821, Sheet 632822, Sheet 635083, Sheet 635084, Sheet 637285, Sheet 637293, Sheet 781895, Sheet 781896, Sheet 632782, Sheet 632783, Sheet 632787, Sheet 632788, Sheet 632790, Sheet 632791, Sheet 632818, Sheet 570000, Sheet 570001, Sheet 632823, Sheet 804020, Sheet 808190, Sheet 808191, Sheet 808192, Sheet 808193

See pages ii to viii, Appendix II for revision number and description of these diagrams.

APPENDIX III – FINAL REPORT FOR ORGANICS PARTITIONING RESULTING FROM OPERATION OF AN INTEC DOUBLE NEEDLE SAMPLER, REVISION 1, June 2003

APPENDIX IV – STANDARD DOUBLE NEEDLE SAMPLING PROTOCOL

APPENDIX V – ETS MERCURY CONCENTRATION JUSTIFICATION

APPENDIX VI – PILOT PLANT REPORT FOR TREATING SODIUM BEARING WASTE SURROGATES CARBONATE FLOWSHEET

APPENDIX VII – OFFICIAL USE ONLY AND CONFIDENTIAL BUSINESS INFORMATION

Includes the following:
Appendix Title Page – Limited Rights Data
Data Sheets F-SRC-153FE and F-SRC-160FE
Drawings:
Sheet 632756, Sheet 632760, Sheet 632762, Sheet 632763, Sheet 632764, Sheet 632765, Sheet 632766, Sheet 632783, Sheet 632801

See pages ii – iii of Appendix VII for the Appendix Title Page – Limited Rights Data and for data sheet and drawing revision number and description of this information.

NOTE: Official Use Only and Confidential Business Information is redacted from public copies of the permit.

APPENDIX VIII – APPLICATION SECTIONS:

E. Ground Water Monitoring
J. Corrective Action
K, Other Federal Laws
L. Certifications

DEFINITIONS

For the purposes of this Permit, the following definitions apply:

a. "Application" means the *HWMA/RCRA Part B Permit Reapplication for the Idaho National Laboratory, Volume 14, Idaho Nuclear Technology and Engineering Center (INTEC) Liquid Waste Management System, Books 1 through 4, April, 2014.* All references to RCRA in the application shall mean HWMA/RCRA.

b. "CERCLA" means the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986.

c. "Days" means calendar day(s) unless otherwise specified. Any requirement of submittal under the terms of this Permit that would be due on a Saturday, Sunday, or a federal or state holiday shall be due on the following business day.

d. "Department" means the Idaho Department of Environmental Quality.

e. "Dike" means an embankment or ridge of either natural or man-made materials used to prevent the movement of liquids, sludges, solids, or other materials.

f. "Director" means the Director of the Department of Environmental Quality, or their designee, or authorized representative.

g. "Discovery (discovered)" means the initial identification of a SWMU or other Area of Concern, which has the potential to release hazardous waste or hazardous waste constituents to the environment.

h. "DOE" means the United States Department of Energy.

i. "Distillation Operation" means an operation, either batch or continuous, separating one or more feed stream(s) into two (2) or more exit streams, each exit stream having component concentrations different from those in the feed stream(s). The separation is achieved by the redistribution of the components between the liquid and vapor phase as they approach equilibrium within the distillation unit. The Process Equipment Waste Evaporator (PEWE) System, the Liquid Effluent Treatment and Disposal (LET & D) System, and the Evaporator Tank System (ETS) qualify as distillation operations.

j. "Facility" means all contiguous land, structures, other appurtenances, and improvements under the control of the Department of Energy at the Idaho National Laboratory, for a total of approximately 890 square miles or 601,260 acres.

k. "Failure" means the inability to achieve a desired end product on the first attempt, or improperly functioning/leaking equipment.

l. "Fractionation Operation" means a distillation operation or method used to separate a mixture of several volatile components of different boiling points in successive stages, each stage removing from the mixture some proportion of one of the components. The LET & D Facility, which recovers nitric acid from the PEWE overhead condensate, is referred to operationally as fractionation but qualifies as a distillation operation.

m. "HSWA" means the Hazardous and Solid Waste Amendments of 1984.

n. "HWMA" means the State of Idaho Hazardous Waste Management Act of 1983, as amended.

o. "Hazardous Waste Management Unit (HWMU)" means those operable units subject to the requirements of IDAPA 58.01.05.012 (40 CFR § 270.14 to 270.29).

p. "INL" means the Idaho National Laboratory, the Facility. The INL was formerly known as the Idaho National Engineering and Environmental Laboratory (INEEL).

q. "Mixed Waste" means waste that is both hazardous and radioactive.

r. "Off-Site" means off the "facility" as defined in "j" of this definition section.

s. "On-Site" means on the "facility" as defined in "j" of this definition section.

t. "Open-ended valve, line or pipe" means any valve, except pressure relief valves, having one side of the valve seat in contact with hazardous waste and one side open to the atmosphere, either directly or through an open pipe.

u. "Operator" means the DOE-designated Contractor that has operational responsibilities and control of the HWMU. The DOE-designated Contractor, as operator for INL, is Fluor Idaho, LLC (Fluor Idaho). Fluor Idaho reports to the DOE-ID.

v. "Owner" means the United States Department of Energy (DOE).

w. "Permittee" means both DOE, as owner, and the DOE-designated Contractor.

x. "Process Vent" means any open-ended pipe or stack that is vented to the atmosphere either directly, through a vacuum-producing system, or through a tank (e.g., distillate receiver, condenser, bottoms receiver, surge control tank, separator tank, or hot well) associated with hazardous waste distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations.

y. "RCRA" means the Resource Conservation and Recovery Act of 1976, as amended in 1984.

z. "Readily retrievable" shall mean available upon request from the Director, given the following: 1) Provided to the Director within one working day if the document is less than three years old, and 2) Provided to the Director within seven working days if the document is greater than three years old.

aa. "Reforming" means the decomposition of nitrogen or organic compounds by heat (e.g. steam reforming) or catalyst. The chief cracking reactions are decomposition of nitrogen oxides and the dehydrogenation of organics (methane + water yields hydrogen gas + carbon monoxide)

bb. "Release" means any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of hazardous and/or mixed wastes (including the abandonment or discarding of barrels, containers, and other closed receptacles containing hazardous and/or mixed wastes or hazardous and/or mixed waste constituents).

cc. "Shutdown" means eliminating the feed and/or steam into a unit.

dd. "Solid Waste Management Unit" (SWMU) means any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous wastes. Such units include any area at a facility at which solid wastes have been routinely and systematically released.

ee. "Tank" means a stationary device, designed to contain an accumulation of hazardous waste, which is constructed primarily of non-earthen materials (e.g., wood, concrete, steel, plastic), which provide structural support.

ff. “Upset” shall mean an unplanned disruption in the normal operations of any equipment or emissions unit which, unresolved, may lead to excess emissions.

All definitions contained in IDAPA 58.01.05.004, .005, .008, and .010 through .013 (40 CFR Parts 260, 261, 264, 266, 268, 270, and 124) are hereby incorporated (in their entirety) by reference into this Permit, except that any of the definitions used above shall supersede any definition of the same term given in IDAPA 58.01.05.000 et seq. Where terms are not defined in the regulations or the Permit, the meaning associated with such terms shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term.

ACRONYMS AND ABBREVIATIONS

ACMM	Analytical Chemistry Methods Manual
AE	Architectural Engineer
ALARA	As low as reasonably achievable (radiation exposures)
API	American Petroleum Institute
APS	Atmospheric Protection System
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWFCO	Automatic Waste Feed Cutoff
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
COPC	Compound of Potential Concern
CPP	Chemical Processing Plant
CRR	Carbon Reduction Reformer
DCS	Distributed Control System
DEQ	Department of Environmental Quality
DMR	Denitration and Mineralization Reformer
DOE	Department of Energy
DOE-HQ	Department of Energy - Headquarters
DOE-ID	Department of Energy - Idaho Operations Office
DOT	Department of Transportation
DQO	Data Quality Objective
EAL	Emergency Action Level
EAM	Emergency Action Manager
EC	Emergency Coordinator
ED	Emergency Director
EDF	Engineering Design File
EDMS	Electronic Document Management System
EMCAP	Environmental Management Consolidated Audit Program
EOC	Emergency Operations Center
EP/RCRA CP	Emergency Plan, RCRA Contingency Plan
EPA	(United States) Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-To-Know Act
ERO	Emergency Response Organization
ERPG	Emergency Response Planning Guideline
ETS	Evaporator Tank System
FFA/CO	Federal Facilities Agreement/Consent Order
FR	Facility Representative (WGS)
g	gram
GAC	Granulated Activated Carbon
GERT	General Employee Radiation Training
HEPA	High-Efficiency Particulate Air
HLLWE	High Level Liquid Waste Evaporator (ETS)

HQ	Hazard Quotient
HSWA	Hazardous and Solid Waste Amendments of 1984
HWMA	Hazardous Waste Management Act of 1983, as amended
HWMU	Hazardous Waste Management Unit
HWN	Hazardous Waste Number
ICDF	INL CERCLA Disposal Facility
ILWMS	INTEC Liquid Waste Management System
INL	Idaho National Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
"	Inch(es)
IWTS	Integrated Waste Tracking System
IWTU	Integrated Waste Treatment Unit
LDR	Land Disposal Restrictions
LET&D	Liquid Effluent Treatment and Disposal
LRA	Level Recorder Alarm
M&O	Management and Operating
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
NWCF	New Waste Calcining Facility
No.	Number
NRC	Nuclear Regulatory Commission
OGC	Off Gas Cooler
OGF	Off Gas Filter
OJT	On-the-Job Training
OSC	On-Scene Commander
OSHA	Occupational Safety and Health Administration
P&ID	Piping and Instrumentation Diagram
PAG	Protective Action Guide
PDC	Power Distribution Center
PE	Professional Engineer
PEW	Process Equipment Waste
PEWE	Process Equipment Waste Evaporator
PGF	Process Gas Filter
PIR	Product of Incomplete Reaction
PK	Process Knowledge
POG	Process Off-gas
PPE	Personal Protective Equipment
ppm	parts per million
psig	Pounds per square inch gauge
PWL	Process Waste Liquid
QA/QC	Quality Assurance/ Quality Control
RAL	Remote Analytical Laboratory
RCRA	Resource Conservation and Recovery Act

RGP	Rare Gas Plant
RSS	Rapid Shutdown System
SAT	Systematic Approach to Training
SLRA	Screening Level Risk Assessment
SCBA	Self-Contained Breathing Apparatus
SSV	Superficial Gas Velocity
SVOC	Semi-Volatile Organic Constituents
SW-846	Test Methods for Evaluating Solid Waste: Physical/Chemical Methods
SWMU	Solid Waste Management Unit
TBP	Tributyl Phosphate
TCLP	Toxicity Characteristic Leaching Procedure
TFF	Tank Farm Facility
TFT	Tank Farm Tanks
TOC	Total Organic Carbon
TSDF	Treatment, Storage, and Disposal Facility
TSS	Total Suspended Solids
UHC	Underlying Hazardous Constituent
USGS	United States Geological Survey
UTS	Universal Treatment Standards
VOC	Volatile Organic Constituents
VOG	Vessel Off-Gas
WAC	Waste Acceptance Criteria
WAP	Waste Analysis Plan
WC	Water Column
WCC	Warning Communications Center
WDDF	Waste Determination and Disposition Form
WGS	Waste Generator Services
WTS	Waste Technical Specialist

PERMIT - MODULE I
STANDARD PERMIT
CONDITIONS

MODULE I - STANDARD PERMIT CONDITIONS

I.A. EFFECT OF PERMIT

The Permittee is allowed to store and treat mixed waste in the Idaho Nuclear Technology and Engineering Center Liquid Waste Management System (ILWMS) in accordance with the conditions of this Partial-Permit. Any storage or treatment of mixed waste in the Hazardous Waste Management Units (HWMU) described herein, not authorized in this Permit, is prohibited.

Pursuant to IDAPA 58.01.05.012 [40 CFR § 270.4], compliance with this Permit generally constitutes compliance (for purposes of enforcement) with the Idaho Hazardous Waste Management Act (HWMA) of 1983, as amended, except for the requirements not included in this Permit, which become effective by future statute or regulatory changes, to include those requirements promulgated under IDAPA 58.01.05.011 [40 CFR Part 268] restricting the placement of hazardous and/or mixed waste in or on the land. Issuance of this Permit does not convey any property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of state or local law or regulations, as specified in IDAPA 58.01.05.012 [40 CFR § 270.4].

I.A.1. The Department of Energy (DOE) is the owner and is responsible for the activities that include policy, programmatic, funding, and scheduling decisions, as well as general oversight.

I.A.2. The DOE-designated contractor, as operator, is responsible for the day-to-day operations of the assigned permitted units and for all permitted activities related to the assigned units, for which the DOE-designated contractor, its agents, employees, or subcontractors have operational control including waste characterization and handling, monitoring, record keeping, reporting, and contingency planning.

I.B. ENFORCEABILITY

The terms and conditions of this Permit are enforceable pursuant to the HWMA or any other applicable federal, state, or local law. Violations of this Permit may result in civil penalties, in accordance with the HWMA (Idaho Code § 39-4414) and the HWMA Civil Penalty Policy.

I.B.1. Any person who knowingly makes any false statement or representation in any application, label, manifest, record, report, permit, or other document filed, maintained, or used for the purposes of complying with the provisions of Idaho Code § 39-4415 shall be guilty of a misdemeanor and subject to a fine of not more than ten thousand dollars ($10,000) or imprisonment not to exceed one (1) year, or both, for each separate violation or for each day of a continuing violation.

I.C. OTHER AUTHORITY

The Department expressly reserves any right of entry provided by law and any authority to order or perform emergency or other response activities as authorized by law.

I.D. PERMIT ACTIONS

I.D.1. This Permit may be modified, revoked and reissued, or terminated for cause as specified in IDAPA 58.01.05.012 [40 CFR §§ 270.41, 270.42, or 270.43].

I.D.2. The filing of a request for a Permit Modification, revocation and reissuance, or termination, or the notification of planned changes, or anticipated noncompliance on the part of the Permittee does not stay the applicability or enforceability of any permit condition.

I.D.3. The Director may modify this Permit when the standards or regulations on which the Permit was based have been changed by statute, amended standards or regulations, or by judicial decision after the effective date of this Permit.

I.D.4. Except as provided by specific language in this Permit or except for the Director's approval of a Class 1 or 2 Permit Modification, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.42(a) and (b)], any modifications which substantially alter INL or its operation as covered by this Permit shall be administered as a Class 3 Permit Modification prior to such change taking place, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.42(c)].

I.D.5. Within forty five (45) days of a Permit Modification being put into effect or approved, the Permittee shall provide clean copies of the relevant portions of the Permit and Attachments to incorporate the change (if not already reflected/provided in the change pages submitted with the Permit Modification Request), reprint the documents (as necessary), and submit them to the Director.

I.D.6. The Permittee shall ensure that Attachment 9 is current, consistent with Permit Condition I.D.5.

I.E. SEVERABILITY

The provisions of this Permit are severable; and if any provision of this Permit or the Application of any provision of this Permit to any circumstance is held invalid, the Application of such provision to other circumstances and the remainder of this Permit shall not be affected thereby. Invalidation of any state or federal statutory or regulatory provision, which forms the basis for any condition of this Permit, does not affect the validity of any other state or federal statutory or regulatory basis for said provision.

I.F. DUTIES TO COMPLY

I.F.1. The Permittee shall comply with all conditions of this Permit, except to the extent and for the duration such noncompliance is authorized by an Emergency Permit issued in accordance with IDAPA 58.01.05.012 [40 CFR § 270.61]. Any permit noncompliance, other than noncompliance authorized by an Emergency Permit, constitutes a violation of HWMA and is grounds for enforcement action or permit termination, revocation and reissuance, or modification of the Permit, or denial of a Permit Renewal Application as specified in IDAPA 58.01.05.012 [40 CFR § 270.30(a)].

I.F.2. Compliance with the terms of this Permit does not constitute a defense to any order issued or any action brought under §§ 3007, 3008, 3013, or 7003 of RCRA [42 U.S.C. §§ 6927, 6928, 6934 and 6973], §§ 104, 106(a), or 107 of CERCLA [42 U.S.C. §§ 9604, 9606(a), or 9607], as amended by the Superfund Amendments and Reauthorization Act of 1986, or any other state or federal law providing for protection of public health or the environment from any imminent and substantial endangerment to human health or the environment.

I.G. DUTY TO REAPPLY

If the Permittee wishes to continue an activity allowed by this Permit after the expiration date of this Permit, the Permittee shall submit a new Application a minimum of one hundred eighty (180) calendar days prior to the expiration of this Permit, in accordance with IDAPA 58.01.05.012 [40 CFR §§ 270.10(h) and 270.30(b)].

I.H. PARTIAL PERMIT EXPIRATION

Except as renewed, modified, revoked, reissued, or terminated by the Department, this Permit shall automatically expire ten (10) years from the effective date of this Permit.

I.I. CONTINUATION OF EXPIRING PERMIT

This Permit and all conditions herein shall continue in force until the effective date of a new permit, if the Permittee has submitted a timely and complete Application, in accordance with IDAPA 58.01.05.012 [40 CFR § § 270.10, 270.13 through 270.29], and through no fault of the Permittee, the Director has neither issued or denied a new permit under IDAPA 58.01.05.013 [40 CFR § 124.15] on or before the expiration date of this Permit.

I.J. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE

It shall not be a defense for the Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit, as specified in IDAPA 58.01.05.012 [40 CFR § 270.30(c)].

I.K. DUTY TO MITIGATE

In the event of noncompliance with this Permit, the Permittee shall take all reasonable steps to minimize releases to the environment resulting from the noncompliance, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.30(d)].

I.L. PROPER OPERATION AND MAINTENANCE

The Permittee shall, at all times, properly operate and maintain all facilities and controls (and related appurtenances), which are installed or used by the Permittee to achieve compliance with the conditions of this Permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary equipment or similar systems only when necessary to achieve compliance with the conditions of this Permit, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.30(e)].

I.M. DUTY TO PROVIDE INFORMATION

The Permittee shall furnish to the Department and/or the Director, within a reasonable time, any relevant information which the Department and/or the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit, or to determine compliance with this Permit. The Permittee shall also furnish to the Department and/or the Director, upon request, copies of records required to be kept by this Permit, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.30(h)].

I.N. INSPECTION AND ENTRY

Pursuant to IDAPA 58.01.05.012 [40 CFR § 270.30(i)], the Permittee shall allow the Department, the Director, and/or their authorized officers, employees, or representatives (upon the presentation of credentials and other documents as may be required by law) to:

I.N.1. Enter at reasonable times upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records are kept as required by the conditions of this Permit;

I.N.2. Have access to and copy, at reasonable times, any records that are kept as required by the conditions of this Permit;

I.N.3. Inspect at reasonable times any portion of the facility, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and

I.N.4. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the HWMA or RCRA, any substances or parameters at any location.

I.O. MONITORING AND RECORDS

I.O.1. The Permittee shall retain copies of all reports required by this Permit, the certification required by IDAPA 58.01.05.008 and .012 [40 CFR §§ 264.73(b)(9) and 270.30(j)(2)], and records of all data used to complete the Application for this Permit for a period of at least three (3) years from the date of the report, record, or certification unless a longer retention period for certain information is required by other conditions of this Permit.

I.O.2. Pursuant to IDAPA 58.01.05.012 [40 CFR § 270.30(j)(3)], records of monitoring information shall specify:

I.O.2.a. The date(s), exact place, and times of sampling or measurements;

I.O.2.b. The name(s) of individuals who performed the sampling or measurements;

I.O.2.c. The date(s) analyses were performed;

I.O.2.d. The name(s) of individuals who performed the analyses;

I.O.2.e. The analytical techniques or methods used; and

I.O.2.f. The results of such analyses, including the Quality Assurance/Quality Control summary.

I.O.3. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.30(j)(1)]. The method used to obtain a representative sample of the waste to be analyzed shall be the appropriate method from IDAPA 58.01.05.005 [40 CFR Part 261, Appendix I], or an equivalent method approved by the Director. Laboratory methods shall be those specified in Test Methods for Evaluating Solid

Waste: Physical/Chemical Methods SW-846, Standard Methods for the Examination of Water and Wastewater (prevailing edition), or other alternate methods approved in this Permit, or an equivalent method in accordance with Permit Condition I.O.4. of this Permit.

I.O.4. The Permittee may substitute analytical methods, which are equivalent or superior to those specifically approved for use in this Permit, in accordance with the following:

I.O.4.a. The Permittee submits to the Director a request for substitution of analytical method(s) specifically approved for use in this Permit. The request shall provide information demonstrating that the proposed method(s) requested to be substituted are equivalent or superior in terms of sensitivity, accuracy, and precision (i.e., reproducibility); and

I.O.4.b. The Permittee receives a written approval from the Director for the substitution of analytical method(s). Such approval shall not require a Permit Modification under IDAPA 58.01.05.012 [40 CFR § 270.42].

I.P. REPORTING PLANNED CHANGES

The Permittee shall give notice as soon as possible to the Director of any planned physical alteration or additions to the permitted facility, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.30(l)(1)].

I.Q. REPORTING ANTICIPATED NONCOMPLIANCE

The Permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity, which may result in noncompliance with requirements of this Permit, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.30(l)(2)]. Advance notice shall not constitute a defense for any noncompliance.

I.R. CERTIFICATION OF CONSTRUCTION OR MODIFICATION

I.R.1. The Permittee may not commence storage or treatment of mixed waste in a new permitted HWMU or in a modified portion of an existing permitted HWMU, except as provided in IDAPA 58.01.05.012 [40 CFR § 270.42], until the Permittee has submitted to the Director by certified mail, express mail, or hand-delivered letter, along with the Attachments required under Permit Condition II.A.2., signed by the Permittee, and a registered professional engineer certifying that the permitted unit(s) at INL have been constructed or modified, in accordance with the approved plans and specifications in compliance with this Permit (IDAPA 58.01.05.012 [40 CFR § 270.30(l)]); and

I.R.2. The Director has reviewed and inspected (if deemed appropriate) the modified or newly constructed unit(s), and has notified the Permittee in writing that the unit(s) were found in compliance with the conditions of this Permit; or

I.R.3. If within fifteen (15) calendar days after the date of submission of the letter, in Permit Condition I.R.1. of this Permit, the Permittee has not received notice from the Director of the intent to inspect, prior inspection is waived; and the Permittee may commence storage or treatment of hazardous and mixed waste in the permitted unit(s), certified in accordance with Permit Condition I.R.1. of this Permit.

I.S. TRANSFER OF PERMIT

This Permit shall be transferred to a new owner or operator only if it is modified or revoked and reissued, pursuant to IDAPA 58.01.05.012 [40 CFR § 270.40]. Prior to transferring ownership or operation of the facility during its operating life, the Permittee shall notify the new owner or operator, in writing, of the requirements of IDAPA 58.01.05.008 and 58.01.05.012 [40 CFR Parts 264 and 270] and this Permit.

I.T. REPORTING

I.T.1. In accordance with IDAPA 58.01.05.012 [40 CFR § 270.30(l)(6)], the Permittee shall verbally report to the Idaho State Communications Center any noncompliance with this Permit, which may endanger human health or the environment, within twenty-four (24) hours from the time the Permittee becomes aware of the noncompliance, including:

I.T.1.a. Noncompliance with Permit Condition II.A.1. of this Permit; or

I.T.1.b. Information concerning a release of any mixed waste that may endanger public drinking water supplies; or

I.T.1.c. A release or discharge of mixed waste, or of a fire or explosion at the INL that could threaten human health or the environment outside the facility.

I.T.2. The description of the occurrence and its cause shall, at a minimum, include:

- Name, title, and telephone number of the individual reporting;
- Name, address, and telephone number of the owner or operator;
- Name, address, and telephone number of the facility;
- Date, time, and type of incident;
- Location and cause of the accident;
- Name and quantity of materials involved;
- The extent of injuries, if any;
- An assessment of actual or potential hazards to the environment and human health, where this is applicable;
- Description of any emergency action taken to minimize possible threat(s) to human health and the environment;
- Estimated quantity and disposition of recovered material that resulted from the incident; and
- Any other information necessary to evaluate the situation fully, and to develop an appropriate course of action.

I.T.3. Within five (5) calendar days after the Permittee is required to provide verbal notification, as specified in Permit Condition I.T.1. of this Permit, the Permittee shall provide to the Director a written submission.

I.T.3.a. The written submission shall include, but not be limited to, the following:

- Name, address, and telephone number of the individual reporting;
- A description (include cause, location, extent of injuries (if any), and an assessment of actual or potential hazard(s) to the environment and human health outside the INL, where this is applicable) of the incident (noncompliance and/or release);
- The period(s) in which the incident (noncompliance and/or release) occurred (including exact dates and times);
- Whether the results of the incident remain a threat to human health and the environment (whether the noncompliance has been corrected and/or the release has been adequately remediated); and
- If not, the anticipated time it is expected to continue and the steps taken or planned to reduce, eliminate, and prevent re-occurrence of the noncompliance, and/or the steps taken or planned to adequately remediate the release.

I.T.4. The Permittee need not comply with the five (5) calendar day written notice requirement, if the Director waives the requirement and the Permittee submits a written report within fifteen (15) calendar days from the time the Permittee is required to provide verbal notification, as specified in Permit Condition I.T.1. of this Permit.

I.T.5. If the facility stops operations in response to a fire, explosion, or release, a report must be submitted within fifteen (15) days that includes the following information:

- Name, title, and telephone number of the individual submitting the report;
- Date, time and type of incident;
- Location and suspected cause of the incident;
- Name and quantity of materials involved, if any;
- Any leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment;
- All changes made to the operation of the facility to ensure that the event does not recur.

I.T.5.a. If the required information is provided electronically or verbally within 24 hours of the incident, DEQ, at its' discretion, may provide a written waiver of this reporting requirement.

I.U. OTHER NONCOMPLIANCE

The Permittee shall report, on a semi-annual basis, all other instances of noncompliance not otherwise required to be reported, in accordance with Permit Condition I.T. of this Permit, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.30(l)(10)]. Reports shall be due on February 1 and August 1 of each year.

The reports shall contain the information, as applicable, listed in Permit Condition I.T. of this Permit. Reporting shall not constitute a defense for any noncompliance.

I.V. OTHER INFORMATION

Whenever the Permittee becomes aware that any relevant information was omitted in the Permit Application or incorrectly submitted in the Permit Application, or in any report to the Director, the Permittee shall promptly submit such facts or information to the Director in accordance with Permit Condition I.Y. of this Permit, and in accordance with IDAPA 58.01.05.012 [40 CFR § 270.30(l)(11)].

I.W. SIGNATORY REQUIREMENT

All applications, reports, or information requested by or submitted to the Director shall be signed and certified, in accordance with IDAPA 58.01.05.012 [40 CFR § 270.11] and submitted in accordance with Permit Condition I.Y.

I.X. CONFIDENTIAL INFORMATION

Pursuant to Title 9, Chapter 3, of the Idaho Code, IDAPA 58.01.05.012 [40 CFR § 270.12] or any other applicable federal, state, or local law, the Permittee may assert a claim of confidentiality regarding any information required to be submitted pursuant to this Permit. The Department shall determine whether said information is exempt from disclosure, pursuant to applicable law.

I.Y. REPORTS, NOTIFICATIONS, AND SUBMISSIONS

All reports, notifications, or other submissions, which are required by this Permit and IDAPA 58.01.05.012 [40 CFR § 270.5], shall be sent or given to the Director in duplicate by certified mail, express mail, or hand-delivered to:

Director
c/o Hazardous Waste Program Manager
Department of Environmental Quality
1410 North Hilton
Boise, Idaho 83706-1255
Telephone No. (208) 373-0502

Twenty-four (24) hour telephone number 1-800-632-8000

The addresses and telephone numbers listed above are current as of the effective date of this Permit and may be subject to change.

I.Z. DOCUMENTS TO BE MAINTAINED AT THE FACILITY

I.Z.1. The Permittee shall maintain until closure is completed and certified by a qualified professional engineer, the following documents and amendments, and revisions or modifications to these documents:

I.Z.1.a. A complete copy of this Permit including attachments and tables;

I.Z.1.b. Waste Analysis Plan(s) for each HWMU of this Permit, as required by IDAPA 58.01.05.008 [40 CFR § 264.13] and this Permit;

I.Z.1.c. Operating Record, as required by IDAPA 58.01.05.008 [40 CFR § 264.73] and this Permit;

I.Z.1.d. Inspection procedures, schedules, logs, and records for each HWMU of this Permit, as required by IDAPA 58.01.05.008 [40 CFR §§ 264.15(b)(2), 264.73(b)(5)] and this Permit;

I.Z.1.e. Personnel training requirements for each position, and personnel training records for each individual involved with management or treatment of mixed waste at each HWMU in this Permit, as required by IDAPA 58.01.05.008 [40 CFR § 264.16(d)] and this Permit;

I.Z.1.f. The Site-wide Contingency Plan and Contingency Plan(s) for each HWMU of this Permit, as required by IDAPA 58.01.05.008 [40 CFR § 264.53(a)] and this Permit;

I.Z.1.g. Closure Plan(s) for each HWMU of this Permit, as required by IDAPA 58.01.05.008 [40 CFR § 264.112(a)] and this Permit.

I.Z.2. Documents, as specified by this Permit, may be maintained at INTEC records storage, records storage in Idaho Falls, and/or Electronic Document Management System [EDMS] Records Vault in a readily retrievable manner. These documents may be maintained solely using an electronic format, as long as the documents are readily retrievable to obtain a printed copy.

This Space Intentionally left blank

PERMIT - MODULE II
GENERAL FACILITY
CONDITIONS

MODULE II - GENERAL FACILITY CONDITIONS

II.A. DESIGN AND OPERATION OF FACILITY

II.A.1. The Permittee shall construct, maintain, and operate all permitted HWMUs on the INL to minimize the possibility of a fire, explosion, or any unplanned, sudden or non-sudden release of hazardous and mixed waste or hazardous and mixed waste constituents to the air, soil, ground water, or surface water which could threaten human health and/or the environment.

II.A.2. The Permittee shall construct and/or maintain all HWMUs in accordance with the approved designs, specifications, and maintenance schedules that are included as Attachments 1 through 8 of this Permit. Minor deviations from the approved designs or specifications, necessary to accommodate proper construction and the substitution of equivalent or superior materials or equipment, shall be noted on the As-built drawings and the rationale for those deviations shall be provided in narrative form. After completion of construction or modification of each new HWMU, the Permittee shall submit final As-built drawings and the narrative report to the Director as part of the construction certification documentation specified in Permit Condition I.R.

II.A.3. The Permittee shall comply with all applicable requirements of the Land Disposal Restrictions of IDAPA 58.01.05.011 [40 CFR Part 268].

II.A.4. The Permittee shall inspect all transfer lines from which there has been a release, suspected release, or unexplained volume of missing transferred waste, and for which a report was filed under the requirement of Permit Conditions I.T. or I.U. The suspect transfer lines shall not be returned to service until the integrity of the line has been demonstrated.

II.B. RECEIPT OF OFF-SITE WASTE

II.B.1. The Permittee shall not accept into the ILWMS mixed waste generated off-site.

II.C. WASTE ANALYSIS PLAN

The Permittee shall comply with the procedures and requirements of the Waste Analysis Plan provisions, in accordance with IDAPA 58.01.05.008 and 58.01.05.011 [40 CFR §§ 264.13 and 268.7] and Attachment 2 of this Permit, and as follows:

II.C.1. The Permittee shall collect representative samples of waste to be analyzed in accordance with IDAPA 58.01.05.005, 58.01.05.008, and 58.01.05.011 [40 CFR Part 261, Appendix I and 40 CFR §§ 264.13(a) and 268.7], and as specified in Attachment 2 of this Permit.

II.C.2. The Permittee shall perform the analysis of each waste stream in accordance with the latest edition of Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA Publication SW-846, Standard Methods for the Examination of Water and Wastewater (prevailing edition), or equivalent method approved by the Director in accordance with Permit Condition I.O.3. and I.O.4. of this Permit. At a minimum, the Permittee shall maintain proper functional instruments, use-approved sampling and analytical methods, verify the validity of sampling and analytical procedures, and perform correct calculations. If the Permittee uses a contract laboratory to perform analyses, the Permittee shall notify the laboratory in writing of the waste analysis conditions it is to meet, in order that waste analysis conditions of the Permit are met.

II.C.3. The Director, based on data provided, approves the use of a double-needle sampler when collecting mixed waste volatile organic and total organic samples from the ILWMS.

II.C.3.a. Double-needle sampling results must not be used in Land Disposal Restriction certifications.

II.C.3.b. Analytical data obtained from double-needle sampling may be used for demonstrating compliance with IDAPA 58.01.05.008 [40 CFR Part 264 Subpart AA].

II.D. SECURITY

The Permittee shall comply with the Security Provisions of IDAPA 58.01.05.008 [40 CFR § 264.14] and the INL site-specific security measures described in Attachment 3 of this Permit.

II.E. INSPECTION PLAN

The Permittee shall comply with the inspection provisions of IDAPA 58.01.05.008 [40 CFR § 264.15] and as follows:

II.E.1. The Permittee shall maintain the inspection schedules and logs, in accordance with Permit Condition I.Z.1.d. and I.Z.2. of this Permit;

II.E.2. The Permittee shall comply with the inspection schedules and logs for the ILWMS, as included in Attachment 4 of this Permit;

II.E.3. The Permittee shall remedy, as required by IDAPA 58.01.05.008 [40 CFR § 264.15(c)], any deterioration or malfunction discovered by an inspection;

II.E.4. The Permittee shall retain the inspection procedures, schedules, logs and records required by Permit Condition II.E.1., in accordance with Permit Condition I.Z.1.d. and I.Z.2. of this Permit;

II.E.5. The Permittee shall inspect the Cathodic Protection System for proper operation at least annually; and all sources of impressed current shall be inspected and/or tested bi-monthly, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.195(g)].

II.E.6. The Permittee shall record inspections on the inspection logs and inspection log sheets, required by Permit Condition II.E.1., as specified in IDAPA 58.01.05.008 [40 CFR § 264.15(d)]. At a minimum, the following information shall be recorded:

- The date and time of the inspection;
- The name of the inspector;
- A notation of the observations made; and
- The date and nature of any repairs or other remedial actions.

II.E.7. The Permittee shall inspect the instrumentation found in Attachment 1 Section D of this permit, at a minimum, according to the Operations and Maintenance Schedule provided with the instrument list.

II.F. TRAINING PLAN

II.F.1. The Permittee shall comply with the INL Personnel Training Plan, as included in Attachment 5 of this Permit and in accordance with IDAPA 58.01.05.008 [40 CFR § 264.16], until each HWMU is fully closed and certified.

II.F.2. The Permittee shall ensure that all personnel who handle mixed waste are trained in mixed waste management, safety, and emergency procedures, as applicable to their job description, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.16(a)] and the Personnel Training Plan included in Attachment 5 of this Permit.

II.F.3. The Permittee shall maintain the Personnel Training Plan in Attachment 5 of this Permit and documentation of personnel training received, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.16(e)] and Permit Condition I.Z.1.e. and I.Z.2. of this Permit.

II.G. PREPAREDNESS AND PREVENTION

The Permittee shall comply with the Preparedness and Prevention Provisions of IDAPA 58.01.05.008 [40 CFR Part 264 Subpart C] and as follows:

II.G.1. The Permittee shall operate the permitted INTEC Units so as to minimize the possibility of a fire, explosion, or sudden or non-sudden releases to the air or soil

(which could threaten human health or the environment), in accordance with IDAPA 58.01.05.008 [40 CFR § 264.31] and Attachment 6 of this Permit.

II.G.2. At a minimum, the Permittee shall perform preventative maintenance and repair of the INL emergency equipment, safety devices, and miscellaneous equipment included in the Attachments of this Permit, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.33] and the manufacturer's specifications. The Permittee shall maintain records of these preventative maintenance and repair activities on this equipment and schedules, reflecting minimum and planned performance of these preventative maintenance activities in the Operating Record at the facility, in accordance with Permit Condition I.Z.1.c and I.Z.2 of this Permit.

II.G.3. The Permittee shall maintain access to the communications and alarm systems, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.34] and Attachment 6 of this Permit.

II.G.4. The Permittee shall maintain arrangements with state and local authorities, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.37] and Attachment 7 of this Permit. If state or local officials refuse to enter into preparedness and prevention arrangements with the Permittee for a given HWMU, the Permittee must document this refusal in the Operating Record for the excluded unit.

II.H. CONTINGENCY PLAN

The Permittee shall comply with the Contingency Plan matrix provisions of IDAPA 58.01.05.008 [40 CFR Part 264 Subpart D] and as follows:

II.H.1. The Permittee shall comply with the Contingency Plan included in Attachment 7 of this Permit, at a minimum, whenever there is:

II.H.1.a A fire;

II.H.1.b An explosion; or,

II.H.1.c A sudden or non-sudden release of hazardous or mixed waste or hazardous waste constituents to the environment.

II.H.2. The Permittee shall review and amend, as necessary, the Contingency Plan, pursuant to IDAPA 58.01.05.008 and .012 (40 CFR §§ 264.54 and 270.42) and Permit Conditions I.D.4. and I.D.5. of this Permit within fourteen (14) calendar days of the following events:

II.H.2.a. This Permit is revised;

II.H.2.b. The plan fails in an emergency;

II.H.2.c. The Permittee changes the INL design, construction, operation, maintenance, or other circumstances in a way that materially increases the potential for fires, explosions, or releases of mixed waste or mixed waste constituents, or changes the response necessary in an emergency;

II.H.2.d. The list of emergency coordinators changes; or

II.H.2.e. The list of emergency equipment changes.

II.H.3. The Permittee shall ensure that a trained Emergency Coordinator or equivalent is available at all times in case of an emergency, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.55] and Attachment 7 of this Permit.

II.H.4. The Permittee shall submit a copy of the Contingency Plan (and all revisions to the plan) to all local police departments, fire departments, hospitals, and state and local emergency response teams that may be called upon to provide emergency services, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.53(b)] and Attachment 7 of this Permit.

II.H.5. The point of contact (POC) for reporting emergencies to the State of Idaho shall be the State of Idaho Communications Center at (800) 632-8000 or (208) 846-7610, and Fax Number (208) 846-7620.

II.H.6. The Permittee shall document in the Facility Operating Record the time, date, and details of any incident that requires implementing the Contingency Plan. Within fifteen (15) days after the incident, the Permittee shall submit a written report on the incident to the Director, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.56(j)] and Attachment 7 of this Permit. Said report shall include, at a minimum, the items in Permit Condition I.T.3.a. of this Permit.

II.I. MANIFEST SYSTEM

The Permittee shall comply with the manifest requirements of IDAPA 58.01.05.008 [40 CFR Part 264 Subpart E].

II.J. RECORD KEEPING AND REPORTING

In addition to the record keeping and reporting requirements specified elsewhere in this Permit, the Permittee shall comply with the following:

II.J.1. The Permittee shall maintain a written Operating Record at INL, in accordance with Permit Condition I.Z.1.c. and I.Z.2. and IDAPA 58.01.05.008 [40 CFR § 264.73(a)], for all records identified in IDAPA 58.01.05.008 [40 CFR § 264.73(b)(1) through (b)(16)].

II.J.2. The Permittee shall, by March 1 of each year, submit to the Director a waste minimization certification, pursuant to IDAPA 58.01.05.008 [40 CFR § 264.73(b)(9)],

that the Permittee has a program in place to reduce the volume and toxicity of hazardous waste that he generates to the degree determined by the Permittee to be economically practicable; and the proposed method of treatment, storage, or disposal is the most practicable method currently available to the Permittee, which minimizes the present and future threat to human health and the environment.

II.J.3. The Permittee shall, by March 1 of each even numbered year, submit to the Director a biennial report covering the facility (INL-wide) activities pursuant to IDAPA 58.01.05.008 [40 CFR § 264.75(a) through (j)].

II.J.4. The Permittee shall conduct and complete a source reduction evaluation review and written plan in accordance with the procedures and format provided in the "EPA Waste Minimization Opportunity Assessment Manual" (EPA/625/7-88/003). The review and plan shall be completed in compliance with Permit Condition II.J.5. of this Permit and include, at a minimum, the following general operating and reporting requirements:

II.J.4.a. The Permittee shall submit to the Director detailed descriptions of any programs the Permittee may have to assist generators of hazardous waste in reducing the volume or quantity and toxicity of wastes they produce.

II.J.4.b. The Permittee shall submit the following information to the Director and shall submit revisions or changes to the Director within thirty (30) calendar days after those revisions or changes:

II.J.4.b.1. A list of generators who received information from the Permittee according to Permit Condition II.J.4.a. of this Permit.

II.J.4.b.2. A list of generators who used the Permittee's contractor services on a Waste Minimization Program.

II.J.4.b.3. A list of generators known to the Permittee who have a Waste Minimization Program in place and any known results (i.e., has there been a reduction in wastes submitted for treatment, recycling, or disposal).

II.J.5. A waste minimization review and plan shall be submitted to the Director by March 31, 2015 and every four (4) years thereafter, in accordance with Permit Condition II.J.4. of this Permit. The review and plan shall address the entire INL, unless otherwise approved by the DEQ.

II.J.6. All reports, notifications, applications, or other materials (required to be submitted to the Director) shall be submitted in accordance with Permit Condition I.W. of this Permit.

II.K. CLOSURE

II.K.1. The Permittee shall meet the general Closure Performance Standard, as specified in IDAPA 58.01.05.008 [40 CFR § 264.111] and Attachment 8 of this permit, as modified here, during any partial and final closure of the ILWMS.

II.K.1.a. Clean closure of each HWMU shall be demonstrated by no detectable hazardous waste or underlying hazardous constituents in samples of the final rinse solution for both the tank and associated containment system. Revised action levels may be developed prior to closure and implemented through the appropriate class permit modification.

II.K.1.b. The pH of the final rinse water, before and after use, shall not change more than one-half (0.5) pH. A pH variance by more than one-half unit suggests hazardous waste or hazardous waste constituents are present, thus clean closure is not demonstrated.

II.K.2. The integrity of waste lines that will not be removed as a part of closure shall be determined by pressure testing, or other methods pre-approved by the Director, prior to completion of decontamination activities.

II.K.2.a. If a line fails a pressure test, or other integrity test method pre-approved by the Director, the Permittee shall determine the cause of the failure (e.g. open connection, loss of line integrity, malfunctioning pressure relief valve, etc.).

II.K.2.b. If a line fails a pressure test, or other integrity test method pre-approved by the Director, the Permittee shall determine if there has been a release to the environment.

II.K.2.b.1. If there has been a release to the environment, the Permittee shall characterize the nature and extent of the release.

II.K.2.b.2. If the release cannot be remediated as part of the general closure activity, the release may be passed to the FFA/CO for corrective action, with HWMA as an applicable requirement.

II.K.3. Closure of HWMA/RCRA lines shall be verified as empty and closed by blind flanging. If a line is to remain after closure, both ends shall be blind flanged. In the case that one end of the pipe cannot be reached; the pipe shall be blind flanged at the end nearest the source. In addition to this, all valves leading to the blind flange shall be locked closed, and the valves tagged out.

II.K.4. During all closure activities, atmospheric releases of hazardous waste and hazardous waste constituents shall be minimized by venting any off-gases through the appropriate off-gas system. If gases are vented directly to the atmosphere, the Permittee shall obtain any necessary air permits or exemptions.

II.K.5. The Permittee shall perform a hazardous waste determination on all solid waste generated during closure including, but not limited to, contaminated process equipment, building components, tanks and ancillary equipment, scrap metal, soils, etc., in accordance with IDAPA 58.01.05.006 [40 CFR § 262.11] and Attachment 2 of this Permit.

II.K.6. The following corrections are hereby made to the ILWMS Closure Plan, Attachment 8, of this Permit:

II.K.6.a. Locking valves closed or tagging out valves is not sufficient to secure a system to prevent reintroduction of waste to a closed HWMU. DEQ will not consider locking or tagging out a valve unless the integrity of the valve is demonstrated, and the valve is then added to a weekly inspection procedure through a modification to this Permit.

II.K.6.b. References in the plan to the closure requirements for surface impoundments, land treatment, incinerators, and containment buildings are not applicable and are hereby deleted from the plan.

II.K.6.c. The Permittee shall conduct sampling and analysis, performed in accordance with Permit Condition I.O., to verify that the Clean Closure Performance Standard has been achieved.

II.K.7. The Permittee shall amend the Closure Plans, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.112(c)] and Attachment 8 of this Permit, prior to partial or final closure and whenever necessary.

II.L. EQUIVALENT MATERIALS/INFORMATION

II.L.1. If administrative information (such as names, phone numbers, addresses) are specified in this Permit, the Permittee is hereby authorized to revise said lists provided the substitute has completed all requisite training prior to assuming responsibility. Such administrative changes shall not be considered a modification of this Permit and the change shall be documented in the administrative record. The format of tables, forms, and figures are not subject to the requirements of this Permit and may be revised at the Permittee's discretion.

Equipment replacement/maintenance or upgrade with functionally equivalent components (e.g., valves, pumps, controls, etc.) which do not require a change to the permit conditions, permit attachments, or drawings, will be completed and documented under the work control process as maintenance activities under Permit Condition II.A.1., and do not require a modification of the permit.

II.L.2. If the Department determines that the substitution was not equivalent to the original, it will notify the Permittee that the Permittee's claim of equivalency has been denied, the reasons for the denial, and that the original material or equipment must be used. If the product substitution is denied, the Permittee shall comply with the original approved product specification, find an acceptable substitution, or apply for a Permit Modification, in accordance with Permit Condition I.D.4.

II.M. AIR EMISSION STANDARDS FOR PROCESS VENTS

II.M.1. Applicability

II.M.1.a. The Process Equipment Waste Evaporator (PEWE) off-gas is processed through both the Building 604 Vessel Off-Gas System and the Process Atmospheric Protection System (APS) in Building 649, prior to discharge to the INTEC main stack. The PEWE vent does not meet the definition of a process vent at IDAPA 58.01.05.008 [40 CFR § 264.1031]. Therefore, the air emission standards for process vents do not apply.

II.M.1.b. The Evaporator Tank System (ETS) off-gas is processed through both the Building 659 Process Off-Gas System and the Atmospheric Protection System (APS) in Building 649, prior to discharge to the INTEC main stack. The ETS vent does not meet the definition of a process vent at IDAPA 58.01.05.008 [40 CFR § 264.1031]. Therefore, the air emission standards for process vents do not apply.

II.M.1.c. The Liquid Effluent Treatment and Disposal Facility (LET&D) off-gas is discharged to the INTEC main stack through a process vent, therefore, IDAPA 58.01.05.008 [40 CFR § 264.1031] is applicable.

II.M.1.d. The Integrated Waste Treatment Unit (IWTU) uses a two stage steam reformation process to treat the waste. The IWTU process does not involve distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping. The IWTU vent does not meet the definition of a process vent at IDAPA 58.01.05.008 [40 CFR § 264.1031]. Therefore, the air emission standards for process vents do not apply.

II.M.2. The Permittee shall determine the applicability of IDAPA 58.01.05.008 [40 CFR Part 264 Subpart AA] by documenting the total organic concentration in all feed sources to the LET&D.

II.M.2.a. If the LET&D manages only mixed hazardous waste with total organic concentrations less than 10 ppmw, then IDAPA 58.01.05.008 [40 CFR Part 264 Subpart AA] does not apply.

II.M.2.b. If the LET&D manages mixed hazardous waste with total organic concentrations greater than or equal to 10 ppmw, then IDAPA 58.01.05.008 [40 CFR Part 264 Subpart AA] applies.

II.M.3. The Permittee shall document compliance with the IDAPA 58.01.05.008 [40 CFR Part 264 Subpart AA] standards by:

II.M.3.a. Reducing the input total organic concentrations to the LET&D to less than 10 ppmw for all wastes processed; or

II.M.3.b. Reducing total organic emissions from all affected process vents at INL below 1.4 kg/h (3.0 lb/h) and 2.8 Mg/yr (3.1 tons/yr); or

II.M.3.c. Reducing, by means of a control device, total organic emissions from all affected process vents at INL by 95 weight percent.

II.M.4. The Permittee shall record the following information in the Facility Operating Record, in accordance with IDAPA 05.01.008 [40 CFR § 264.1035]:

II.M.4.a. Up-to-date documentation of the applicability and/or compliance with the process vent standards in Permit Conditions II.M.3., including:

II.M.4.a.1. Information and data identifying all affected process vents, annual throughput and operating hours of each affected unit, estimated emission rates for each affected vent and for the overall facility [i.e., the total emissions for all affected vents at the facility, and the approximate location within the facility of each affected unit (e.g., identify the hazardous waste management units on a facility plot plan)].

II.M.4.a.2. Information and data supporting determinations of vent emissions and emission reductions achieved by add-on control devices based on engineering calculations or source tests. For the purpose of determining compliance, determinations of vent emissions and emission reductions must be made using operating parameter values (e.g., temperatures, flow rates, or vent stream organic compounds and concentrations) that represent the conditions that result in maximum organic emissions, such as when the waste management unit is operating at the highest load or capacity level reasonably expected to occur. If any action is taken (e.g., managing a waste of different composition or increasing operating hours of affected waste management units) that would result in an increase in total organic emissions from affected process vents at the facility, then a new determination is required.

II.M.5. Records of the monitoring, operating, and inspection information, required by Permit Condition II.M.4., shall be maintained in accordance with Permit Conditions I.Z.1.c. and I.Z.2.

II.M.6. Information and data used to determine whether any other INL process vents are subject to the requirements of IDAPA 58.01.05.008 [40 CFR Part 264 Subpart AA] shall be kept in the Operating Record.

II.M.6.a. The Operating Record shall be updated within thirty (30) days of a change in INL operations that potentially involve regulated process vents.

II.M.6.b. INL process vent data shall be reviewed at least annually for compliance with the IDAPA 58.01.05.008 [40 CFR §§ 264.1030 and .1035].

II.M.7. The Permittee shall modify this permit as necessary to ensure compliance with Permit Condition II.M.3. whenever:

II.M.7.a. The Permittee identifies additional hazardous waste process vents; or

II.M.7.b. The Permittee determines that the LET&D is subject to the requirements of IDAPA 58.01.05.008 [40 CFR Part 264 Subpart AA].

II.N. FINANCIAL ASSURANCE FOR FACILITY CLOSURE

The Permittee (DOE, as a federal government unit, and the DOE-designated contractor, as co-Permittee) is exempt from the financial assurance requirements, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.140(c)].

II.O. LIABILITY INSURANCE FOR SUDDEN ACCIDENTAL OCCURRENCES

The Permittee (DOE, as a federal government unit, and the DOE-designated contractor, as co-Permittee) is exempt from the liability coverage for sudden accidental occurrence requirements, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.140(c)].

II.P. COMPLIANCE SCHEDULE

II.P.1. The Permittee shall continue to evaluate methods to conduct inspections of the ILWMS tanks that cannot presently be inspected using standard techniques.

II.P.1.a. Inspection techniques that are to be adopted shall be incorporated into the permit through the procedures of Permit Condition I.D.

II.P.1.b. The Permittee shall record a brief description and justification for adopting/rejecting each inspection method evaluated in the facility operating record.

II.P.1.c. The Permittee shall summarize the inspection methods evaluated in the semi-annual non-compliance report.

II.P.2. The Permittee shall revise, as necessary, and finalize the IWTU System Performance Test Plan (PLN-3298) at least thirty (30) days before the scheduled start of the System Performance Test.

II.P.3 The Permittee shall prepare and submit a Class 2 Permit Modification Request to update IWTU information such as the contingency plan, emergency contact list, inspection schedules and checklists, and any other affected permit conditions, as necessary, reflecting as-built conditions and results of performance testing to ensure compliance with IDAPA 58.01.05.008 [40 CFR Part 264, Subparts B, C, D, and X] according to the following schedule:

II.P.3.a. Forty five (45) days after the System Performance Test (SPT) Report is submitted to the DEQ, submit the permit modification request to the DEQ.

II.P.4. Prior to start of hazardous waste operations, DEQ must receive all certification of construction documents of Permit Condition I.R. for engineering changes to the HWMU.

II.Q. RISK ANALYSIS VALIDATION

II.Q.1. The risk analysis was prepared to demonstrate the protectiveness of the ILWMS shall be re-evaluated:

II.Q.1.a. Upon receipt and validation of the IWTU System Performance Test sampling data, the risk analysis shall be updated using cancer slope factors and hazard quotients current as of July 1, 2014.

II.Q.1.b. Whenever a compound of potential concern (COPC) is added to the emission inventory, as indicated by offgas measurements or the emission rate of a known COPC exceeds the predicted emissions estimate found in Attachment 1 Appendix D-6 of this permit by a factor of two (2) or more.

II.Q.2. If the calculated total risk from ILWMS exceeds 5.0E-6 risk for carcinogens and/or 0.5 hazard quotient for noncarcinogens, the risk analysis shall be revised and submitted to the Director within twenty one (21) days of the submission of the SPT Report.

II.Q.3. If the calculated total risk from ILWMS does not exceed 5.0E-6 risk for carcinogens and/or 0.5 hazard quotient for noncarcinogens, the risk re-evaluation shall be noted in the operating record.

This Space Intentionally left blank

MODULE III - CONTAINER STORAGE

III.A. PERMITTED CONTAINER STORAGE

Subject to the terms of this Permit, the Permittee may store mixed waste in the container storage areas of Building CPP-1696. Waste containers may be stored in vaults in the Vault Staging Area and the Vault Storage Area.

III.B. PERMITTED AND PROHIBITED WASTES IN THE CONTAINER STORAGE AREAS

III.B.1 The Permittee shall only store mixed waste that is exempt from IDAPA 58.01.05.008 (40 CFR 264 Subpart CC), as provided in IDAPA 58.01.05.008 (40 CFR § 264.1080).

III.B.2 Waste must meet the unit-specific waste acceptance criteria in Attachment 2 of this Permit.

III.B.3 The maximum permitted capacity for container storage is 175,000 gallons (663 m^3) in the Vault Storage Area and 4,070 gallons (15 m^3) in the Vault Loading Area.

III.B.4 Waste containing free liquids cannot be stored in the Vault Loading Area or Vault Storage Area.

III.C. CONDITION OF CONTAINERS

If a container holding waste is not in good condition (e.g., severe rusting, apparent structural defects), or if it begins to leak, the Permittee shall: transfer the waste from said container to a container that is in good condition or otherwise manage the waste in accordance with IDAPA 58.01.05.008 [40 CFR § 264.171] and Attachment 1.

III.D. COMPATIBILITY OF WASTE WITH CONTAINERS

The Permittee shall assure that the ability of the container to contain the waste is not impaired, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.172] and Attachments 1 and 6 of this Permit.

III.E. MANAGEMENT OF CONTAINERS

III.E.1. The Permittee shall keep all storage containers closed during storage, and shall not open, handle, or store containers in a manner which may rupture the container or cause it to leak, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.173] and Attachments 1 and 6 of this Permit.

III.E.2. The waste stored in the Vault Loading Area does not contain free liquids due to the elevated process temperatures. The containers (canisters) are placed in cement vaults; therefore, secondary containment is not required in the Vault Storage Area.

III.F. INSPECTIONS

III.F.1. The Permittee shall inspect the permitted container storage areas in accordance with IDAPA.58.01.05.008 [40 CFR § 264.174] and the inspection schedules found in Attachment 4 of this permit.

III.F.1.a. Due to the high radiation fields anticipated for the stored waste, DEQ approves managing the concrete vaults as the container for the purposes of inspection.

III.F.1.b. The Permittee shall inspect the canisters within a vault to ensure canister integrity when a vault is opened, weekly if the vault remains open, and prior to vault closure. These inspections may be visual, camera or by some other method pre-approved by DEQ.

III.G. RECORDKEEPING

The Permittee shall document the results of all inspections, spill responses, waste analysis, and certifications in accordance with Permit Conditions I.Z. and II.J. of this Permit.

III.H. CLOSURE

The Permittee shall close the permitted container storage area in accordance with IDAPA 58.01.05.008 [40 CFR § 264.178] and Attachment 8 of this Permit.

This Space Intentionally left blank

PERMIT - MODULE IV
STORAGE IN TANKS

MODULE IV - STORAGE IN TANKS

IV.A. TANK STORAGE

IV.A.1. Deep Tanks
Deep Tanks have been closed. Post Closure addressed in INL Post Closure Permit.

IV.A.2. PEWE Storage and Treatment Tanks

UNIT NAME:	**Evaporator Feed Sediment Tank: VES-WL-132**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, T01**	
DESCRIPTION:	**Size:** The tank is cylindrical and vertical-oriented, with domed ends. The dimensions of the tank are an outside diameter of 9' and a length of 11', with a tangent-to-tangent length of 7' 9". The tank construction material is Nitronic 50 SS. **Secondary Containment:** The tank is located in an underground vault constructed of reinforced concrete, with floors and the lower 2' 6" of the walls lined with SS. The vault has the dimensions of 17' x 16' 6" x 13' 8". The cell floor slopes to a 3" drain line that leads to the VES-WL-133 vault sump. Upon high alarm, liquid in the sump is jetted to the inlet line to VES-WL-132.			
CAPACITY:	**~4,700 Gallons**			
NOTES:	**Receives:** Inputs come from New Waste Calcining Facility Tanks, VES-WL-101/111, VES-WM-100/101/102, snow melt or other liquids from TFF sumps, basin water from CPP-666 or CPP-603. Waste is jetted or pumped into the tank. **Output:** The waste is normally drained by gravity to VES-WL-133.			

UNIT NAME:	**Evaporator Feed Collection Tank: VES-WL-133**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, T01**	
DESCRIPTION:	**Size:** The tank is cylindrical and horizontal-oriented with domed ends. The dimensions of the tank are an outside diameter of 10', and a length of 34' with a tangent-to-tangent length of 30'. The tank construction material is Nitronic 50 SS. **Secondary Containment:** The tank is located in an underground vault constructed of reinforced concrete, with floors and the lower 5' of the walls lined with SS. The vault has the dimensions of 42' x 16' 6" x 17'. The cell drains to a sump shared with the VES-WL-132 vault, with the floor sloping to a sump along the west wall. Upon high alarm, liquid in the sump is jetted to the inlet line to VES-WL-132.			
CAPACITY:	**~19,000 Gallons**			
NOTES:	**Receives:** Inputs come from VES-WL-132 and all the same sources as VES-WL-132 and recycled condensate from WL-106, WL-107 and WL-163 via gravity drain lines. Liquid that collects in the PWL system tanks and sumps is transferred via steam jets. Waste is gravity-fed into the tank. **Outputs:** Waste is normally pumped to VES-WL-109 or EVAP-WL-129.			

UNIT NAME:	**Surge Tank: VES-WL-102**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, T01**	
DESCRIPTION:	**Size:** The tank is a cylindrical and horizontal-oriented tank with domed ends. The dimensions of the tank are an outside diameter of 10', and a length of 33', with a tangent-to-tangent length of 30'. The tank construction material is Type 347 SS. **Secondary Containment:** The tank is located in a vault constructed of reinforced concrete, with floors and the lower 3' of the walls lined with Hypalon. The vault has the dimensions of 30' 6" x 43' x 16'. The cell drains to an SS-lined floor sump in the center of the cell. Upon high alarm, the liquid in the sump is jetted to VES-WL-150 and then to VES-WL-132.			
CAPACITY:	**~18,400 Gallons**			
NOTES:	**Receives:** Inputs are normally pumped from VES-WL-133. **Outputs:** Waste is normally pumped to VES-WL-133.			

UNIT NAME:	**Evaporator Head Tank: VES-WL-109**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The tank is cylindrical and vertical-oriented, with domed ends. The dimensions of the tank are an outside diameter of 3' and a length of 7' 2", with a tangent-to-tangent length of 5'. The tank construction material is Type 347 SS. **Secondary Containment:** The tank is located in a cell constructed of reinforced concrete, with the floors and lower 3' of the walls lined with SS. The cell has the dimensions of 22' x 18' x 34'. The cell drains to an SS-lined sump (10" x 1') in the NW corner of the cell. Upon high alarm, liquid in the sump is jetted as part of the PWL Collection System to VES-WL-133.			
CAPACITY:	**~270 Gallons**			
NOTES:	**Receives:** Inputs come from VES-WL-133 or VES-WL-102. Waste is jetted or pumped into the tank. **Outputs:** The waste is gravity-fed into EVAP-WL-161, and the overflow returns to VES-WL-133 or VES-WL-102.			

UNIT NAME:	**Evaporator Flash Column: VES-WL-129**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, X99**	
DESCRIPTION:	**Size:** The tank is cylindrical and vertical-oriented, with domed ends. The dimensions of the tank are an outside diameter of 3', and a length of 19 '6" with a tangent-to-tangent length of 14' 9". The tank construction material is Nitronic 50 SS. **Secondary Containment:** The unit is located in a cell constructed of reinforced concrete, with the floors and walls lined with SS. The vault has the dimensions of 14' x 21' 4" (including the access area) x 34' (the access area is only 8' high). The access area floor and lower 1' of the walls are lined with SS. The cell drains to a sump, with the floor sloping to a 2-inch drain that leads to the feed pump cell sump. The sump has dimensions of 1' 6" x 1' 6" x 2' 6". Upon high alarm, the sump is jetted to VES-WL-133.			
CAPACITY:	**~1000 Gallons**			
NOTES:	**Receives:** Inputs come from VES-WL-133. Waste is pumped into the column. **Outputs:** The overheads are collected in VES-WL-131. The bottoms are gravity fed to VES-WL-133, VES-WL-101, or VES-WL-111.			

UNIT NAME:	**Process Condensate Surge Tank: VES-WL-134**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The tank is cylindrical and vertical-oriented, with domed ends. The dimensions of the tank are an outside diameter of 3' 6", and a length of 8' 9", with a tangent-to-tangent length of 7'. The tank construction is Type 304L SS. **Secondary Containment:** The tank is located in a cell constructed of reinforced concrete, with the floors and the lower 1' of the walls lined with SS. A barrier that is 6" high is located in front of the condensate collection cell door to prevent leakage to the access corridor. The cell has the dimensions of 46' x 21' x 35'6". The containment area drains to either SU-WL-145 or SU-WL-146. Upon high alarm, liquid in the sump is jetted as part of the PWL Collection System to VES-WL-133.			
CAPACITY:	**~500 Gallons**			
NOTES:	**Receives:** Inputs come from HE-WL-308 (acidic condensate). Waste is gravity fed into the tank. **Outputs:** In series operation, this tank provides feed for EVAP-WL-161. The waste is pumped to VES-WL-161.			

UNIT NAME:	**Evaporator Flash Column: VES-WL-161**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, X99**	
DESCRIPTION:	**Size:** The column is vertical and cylindrical, with domed ends. The dimensions of the tank are an outside diameter of 3', and a length of 19' 6", with a tangent-to-tangent length of 14' 9". The tank construction material is Nitronic 50 SS. **Secondary Containment:** The unit is located in a cell constructed of reinforced concrete, with the floors and lower 3' of the walls lined with SS. The cell has the dimensions of 22' x 18' x 34'. The cell drains to an SS-lined sump (10" x 1') in the NW corner of the cell. Upon high alarm, liquid in the sump is jetted as part of the PWL Collection System to VES-WL-133.			
CAPACITY:	**~1,000 Gallons**			
NOTES:	**Receives:** Inputs come from VES-WL-109 or VES-WL-134. Waste is gravity fed into the column. **Outputs:** The overheads are collected in VES-WL-131. The bottoms are gravity fed to VES-WL-133, VES-WL-101, or VES-WL-111.			

UNIT NAME:	**Process Condensate Surge Tank: VES-WL-131**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The tank is cylindrical and horizontal-oriented, with domed ends. The dimensions of the tank are an outside diameter of 2', and a length of 2' 10" with a tangent-to-tangent length of 2' 9". The tank construction material is Type 304L SS. **Secondary Containment:** The tank is located in a cell constructed of reinforced concrete, with the floor and lower 1' of the walls lined with SS. The barrier is 6" high and is located in front of the condensate collection cell door to prevent leakage to the access corridor. The cell has the dimensions of 46' x 21' x 35' 6". The cell drains to either SU-WL-145 or SU-WL-146. Upon high alarm, liquid in the sump is jetted as part of the PWL Collection System to VES-WL-133.			
CAPACITY:	**~66 Gallons**			
NOTES:	**Receives:** Inputs come from HE-WL-301 or HE-WL-308 (acidic condensate). Waste is gravity-fed into the tank. **Outputs:** The waste is pumped to VES-WL-106, VES-WL-107, and VES-WL-163.			

UNIT NAME:	**Process Off-gas Condensate Knock-Out Pot: VES-WL-108**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The tank is cylindrical and vertical-oriented, with domed ends. The dimensions of the tank are an outside diameter of 2', and a length of 5' 8", with a tangent-to-tangent length of 2' 8". The tank construction material is Type 347 SS. **Secondary Containment:** The tank is located in the same cell as VES-WL-106, VES-WL-107, and VES-WL-163.			
CAPACITY:	**~98 Gallons**			
NOTES:	**Receives:** Inputs are the condensed liquid from the evaporator VOG before the off-gas is released to the plant VOG system. **Outputs:** The waste is gravity-fed to VES-WL-133.			

UNIT NAME:	**Bottoms Collection Tank: VES-WL-111**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, T01**	
DESCRIPTION:	**Size:** The tank is rectangular and horizontal-oriented. The dimensions of the tank are 12' long, 4' 8" wide, and 3' 6" high. The tank construction material is Type 304L SS. **Secondary Containment:** The tank is located in a cell constructed of reinforced concrete, with the floors and lower 3' of the walls lined with SS. The cell has the dimensions of 22' x 18' x 34'. The cell drains to a SS-lined sump (10" x 1') in the NW corner of the cell. Upon high alarm, liquid in the sump is jetted as part of the PWL Collection System to VES-WL-133.			
CAPACITY:	**~1,500 Gallons**			
NOTES:	**Receives:** Inputs come from VES-WL-129 and VES-WL-161 (concentrated acidic bottoms). Waste is gravity-fed into the tank. **Outputs:** The waste is normally jetted to the CPP-604 TFT, the TFF, VES-WL-101 or the ETS.			

UNIT NAME:	**Bottoms Collection Tank: VES-WL-101**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, T01**	
DESCRIPTION:	**Size:** The tank is cylindrical and horizontal-oriented, with domed ends. The dimensions of the tank are an outside diameter of 10', and a length of 33', with a tangent-to-tangent length of 30'. The tank construction material is Type 347 SS. **Secondary Containment:** The tank is located in a vault constructed of reinforced concrete, with the floors and the lower 3' of the walls lined with Hypalon. The vault has the dimensions of 30' 6" x 43' x 16'. The cell drains to a SS-lined floor sump in the center of the cell. Upon high alarm, the sump is jetted to VES-WL-150 and then to VES-WL-132.			
CAPACITY:	**~18,400 Gallons**			
NOTES:	**Receives:** Inputs come from VES-WL-129 and VES-WL-161 (concentrated acidic bottoms). The waste is gravity-fed into the tank. **Outputs:** The waste is normally jetted to the CPP-604 TFT, the TFF, or the ETS.			

UNIT NAME:	**Tank Farm Tank: VES-WM-100**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, T01**	
DESCRIPTION:	**Size:** The tank is cylindrical and horizontal-oriented with domed ends. The dimensions of the tank are an outside diameter of 10' and a length of 33', with a tangent-to-tangent length of 30'. The tank construction material is Type 347 SS. **Secondary Containment:** This tank is located in a vault constructed of reinforced concrete, with the floor and lower 3' 6" of the walls lined with SS. The vault has the dimensions of 17' x 43' x 16'. The floor of the vault slopes to a sump with the dimensions of 2' x 2' x 4' along east wall of the vault. Upon high alarm, the liquid in the sump is jetted to VES-WL-132.			
CAPACITY:	**~18,400 Gallons**			
NOTES:	**Receives:** Inputs come from CPP-659, VES-WL-101, 111, and fuel storage basins. Waste is gravity-fed, jetted, or pumped into the tank. **Outputs:** Waste is normally jetted to VES-WL-132, the ETS, or the TFF.			

UNIT NAME:	**Tank Farm Tanks: VES-WM-101 and VES-WM-102**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**2**	**PROCESS CODES:**	**S02, T01**	
DESCRIPTION:	**Size:** The tanks are cylindrical and horizontal-oriented with domed ends. The dimensions of the tanks are an outside diameter of 10' and a length of 33', with a tangent-to-tangent length of 30'. The tank construction material is Type 347 SS. **Secondary Containment:** The tanks are located in a vault constructed of reinforced concrete, with the floor and the lower 3' 6" of the walls lined with SS. The vault has the dimensions of 30' 6"' x 43' x 16'. The vault floor slopes to a sump with the dimensions of 2' x 2' x 4' in the center of the vault. Upon high alarm, the liquid in the sump is jetted to VES-WL-132.			
CAPACITY:	**~18,400 Gallons Each**			
NOTES:	**Receives:** Inputs come from VES-WM-100. The waste is gravity-fed or jetted into the tanks. **Outputs:** Waste is jetted to VES-WL-132, VES-WM-100, VES-WM-101, the ETS, or the TFF.			

UNIT NAME:	**Process Waste Liquid System: VES-WL-135, VES-WL-136, VES-WL-139, VES-WL-142**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**4**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** Each tank is cylindrical and vertical-oriented with domed ends. The dimensions of the tanks are an outside diameter of 1' 6" and a length of 10", with a tangent-to-tangent length of 8". The tanks' construction material is Type 304L SS. **Secondary Containment:** The tanks are located in sumps constructed of reinforced concrete lined with SS. The sump has the dimensions of 2' x 2' x 1' 8". VES-WL-135 is located in Valve Box D5, which has measurements of 6' x 8' x 11' 9". Upon high alarm, all are jetted to a common header and transferred to VES-WL-133.			
CAPACITY:	**~10 Gallons Each**			
NOTES:	**Receives:** Off-gas condensate from CPP-604, CPP-649, and associated valve boxes. Waste is gravity-fed into the tanks. **Outputs:** Waste is jetted to VES-WL-133.			

UNIT NAME:	**Process Waste Liquid System: VES-WL-137, VES-WL-138, VES-WL-144**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**3**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** Each tank is cylindrical and vertical-oriented with domed ends. The dimensions of the tanks are an outside diameter of 2' and a length of 13", with a tangent-to-tangent length of 1'. The construction material of each tank is Type 304L SS. **Secondary Containment:** The tanks are located in sumps constructed of reinforced concrete and lined with SS. The sumps have the dimensions of 2' 6" x 2' 6" x 2'. Upon high alarm liquid from the sumps is jetted to a common header and transferred to VES-WL-133.			
CAPACITY:	**~25 Gallons Each**			
NOTES:	**Receives:** Inputs are off-gas condensate from CPP-604, CPP-649, and associated valve boxes. Waste is gravity-fed into the tanks. **Outputs:** Waste is jetted to VES-WL-133.			

UNIT NAME:	**Process Waste Liquid System: VES-WL-150**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The tank is cylindrical and vertical-oriented with domed ends. The dimensions of the tank are a diameter of 2' and a length of 2' 3", with a tangent-to-tangent length of 2'. The tank construction material is Type 304L SS. **Secondary Containment:** The tank is located in the same cell as VES-WL-101/102.			
CAPACITY:	**~50 Gallons**			
NOTES:	**Receives**: Inputs come from floor drains. Waste is jetted or gravity-fed from floor drains into the tank. **Outputs:** Waste is jetted to VES-WL-132.			

UNIT NAME:	**Process Condensate Collection Tanks: VES-WL-106 and VES-WL-107**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**2**	**PROCESS CODES:**	**S02, T01**	
DESCRIPTION:	**Size:** Each tank is cylindrical and vertical-oriented with domed ends. The dimensions of the tanks are an outside diameter of 8' and a length of 14', with a tangent-to-tangent length of 12'. The tanks construction material is Type 347 SS. **Secondary Containment:** The tanks are located in a cell constructed of reinforced concrete, with the floor and lower 1' of the wall lined with SS. A 6-inch high barrier is located in front of the condensate collection cell door to prevent leakage to the access corridor. The cell has the dimensions of 46' x 21' x 35' 6". The liquid drains to either SU-WL-145 or SU-WL-146. Upon high alarm, the liquid in the sump is jetted as part of the PWL Collection System to VES-WL-133.			
CAPACITY:	**~5,000 Gallons Each**			
NOTES:	**Receives:** Inputs are evaporator vapor condensate from VES-WL-131. Waste is pumped into the tank. **Outputs:** Waste is normally pumped to the LET&D facility.			

UNIT NAME:	**Process Condensate Collection Tank: VES-WL-163**		**BUILDING NO.**	**CPP-604**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, T01**	
DESCRIPTION:	**Size:** This tank is cylindrical and vertical-oriented with domed ends. The dimensions of the tank are an outside diameter of 8' and a length of 14', with a tangent-to-tangent length of 12'. The tank construction material is Type 304L SS. **Secondary Containment:** The tank is located in a cell constructed of reinforced concrete, with the floor and lower 1' of the wall lined with SS. A 6-inch high barrier is located in front of the condensate collection cell door to prevent leakage to the access corridor. The vault has the dimension of 46' x 21' x 35' 6". The liquid drains to either SU-WL-145 or SU-WL-146. Upon high alarm, the liquid in the sump is jetted as part of the PWL Collection System to VES-WL-133.			
CAPACITY:	**5,000 Gallons**			
NOTES:	**Receives:** Input is evaporator vapor condensate from VES-WL-131. Waste is pumped into the tank. **Outputs:** Waste is normally pumped to the LET&D Facility.			

IV.A.2.a. The following components are integral equipment to the PEWE Distillation Systems. Failure of one of these components will result in the shut down of the associated PEWE distillation unit. These components may contain de minimus volumes of waste during operations and shut down.

<u>EVAPORATOR UNIT (EVAP-WL-129)</u>

VES-WL-130 Mist Eliminator
HE-WL-307 Evaporator Reboiler
HE-WL-308 Evaporator Condenser

<u>EVAPORATOR UNIT (EVAP-WL-161)</u>

VES-WL-162 Evaporator Separator
HE-WL-300 Evaporator Reboiler
HE-WL-301 Evaporator Condenser

IV.A.3. Liquid Effluent Treatment and Disposal Tanks (LET&D)

UNIT NAME:	**Acid Fractionator Waste Feed Head Tank: VES-WLK-197**		**BUILDING NO.**	**CPP-1618**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The tank is cylindrical and horizontal-oriented with domed ends. The dimensions of the tank are an outside diameter of 3' and a length of 5' 6", with a tangent-to-tangent length of 4'. The tank construction material is Type 304L SS. **Secondary Containment:** The tank is located in the top of CPP-1618, above the Fractionator Cell 1 containment. The tank is located in a vault made of steel-reinforced concrete, with the floors and lower 3' of the walls lined with SS. The floor dimensions of the vault are 17' x 14' 6". The cell drains to a SS lined sump located slightly northeast of the center of the cell. Liquid in the sump is jetted to VES-WL-195 or VES-WL-133. Upon high-high alarm, the feed inlet valve and pump are automatically shut down.			
CAPACITY:	**~270 Gallons**			
NOTES:	**Receives:** Inputs come from VES-WL-106, 107, and 163. Waste is pumped into the tank. **Outputs:** The waste is gravity fed to either Acid Fractionator FRAC-WLL-170 or FRAC-WLK-171.			

UNIT NAME:	**Acid Fractionator: FRAC-WLL-170**		**BUILDING NO.**	**CPP-1618**
NUMBER OF UNITS:	**1**	**PROCESS CODES:**	**S02, X99**	
DESCRIPTION:	**Size:** The two acid fractionators are identical thermal siphon units, with an inside diameter of 42" and a height of approximately 28' 6" (24' from tangent to tangent). Both units consist of vertical-oriented, cylindrical tanks, with domed ends. Hastelloy G-30 is used for equipment and piping. **Secondary Containment:** Acid Fractionator Cell 2 is 17' long and 14' 6" wide. The cell is constructed of steel-reinforced concrete with a stainless-steel liner that is 3' high. The cell has a door in the east wall. In front of the door is a step measuring 3' 10" by 3' 10" by 4". The floor is sloped toward a sump, which is located slightly to the northeast of the center of the cell.			
CAPACITY:	**~460 Gallons**			
NOTES:	**Receives:** Waste is gravity-fed from VES-WLK-197. **Outputs:** Overheads pass through air pollution control equipment and are transferred out the INTEC Main Stack. Bottoms are collected in VES-WLL-195.			

UNIT NAME:	Acid Fractionator: FRAC-WLK-171		BUILDING NO.	CPP-1618
NUMBER OF UNITS:	1	PROCESS CODES:	S02, X99	
DESCRIPTION:	**Size:** The two acid fractionators are identical thermal siphon units, with an inside diameter of 42" and a height of approximately 28' 6" (24' from tangent to tangent). Both units consist of vertical-oriented, cylindrical tanks, with domed ends. Hastelloy G-30 is used for equipment and piping. **Secondary Containment:** Acid Fractionator Cell 1 is 17' long and 14' 6" wide. The cell is constructed of steel-reinforced concrete with a stainless-steel liner that is 3' high. The cell has a door in the west wall. The floor is sloped toward a sump, which is located in the cell.			
CAPACITY:	**~460 Gallons**			
NOTES:	**Receives:** Waste is gravity-fed from VES-WLK-197. **Outputs:** Overheads pass through air pollution control equipment and are transferred out the INTEC Main Stack. Bottoms are collected in VES-WLL-195.			

UNIT NAME:	Acid Fractionator Bottoms Tank: VES-WLL-195		BUILDING NO.	CPP-1618
NUMBER OF UNITS:	1	PROCESS CODE:	S02	
DESCRIPTION:	**Size:** The tank is a cylindrical and horizontal-oriented tank with domed ends. The dimensions of the tank are an inner diameter of 3' and a length of 5' 9", with a tangent-to-tangent length of 4'. The tank construction material is Type 304L SS. **Secondary Containment:** The tank is located in a pit in Acid Fractionator Cell 2 of CPP-1618, constructed of steel-reinforced concrete with a SS liner. The pit has the dimensions of 7' 10" x 6' 9" x 6'. Upon high alarm, the operator is notified of a potential overfill condition and the need to transfer the waste. The secondary containment can contain 100% of the volume of VES-WLL-195.			
CAPACITY:	**~270 Gallons**			
NOTES:	**Receives:** Inputs are the fractionator bottoms, from either VES-WLL-170 or VES-WLK-171. Waste is gravity fed into the tank. **Outputs:** The waste is pumped to VES-WL-133, VES-WL-101/111, VES-NCR-171, or the TFF.			

UNIT NAME:	**Acid Recycle Tank: VES-NCR-171**		**BUILDING NO.**	**CPP-659 Annex**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The tank is cylindrical and horizontal-oriented. The dimensions of the tank are an outside diameter of 11' and a length of 33' 8". The tank construction material is Type 304 SS. **Secondary Containment:** The tank is located in a vault constructed of reinforced concrete with the floor and lower 4' 8" lined with Type 304L SS. The vault has the floor dimensions of 17' 4" x 41' 3", with a minimum containment volume of 24,676 gallons. The cell drains to a gutter on the south side of the vault, which drains to the southeast into a sump unit. Upon high level alarm, liquid in the sump is jetted to VES-NCR-171.			
CAPACITY:	**~22,500 Gallons**			
NOTES:	**Receives:** Inputs come from the fractionator bottoms tank, VES-WLL-195. Waste is pumped into the tank. **Outputs:** Waste is airlifted to VES-NCR-173 and distributed into a common header for use elsewhere at the INTEC.			

UNIT NAME:	**Nitric Acid Head Tank: VES-NCR-173**		**BUILDING NO.**	**CPP-659 Annex**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The tank is cylindrical and vertical-oriented. The dimensions of the tank are a diameter of 2' and a length of 4' 8". The tank construction material is Type 304L SS. **Secondary Containment:** The tank is located in the Acid Recycle Tank Vault, constructed of reinforced concrete with the floor and lower 4' 8" of the walls lined with Type 304L SS. The vault has the floor dimensions of 17' 4" x 41' 3", with a minimum containment volume of 24,676 gallons. The cell drains to a gutter on the south side of the vault, which drains to the southeast into a sump unit. Upon high level alarm, the liquid in the sump is jetted to VES-NCR-171.			
CAPACITY:	**~90 Gallons**			
NOTES:	**Receives:** Inputs come from VES-NCR-171. Waste is airlifted into the tank. **Outputs:** The waste is gravity fed to a common header that can be routed for reuse throughout the INTEC.			

IV.A.3.1. The following components make up the LET&D Treatment Unit. Failure of one component will result in the shut down of the associated LET&D Distillation Unit. These components may contain waste during operation shut downs.

ACID FRACTIONATOR (FRAC-WLL-170)

HE-WLL-391 Heat Exchanger
HE-WLL-396 Condenser
HE-WLL-398 Reboiler
VES-WLL-198 Liquid Separator
HE-WLL-394 Superheater

ACID FRACTIONATOR (FRAC-WLK-171)

HE-WLK-392 Heat Exchanger
HE-WLK-397 Condenser
HE-WLK-399 Reboiler
VES-WLK-198 Liquid Separator
HE-WLK-395 Superheater

IV.A.4. EVAPORATOR TANK SYSTEM (ETS) TANKS

UNIT NAME:	**Blend Tank: VES-NCC-101**		**BUILDING NO.**	**CPP-659**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02,T01**	
DESCRIPTION:	**Size:** The tank has an approximate diameter of 9 ft 6 in. and a height of 13 ft. It is a vertical, cylindrical tank with domed ends. It is constructed of Nitronic 50 stainless steel. **Secondary Containment:** Located in a concrete cell – 32' 4". x 24'. The floor and lower 3' of the walls are lined with stainless steel. The floor slopes to a drain. An alarm sounds when liquid is detected. The floor is drained to VES-NCC-119.			
CAPACITY	**~5,870 Gallons**			
NOTES:	**Receives:** Inputs normally come from VES-NCC-102, VES-NCC-103, VES-NCC-119, VES-NCC-122, VES-NCD-123, VES-NCD-129, PEWE, and the TFF. May also receive liquid from VES-SRC-131, since transfers from VES-SCR-131 may occur to this tank, if necessary. **Output:** The waste is jetted to VES-NCC-102, VES-NCC-103, VES-NCC-119, PEWE, or back to the TFF and is airlifted to VES-NCC-152. May also be airlifted to VES-NCC-102 or VES-NCC-103.			

UNIT NAME:	**Hold Tanks: VES-NCC-102 and VES-NCC-103**		**BUILDING NO.**	**CPP-659**
NUMBER OF UNITS:	**2**	**PROCESS CODE:**	**S02, T01**	
DESCRIPTION:	**Size:** The tanks have an approximate diameter of 8' and a height of 12'. These vertical cylindrical tanks are equipped with domed ends. They are constructed of Nitronic 50 stainless steel. **Secondary Containment:** Located in a concrete cell 32' 4" x 24'. The floor and lower 3' of the walls are lined with stainless steel. The floor slopes to a drain. An alarm sounds when liquid is detected. Floor is drained to VES-NCC-119.			
CAPACITY	**~4,000 Gallons Each**			
NOTES:	**Receives:** Input is normally from VES-NCC-101, VES-NCC-102, VES-NCC-103, VES-NCC-119, VES-NCC-122, VES-NCD-123, VES-NCD-129, PEWE, and the TFF. May also receive liquid from VES-SRC-131, since transfers from VES-SCR-131 may occur to this tank, if necessary. **Output:** The waste is jetted to VES-NCC-101, VES-NCC-102, VES-NCC-103, VES-NCC-119, PEWE, back to the TFF, or pumped to VES-SRC-131.			

UNIT NAME:	**Constant Head Feed Tank: VES-NCC-152**		**BUILDING NO.**	**CPP-659**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The tank has an approximate diameter of a 2' and a length of 9'. The tank is horizontally oriented, cylindrical and has domed ends. It is constructed of Nitronic 50 stainless steel. **Secondary Containment:** Located in a concrete cell 32' 4" x 24'. The floor and lower 3' of the walls are lined with stainless steel. The floor slopes to a drain. An alarm sounds when liquid is detected. Floor is drained to VES-NCC-119.			
CAPACITY	**~200 Gallons**			
NOTES:	**Receives:** The waste is airlifted to VES-NCC-152 from VES-NCC-101. **Output:** The waste is gravity fed to the EVAP-NCC-150 or overflows back to VES-NCC-101.			

UNIT NAME:	**Evaporator Flash Column: VES-NCC-150**		**BUILDING NO.**	**CPP-659**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02, X99**	
DESCRIPTION:	Size: The column tank has an approximate diameter of 5' 6". and a height of 21' 6" from bottom to the top 14" flange. This tank is vertical and cylindrical with domed ends. It is constructed of G-30 Hastelloy stainless steel. Secondary Containment: Located in a concrete cell 32' 4" x 24'. The floor and lower 3' of the walls are lined with stainless steel. The floor slopes to a drain. An alarm sounds when liquid is detected. Floor is drained to VES-NCC-119.			
CAPACITY	**~2,600 Gallons**			
NOTES:	Receives: Waste is airlifted to VES-NCC-152 and then gravity fed to VES-NCC-150. Output: The overheads are transferred to VES-NCC-122. The bottoms are transferred to VES-NCC-119 or VES-NCC-101.			

UNIT NAME:	**Fluoride Hot Sump Tank: VES-NCC-119**		**BUILDING NO.**	**CPP-659**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02, T01**	
DESCRIPTION:	Size: The tank is a horizontal, cylindrical tank with domed ends. It has an approximate diameter of 9' and length of 16'. It is constructed of Nitronic 50 stainless steel. Secondary Containment: Located in a concrete cell – 24' 2" x 24' 6" x 17' 6". The floor and walls are lined with stainless steel. This area is also connected to an adjacent valve access room 19' 6" by 11' 10". The floor and lower 3' of the wall is lined with stainless-steel. The floor is sloped to a sump that can be jetted to VES-NCC-119. The sump is equipped with a liquid level indicator and an alarm.			
CAPACITY	**~6,500 Gallons**			
NOTES:	Receives: Normally receives wastes from floor drains, VES-NCC-150, VES-NCC-101, VES-NCC-102, VES-NCC-103, and VES-NCC-108. Output: The waste can be jetted or pumped to the evaporator feed system, the PEWE, or TFF.			

UNIT NAME:	**Non-fluoride Hot Sump Tank: VES-NCC-122**		**BUILDING NO.**	**CPP-659**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02, T01**	
DESCRIPTION:	Size: The tank is a horizontal cylindrical tank with domed ends. It has an approximate diameter of 7' 6" and a length of 14'. It is constructed of Nitronic 50 stainless steel. Secondary Containment: Located in a concrete cell 24' 2" x 24' 6" x 17' 6". The floor and walls are lined with stainless steel. This area is also connected to an adjacent valve access room – 19' 6" by 11' 10". The floor and lower 3' of the wall is lined with stainless steel. The floor is sloped to a sump that can be jetted to VES-NCC-119. The sump is equipped with a liquid level indicator and an alarm.			
CAPACITY	**~4,300 Gallons**			
NOTES:	Receives: Normally receives wastes from floor drains, HE-NCC-351, VES-NCD-122, and VES-NCD-129. Output: The waste can be jetted to the evaporator feed system, the PEWE, VES-NCC-119, or TFF.			

UNIT NAME:	**Scrub Hold Tank: VES-NCC-108**		**BUILDING NO.**	**CPP-659**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02, T01**	
DESCRIPTION:	Size: The tank is a horizontal, cylindrical tank with domed ends, an approximate diameter of 5' and a length of 12'. Secondary Containment: Located in a concrete cell – 33' 4" x 16' 3". The floor and lower 3' of the walls are lined with stainless steel. A sloped, 1"-deep gutter runs along the length of the east wall. The floor drain line is equipped with a liquid level indicator and an alarm. Containment of solution is provided by the floor drain, which directs solution to VES-NCC-119.			
CAPACITY	**~2,000 Gallons**			
NOTES:	Receives: Condensed liquid from the equipment vent system. Output: The waste can be jetted to VES-NCC-119.			

UNIT NAME:	**Mist Collector: VES-NCC-116**		**BUILDING NO.**	**CPP-659**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	Size: The tank is vertical and cylindrical with domed ends, an approximate diameter of 3' 6" and a height of 7' 6". It is designed to remove any liquid from the process and vessel offgas mixture entering the vessel. It is constructed of Type 304 stainless steel Secondary Containment: Located in a concrete cell – 26' 6" x 31' 6". The floor and lower 3' of the walls are lined with stainless steel. The floor has a sump with leak detection. Upon high level alarm, the collected liquid is drained to VES-NCC-122.			
CAPACITY	**~500 Gallons**			
NOTES:	Receives: Vapor from the evaporator POG before the off-gas is released to APS. Output: The waste is gravity fed to VES-NCC-119.			

UNIT NAME:	**Vent Condenser Knockout Drum: VES-NCC-136**		**BUILDING NO.**	**CPP-659**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	Size: The tank is a vertical, cylindrical vessel with domed ends, an approximate diameter of 16" and a height of 6'. It is constructed of Type 304 stainless steel. Secondary Containment: Located in a concrete cell – 26' 6" x 31' 6". The floor and lower 3' of the walls are lined with stainless steel. The floor has a sump with leak detection. Upon high level alarm, the collected liquid is drained to VES-NCC-122.			
CAPACITY	**~60 Gallons**			
NOTES:	Receives: Vapor from the evaporator POG before the off-gas is released to the APS. Output: The waste is gravity fed to VES-NCC-108.			

IV.A.5 The following component is integral equipment to the ETS distillation system. Failure of this component will result in the shut down of the ETS distillation unit. This component may contain de minimus volumes of waste during operations and shut down.

<u>EVAPORATOR UNIT (EVAP-NCC-150)</u>

HE-NCC-351 Condenser

IV.A.6. INTEGRATED WASTE TREATMENT UNIT (IWTU) TANKS

UNIT NAME:	**Waste Feed Tank: VES-SRC-131**		**BUILDING NO.**	**CPP-1696**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02, T01**	
DESCRIPTION:	**Size:** The feed tank is a vertical, cylindrical vessel with domed ends, with an approximate diameter of 7' and 8' 9" in height. It is constructed of Type 304L stainless steel. **Secondary Containment:** Located in a shielded cell – 37' 2" x 34' 5. The floor and lower 2' of the walls are lined with stainless steel. The floor has a sump (1'6" x 1'6" x 1'6") with leak detection. Upon high level alarm, the collected liquid is jetted to VES-NCC-101, VES-NCC-102, or VES-NCC-103. The sump may be jetted back to VES-SRC-131 if this vessel is not the source of the liquid.			
CAPACITY	**~2,170 Gallons**			
NOTES:	**Receives:** Liquid waste from the NWCF Hold Tanks, VES-NCC-102 and -103 and CPP-1696 sumps **Outputs:** The waste is normally pumped to the DMR. It can also be pumped to VES-NCC-101, VES-NCC-102, or VES-NCC-103.			

UNIT NAME:	**Product Receiver/Coolers: VES-SRC-190 and -191**		**BUILDING NO.**	**CPP-1696**
NUMBER OF UNITS:	**2**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The two Product Receiver/Cooler tanks are identical vertical, cylindrical vessels with domed tops and cone-shaped bottoms. They are approximately 4' in diameter and 7' 9" in height. They are constructed of Type 316H stainless steel. **Secondary Containment:** Located in shielded cells – 17' 6" x 23' 8". The floor and lower 1' of the walls are lined with stainless steel. The floor has a sump (1' x 1' x 1') with leak detection. Upon high level alarm, the collected liquid is pumped to VES-SRC-131.			
CAPACITY	**~512 Gallons Each**			
NOTES:	**Receives:** Primarily receives sodium carbonate based granular solid treatment product from the DMR. Also, receives fines from the Process Filter, Offgas Filter, Product Receiver Filter, and Vacuum Filter. **Outputs:** The IWTU treatment product is gravity loaded into canisters for storage and transport for ultimate disposal.			

UNIT NAME:	**Firewater Collection Tank: TK-SRE-196**		**BUILDING NO.**	**CPP-1696**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The Firewater Collection Tank is a horizontal, cylindrical vessel with domed ends. It is approximately 32' long and 9' in diameter. **Secondary Containment:** The Firewater Collection Tank is a double shelled tank that is directly buried in the soil. The tank is equipped with leak detection and the ability to remove liquid from the annulus to appropriate containers. Any liquids collected in the tank will be removed via an external portable pump.			
CAPACITY	**~15,000 Gallons**			
NOTES:	**Receives:** During a fire incident, this tank will collect firewater from the Process and Building HEPA Filters and the Mercury Adsorbers. **Output:** If removal of firewater from this tank is necessary, a portable pump will be used to empty the contents.			

UNIT NAME:	**Condensate Collection Tank: TK-SRH-141**		**BUILDING NO.**	**CPP-1696**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02**	
DESCRIPTION:	**Size:** The Condensate Collection Tank is a horizontal, double walled, rectangular vessel. It's dimensions are approximately 4' x 2' x 2'. **Secondary Containment:** Double walled tank with leak detection. Any collected liquid is removed and placed in appropriate containers.			
CAPACITY	**~120 Gallons**			
NOTES:	**Receives:** Condensate from the off-gas system including the IWTU stack. **Output:** Pumped to the VES-SRC-131.			

UNIT NAME:	**Sump Tank: VES-SRC-133**		**BUILDING NO.**	**CPP-1696**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02, T01**	
DESCRIPTION:	**Size:** The sump tank is a horizontal, cylindrical vessel with domed ends. It has an approximate diameter of 8' and is 10'4" in length. It is constructed of Type 304L stainless steel. **Secondary Containment:** Located in a shielded cell – 37'2" x 34'5". The floor and lower 2' of the walls are lined with stainless steel. The floor has a sump (1'6" x 1'6" x 1'6") with leak detection. Upon high level alarm, the collected liquid is jetted to VES-NCC-101, VES-NCC-102, or VES-NCC-103. The collected liquid may be jetted back to VES-SRC-131 if this vessel is not the source of the liquid.			
CAPACITY	**~3,390 Gallons**			
NOTES:	**Receives:** Decontamination liquids from the WFT, DMR, PGF, and OGF. **Output:** The liquid is normally pumped to the WFT.			

UNIT NAME:	**Clarifier Tank: VES-SRC 134**		**BUILDING NO.**	**CPP-1696**
NUMBER OF UNITS:	**1**	**PROCESS CODE:**	**S02, T01**	
DESCRIPTION:	**Size:** The Clarifier Tank is a Lamella clarifier approximately 2' wide, 7' 7" overall height, and 8' in length. It is constructed of Type 304L stainless steel. **Secondary Containment:** Located in a shielded cell – 37'2" x 34'5". The floor and lower 2' of the walls are lined with stainless steel. The floor has a sump (1'6" x 1'6" x 1'6") with leak detection. Upon high level alarm, the collected liquid is jetted to VES-NCC-101, VES-NCC-102, or VES-NCC-103. The collected liquid may be jetted back to VES-SRC-131 if this vessel is not the source of the liquid.			
CAPACITY	**~494 Gallons**			
NOTES:	**Receives:** Decontamination liquids from the WFT, DMR, PGF, and OGF. **Output:** The liquid is normally overflowed to the sump tank VES-SRC-133.			

IV.A.6.1. The following components are integral to the Integrated Waste Treatment Unit. Failure of one of these components will result in the shut down of the associated IWTU. These components may contain waste during operation and/or shut downs.

P-SRC-231	Waste Feed Pump
VES-SRC-140	Denitration and Mineralization Reformer
F-SRC-153	Process Gas Filter
VES-SRC-160	Carbon Reduction Reformer
COL-SRC-160	Offgas Cooler
F-SRC-160	Offgas Filter
F-SRH-140-A/B/C/D	Process HEPA Pre-filters and Process HEPA Filters
F-SRH-141A/B	Mercury Adsorbers
VES-SRC-190/191	Product Receiver Coolers
F-SRC-191	Product Receiver Filter
VES-SRC-180	Product Receiver Filter Product Pump
F-SRC-190	Product Handling Vacuum Filter

IV.B. PERMITTED AND PROHIBITED WASTES IN THE INTEC LIQUID WASTE MANAGEMENT SYSTEM UNITS

IV.B.1. Storage of mixed wastes in tanks is authorized in the tanks identified in Permit Condition IV.A. of this Permit.

IV.B.2. Discharge of hazardous only waste, including de minimus volumes, to the ILWMS is not authorized.

IV.B.3. The Permittee may store the mixed waste identified in the Part A of Attachment 1 of this Permit, in the tanks identified in Permit IV.A., as modified below:

IV.B.3.a. If a prohibited waste [see Attachment 2, Section C-2a(1)] is identified in the ILWMS the following shall occur:

IV.B.3.a.1. The affected tanks and process lines shall be isolated from the remainder of the ILWMS until such time as the Director approves the completed remedial measures.

IV.B.3.a.2. A notification will be sent to DEQ within seven (7) days, in accordance with Permit Condition I.Y., and shall include at least the following information:

- A list of the affected tanks and process lines isolated;
- A description of the prohibited waste including volume and potential hazards;
- Proposed measures necessary to neutralize or remove the prohibited waste;
- Proposed schedule to remediate the affected tanks; and
- Proposed measures to prevent recurrences.

IV.B.3.b. The Director shall approve all remedial measures prior to implementation.

IV.B.3.c. The affected tanks and ancillary equipment shall remain isolated until such time as the Director approves the completed remedial measures.

IV.C. SECONDARY CONTAINMENT AND CONTAINMENT SYSTEM SUMPS

IV.C.1. The Permittee shall operate and maintain Secondary Containment Systems that are capable of detecting and collecting releases, and which prevent any migration of waste or accumulated liquid out of the system to the soil, ground water, or surface water during use of the tank systems, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.193] and Attachment 1 of this Permit.

IV.C.2. Secondary Containment Systems, materials of construction, and design calculations are located in Attachment 1 [D-2f(1)(b) and B-1] of the Permit.

IV.C.3. The following requirements apply to all ILWMS tank containment sumps:

IV.C.3.a. The liquid level in all tank sumps shall be monitored and recorded daily;

IV.C.3.b. The Permittee shall note in the Operating Record any rise in the sump level during waste management operations.

IV.C.3.c. If the liquid level in a sump exceeds the high/high setpoint or overflows the sump, the Permittee shall immediately comply with the requirements of IDAPA 58.01.05.008 [40 CFR § 264.196].

IV.C.4. The following requirements apply to ILWMS ancillary equipment (valve-box) containment sumps:

IV.C.4.a. Ancillary equipment sumps shall be checked for free liquids prior to initiating waste transfers. The presence of liquids shall be noted in the Facility Operating Record.

IV.C.4.b. The Permittee shall note in the Operating Record any rise in the sump level during waste management operations.

IV.C.4.c. If liquid levels overtop a sump during waste transfer operations, the Permittee shall immediately discontinue the waste transfer operation and take the necessary response actions, in accordance with Permit Condition IV.C.6. and IDAPA 58.01.05.008 [40 CFR § 264.196].

IV.C.4.d. If the liquid level in a sump increases during waste transfer operations but do not overtop the containment sump, the waste transfer may continue. Upon completion of the waste transfer, the Permittee shall comply with Permit Condition IV.C.6. and IDAPA 58.01.05.008 [40 CFR § 264.196(b)].

IV.C.5. In addition to the requirements of Permit Condition IV.C.3., the following requirements apply to VES-NCC-119 only:

IV.C.5.a. Detection of liquids in the VES-NCC-119 sump shall be reported in accordance with Permit Condition I.T.

IV.C.5.b. The operator shall determine if the source of sump liquids is a leak in VES-NCC-119

IV.C.5.b.i. If the source of liquids is determined to be non-waste (e.g., steam leak, pump priming water, etc) then operations of VES-NCC-119 may continue provided the level of liquids remains below the action levels set in Permit Condition IV.C.3;

IV.C.5.b.ii. If the source of liquids either is a leak in VES-NCC-119 or cannot be determined, the Permittee shall respond in accordance with IDAPA 58.01.05.008 [40 CFR §264.196]. This includes closing the secondary containment sump drain lines that empty to VES-NCC-119.

IV.C.6. The Permittee shall immediately remove a tank system from service if there is a leak or spill from the tank system Secondary Containment, or if the system or Secondary Containment are unfit for use, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.196]. The Permittee shall then:

IV.C.6.a. Immediately stop the flow of hazardous waste into the tank system or Secondary Containment System and inspect the system to determine the cause of the release, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.196(a)] and Attachment 1 and 7 [D-2f(1)(b) and G-4] of this Permit.

IVC.6.b. Within 24 hours, remove as much of the waste as is necessary to prevent further releases of hazardous waste and to allow inspection and repair of the tank system, including the Secondary Containment System, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.196(a) and (b)], and Attachment 1 (D-2f(1)(b)) of this Permit.

IV.C.6.b.1. If, after pumpable waste is removed from a sump, liquids continue to be detected, the facility shall:

- Notify DEQ of the sump involved, volume of liquid, and proposed path forward within seven (7) days; and
- The Permittee shall initiate corrective measures to remove liquids from the sump within seven (7) days of notifying DEQ. Removal by evaporation of non-pumpable (using existing steam jets) volumes of liquid is authorized.

IV.C.6.c. Follow the verbal and written reporting requirements for any release to the environment, in accordance with Permit Condition I.T. of this Permit.

IV.C.6.d. The Permittee shall follow Permit Conditions IV.C.6.b and IV.C.6.c of this Permit for de minimus spills into the secondary containment system from normal treatment processes (i.e., transfers into and out of tanks, condensate drippage, etc.).

IV.C.7. The Permittee shall isolate and close any unfit portion of the ILWMS System, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.197], Permit Condition II.K., and Attachments 8 and 8A of this Permit unless he satisfies the following requirements:

IV.C.7.a. For a release caused by a spill that has not damaged the integrity of the system, the Permittee shall remove the released waste and make any necessary repairs before returning the tank system to service, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.196(e)(2)].

IV.C.7.b. For a release caused by a leak from a primary tank system to a Secondary Containment System, the Permittee shall repair the tank system prior to returning it to service, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.196(e)(3)].

IV.C.7.c. If the Permittee replaces a component of the tank system to eliminate the leak, that component must satisfy the requirements for new tank systems or components in IDAPA 58.01.05.008 [40 CFR §§ 264.192 and 264.193].

IV.C.8. If the Permittee has repaired a tank system, in accordance with Permit Condition IV.C.7. of this Permit, and the repair has been extensive (e.g., installation of an internal liner, repair of a ruptured primary containment or Secondary Containment vessel), the tank system must not be returned to service until the Permittee obtains a certification by a qualified professional engineer that the repaired system is capable of handling hazardous waste without release for the intended life of the system. The certification shall be kept on file in the Operating Record until closure of the facility in accordance with Permit Conditions I.Z. and II.J., and Attachment 4 [F-2b(2)(a)] of this Permit.

IV.D. TANK SYSTEM OPERATING CONDITIONS

IV.D.1. The Permittee shall not place waste or treatment reagents in a tank system if they could cause the tank, ancillary equipment, or containment system to rupture, leak, corrode, or otherwise fail, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.194(a)] and Attachments 1, 2, and 6 of this Permit.

IV.D.2. The Permittee shall use appropriate controls and practices to prevent spills and overflows from the tank or containment systems, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.194(b)(1)(2)] and the following Table:

INTEC LIQUID WASTE MANAGEMENT SYSTEM

TANK DIMENSIONS, HIGH ALARM SETPOINTS, AND OVERFLOW

TANK	APPROXIMATE OUTSIDE DIMENSIONS	HIGH ALARM SETPOINTNOT TO EXCEED[1]	OVERFLOW (IF ALARMS IGNORED)
VES-WL-132	11' 0" × 9' 0"	9" water column (wc) (4,230 Gallons)	Designed to Overflow to VES-WL-133
VES-WL-133	10' 0" × 34' 0"	109" wc[4] (18,000 gallons)	Overflows to the Vault Sump, Which is Equipped with Leak Detection
VES-WL-102	10' 0" × 33' 0"	104" wc[4] (17,000 gallons)	Overflows to VES-WL-101
VES-WL-108	5' 8" × 2' 0"[2]	NA	Designed to Overflow to VES-WL-131 or VES-WL-133
VES-WL-109	7' 2"× 3' 0"[2]	NA	Designed to Overflow to VES-WL-133 or VES-WL-102
EVAP-WL-129	19' 6" × 3' 0"	75" wc[4] (750 gallons)	Overflows to VES-WL-131 or VES-WL-134
EVAP-WL-161	19' 6" × 3' 0"	75" wc[4] (750 gallons)	Overflows to VES-WL-131
VES-WL-131	2' 0" × 2' 10"	18" wc[3] (59 gallons)	Overflows to VES-WL-161, VES-WL-129, VES-WL-106, VES-WL-107, VES-WL-163, or VES-WL-134

INTEC LIQUID WASTE MANAGEMENT SYSTEM TANK DIMENSIONS, HIGH ALARM SETPOINTS, AND OVERFLOW			
TANK	**APPROXIMATE OUTSIDE DIMENSIONS**	**HIGH ALARM SETPOINTNOT TO EXCEED[1]**	**OVERFLOW (IF ALARMS IGNORED)**
VES-WL-134	8’ 9” × 3’ 6”	90” wc (450 gallons)	Overflows to VES-WL-129, VES-WL-161, VES-WL-131, VES-WL-106, VES-WL-107, or VES-WL-163
VES-WL-101	10’ 0” × 33’ 0”	104” wc[4] (17,000 gallons)	Overflows to VES-WL-102
VES-WL-111	3’ 6” × 4’ 8” × 12’ 0”	34” wc[4] (1,275 gallons)	Overflows to VES-WL-101, VES-WL-102, or VES-WL-133
VES-WL-106	14’ 0” × 8’ 0”	130” wc[3] (4,250 gallons)	Overflows to VES-WL-107, VES-WL-163, VES-WL-131, VES-WL-129, VES-WL-161, or VES-WL-134
VES-WL-107	14’ 0” × 8’ 0”	130” wc[3] (4,250 gallons)	Overflows to VES-WL-106, VES-WL-163, VES-WL-131, VES-WL-129, VES-WL-161, or VES-WL-134
VES-WL-163	14’ 0” × 8’ 0”	130” wc[3] (4,250 gallons)	Overflows to VES-WL-106, VES-WL-107, VES-WL-131, VES-WL-129, VES-WL-161, or VES-WL-134
VES-WM-100	10’ 0” × 33’ 0”	100” wc[4] (16,950 gallons)	Administratively controlled to prevent overflow.
VES-WM-101	10’ 0” × 33’ 0”	100” wc[4] (16,950 gallons)	Administratively controlled to prevent overflow.
VES-WM-102	10’ 0” × 33’ 0”	94” wc[4] (16,000 gallons)	Overflows to VES-WM-101

INTEC LIQUID WASTE MANAGEMENT SYSTEM TANK DIMENSIONS, HIGH ALARM SETPOINTS, AND OVERFLOW			
TANK	**APPROXIMATE OUTSIDE DIMENSIONS**	**HIGH ALARM SETPOINTNOT TO EXCEED[1]**	**OVERFLOW (IF ALARMS IGNORED)**
VES-WL-135	10” × 1’ 6”	12” wc (10 gallons)	New Waste Calcining Facility Off-gas Line or the Vault Sump, Which is Equipped with Leak Detection
VES-WL-136	10” × 1’ 6”	12” wc (10 gallons)	New Waste Calcining Facility Off-Gas Line or the Vault Sump, Which is Equipped with Leak Detection
VES-WL-137	13” × 2’ 0”	18” wc (28 gallons)	Overflows to VES-OGF-132, VES-WL-104, or the Vault Sump, Which is Equipped with Leak Detection
VES-WL-138	13” × 2’ 0”	18” wc (28 gallons)	Overflows to the Vault Sump, Which is Equipped with Leak Detection
VES-WL-139	10” × 1’ 6”	12” wc (10 gallons)	Overflows to the Vault Sump, Which is Equipped with Leak Detection
VES-WL-142	10” × 1’ 6”	12” wc (10 gallons)	Overflows to the Vault Sump, Which is Equipped with Leak Detection
VES-WL-144	13” × 2’ 0”	18” wc (28 gallons)	Overflows to the Vault Sump, Which is Equipped with Leak Detection
VES-WL-150	2’ 3” × 2’ 0”	31” wc[3] (48 gallons)	Overflows to the Vault Sump, Which is Equipped with Leak Detection
VES-WLK-197	3’ 0” × 5’ 6”	28” wc[3] (225 gallons)	Overflows to VES-WLL-195
FRAC-WLL-170	28’ 6” × 3’ 6”[2]	40” wc[3, 4] (325 gallons)	Overflows to VES-WLL-195

INTEC LIQUID WASTE MANAGEMENT SYSTEM TANK DIMENSIONS, HIGH ALARM SETPOINTS, AND OVERFLOW			
TANK	**APPROXIMATE OUTSIDE DIMENSIONS**	**HIGH ALARM SETPOINTNOT TO EXCEED[1]**	**OVERFLOW (IF ALARMS IGNORED)**
FRAC-WLK-171	28’ 6” × 3’ 6”[2]	40” wc[3, 4] (325 gallons)	Overflows to VES-WLL-195
VES-WLL-195	3’ 0” × 5’ 9”	28” wc[4] (220 gallons)	Overflows to FRAC-WLL-170, FRAC-WLK-171, or the Vault Sump, Which is Equipped with Leak Detection
VES-NCR-171	11’ 0” × 33’ 8”	109” wc[4] (21,300 gallons)	Overflows to the Vault Sump, Which is Equipped with Leak Detection
VES-NCR-173	4’ 8” × 2’ 0”	NA	Designed to Overflow to VES-NCR-171
VES-NCC-101	9’ 6” x 13’	113” wc[3 and 4] (4910 gallons)	Overflows to VES-NCC-119
VES-NCC-102	8’ 1” x 12’	111” wc[3 and 4] (3455 gallons)	Overflows to VES-NCC-119
VES-NCC-103	8’ 1” x 12’	111” wc[3 and 4] (3455 gallons)	Overflows to VES-NCC-119
VES-NCC-152	2’ 1” x 9’ 2”	N/A	Designed to Overflow to VES-NCC-101
VES-NCC-150	5’ 6” x 21’ 6”	158” wc[3 and 4] (2362 gallons)	Overflows to VES-NCC-122
VES-NCC-119	9’ 1” x 13’ 6”	84” wc[3 and 4] (5765 gallons)	Overflows to room 101 that has a sump with leak detection
VES-NCC-122	7’ 6” x 14’	78” wc[3 and 4] (4180 gallons)	Overflows to VES-NCC-119
VES-NCC-108	5’ x 14’	36” wc[4] (1500 gallons)	Overflows to VES-NCC-119
VES-NCC-116	3’ 6” x 7’ 6”	12” wc (70 gallons)	Overflows to the offgas system
VES-NCC-136	1’ 4” x 6’	12 inches (17 gallons)	Overflows to the offgas system
VES-SRC-131	7’ x 8’ 9”	95% of capacity[3] (2,050 gallons)	Overflows through VES-SRC-134 to VES-SRC-133

INTEC LIQUID WASTE MANAGEMENT SYSTEM TANK DIMENSIONS, HIGH ALARM SETPOINTS, AND OVERFLOW			
TANK	**APPROXIMATE OUTSIDE DIMENSIONS**	**HIGH ALARM SETPOINTNOT TO EXCEED[1]**	**OVERFLOW (IF ALARMS IGNORED)**
TK-SRE-196	9' x 32'	95% of capacity (14,250 gallons)	Overflows to the Building HEPA filter enclosure
VES-SRC-190, VES-SRC-191	4' x 7' 9"	95% of capacity	Dry solids
TK-SRH-141	4' x 2' x 2'	~50% of capacity (~60 gallons) and high-high alarm at 86% (103 gallons)	Overflows to vent inlet
VES-SRC-133	8' x 10'4"	95% of capacity (~3,200 gallons)	Overflows to SU-SRC-190 sump which is equipped with leak detection
VES-SRC-134	2' x 7' 7" x 8'	N/A	Designed to Overflow to VES-SRC-133

1 High alarm set points may be exceeded on a case-by-case basis (e.g., to allow tanks to be filled to capacity with water to provide shielding during periods of maintenance, or when tanks are designed to overflow to other tanks). When allowed, notations will be made in the Operating Record. In actual practice the high alarm setpoint will be set at or below the indicated value. Alarm set points for tanks with more than one instrument have a setpoint for both instruments listed. Volume given is based on liquids with a specific gravity of 1.0; actual volume is calculated based on the measured specific gravity.
2 Height measured from the bottom of the lower connection to the top of the upper connection.
3 This is a high-high alarm setpoint.
4 Density compensated instrument. Density compensation is used to read true level that will not be affected by the solution density.

IV.D.2.a. Any overfill events, except as authorized in IV.D.7., shall be recorded in the Facility Operating Record and included in either the Permit Condition I.T. or I.U. Report (as appropriate).

IV.D.2.b. The tank operating procedures shall be reviewed and modified, as appropriate, to prevent recurrences of overfill situations.

IV.D.3. Waste transfers are to be minimized to reduce the potential for releases to the environment.

IV.D.4. Tank inventory records, including tank volume changes as a result of transfers, shall be maintained as part of the Operating Record, in accordance with Permit Condition II.J.

IV.D.5. If the waste volume increase in the influent and the related decrease in the effluent tanks vary by more than (+)10 percent (10%) or (-)3 percent (3%), but there is no evidence of a release, then the circumstances must be reported in the Permit Condition I.U. Report. Out of specification transfers between tanks with significant

capacity differences (i.e., where one tank is greater than three times the size of the other), that have no evidence of release, will be documented in the operating record but do not have to be included in this report.

IV.D.6. If a release during transfer is suspected, based on inconsistent tank volumes, detection of liquids in the Secondary Containment System or other information, the requirements of Permit Condition I.T.1. shall be followed.

IV.D.7. Completely filling a tank with water for shielding purposes during maintenance/ manned entry shall be noted in the Facility Operating Record. No additional reporting is required unless the procedure overfills the tank, resulting in a discharge to the Secondary Containment System.

IV.D.8. Transfers through lines equipped with carboys, or other containers, used as leak detection devices, must be monitored before, during (as appropriate), and immediately following transfers to ensure that the containers do not overflow, resulting in a spill or release to the environment. Such monitoring will be documented in the facility operating record. If liquids are detected in quantities that exhibit a potential for overflow, the transfer will be terminated.

IV.E. INSPECTION SCHEDULES AND PROCEDURES

IV.E.1. The Permittee shall develop and maintain a schedule and procedures for inspecting the overfill controls, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.195(a)] and Attachment 4 of this Permit.

IV.E.2. The Permittee shall inspect the following, at least once each operating day, in accordance with Attachment 4 (F-2a and Appendices F-2 – F-7) of this Permit:

IV.E.2.a. Data gathered from monitoring and leak detection equipment and overfill controls to ensure that the tank system is being operated according to design; and

IV.E.2.b. The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the Secondary Containment System and ancillary equipment, to detect corrosion or signs of release of hazardous waste when performing equipment maintenance or repair inside a cell or vault.

IV.E.3. The Permittee shall visually inspect tanks and ancillary equipment, located within radiological containment areas, daily whenever the cells are entered. The inspection protocols for the initial entrance inspection, and on-going daily inspections, may be established as part of the specific work permit.

IV.E.4. The inspection protocols shall be placed in the Facility Operating Record.

IV.E.5. The results of all inspections shall be documented in accordance with Permit Condition II.J.1.

IV.F. IGNITABLE OR REACTIVE WASTES

Ignitable or reactive waste shall not be placed in the tank systems unless the waste is treated, rendered, or mixed before or immediately after placement in the tank systems so that:

IV.F.1. The resulting waste, mixture, or dissolved material no longer meets the definition of ignitable or reactive waste under IDAPA 58.01.05.005 [40 CFR §§ 261.21 or 261.23]; and

IV.F.2. The requirements of IDAPA 58.01.05.008 [40 CFR § 264.17(b)] are satisfied.

IV.G. INCOMPATIBLE WASTE

The Permittee shall not place incompatible waste or materials that are incompatible in the same tank system, except in accordance with IDAPA 58.01.05.008 [40 CFR § 264.199(a)].

This Space Intentionally left blank

PERMIT - MODULE V
TREATMENT IN
TANKS

MODULE V - TREATMENT IN TANKS

V.A. SOLIDS SETTLING, CHEMICAL ADDITION, WASTE BLENDING AND PH ADJUSTMENT

V.A.1. Treatment by solids settling is authorized in VES-WL-132 and VES-SRC-134.

V.A.2. Chemical addition, waste blending, and pH adjustment are permitted treatment activities in the following tanks:

VES-WL-133, VES-WL-102, VES-WL-101, VES-WL-111, VES-WM-100, VES-WM-101, VES-WM-102, VES-WL-106, VES-WL-107, VES-WL-163, VES-NCC-101, VES-NCC-102, VES-NCC-103, VES-NCC-108, VES-NCC-119, VES-NCC-122, VES-SRC-131, VES-SRC-133, and VES-SRC-134.

V.A.3. Treatment failure shall be indicated by the following:

V.A.3.a. The inability to achieve the treatment objective of creating waste that is acceptable to the ILWMS according to the WAC; or

V.A.3.b. The treatment tank reaching operational capacity prior to completion of the pH adjustment or blending operation.

V.A.4. If a specific treatment method fails the following shall occur:

V.A.4.a. All treatment failures shall be reported in the Permit Condition I.U. Report.

V.A.4.b. If a second treatment is performed on the same batch and the waste still does not meet the WAC, then:

- DEQ shall be notified within 72 hours via telephone or facsimile;
- The waste shall be re-characterized, and DEQ shall be provided with the new proposed treatment plan for that batch; and
- The current treatment procedure shall be revised through a Permit Modification to prevent repeated failures.

V.A.4.c. If a treatment procedure fails a second time, but on a different batch than that which failed earlier, the failure shall not only be reported in the Permit Condition I.U. Report, but the treatment procedure shall also be analyzed to determine the cause of the failures and how to prevent further failures.

V.A.4.d. If a treatment procedure fails three (3) times, it shall be reported in the Permit Condition I.U. Report and a new treatment method must be implemented through a Permit Modification in accordance with Permit Condition I.D.

V.A.5. Treatment volumes for each tank shall be subject to the limits found on Page 3c and 3d of 6 in the Part A, found in Attachment 1 of this Permit.

V.B. PERMITTED/PROHIBITED WASTE TO BE TREATED

V.B.1. Treatment of hazardous only (no radioactive waste component) waste is not authorized.

V.B.2. The Permittee may pH adjust or blend the wastes identified in Permit Condition IV.B.3. of this Permit, except that blending or pH adjustment of wastes to comply with LDR is not authorized.

V.B.3. Blending and/or pH adjustment is a pre-treatment process meant only to facilitate further treatment in the PEWE, LET&D, ETS, IWTU, or other INTEC Treatment Unit.

V.B.4. Blending or pH adjustment to meet Land Disposal Restriction requirements is not authorized.

V.B.5. The Permittee shall minimize waste and material transfers through the ILWMS process lines since transfers increase the potential for releases to the environment.

V.B.6. Addition of acid to ensure radioactive components of the waste remain in solution to preclude the possibility of a criticality event, is not subject to regulation under this Permit except for the following:

V.B.6.a. The addition of materials to a tank shall not result in overfilling of the tank.

V.B.6.b. The Permittee shall ensure compliance with Permit Conditions IV.F. and IV.G. prior to initiating chemical addition procedures.

V.C. RECORD KEEPING

V.C.1. The Permittee shall record the following information associated with each blending operation or pH adjustment:

V.C.1.a. Date and time of treatment;

V.C.1.b. Tank where treatment occurs;

V.C.1.c. Initial volume of waste in tank;

V.C.1.d. Volume of waste added for blending or volume of acid/base added for pH adjustment;

V.C.1.e. Cross references to any waste analyses, including field methods, performed on the tank contents or documentation of the process knowledge used to determine the need for treatment;

V.C.1.f. Treatment failures as defined in Permit Condition V.A.3.; and

V.C.1.g. Final volume and composition (parameters of concern and underlying hazardous constituents) of the waste after blending and/or pH adjustment.

This Space Intentionally left blank

PERMIT - MODULE VI
MISCELLANEOUS
TREATMENT

MODULE VI - MISCELLANEOUS TREATMENT

VI.A. TREATMENT BY DISTILLATION, EVAPORATION, OR STEAM REFORMING

The Permittee may treat aqueous liquid waste in the following treatment units:

VI.A.1. Process Equipment Waste Evaporators (PEWE).

VI.A.1.a. The PEWE consists of two (2) similarly designed thermo-siphon evaporators and associated ancillary equipment.

VI.A.1.b. A complete description of the PEWE is found in Attachment 1 of this Permit and summarized in Exhibit D-1 Attachment 1 of this Permit.

VI.A.2. Liquid Effluent Treatment and Disposal Facility (LET&D).

VI.A.2.a. The LET&D consists of two (2) fractionation columns and associated ancillary equipment.

VI.A.2.b. A complete description of the LET&D is found in Attachment 1 of this Permit and summarized in Exhibit D-2 Attachment 1 of this Permit.

VI.A.3. Evaporator Tank System (ETS)

VI.A.3.a. The ETS consists of a thermo-siphon evaporator and associated ancillary equipment.

VI.A.3.b. A complete description of the ETS is found in Attachment 1 of this Permit and summarized in Exhibit D-3 Attachment 1 of this Permit.

VI.A.4. Integrated Waste Treatment Unit (IWTU)

VI.A.4.a. The IWTU consists of a two-stage steam reformer (Denitration Mineralization Reformer and the Carbon Reduction Reformer) and associated ancillary equipment.

VI.B. PERMITTED AND PROHIBITED WASTE

VI.B.1. The PEWE may process the waste described in Permit Condition IV.B., subject to the following supplemental conditions:

VI.B.1.a. Waste containing greater than or equal to 260 mg/l Hg may not be processed in the PEWE;

VI.B.1.b. Total organic carbon concentration in the feed shall be less than 800 parts per million;

VI.B.1.c. If the feed contains ≥ 50 ppm but ≤ 150 ppm chlorides, the following equation applies:
$[No_3]$ (in Molar) ≥ [Cl] (in ppm) x 0.006 + 0.1

This equation ensures that there are enough nitrates to passivate the stainless steel.

Waste containing greater than 150 ppm chlorides will not be processed in the PEWE.

VI.B.1.d. The feed shall contain a minimum of a 1:1 mole ratio of aluminum to fluoride; and

VI.B.1.e. Sulfate concentration shall be limited to less than, or equal to, 500 parts per million as fed.

VI.B.2. The LET&D may process only PEWE overhead condensate waste containing the waste codes identified in Permit Condition IV.B, subject to the following supplemental conditions:

VI.B.2.a. Waste containing greater than or equal to 260 mg per liter Hg may not be processed in the LET&D;

VI.B.2.b. Waste subject to regulation under IDAPA 58.01.05.008 [40 CFR Part 264 Subpart AA] may not be processed in the LET&D unless the requirements of Permit Condition II.M are satisfied; and

VI.B.2.c. The feed shall contain a minimum of a 1:1 mole ratio of aluminum to fluoride.

VI.B.3. The ETS may process the waste described in Permit Condition IV.B., subject to the following supplemental conditions;

VI.B.3.a. Waste containing greater than or equal to 3,000 ppm mercury will not be processed in the ETS;

VI.B.3.b. The feed shall contain a minimum of a 1:1 mole ratio of aluminum to fluoride, if fluoride is present in the feed;

VI.B.3.c. Maintain at least a 2:1 mole ratio of sodium to sulfate, as fed if the feed contains ≥ 500 ppm sulfate

VI.B.3.d. Waste containing greater than 5,000 ppm chloride in solution will not be processed in the ETS.

VI.B.4. The IWTU may process the waste described in Permit Condition IV.B., subject to the following supplemental conditions;

VI.B.4.a. Waste containing greater than or equal to 3,000 ppm mercury in solution will not be processed in the IWTU;

VI.B.4.b. Waste containing greater than 5,000 ppm chloride in solution will not be processed in the IWTU;

VI.B.4.c. Waste containing greater than 3,000 ppm fluoride in solution will not be processed in the IWTU

VI.C. OPERATING CONDITIONS

Permit conditions for PEWE, LET&D, ETS, and IWTU. If liquid is detected in the treatment unit sump the facility shall determine the following;

Source of the liquids. If the source cannot be determined or if the source is mixed waste, the affected treatment unit shall be shut down until the source of the liquid is determined and appropriate action is taken in accordance with Permit Condition IV.C.

VI.C.1. Operating conditions for each of the distillation columns associated with the PEWE System shall include, but not be limited to, the following:

VI.C.1.a. The waste feed limit to each distillation column shall not exceed 500 gallons per hour throughput. Total combined waste feed for both evaporators shall not exceed 12,000 gallons per each twenty-four (24) -hour period.

VI.C.1.b. Steam, fed to the reboiler, shall be discontinued in the event the operating temperature exceeds 108°C.

VI.C.1.c. Shutdown shall be initiated when the specific gravity of the liquids in the evaporator equals or exceeds 1.3.

VI.C.1.d. Shutdown shall be initiated if the condenser outlet temperature exceeds 50°C.

VI.C.1.e. Shutdown shall be initiated if negative atmospheric pressure cannot be maintained in the VOG system providing vacuum for the PEWE.

VI.C.1.f. Shutdown shall be initiated if the 604 VOG System or the INTEC Process APS is malfunctioning, or the differential pressure (DP) across any HEPA filter bank

exceeds five (5) inches of water or if the DP drops unexpectedly across any HEPA filter bank.

VI.C.2. Operating conditions for each of the fractionation columns associated with the LET&D shall include, but not be limited to, the following:

VI.C.2.a. The combined maximum operating throughput for the two (2) LET&D fractionation columns shall be 1,100 gallons per hour, or 550 gallon per hour per fractionation column;

VI.C.2.b. Process shutdown shall be initiated if the fractionator level drops below ten (10) inches water column;

VI.C.2.c. Process shutdown shall be initiated if the temperature on Tray #1 exceeds 130°C;

VI.C.2.d. Process shutdown shall be initiated if the fractionator level rises above 40 inches water column;

VI.C.2.e. Process shutdown shall be initiated if the separator level exceeds ten (10) inches water column; or

VI.C.2.f. Process shutdown shall be initiated if the differential pressure across the HEPA filter exceeds five (5) inches water column or suddenly decreases.

VI.C.3. Operating conditions for the distillation column associated with the ETS shall include, but not be limited to, the following;

VI.C.3.a. The waste feed limit to the distillation column shall not exceed 500 gallons per hour throughput as determined by tank depletion in VES-NCC-101. Total waste feed shall not exceed 12,000 gallons per each twenty-four (24) -hour period.

VI.C.3.b. Steam fed to the reboiler shall be discontinued in the event the operating temperature exceeds 117°C as read on T150-1C thru 10C.

VI.C.3.c. Shutdown shall be initiated before the specific gravity of the liquids in the evaporator equals or exceeds 1.4 as read on D150-1C.

VI.C.3.d. Start-up shall not begin or shutdown shall be initiated if T-351-1 is not operating within normal parameters.

VI.C.3.e. Shutdown shall be initiated if the condenser HE-NCC-351 outlet temperature exceeds 60° C as read on T-351-1.

VI.C.3.f. Shutdown shall be initiated if atmospheric pressure exceeds 18 in. water column in the ETS as read on P150-1C.

VI.C.4. Operating conditions for the IWTU shall include, but not be limited to, the following:

VI.C.4.a. Shutdown of the liquid waste feed will occur for the conditions identified in the following table. Liquid waste feed shall not be reinitiated until all conditions in the table are in a satisfactory state.

Table VI-1. IWTU Automatic Waste Feed Cutoff

DCS Instrument	Function	AWFCO Actuation
YS-C-401-11	Hydrogen deflagration protection	Tripped
YS-C-402-21	High temperature protection system	Tripped
YS-H-403-31	High CO detection system	Tripped
L-C-231-3	Seal water tank level	≤9 inches WC
FY-C-140-1	Total feed rate	≥2.5 gpm
VOL-C-131-2	Waste feed tank volume	≤200 gal
P-C-131-1A/B	Feed pump discharge pressure (one pressure instrument in use, one on standby)	≤20 PSIG
TC-C-140-9	DMR average bed temperature	≤580 C
TC-C-140-9	DMR average bed temperature	≥680 C
TDY-C-140-9	Temperature difference across DMR bed	≥50 C
P-C-140-1/7	DMR freeboard pressure (both)	≥10 PSIG (10 second delay)
AC-C-153-1	Hydrogen in DMR/PGF off-gas average	≤1.5% (rolling 10 minute average dry basis)
AC-C-153-1	Hydrogen in DMR/PGF off-gas average	≥15% (rolling 10 minute average dry basis)
FY-B-365-1	SSV	≤0.4 ft/sec (10 second delay)
FY-B-365-1	SSV	≥1.6 ft/sec (10 second delay)
P-B-365-11A	N2/steam pressure to fluidizing gas superheater	≥45 PSIG
T-B-365-17	DMR fluidizing gas temperature average	≤430 C
P-C-153-11	PGF rupture Disk pressure	≥12 PSIG
PD-C-153-1	Differential Pressure across the PGF	≥81 in. W.C. (10 second delay)
TC-C-160-4	CRR average bed temperature	≥1100 C
TC-C-160-4	CRR average bed temperature	≤850 C
TDY-C-160-4	Temperature difference across CRR bed	≥50 C
P-C-760-10/16	CRR Exit Gas Pressure (both)	≥0 (10 second delay)
AC-C-760-1	O2 concentration in the CRR off-gas outlet (AVG)	≥8 Vol% (average wet basis)
AC-C-760-1	O2 concentration in the CRR off-gas outlet (AVG)	≤1.0 Vol% (average wet basis)

DCS Instrument	Function	AWFCO Actuation
AC-C-760-1	O2 concentration in the CRR off-gas outlet (AVG)	≤1.0 Vol% (average wet basis)
PD-C-160-3	Differential Pressure across the OGF	≥81 in. W.C. (10 second delay)
T-C-160-1A/1B	Temperature after the off-gas cooler (either)	≥205 C
T-C-160-1A/1B	Temperature after the off-gas cooler (either)	≤130 C
PSH-H-160-13	OGC rupture disk pressure	Tripped
I-H-260-1A/B	Off-gas blowers current (both)	≤35 amps (after 10 second delay)
T-H-140-3A/B	Temperature at outlet of process HEPA/Inlet to GAC beds (Average)	≤105 C
T-H-140-3A/B	Temperature at outlet of process HEPA/Inlet to GAC beds (Average)	≥175 C
T-H-140-2	Temperature at inlet to process HEPA pre-filter inlet	≤130 C
PD-H-140-4A/B/C/D	Process HEPA pre-filter differential pressure (any)	≥8 inches WC
PSH-H-140-8	HEPA filter inlet rupture disk pressure	Tripped
PSH-H-140-9	HEPA filter inlet rupture disk	Tripped
T-H-141-7A/B	GAC outlet temperature (both)	≥200 C
P-H-141-7A	GAC bed A rupture disk pressure	≥0.5 PSIG
P-H-141-7B	GAC bed B rupture disk pressure	≥0.5 PSIG
I-H-240-10A/B	Process exhaust blowers current (both)	≤35 amps (after 10 second delay)
L-E-121-5	N2 Tank Level	≤25 inches
P-B-357-2A/2B	Loss of N2 (both)	≤80 PSIG
P-B-146-3A/3B	Loss of O2 (both)	≤75 PSIG
L-E-124-5	O2 Tank Level	≤30 inches
A-H-941-3A/B	CO concentration Hourly rolling ave 2 instruments	≥ 100 PPM
JS-B-120-1	PDC power loss	NA
P-B-166-2A/B	Loss of compressed air pressure (both)	≤70 PSIG
XSH023-1CXSH023-2C	Seismic event (both)	NA

VI.C.4.b. If the differential pressure of any Process HEPA filter element exceeds 5" water column or suddenly decreases, the affected HEPA bank must be isolated and filter element replacement initiated;

VI.C.4.c. If the differential pressure on any process HEPA pre-filter element exceeds 6.5 " water column or suddenly decreases unexpectedly, the affected HEPA bank must be isolated and the process HEPA pre-filter element replacement initiated;

VI.C.4.d. Pure oxygen may be injected into the CRR using the process gas distributor only during initial heat up or cool down and shall be disabled while adding waste feed to the DMR;

VI.C.4.e. Bleed in air for the process offgas blowers shall be disabled when waste feed is being processed.

VI.C.4.f. The solids in the Product Receiver Cooler shall be cooled to <204 °C before being transferred to a canister.

VI.C.4.g. There shall be no visible emissions, except water in an uncombined form from STK-SRE-140

VI.C.4.h. For the interim period between completion of the SPT and receipt of final approval from DEQ for full operation, the operating parameters will be those identified above or as modified during the shakedown and SPT (following the process in Appendix D-7 of this permit). However, during this interim period, the maximum feed rate will be 2.5 gallons per minute.

VI.C.4.i. Transfer of solids accumulated in the IWTU off gas filters will be as follows: Process Gas Filter shall be at least once every 24 hours, Off Gas Filter shall be at least once every 48 hours, Product Receiver Filter shall be at least once every 24 hours, and the Product Handling Vacuum Filter shall be at least once every 48 hours.

VI.C.4.j. The functionality of the AWFCO system will be tested prior to starting initial waste feed to the DMR. Results of the functionality test will be provided to the DEQ prior to the start of the SPT. To ensure modifications of the DCS software logic do not adversely affect the functionality of the AWFCOs, all DCS software logic modifications will be tested on the IWTU simulator prior to installing on the IWTU DCS.

VI.C.5. The following requirements apply to the ILWMS miscellaneous units containment sumps:

VI.C.5.a The liquid level in all tank sumps shall be monitored and recorded daily;

VI.C.5.b. The Permittee shall note in the Operating Record any rise in the sump level during waste management operations.

VI.C.5.c. If the liquid level in a sump exceeds the high/high setpoint or overflows the sump, the Permittee shall immediately comply with the requirements of IDAPA 58.01.05.008 [40 CFR § 264.196].

VI.D. INSPECTIONS

The Permittee shall conduct inspections of the PEWE, LET&D, ETS, and IWTU in accordance with the schedules found in Attachment 4 as amended by Permit Condition IV.E.

VI.D.1. Inspection of the temperature control equipment for the power supply cabinet for the superheater shall be added to the daily inspection for the IWTU.

VI.E. RECORD KEEPING AND REPORTING

VI.E.1. The Permittee shall document the following PEWE operations data in the Facility Operating Record:

VI.E.1.a. Volume of waste fed to the PEWE;

VI.E.1.b. Volume of PEWE bottoms waste and disposition;

VI.E.1.c. Volume of PEWE condensate waste and disposition;

VI.E.1.d. A calculation of material (steam) discharged per cycle from the PEWE System as a gas (i.e., Volume of discharge equals volume of input minus [volume of condensate plus volume of bottoms]);

VI.E.1.e. Waste analysis data, including underlying hazardous constituents, for each waste stream processed;

VI.E.1.f. Data demonstrating compliance with the operating requirements for the PEWE; and

VI.E.1.g. Waste feed shut downs including cause of shutdown, if unscheduled, and measures to prevent repeat shutdowns from the same cause/operating conditions.

VI.E.2. The Permittee shall document the following LET&D operations data in the Facility Operating Record:

VI.E.2.a. Volume of waste fed to the LET&D;

VI.E.2.b. Volume of nitric acids bottoms removed from the LET&D;

VI.E.2.c. Material balance determination of the volume of water vapor discharged to the INTEC Main stack as a result of processing PEWE condensate;

VI.E.2.d. Waste analysis data, including organic concentration and underlying hazardous constituents, for the condensate feed;

VI.E.2.e. Data demonstrating compliance with the operating requirements for the LET&D; and

VI.E.2.f. Waste feed shutdowns, including cause of shutdown if unscheduled, and measures to prevent repeat shutdowns from the same cause/operating conditions.

VI.E.3. The Permittee shall document the following ETS operations data in the Facility Operating Record:

VI.E.3.a. Volume of waste fed to the ETS;

VI.E.3.b. Volume of ETS bottoms waste and disposition;

VI.E.3.c. Volume of ETS condensate waste and disposition;

VI.E.3.d. Waste analysis data, including underlying hazardous constituents, for each waste stream;

VI.E.3.e. Data demonstrating compliance with the operating requirements for the ETS; and

VI.E.3.f. Unscheduled waste feed shutdowns, including cause of the unscheduled shutdown and measures to prevent repeat unscheduled shutdowns from the same cause/operating conditions.

VI.E.4 The Permittee shall document the following IWTU operations data in the Facility Operating Record:

VI.E.4.a. Volume of waste fed to the DMR;

VI.E.4.b. Volume of IWTU solids generated and disposition;

VI.E.4.c. Waste analysis data, including underlying hazardous constituents, for each waste stream;

VI.E.4.d. Data demonstrating compliance with the operating requirements for the IWTU; and

VI.E.4.e. Unscheduled waste feed shutdowns, including cause of the unscheduled shutdown and measures to prevent repeat unscheduled shutdowns from the same cause/operating conditions.

VI.E.5. Activation of an IWTU Automatic Waste Feed Cut Off (AWFCO)

VI.E.5.a. If the IWTU stops operations due to an AWFCO event, the Permittee must submit a quarterly report that includes the following information:

- Date, time and cause for an AWFCO;
- Corrective actions to preclude reoccurrence.

VI.E.5.b. If an IWTU AWFCO occurs more than two times in a 14 day period, the Permittee must provide verbal notification to the Director within 24 hours or as soon as possible during the next business day.

VI.F. START OF STEAM REFORMER OPERATIONS

VI.F.1. Prior to start of hazardous waste operations, DEQ must receive the certification of construction documents of Permit Condition I.R.

VI.F.2. Upon start of hazardous waste operations, consistent with IDAPA 58.01.05.008 and .012 [40 CFR § 264.601 and 40 CFR §270.62(a)], the Permittee may operate for up to 720 hours on waste feed to determine operational readiness prior to initiating the IWTU performance test described at Condition II.P.2 of this permit.

VI.F.3. The Permittee shall operate the IWTU consistent with the operational parameters set forth in Permit Condition VI.C.4. during this 720 hour period.

VI.F.4. This 720 hour start up period may be extended once for up to 720 additional hours, by the Director at the request of the applicant when good cause is shown.

VI.F.5. The Permittee shall maintain a running total of hours operated in the facility operating record to demonstrate compliance with the 720 operating hour limit.

VI.G. CLOSURE

The Permittee shall close the PEWE, LET&D, ETS Units, and IWTU in accordance with the approved Closure Plan, Attachments 8 and 8A of this Permit, as modified by Permit Condition II.K.

This Space Intentionally left blank

PERMIT - MODULE VII
WASTE PILES

MODULE VII – WASTE PILES

VII.A. PERMITTED WASTE PILE STORAGE AREAS

Subject to the terms of this Permit, the Permittee may store hazardous and mixed waste, as specified in Permit Condition VII.C. of this Permit, in the waste pile storage areas of the IWTU, Building CPP-1696, Rooms 112 and 113.

VII.B. DESIGN AND OPERATING REQUIREMENTS

The Permittee is exempt from the IDAPA 58.01.05.008 [40 CFR § 264.251] design requirements and IDAPA 58.01.05.008 [40 CFR § 264 Subpart F], in accordance with IDAPA 58.01.05.008 [40 CFR § 264.250(c)] and as shown in Attachment 1, Section D Process Description.

VII.C. PERMITTED AND PROHIBITED WASTES IN THE WASTE PILE STORAGE AREAS

VII.C.1 Waste pile units at IWTU

VII.C.1.a. Storage of hazardous and mixed waste generated within the Product Load-Out Cells (Rooms 112 and 113) is authorized.

VII.C.1.b. Storage of hazardous and mixed waste containing free liquids is prohibited.

VII.C.1.c. The permittee must meet the unit specific criteria in Attachment 2 of this Permit,

VII.C.1.d. The maximum permitted capacity for waste pile storage in the IWTU is 64 cubic yards with the maximum waste volume for each room set at 32 cubic yards.

VII.D. IGNITABLE OR REACTIVE WASTES

VII.D.1. The Permittee shall not place ignitable or reactive waste(s) in a waste pile.

VII.E. INCOMPATIBLE WASTES

VII.E.1. The Permittee shall not place incompatible waste(s) and materials that are incompatible in the same waste pile.

VII. F. INSPECTION SCHEDULES AND PROCEDURES

The Permittee shall inspect waste piles on a weekly basis to detect the presence of free liquids or the deterioration or malfunction of the run-on and run-off protection systems, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.254(b)] and the Inspection Schedules in Book 2, Attachment 4 of this Permit.

VII.G. RECORDKEEPING

The Permittee shall document the results of all inspections in accordance with Permit Conditions I.Z. and II.J. of this Permit.

VII.H. CLOSURE

The Permittee shall close the permitted waste pile storage areas in accordance with IDAPA 58.01.05.008 [40 CFR §264.258], Attachment 8, and Permit Condition II.K. of this Permit.

This Space Intentionally left blank

MODULE VIII - CORRECTIVE ACTION

The Corrective Action Requirements for INTEC are addressed in the Volume 18 Partial-Permit.

This Space Intentionally left Blank

ATTACHMENT 1 - PART A PERMIT

United States Environmental Protection Agency
RCRA SUBTITLE C SITE IDENTIFICATION FORM

1. Reason for Submittal (Select only one.)

❑	Obtaining or updating an EPA ID number for an on-going regulated activity that will continue for a period of time. (Includes HWM activity)
❑	Submitting as a component of the Hazardous Waste Report for _____ (Reporting Year)
	❑ Site was a TSD facility and/or generator of >1,000 kg of hazardous waste, >1 kg of acute hazardous waste, or >100 kg of acute hazardous waste spill cleanup in one or more months of the reporting year (or State equivalent LQG regulations)
❑	Notifying that regulated activity is no longer occuring at this Site
❑	Obtaining or updating an EPA ID number for conducting Electronic Manifest Broker activities
☑	Submitting a new or revised Part A Form **- Volume 14 Class 2 PMR - Approved: 11/27/2017**

2. Site EPA ID Number

ID4890008952

3. Site Name

IDAHO NATIONAL LABORATORY

4. Site Location Address

Street Address		
City, Town, or Village **SCOVILLE**	County **BUTTE, CLARK, JEFFERSON, BONNEVILLE, BINGHAM**	
State **ID**	Country **USA**	Zip Code **83415**

5. Site Mailing Address ❑ Same as Location Address

Street Address **1955 FREMONT AVENUE**		
City, Town, or Village **IDAHO FALLS**		
State **ID**	Country **USA**	Zip Code **83415**

6. Site Land Type

❑ Private ❑ County ❑ District ☑ Federal ❑ Tribal ❑ Municipal ❑ State ❑ Other

7. North American Industry Classification Systsem (NAICS) Code(s) for the Site (at least 5-digit codes)

A. (Primary) **92411**	B. **54171**
C. **336992**	D.

8. Site Contact Information ❑ Same as Location Address

First Name **TERESA**	MI **L**	Last Name **PERKINS**
Title **DIRECTOR, ENVIRONMENT & SUSTAINABILITY DIVISION**		
Street Address **1955 FREMONT AVENUE**		
City, Town, or Village **IDAHO FALLS**		
State **ID**	Country **USA**	Zip Code **83415**
Email **PERKINTL@ID.DOE.GOV**		
Phone **(208) 526-1483**	Ext **NOT APPLICABLE**	Fax **(208) 526-1926**

9. Legal Owner and Operator of the Site

A. Name of Site's Legal Owner ❑ Same as Location Address

Full Name **US DEPARTMENT OF ENERGY IDAHO OPERATIONS OFFICE**		Date Became Owner (mm/dd/yyyy) **01/01/1952**
Owner Type ❑ Private ❑ County ❑ District ☑ Federal ❑ Tribal ❑ Municipal ❑ State ❑ Other		
Street Address **1955 FREMONT AVENUE**		
City, Town, or Village **IDAHO FALLS**		
State **ID**	Country **USA**	Zip Code **83415**
Email **PERKINTL@ID.DOE.GOV**		
Phone **(208) 526-1483**	Ext **NOT APPLICABLE**	Fax **(208) 526-1926**
Comments		

B. Full Name of Site's Legal Operator ❑ Same as Location Address

Full Name **FLUOR IDAHO, LLC**		Date Became Operator (mm/dd/yyyy) **06/01/2016**
Operator Type ☑ Private ❑ County ❑ District ❑ Federal ❑ Tribal ❑ Municipal ❑ State ❑ Other		
Street Address **1580 SAWTELLE STREET**		
City, Town, or Village **IDAHO FALLS**		
State **ID**	Country **USA**	Zip Code **83415**
Email **Fred.Hughes@icp.doe.gov**		
Phone **(208) 533-0525**	Ext **NOT APPLICABLE**	Fax **(208) 533-0202**
Comments		

10. Type of Regulated Waste Activity (at your site)

Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities

Y☑ N❑	1. Generator of Hazardous Waste - If "Yes", mark only one of the following - a, b, c	
☑	a. LQG	*Generates, in any calendar month (includes quantities imported by importer site 1,000 kg/mo 2,200 lbs/mo) or more of hazardous waste; or * Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or * Generates, in any calendar motnth or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material.
❑	b. SQG	100 to 1,000 kg/mo (220-2,200 lb/mo) of non-acute hazardous waste and no more than 1 kg (2.2 lb) of acute hazardous waste and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material.
❑	c. VSQG	Less than or equal to 100 kg/mo (220 lb/mo) of non-acute hazardous waste.
If "Yes" above, indicate other generator activities in 2 and 3, as applicable.		
Y ❑ N ☑	2. Short-Term Generator (generate from a short term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section.	
Y ☑ N ❑	3. Mixed Waste (hazardous and radioactive) Generator	
Y ☑ N ❑	4. Treater, Storer, or Disposer of Hazardous Waste - Note: A hazardous waste Part B permit is required for these activities	
Y ☑ N ❑	5. Receives Hazardous Waste from Off-site	
Y ❑ N ☑	6. Recycler of Hazardous Waste	
	❑	a. Recycler who stores prior to recycling
	❑	b. Recycler who does not store prior to recycling
Y ❑ N ☑	7. Exempt Boiler and/or Industrial Furnace - If "Yes", mark all that apply.	
	❑	a. Small Quantity On-Site Burner Exemption
	❑	b. Smelting, Melting, and Refining Furnace Exemption

B. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g. D001, D003, F007, U112). Use an additional page if more spaces are needed.

See Item 18. Comments (page 6 of 6 and see Attached Form OMB# 2050-0024, Item 7. Description of Hazardous Wastes, additional pages.

C. Waste Codes for State Regulated (non-Federal) Hazardous Wastes. Please list the waste codes of the State hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

See Item 18. Comments (page 6 of 6).

11. Additional Regulated Waste Activities (NOTE: Refer to your State regulations to determine if a separate permit is required.)

A. Other Waste Activities

Y ☑ N ☐	1. Transporter of Hazardous Waste - If "Yes", mark all that apply.
☑	a. Transporter
☐	b. Transfer Facility (at your site)
Y ☐ N ☑	2. Underground Injection Control
Y ☐ N ☑	3. United States Importer of Hazardous Waste
Y ☐ N ☑	4. Recognized Trader - If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter
Y ☐ N ☑	5. Importer/Exporter of Spent Lead-Acid Batteries (SLAB) under 40 CFR 266 Subpart G - If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter

B. Universal Waste Activities

Y ☑ N ☐	1. Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more) - If "Yes", mark all that apply. Note: Refer to your State regulations to determine what is regulated.
☑	a. Batteries
☑	b. Pesticides
☑	c. Mercury containing equipment
☑	d. Lamps
☐	e. Other (specify) _____
☐	f. Other (specify) _____
☐	g. Other (specify) _____
Y ☐ N ☑	2. Destination Facility for Universal Waste Note: A hazardous waste permit may be required for this activity.

C. Used Oil Activities

Y ☐ N ☑	1. Used Oil Transporter - If "Yes", mark all that apply.
☐	a. Transporter
☐	b. Transfer Facility (at your site)
Y ☐ N ☑	2. Used Oil Processor and/or Re-refiner - If "Yes", mark all that apply.
☐	a. Processor
☐	b. Re-refiner
Y ☐ N ☑	3. Off-Specification Used Oil Burner
Y ☐ N ☑	4. Used Oil Fuel Marketer - If "Yes", mark all that apply.
☐	a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner
☐	b. Marketer Who First Clalims the Used Oil Meets the Specifications

12. Eligible Academic Entities with Laboratories - Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR 262 Subpart K.

Y ❑ N ☑	A. Opting into or currently operating under 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories - If "Yes", mark all that apply. Note: See the item-by-item instruction for definitions of types of eligble academic entities.
❑	1. College or University
❑	2. Teaching Hospital that is owned by or has a formal written affiliation with a college or university
❑	3. Non-profit institute that is owned by or has a formal written affiliation with a college or university
Y ❑ N ❑	B. Withdrawing from 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories.

13. Episodic Generation

Y ❑ N ☑	Are you an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves you to a higher generator category. If "Yes", you must fill out the Addendum for Episodic Generator.

14. LQG Consolidation of VSQG Hazardous Waste

Y ❑ N ☑	Are you an LQG notifying of consolidating VSQG Hazardous Waste Under the Control of the Same Person pursuant to 40 CFR 262.17(f)? If "Yes", you must fill out the Addendum for LQG Consolidation of VSQGs hazardous waste.

15. Notification of LQG Site Closure for a Central Accumulation Area (CAA) (optional) OR Entire Facility (required)

Y ❑ N ☑	LGQ Site Closure of a Central Accumulation Area (CAA) or Entire Facility
A.❑	Central Accumulation Area (CAA) ❑ Entire Facility
B.	Expected closure date: _____ mm/dd/yyyy
C.	Requesting new closure date: _____ mm/dd/yyyy
D.	Date Closed: _____ mm/dd/yyyy
	❑ 1. In compliance with the closure performance standards 40 CFR 262.17(a)(8) ❑ 2. Not in compliance with the closure performance standards 40 CFR 262.17(a)(8)

16. Notification of Hazardous Secondary Material (HSM) Activity

Y ❑ N ☑	A. Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 260.30, 40 CFR 261.4(a)(23), (24), OR (27)? If "Yes", you must fill out the Addendum to the Site Identification Form for Managing Hazardous Secondary Material.
Y ❑ N ☑	B. Are you notifying under 40 CFR 260.43(a)(4)(iii) that the product of your recycling process has levels of hazardous constituents that are not comparable to or unaboe to be compared to a legitimate product or intermediate but that the recycling is still legitimate? If "Yes", you may orivude explanation in Comments section. You must also document that your recycling is still legitimate and maintain that documentation on site.

17. Electronic Manifest Broker

Y ❑ N ☑	Are you notifying as a person, as defined in 40 CFR 260.10, electing to use the EPA electronic manifest system to obtain, complete, and transmit an electronic manifest under a contractual relationship with a hazardous waste generator?

12. Notification of Hazardous Secondary Material (HSM) Activity

Y☐ N ☒ Are you notifying under 40 CFR 260.42 that you will begin managing, are managing or will stop managing hazardous secondary material under 40 CFR 261.2(a)(2)(ii), 40 CFR 261.4(a)(23), (24), or (25)?

If "Yes", you must fill out the Addendum to the Site Identification Form: Notification for Managing Hazardous Secondary Material.

13. Comments

Volume 14 Part A

14. Certification. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations. For the RCRA Hazardous Waste Part A Permit Application, all owner(s) and operator(s) must sign (se 40 CFR 270.10(b) and 270.11).

Signature of legal owner, operator, or an authorized representative	Name and Official Title (type or print)	Date Signed (mm/dd/yyyy)
Frederick P. Hughes	F. P. Hughes, Program Manager, Fluor Idaho, LLC.	08/10/2017
	R. B. Provencher, Manager, Department of Energy Idaho Operations Office	8/31/2017

United States Environmental Protection Agency
HAZARDOUS WASTE PERMIT PART A FORM

1. Facility Permit Contact

First Name **TERESA**	MI **L**	Last Name **PERKINS**
Title **DIRECTOR, ENVIRONMENT & SUSTAINABILITY DIVISION**		
Email **PERKINSTL@ID.DOE.GOV**		
Phone **(208) 526-1483**	Ext **NOT APPLICABLE**	Fax **(208) 526-1926**

2. Facility Permit Contact Mailing Address

Street Address **1955 FREMONT DRIVE**		
City, Town, or Village **IDAHO FALLS**		
State **ID**	Country **USA**	Zip Code **83415**

3. Facility Existence Date (mm/dd/yyyy)

01/01/1949

4. Other Environmental Permits

A. Permit Type	B. Permit Number													C. Description
R	I	D	4	8	9	0	0	0	8	9	5	2		Final HWMA Storage & Treatment Permit for the INTEC on the INL (Volume 14)
R	I	D	4	8	9	0	0	0	8	9	5	2		Final HWMA Storage & Treatment Permit for the INTEC and RWMC on the INL (Volume
R	I	D	4	8	9	0	0	0	8	9	5	2		HWMA/RCRA Part B Permit Application for the INL (Volume 3)
R	I	D	4	8	9	0	0	0	8	9	5	2		HWMA/RCRA Post-Closure Permit for the INTE on the INL - Waste Calcine Facility and CPP-601/627/640 (Volume 21)
R	I	D	4	8	9	0	0	0	8	9	5	2		HWMA/RCRA Storage Permit for the CSSF at the INTEC on the INL (Volume 22)
R	I	D	4	8	9	0	0	0	8	9	5	2		HWMA/RCRA Part A Permit Application for the INL (Volume 1)
R, P, E, U														See Additional Information Supplement to Item 4 - Other Environmental Permits List (page 1a of 2).

5. Nature of Business

The Idaho National Laboratory was established in 1949, as a center where nuclear power reactors and support facilities could be built, tested, and operated. The INL site covers approximately 890 square miles and is 25 miles west of Idaho Falls, ID. For many years the INL was the site of the largest nuclear power research & development effort in the world. During the 1970's the INL's mission broadeded to include such areas a biotechnology, energy and materials research, and conservation and renewable energy. At the end of the Cold War, waste treatment and cleanup of previously contaminated sites became a priority. Today the INL is a science-based, applied engineering national laboratory dedicated to completing its waste cleanup mission and meeting the nation's environmental, energy, nuclear science and technology, and national security needs. Additionally, in 2002, it was announced that the INL will serve as the nation's leading nuclear technology center.

Supplement to Item 4. Other Environmental Permits List

RCRA PERMITS

State of Idaho Hazardous Waste Permit

(Permit Type R)

- Final HWMA Storage & Treatment Permit for the INTEC on the INL (Volume 14)
- Final HWMA Storage & Treatment Permit for the INTEC and RWMC on the INL (Volume 18)
- HWMA/RCRA Part B Permit Application for the INL (Volume 3)
- HWMA/RCRA Post-Closure Permit for the INTEC on the INL - Waste Calcine Facility and CPP-601/627/640 (Volume 21)
- HWMA/RCRA Storage Permit for the CSSF at the INTEC on the INL (Volume 22)
- HWMA/RCRA Part A Permit Application for the INL (Volume 1)

Idaho Nuclear Technology and Engineering Center (INTEC)

PTC (Permit Number PTC-023-00001)

- New Waste Calcining Facility/Decontamination Area, CPP-659

PTC (Permit Number P.2012.0053)

- CPP-606 Distillate Oil-Fired Boilers

PTC (Permit Number P-2008.0199)

- Integrated Waste Treatment Unit at the INL - Idaho Nuclear Technology and Engineering Center

PTC (Permit Number P-2013.0023)

- Sodium Distillation System

PTC (Permit Number P-2013.0124)

- INTEC Radiological Sources

WATER PERMITS

State of Idaho Monitoring Well Permit (IDWR)

(Permit Type U)

INL monitoring well permit applications are sent annually to the IDWR for wells (greater than 18 feet deep) to be constructed in the current calendar year. Permits are authorized by agreement between the DOE-ID and the IDWR.

State of Idaho Wastewater Land Application Permits (WLAP)

(Permit Type E)

- INTEC Service Waste System and Sewage Treatment Plant - Permit Number LA-000130-04

Ground Water Rights

(Permit Type E)

INL operations use water guaranteed by both a Federal Reserved Water Right and a water rights agreement with the State of Idaho

6. Process Codes and Design Capacities

Line Number	A. Process Code			B. PROCESS DESIGN CAPACITY		C. Process Total Number of Units	D. Unit Name
				(1) Amount	(2) Unit of Measure		
1	S	0	1	179,070.00	G	001	See page 2a. Supplement to Item 6. Proces Codes and Design Capacities
2	S	0	2	211,577.00	G	027	
3	T	0	1	227,480.00	U	013	
4	S	0	3	64.00	Y	002	
5	X	9	9	1,100.00	E	001	
6	X	9	9	1,500.00	E	002	
7	X	9	9	210.00	E	001	

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line Number	A. EPA Hazardous Waste No.	B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes	
				(1) Process Codes	(2) Process Description (if code is not entered in 7.D(1))
See Item 7 in Comments Section (Item 11) Below					

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See Instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

ITEM 6. See page 2a. Supplement to Item 6. Proces Codes and Design Capacities
ITEM 7. See Supplemental Pages to Item 7. Description of Hazardous Wastes, Pages 2(A) of 2 through 2(W) of 2 of this Part A Permit
ITEM 8. See Attachment I - Section B Facility Description of thie Part B Permit
ITEM 9. See Page 2(Z) of 2 of this Part A Permit and Appendices I, II, and VII of this Part B Permit
ITEM 10. See Pages 2(X-TOC-1) of 2 through 2(X-17) of 2 of this Part A Permit
ITEM 11. See Page 2(Y) of 2 for Additional Information - Hazardous Waste Debris Categories

SUPPLEMENT TO ITEM 6.
PROCESS CODES AND DESIGN CAPACITIES

LINE NUMBER	PROCESS TYPE - UNIT NAME		PROCESS DESIGN CAPACITY
1	**S01 - CONTAINER STORAGE includes:**		
	• Vault Storage Area		175,000 gallons
	• Vault Staging Area		4,070 gallons
		Line 1 Total:	**680 cubic meters or 179,070 gallons**
2	**S02 - TANK STORAGE INCLUDES:**		
	CPP-604 Evaporator Feed Sediment Tank:		4,700 gallons
	• VES-WL-132 @ 4,700 gallons		
	CPP-604 Evaporator Feed Collection Tank:		19,000 gallons
	• VES-WL-133 @ 19,000 gallons		
	CPP-604 Surge Tank for VES-WL-133		18,400 gallons
	• VES-WL-102 @ 18,400 gallons		
	CPP-604 Evaporator Head Tank:		270 gallons
	• VES-WL-109 @ 270 gallons		
	CPP-604 Evaporator Units:		2,000 gallons
	• VES-WL-129 @ 1,000 gallons		
	• VES-WL-161 @ 1,000 gallons		
	CPP-604 Process Condensate Surge Tanks:		566 gallons
	• VES-WL-134 @ 500 gallons		
	• VES-WL-131 @ 66 gallons		
	CPP-604 Off-gas Condensate Knock Out Tank:		98 gallons
	• VES-WL-108 @ 98 gallons		
	CPP-604 Bottoms Collection Tanks:		19,900 gallons
	• VES-WL-111 @ 1,500 gallons		
	• VES-WL-101 @ 18,400 gallons		
	CPP-604 Tank Farm Tanks:		55,200 gallons
	• VES-WM-100 @ 18,400 gallons		
	• VES-WM-101 @ 18,400 gallons		
	• VES-WM-102 @ 18,400 gallons		
	CPP-604 Process Waste Liquid (PWL) System Tanks:		165 gallons
	• VES-WL-135 @ 10 gallons		
	• VES-WL-136 @ 10 gallons		
	• VES-WL-137 @ 25 gallons		
	• VES-WL-138 @ 25 gallons		
	• VES-WL-139 @ 10 gallons		
	• VES-WL-142 @ 10 gallons		
	• VES-WL-144 @ 25 gallons		
	• VES-WL-150 @ 50 gallons		

SUPPLEMENT TO ITEM 6.
PROCESS CODES AND DESIGN CAPACITIES

LINE NUMBER	PROCESS TYPE - UNIT NAME		PROCESS DESIGN CAPACITY
2	**S02 - TANK STORAGE INCLUDES: (continued)**		
	CPP-604 Process Condensate Collection Tanks:		15,000 gallons
	• VES-WL-106 @ 5,000 gallons		
	• VES-WL-107 @ 5,000 gallons		
	• VES-WL-163 @ 5,000 gallons		
	Acid Fractionator Waste Feed Head Tank:		270 gallons
	• VES-WLK-197 @ 270 gallons		
	Acid Fractionator:		920 gallons
	• VES-WLL-170 @ 460 gallons		
	• VES-WLK-171 @ 460 gallons		
	Acid Fractionator Bottoms Tank:		270 gallons
	• VES-WLL-195 @ 270 gallons		
	LET&D Nitric Acid Recycle Tank System:		22,590 gallons
	• VES-NCR-171 @ 22,500 gallons		
	• VEC-NCR-173 @ 90 gallons		
	CPP-659 Blend/Hold Tanks:		13,870 gallons
	• VES-NCC-101 @ 5,870 gallons		
	• VES-NCC-102 @ 4,000 gallons		
	• VES-NCC-103 @ 4,000 gallons		
	CPP-659 Fluoride Hot Sump Tank:		6,500 gallons
	• VES-NCC-119 @ 6,500 gallons		
	CPP-659 Non-Fluoride Hot Sump Tank:		4,300 gallons
	• VES-NCC-122 @ 4,300 gallons		
	CPP-659 Evaporator Unit:		2,600 gallons
	• EVAP-NCC-150 (includes: VES-NCC-150, HE-NCC-350, HE-NCC-351) @ 2,600 gallons		
	CPP-659 Process Off-gas Condensate System:		2,560 gallons
	• VES-NCC-108 @ 2,000 gallons		
	• VES-NCC-116 @ 500 gallons		
	• VES-NCC-136 @ 60 gallons		
	CPP-659 Constant Head Feed Tank:		200 gallons
	• VES-NCC-152 @ 200 gallons		

SUPPLEMENT TO ITEM 6.
PROCESS CODES AND DESIGN CAPACITIES

LINE NUMBER	PROCESS TYPE - UNIT NAME		PROCESS DESIGN CAPACITY
2	**S02 - TANK STORAGE INCLUDES: (continued)**		
	CPP-1696 Waste Feed Tank		2,170 gallons
	• VES-SRC-131 @ 2,170 gallons		
	CPP-1696 Sump Tank		3,390 gallons
	• VES-SRC-133 @ 3,390 gallons		
	CPP-1696 Clarifier Tank		494 gallons
	• VES-SRC-134 @ 494 gallons		
	CPP-1696 Product Receiver/Cooler Tanks		1,024 gallons
	• VES-SRC-190 @ 512 gallons		
	• VES-SRC-191 @ 512 gallons		
	CPP-1696 Firewater Collection Tank:		15,000 gallons
	• TK-SRE-196 @ 15,000 gallons		
	CPP-1696 Offgas Condensate Collection Tank:		120 gallons
	• TK-SRH-141 @ 120 gallons		
		Line 2 Total:	**211,577 gallons**
3	**T01- TANK TREATMENT INCLUDES:**		
	CPP-604 Evaporator Feed Sediment Tank:		28,000 gallons/day
	• VES-WL-132 @ 28,000 gallons/day		
	CPP-604 Evaporator Feed Collection Tank:		28,000 gallons/day
	• VES-WL-133 @ 28,000 gallons/day		
	CPP-604 Surge Tank for VES-WL-133		18,400 gallons/day
	• VES-WL-102 @ 18,400 gallons/day		
	CPP-604 Bottoms Collection Tanks:		19,000 gallons/day
	• VES-WL-111 @ 3,000 gallons/day		
	• VES-WL-101 @ 16,000 gallons/day		
	CPP-604 Tank Farm Tanks:		55,200 gallons/day
	• VES-WM-100 @ 18,400 gallons/day		
	• VES-WM-101 @ 18,400 gallons/day		
	• VES-WM-102 @ 18,400 gallons/day		
	CPP-604 Process Condensate Collection Tanks:		15,000 gallons/day
	• VES-WL-106 @ 5,000 gallons/day		
	• VES-WL-107 @ 5,000 gallons/day		
	• VES-WL-163 @ 5,000 gallons/day		
	CPP-659 Blend/Hold Tanks		27,740 gallons/day
	• VES-NCC-101 @ 11,740 gallons/day		
	• VES-NCC-102 @ 8,000 gallons/day		
	• VES-NCC-103 @ 8,000 gallons/day		
	CPP-659 Fluoride Hot Sump Tank		6,500 gallons/day
	• VES-NCC-119 @ 6,500 gallons/day		

SUPPLEMENT TO ITEM 6.
PROCESS CODES AND DESIGN CAPACITIES

LINE NUMBER	PROCESS TYPE - UNIT NAME		PROCESS DESIGN CAPACITY
3	**T01 - TANK TREATMENT INCLUDES: (continued)**		
	CPP-659 Non-Fluoride Hot Sump Tank: • VES-NCC-122 @ 8,600 gallons/day		8,600 gallons/day
	CPP-659 Process Off-gas Condensate System: • VES-NCC-108 @ 4,000 gallons/day		4,000 gallons/day
	IWTU Waste Feed Tank: • VES-SRC-131 @ 5,040 gallons/day		5,040 gallons/day
	CPP-1696 Sump Tank • VES-SRC-133 @ 6,000 gallons/day		6,000 gallons/day
	CPP-1696 Clarifier Tank • VES-SRC-134 @ 6,000 gallons/day		6,000 gallons/day
		Line 3 Total:	**227,480 gallons**
4	**S03 - WASTE PILE STORAGE INCLUDES:**		
	CPP-1696 IWTU Product Load-Out Cells • **Room 112 @ 32 cubic yards** • **Room 113 @ 32 cubic yards**		64 cubic yards
		Line 4 Total:	**64 cubic yards**
5	**X99 - OTHER SUBPART X TREATMENT - FRACTIONATION INCLUDES:**		
	CPP-1618 LET&D Fractionators: • FRAC-WLL-170 @ 550 gallons/hour • FRAC-WLK-171 @ 550 gallons/hour		1,100 gallons/hour
		Line 5 Total:	**1,100 gallons/hour**
6	**X99 - OTHER SUBPART X TREATMENT - EVAPORATION INCLUDES:**		
	CPP-604 PEW Evaporators: • EVAP-WL-129 @ 500 gallons/hour • EVAP-WL-161 @ 500 gallons/hour		1,000 gallons/hour
	CPP-659 Evaporator Unit: • VES-NCC-150 (includes: VES-NCC-150, HE-NCC-350, HE-NCC-351) @ 500 gallons/hour		500 gallons/hour
		Line 6 Total:	**1,500 gallons/hour**
7	**X99 - OTHER SUBPART X TREATMENT - STEAM REFORMING INCLUDES:**		
	CPP-1696 Steam Reforming System: • SRC-140 Denitration/Demineralization Reformer and VES-SRC-160 Carbon Reduction Reformer) @ 210 gallons/hour		210 gallons/hour
		Line 7 Total:	**210 gallons/hour**

ITEM 7. DESCRIPTION OF HAZARDOUS WASTE
TABLE OF CONTENTS

TSD UNIT	Page Number
CPP-604 Evaporator Feed Sediment Tank (VES-WL-132)	Page 2(A) of 6
CPP-604 Evaporator Feed Collection Tank (VES-WL-133)	Page 2(B) of 6
CPP-604 Surge Tank for VEW-WL-133 (VES-WL-102)	Page 2(C) of 6
CPP-604 Evaporator Head Tank (VES-WL-109)	Page 2(D) of 6
CPP-604 Evaporator Units (EVAP-WL-129, EVAP-WL-161)	Page 2(E) of 6
CPP-604 Process Condensate Surge Tanks (VES-WL-134, VES-WL-131)	Page 2(F) of 6
CPP-604 Process Off-gas Condensate Knock Out Tank (VES-WL-108)	Page 2(G) of 6
CPP-604 Bottoms Collection Tanks (VES-WL-111, VES-WL-101)	Page 2(H) of 6
CPP-604 Tank Farm Tanks (VES-WM-100, VES-WM-101, VES-WM-102)	Page 2(I) of 6
CPP-604 Process Waste Liquid System Tanks (VES-WL-135, VES-WL-136, VES-WL-137, VES-WL-138, VES-WL-139, VES-WL-142, VES-WL-144, VES-WL-150)	Page 2(J) of 6
CPP-604 Process Condensate Collection Tanks (VES-WL-106, VES-WL-107, VES-WL-163)	Page 2(K) of 6
CPP-1618 Acid Fractionator Waste Feed Head Tank (VES-WL-197)	Page 2(L) of 6
CPP-1618 Acid Fractionators (VES-WLL-170, VES-WLK-171)	Page 2(M) of 6
CPP-1618 Acid Fractionator Bottoms Tank (VES-WLL-195)	Page 2(N) of 6
CPP-1618 LET&D Nitric Acid Recycle Tank (VES-NCR-171, VES-NCR-173)	Page 2(O) of 6
CPP-659 Blend/Hold Tanks (VES-NCC-101, VES-NCC-102, VES-NCC-103)	Page 2(P) of 6
CPP-659 Fluoride Hot Sump Tank (VES-NCC-119)	Page 2(Q) of 6
CPP-659 Non-Fluoride Hot Sump Tank (VES-NCC-122)	Page 2(R) of 6
CPP-659 Evaporator Unit (EVAP-NCC-150)	Page 2(S) of 6
CPP-659 Process Off-gas Condensate Tank (VES-NCC-108)	Page 2(T) of 6
CPP-659 Process Off-gas Condensate Tanks (VES-NCC-116, VES-NCC-136)	Page 2(U) of 6
CPP-659 Constant Head Feed Tank (VES-NCC-152)	Page 2(V) of 6
CPP-1696 Integrated Waste Treatment Unit (IWTU)	Page 2(W) of 6

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,600	T	S	0	2	T	0	1				CPP-604 Evaporator Feed Sediment Tank (VES-WL-132)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,600	T	S	0	2	T	0	1				CPP-604 Evaporator Feed Collection Tank (VES-WL-133)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	16,600	T	S	0	2	T	0	1				CPP-604 Surge Tank for VES-WL-133 (VES-WL-102)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,600	T	S	0	2							CPP-604 Evaporator Head Tank (VES-WL-109)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES (1) PROCESS CODES									D. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,600	T	S	0	2	X	9	9				CPP-604 PEW Evaporators (EVAP-WL-129, EVAP-WL-161)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,600	T	S	0	2							CPP-604 Process Condensate Surge Tanks (VES-WL-134, VES-WL-131)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,500	T	S	0	2							CPP-604 Process Off-gas Condensate Knock Out Tank (VES-WL-108)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	270	T	S	0	2	T	0	1				CPP-604 Bottoms Collection Tanks (VES-WL-111, VES-WL-101)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,600	T	S	0	2	T	0	1				CPP-604 Tank Farm Tanks (VES-WM-100, VES-WM-101, VES-WM-102)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	8	T	S	0	2							CPP-604 Process Waste Liquid System Tanks (VES-WL-135, VES-WL-136, VES-WL-137, VES-WL-138, VES-WL-139, VES-WL-142, VES-WL-144, VES-WL-150)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,500	T	S	0	2	T	0	1				CPP-604 Process Condensate Collection Tanks (VES-WL-106, VES-WL-107, VES-WL-163)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,500	T	S	0	2							CPP-1618 Acid Fractionator Waste Feed Head Tank (VES-WL-197)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,500	T	S	0	2	X	9	9				CPP-1618 Acid Fractionators (VES-WLL-170, VES-WLK-171)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	13,600	T	S	0	2							CPP-1618 Acid Fractionator Bottoms Tank (VES-WLL-195)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	270	T	S	0	2							CPP-1618 LET&D Nitric Acid Recycle Tank System (VES-NCR-171, VES-NCR-173)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	54,800	T	S	0	2	T	0	1				CPP-659 Blend/Hold Tanks (VES-NCC-101, VES-NCC-102, VES-NCC-103)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES (1) PROCESS CODES									D. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	12,800	T	S	0	2	T	0	1				CPP-659 Fluoride Hot Sump Tank (VES-NCC-119)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	15,800	T	S	0	2	T	0	1				CPP-659 Non-Fluoride Hot Sump Tank (VES-NCC-122)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	19,750	T	S	0	2	X	9	9				CPP-659 Evaporator (EVAP-NCC-150 includes: VES-NCC-150, HE-NCC-150, HE-NCC-351)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES (1) PROCESS CODES									D. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	7,900	T	S	0	2	T	0	1				CPP-659 Process Off-gas Condensate Tank (VES-NCC-108)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	7,900	T	S	0	2							CPP-659 Process Off-gas Condensate Tanks (VES-NCC-116, VES-NCC-136)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	19,750	T	S	0	2							CPP-659 Constant Head Feed Tank (VES-NCC-152)
	2	D	0	0	2												INCLUDED WITH ABOVE
	3	D	0	0	4												INCLUDED WITH ABOVE
	4	D	0	0	5												INCLUDED WITH ABOVE
	5	D	0	0	6												INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

ITEM 7. DESCRIPTION OF HAZARDOUS WASTES (ENTER CODES FOR ITEMS 7.A, 7.C AND 7 D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. PROCESSES									
								(1) PROCESS CODES									(2) PROCESS DESCRIPTION (If a code is not entered in 7.D(1))
	1	D	0	0	1	925	T	S	0	1							CPP-1696 Integrated Waste Treatment Unit
	2	D	0	0	2	5,400	T	S	0	2							INCLUDED WITH ABOVE
	3	D	0	0	4	5,400	T	T	0	1							INCLUDED WITH ABOVE
	4	D	0	0	5	5,400	T	X	9	9							INCLUDED WITH ABOVE
	5	D	0	0	6	20	T	S	0	3							INCLUDED WITH ABOVE
	6	D	0	0	7												INCLUDED WITH ABOVE
	7	D	0	0	8												INCLUDED WITH ABOVE
	8	D	0	0	9												INCLUDED WITH ABOVE
	9	D	0	1	0												INCLUDED WITH ABOVE
1	0	D	0	1	1												INCLUDED WITH ABOVE
1	1	D	0	1	8												INCLUDED WITH ABOVE
1	2	D	0	1	9												INCLUDED WITH ABOVE
1	3	D	0	2	1												INCLUDED WITH ABOVE
1	4	D	0	2	2												INCLUDED WITH ABOVE
1	5	D	0	2	6												INCLUDED WITH ABOVE
1	6	D	0	2	8												INCLUDED WITH ABOVE
1	7	D	0	3	2												INCLUDED WITH ABOVE
1	8	D	0	3	4												INCLUDED WITH ABOVE
1	9	D	0	3	5												INCLUDED WITH ABOVE
2	0	D	0	3	6												INCLUDED WITH ABOVE
2	1	D	0	3	8												INCLUDED WITH ABOVE
2	2	D	0	3	9												INCLUDED WITH ABOVE
2	3	D	0	4	0												INCLUDED WITH ABOVE
2	4	F	0	0	1												INCLUDED WITH ABOVE
2	5	F	0	0	2												INCLUDED WITH ABOVE
2	6	F	0	0	3												INCLUDED WITH ABOVE
2	7	F	0	0	5												INCLUDED WITH ABOVE
2	8	U	1	3	4												INCLUDED WITH ABOVE
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

Item 10. Facility Photographs for the Idaho Nuclear Technology and Engineering Center (INTEC)

Photo Number	Photo Description – Unit Process Code(s)	Date of Photo	Page Number
565	Looking North at Building CPP-604/605, Location of Process Equipment Waste Evaporator (PEWE) System Units - S02, T01, X99	6/99	2(X-1) of 2
ODP-31455	CPP-604 Process Condensate Collection Tanks, VES-WL-106, VES-WL-107, and VES-WL-163 – S02, T01	1985	2(X-2) of 2
ODP-32077	CPP-604 Evaporator Feed Sediment Tank, VES-WL-132 – S02, T01	1964	2(X-3) of 2
ODP-32073	CPP-604 Evaporator Feed Collection Tank, VES-WL-133 – S02, T01	1964	2(X-4) of 2
ODP-32074	CPP-604 Evaporator Feed Collection Tank, VES-WL-133 – S02, T01	1964	2(X-5) of 2
No photo number available (N/A)	Looking down at CPP-604 Bottoms Collection Tank, VES-WL-111 – S02, T01	NA	2(X-6) of 2
ODP-3130	CPP-604 Evaporator, EVAP-WL-129 – S02, X99	1989	2(X-7) of 2
ODP-27335	CPP-604 Evaporator, EVAP-WL-161 – S02, X99	1984	2(X-8) of 2
537	Looking Northeast at Buildings CPP-659 and -659 Annex, location of the Liquid Effluent Treatment and Disposal (LET&D) Nitric Acid Recycle Tank, VES-NCR-171 – S02	6/99	2(X-9) of 2
577	Looking Northwest at Building CPP-1618, Location of the LET&D Facility, Location of LET&D Units – S02, X99	6/99	2(X-10) of 2
32795	CPP-1618 LET&D Fractionator, Cell 2, 1st Floor – S02, X99	1991	2(X-11) of 2
N/A	Canister Load Cell Roof showing the vault loading configuration	2/11	2(X-12) of 2
N/A	Looking inside the Product Load Out Cell showing the Canister Staged Under Filling Pipe	3/11	2(X-13) of 2

Photo Number	Photo Description – Unit Process Code(s)	Date of Photo	Page Number
N/A	Looking Northeast at the IWTU (CPP-1696) Facility Exterior	1/14	2(X-14) of 2
N/A	IWTU Waste Feed Tank (VES-SRC-131)	4/10	2(X-15) of 2
N/A	IWTU Offgas Filter (F-SRC-160)	2/11	2(X-16) of 2
N/A	Looking at the Offgas piping from the CRR (VES-SRC-160) to the Offgas Cooler (COL-SRC-160)	4/10	2(X-17) of 2

Photo 565. Looking North at Building CPP-604/605, Location of Process Equipment Waste Evaporator (PEWE) System Units.

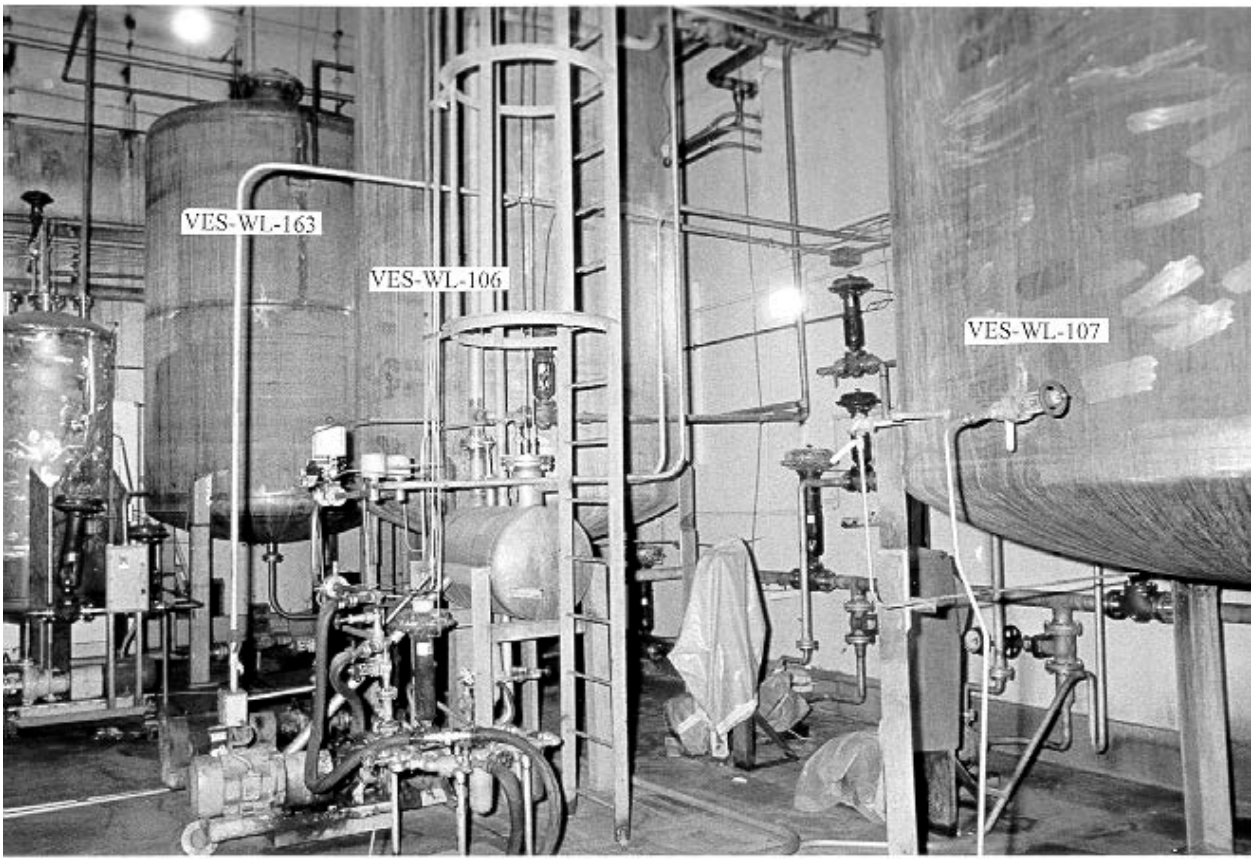


Photo ODP-31455, CPP-604 Process Condensate Collection Tanks,
VES-WL-106, VES-WL-107, and VES-WL-163.

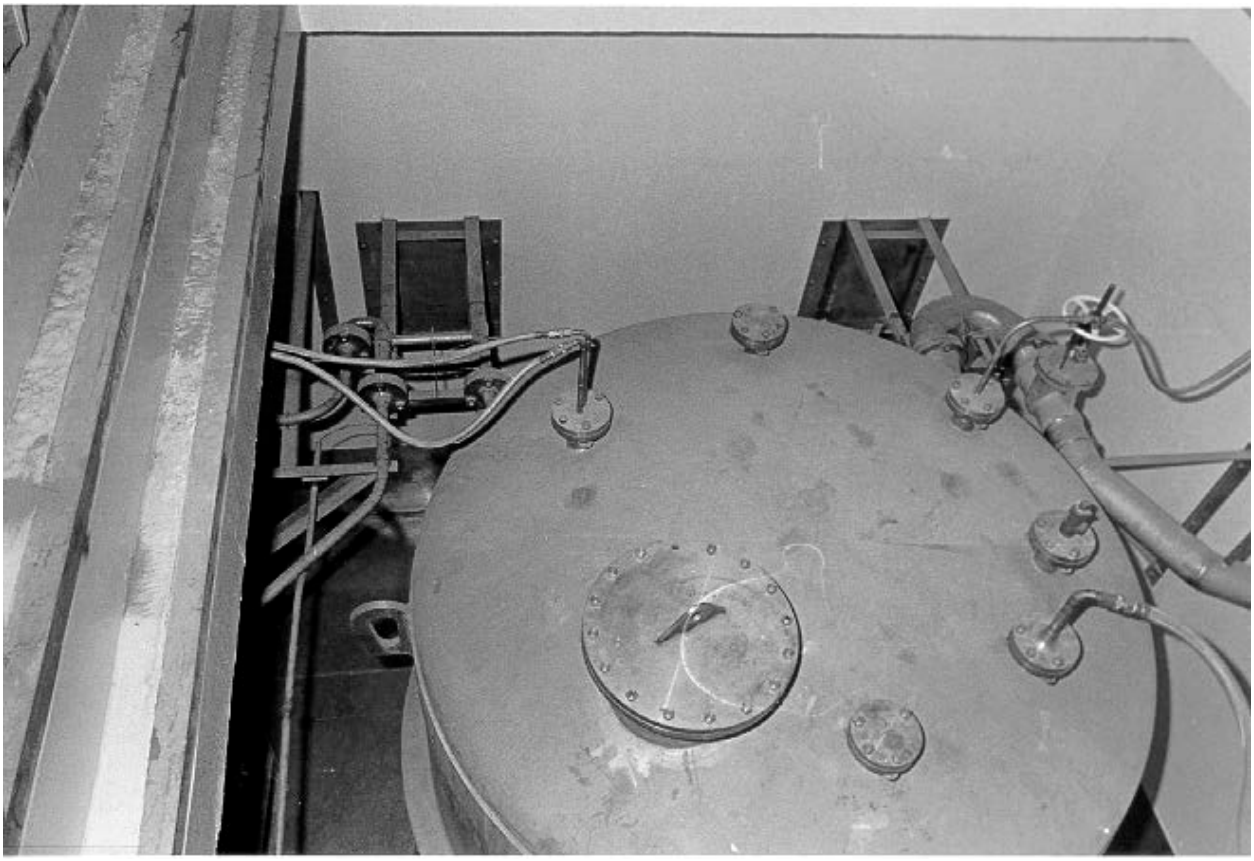


Photo ODP-32077. CPP-604 Evaporator Feed Sediment Tank, VES-WL-132.

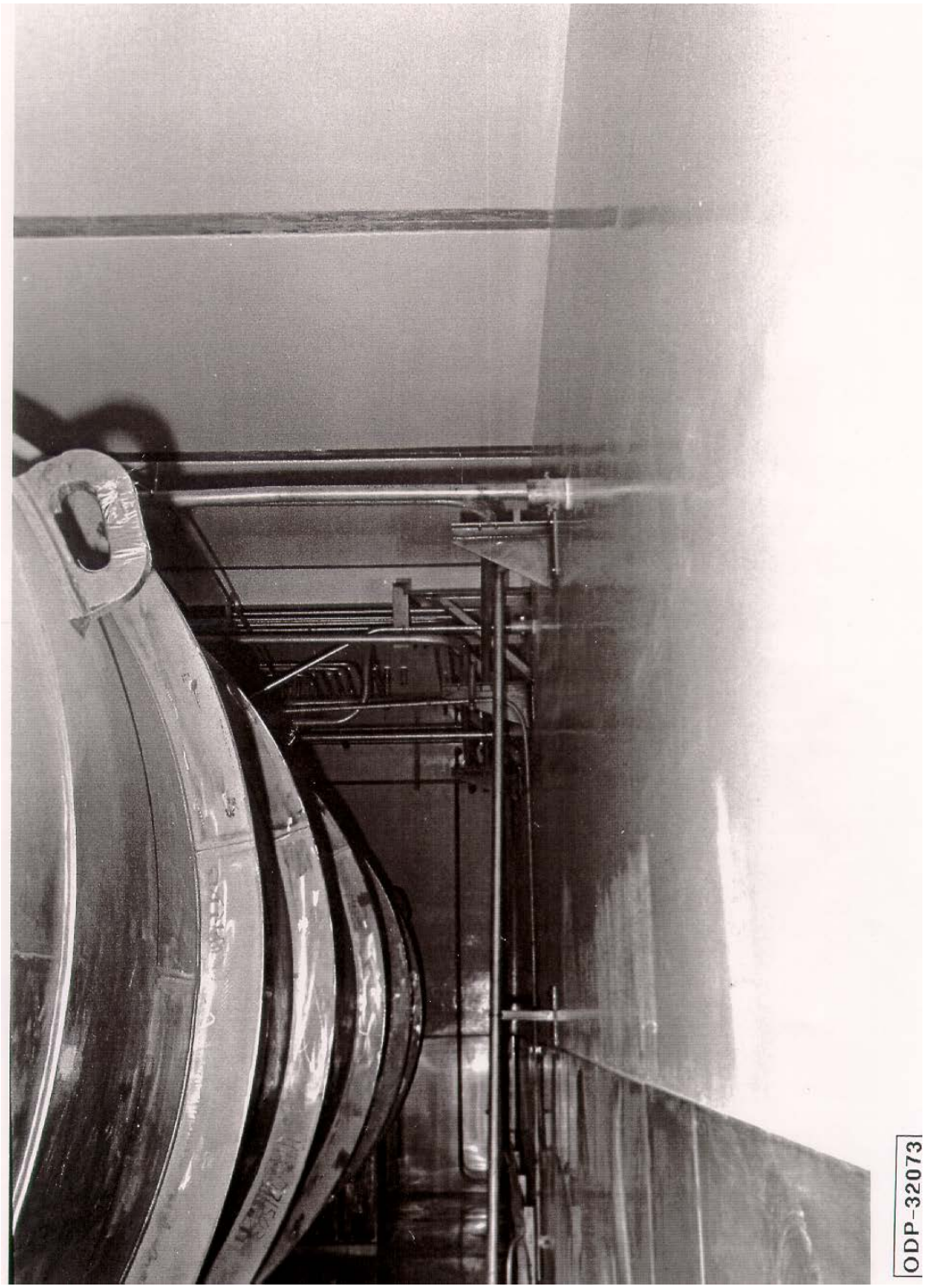


Photo ODP-32073. CPP-604 Evaporator Feed Collection Tank, VES-WL-133.

Photo ODP-32074. CPP-604 Evaporator Feed Collection Tank, VES-WL-133.

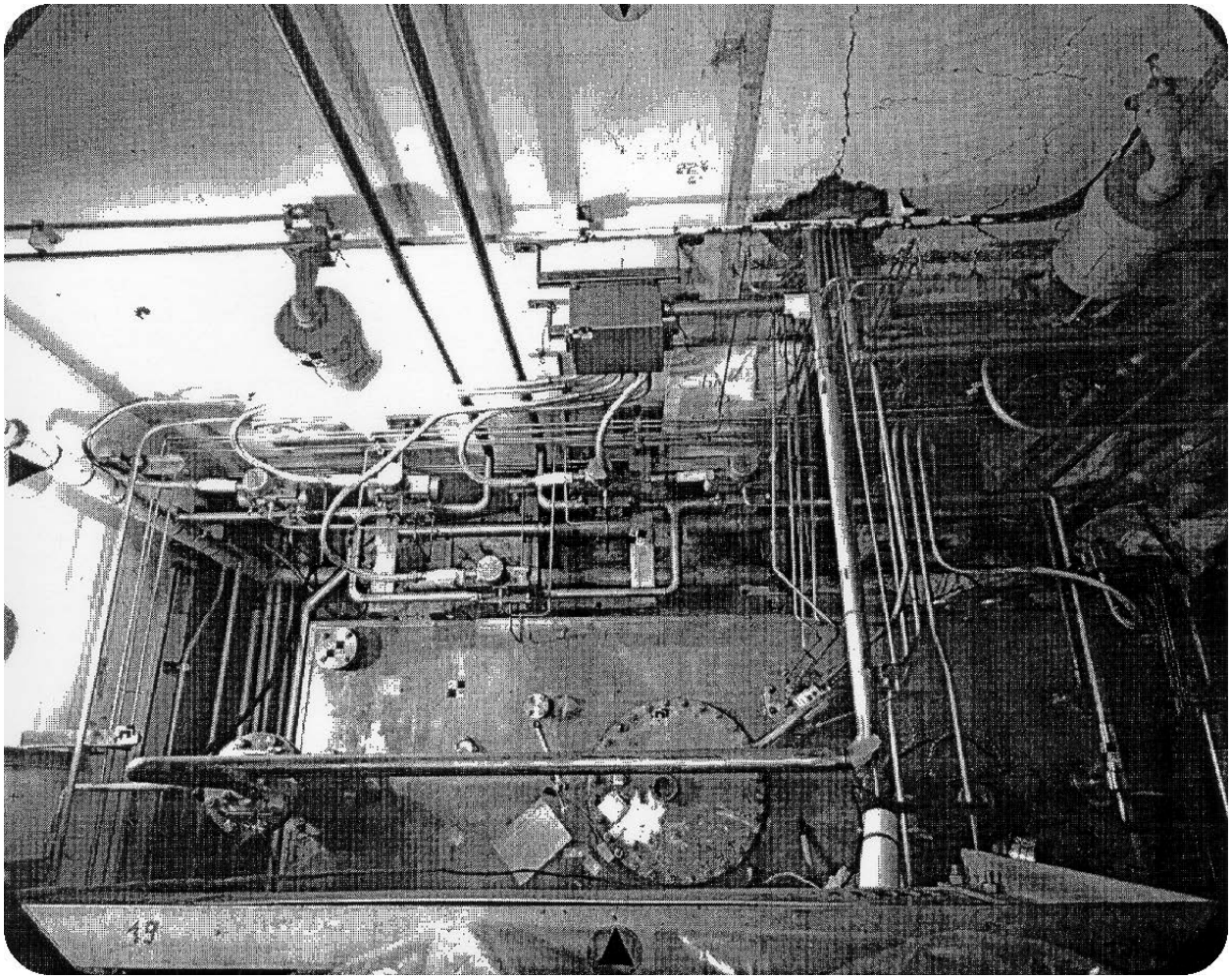


Photo N/A. Looking down at CPP-604 Bottoms Collection Tank, VES-WL-111.

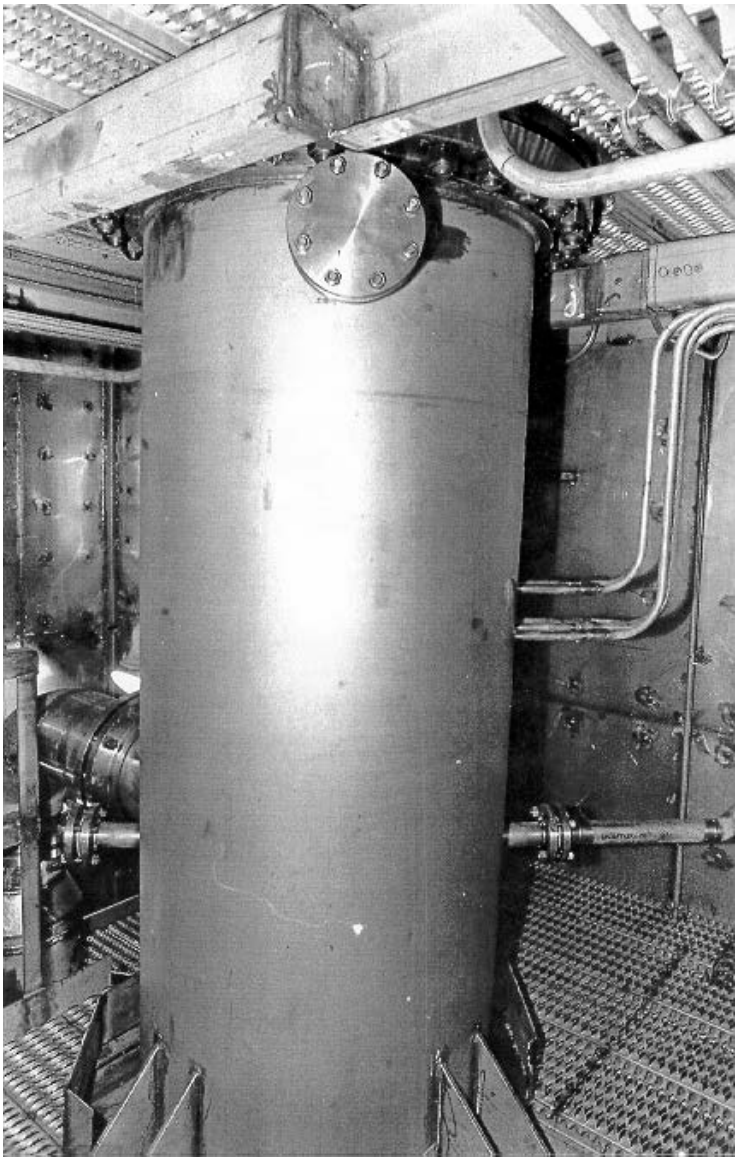


Photo ODP-3130. CPP-604 Evaporator, EVAP-WL-129.

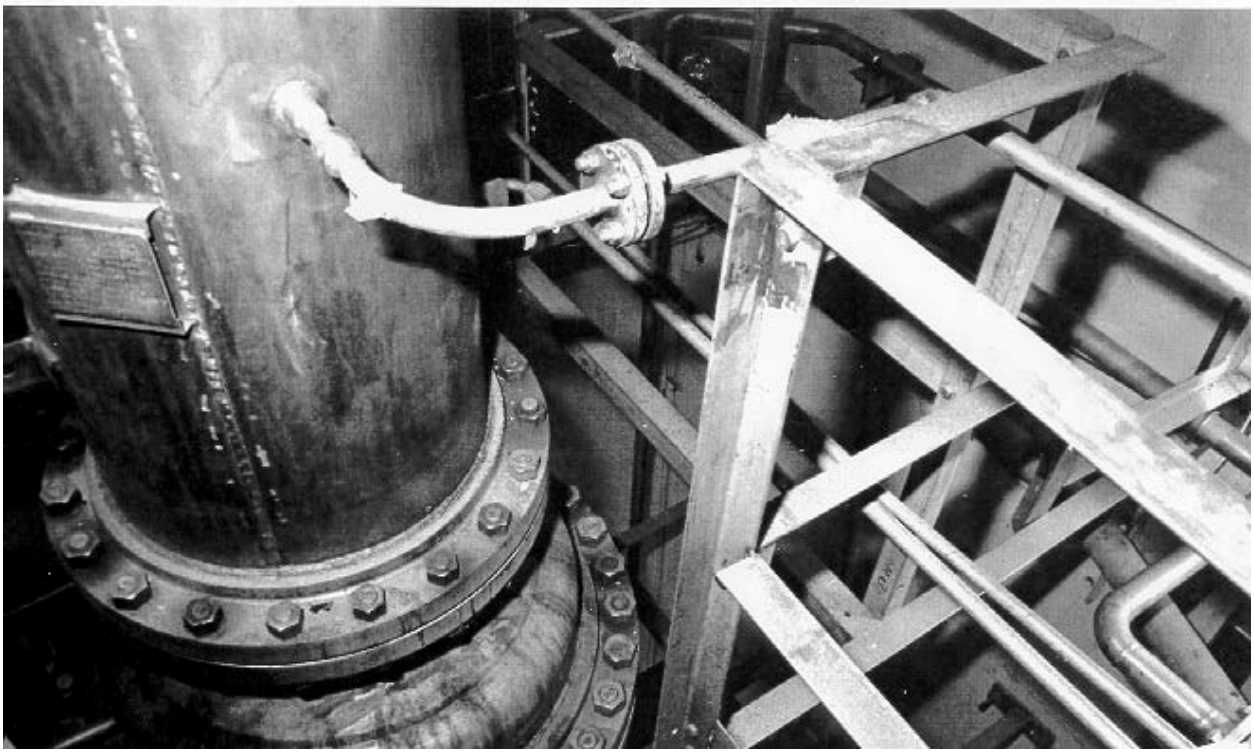


Photo ODP-27335. CPP-604 Evaporator, EVAP-WL-161.

Photo 537. Looking Northeast at Buildings CPP-659 and -659 Annex, Location of the Liquid Effluent Treatment and Disposal (LET&D) Nitric Acid Recycle Tank, VES-NCR-171.

Photo 577. Looking Northwest at Building CPP-1618, LET&D Facility, Location of LET&D Units.

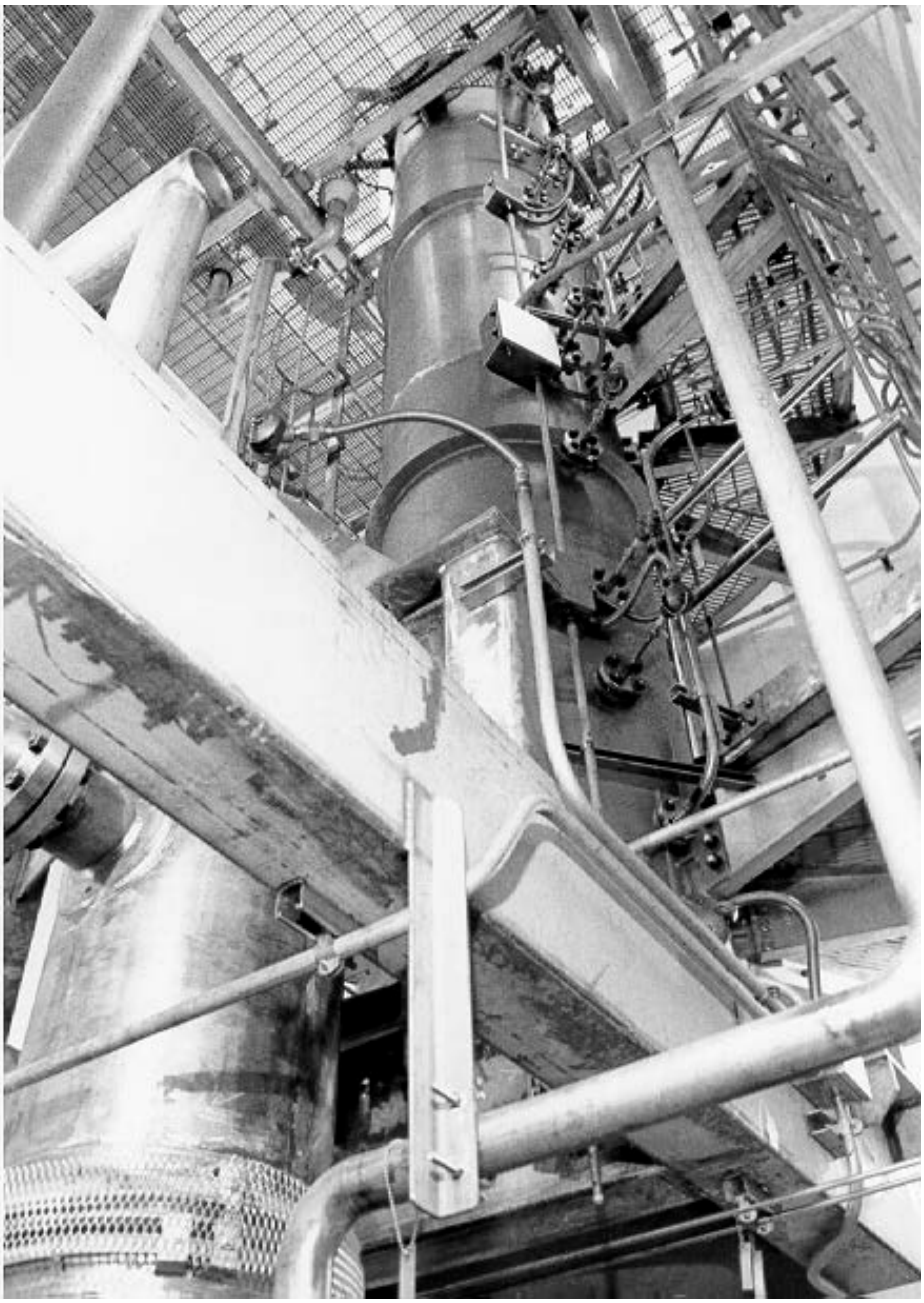
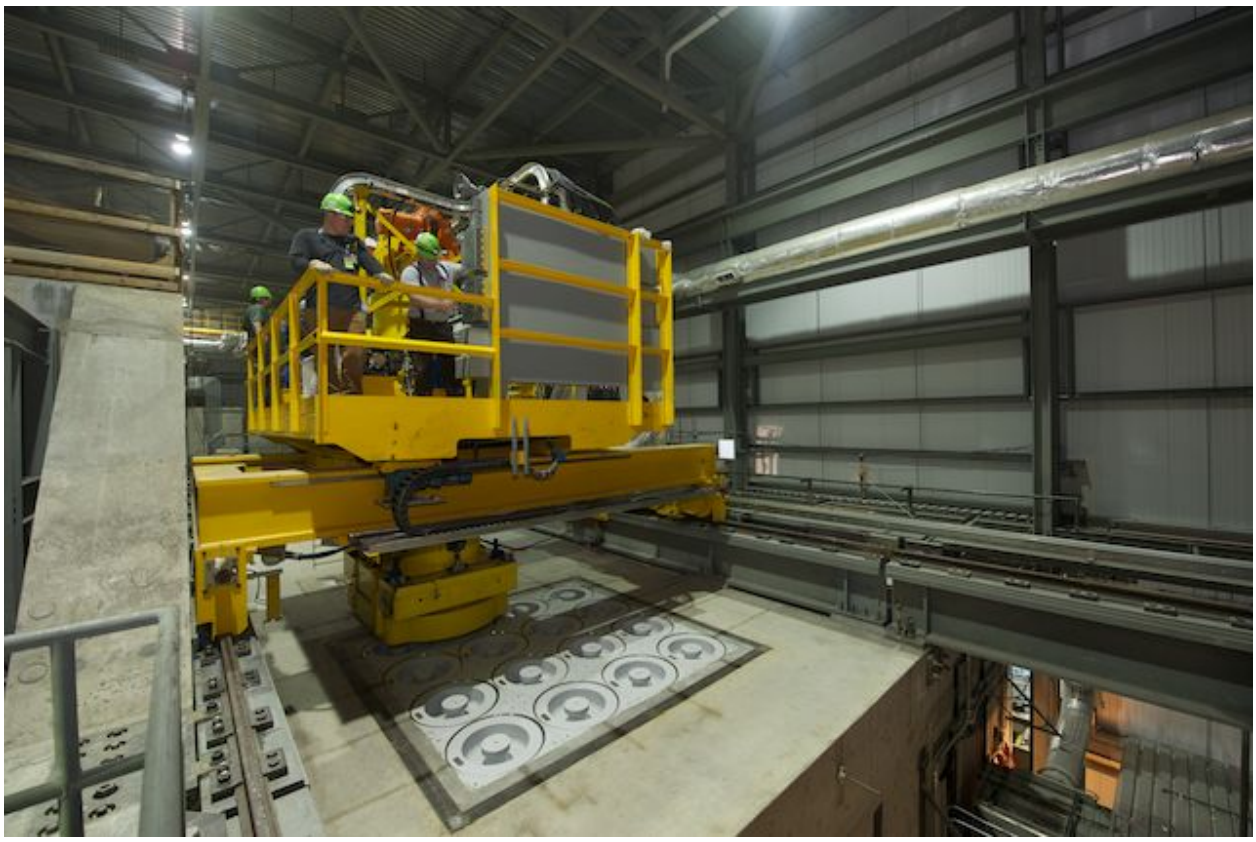


Photo 32795. CPP-1618 LET&D Fractionator, Cell 2, 1st Floor.

.



Canister Load Cell Roof showing the vault loading configuration

Looking inside the Product Load Out Cell showing the Canister Staged Under Filling Pipe

Looking Northeast at the exterior of the IWTU Facility (CPP-1696)

IWTU Waste Feed Tank (VES-SRC-131)

IWTU Offgas Filter (F-SRC-160)

Looking at the Offgas piping from the CRR (VES-SRC-160) to the Offgas Cooler (COL-SRC-160)

HAZARDOUS WASTE DEBRIS CATEGORIES

IDAPA 58.01.05.012 [40 CFR 270.13 (n)] requires a description of the debris categories treated, stored, or disposed of at a facility to be submitted in the Part A Permit Application. Debris defined by 40 CFR 268.2 means a solid material exceeding a 60 mm particle size that is intended for disposal and that is: a manufactured object; or plant or animal matter; or natural geologic material.

Category I - Manufactured Objects

Glass
Concrete
Masonry and refractory bricks
Paper
Plastic
Rubber
Cloth
Pavement
Metal Debris
- Pipes
- Valves
- Scrap Metal

Other Heterogeneous Debris
- Non-intact containers
- Tanks
- Appliances
- Industrial Equipment

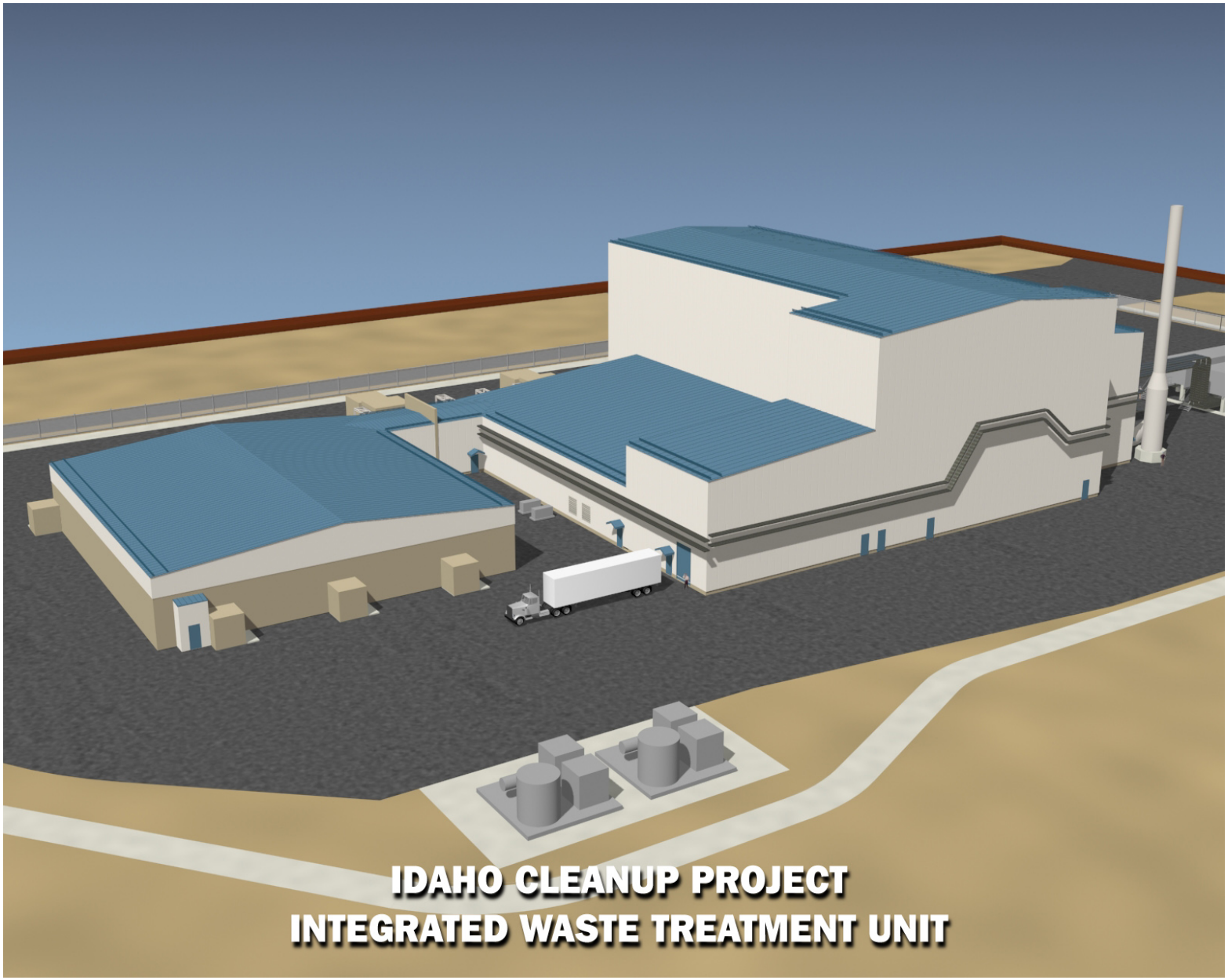
Category II - Plant and Animal Matter

Biological Debris
- Plant Matter

Wood Debris
- Wood
- Plant Stumps

Category III - Natural Geologic Material

Rock
Cobbles
Boulders


IDAHO CLEANUP PROJECT
INTEGRATED WASTE TREATMENT UNIT

ATTACHMENT 1 - SECTION B - FACILITY DESCRIPTION

RCRA PERMIT

FOR THE

IDAHO NATIONAL LABORATORY

Volume 14
INTEC Liquid Waste Management System

Attachment 1, Section B
Facility Description

Revision Date: September 5, 2019

CONTENTS

ACRONYMS iii

B. FACILITY DESCRIPTION 1

B-1. General Description 1

EXHIBITS

B-1. Location of the INTEC at the INL. 2

B-2. Buildings CPP-604, CPP-659, CPP-1618, and CPP-1696 at the INTEC. 3

B-3. Topographic map of the INTEC. 4

B-4. Plant drainage system at the INTEC. 5

B-5. Plant sanitary waste system at the INTEC. 6

B-6. Building CPP-604. 8

B-7. LET&D facility first floor plan. 12

B-8. Isometric View of Building CPP-659 16

ACRONYMS

APS	Atmospheric Protection System
CFR	Code of Federal Regulations
CPP	Chemical Processing Plant
CRR	Carbon Reduction Reformer
DMR	Denitration and Mineralization Reformer
ETS	Evaporator Tank System
GAC	granular activated carbon
HEPA	high efficiency particulate air (filter)
HWMA	Hazardous Waste Management Act
ILWMS	INTEC Liquid Waste Management System
INL	Idaho National Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IWTU	Integrated Waste Treatment Unit
LET&D	Liquid Effluent Treatment and Disposal
NWCF	New Waste Calcining Facility
PEWE	Process Equipment Waste Evaporator
RCRA	Resource Conservation and Recovery Act
TFF	Tank Farm Facility
TFT	Tank Farm Tank

B. FACILITY DESCRIPTION

B-1. General Description [IDAPA 58.01.05.012; 40 CFR 270.14(b)(1)]

This Hazardous Waste Management Act (HWMA)/Resource Conservation and Recovery Act (RCRA) permit addresses the Idaho Nuclear Technology and Engineering Center (INTEC) Liquid Waste Management System (ILWMS). The system consists of the Process Equipment Waste Evaporator (PEWE) system, the Liquid Effluent Treatment and Disposal (LET&D) system, the Evaporator Tank System (ETS), and the Integrated Waste Treatment Unit (IWTU). The ETS was previously referred to as the High Level Liquid Waste Evaporator. The ILWMS is located at INTEC at the Idaho National Laboratory (INL).

The INTEC is located in the south-central portion of the INL Site in Butte County. The location of this complex on the INL Site is shown in Exhibit B-1. The locations of Building Numbers CPP-604, CPP-649, CPP-659, CPP-1618, and CPP-1696 are shown in Exhibit B-2. The physical conditions around these buildings are typical for the INL Site, approximately 5,000 ft above mean sea level, as shown on the topographical map, Exhibit B-3. The area is relatively flat and receives little rainfall. However, poor drainage patterns can produce localized flooding that consists of shallow puddles that form near buildings during periods of rapid snowmelt or heavy rainfall. Due to the lack of rainfall and the poor quality of the surface soils, the site has little agricultural value. Wind patterns are generally in a northeast/southwest axis, with some seasonal variability.

Exhibit B-4 shows the surface water drainage at the INTEC. Drawing 632340 illustrates the site drainage around the IWTU (see Appendix I to this permit). Exhibit B-5 shows the sanitary waste system at the INTEC. There are no recreational areas present on or adjacent to the INTEC.

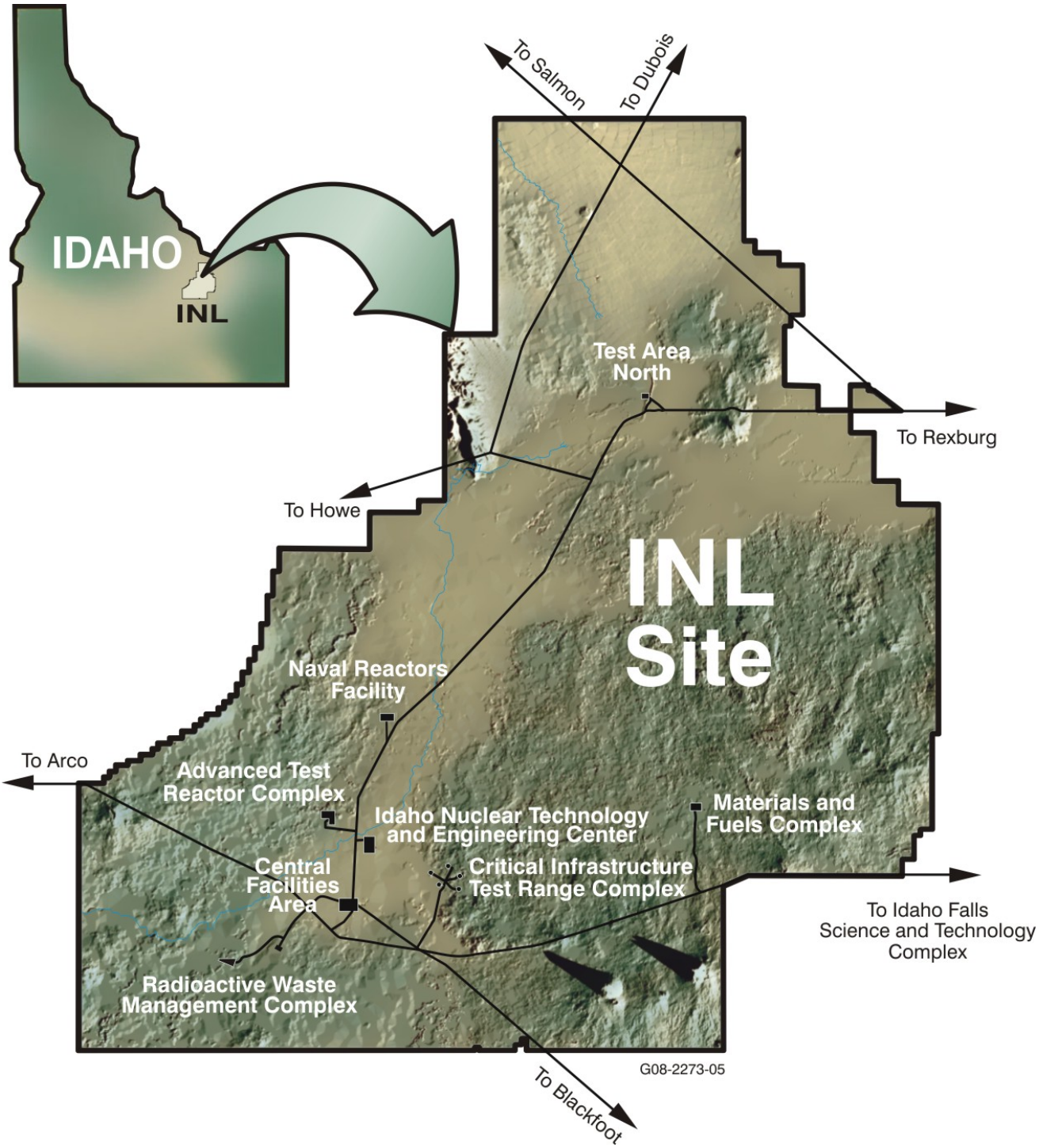


Exhibit B-1. Location of the INTEC at the INL.

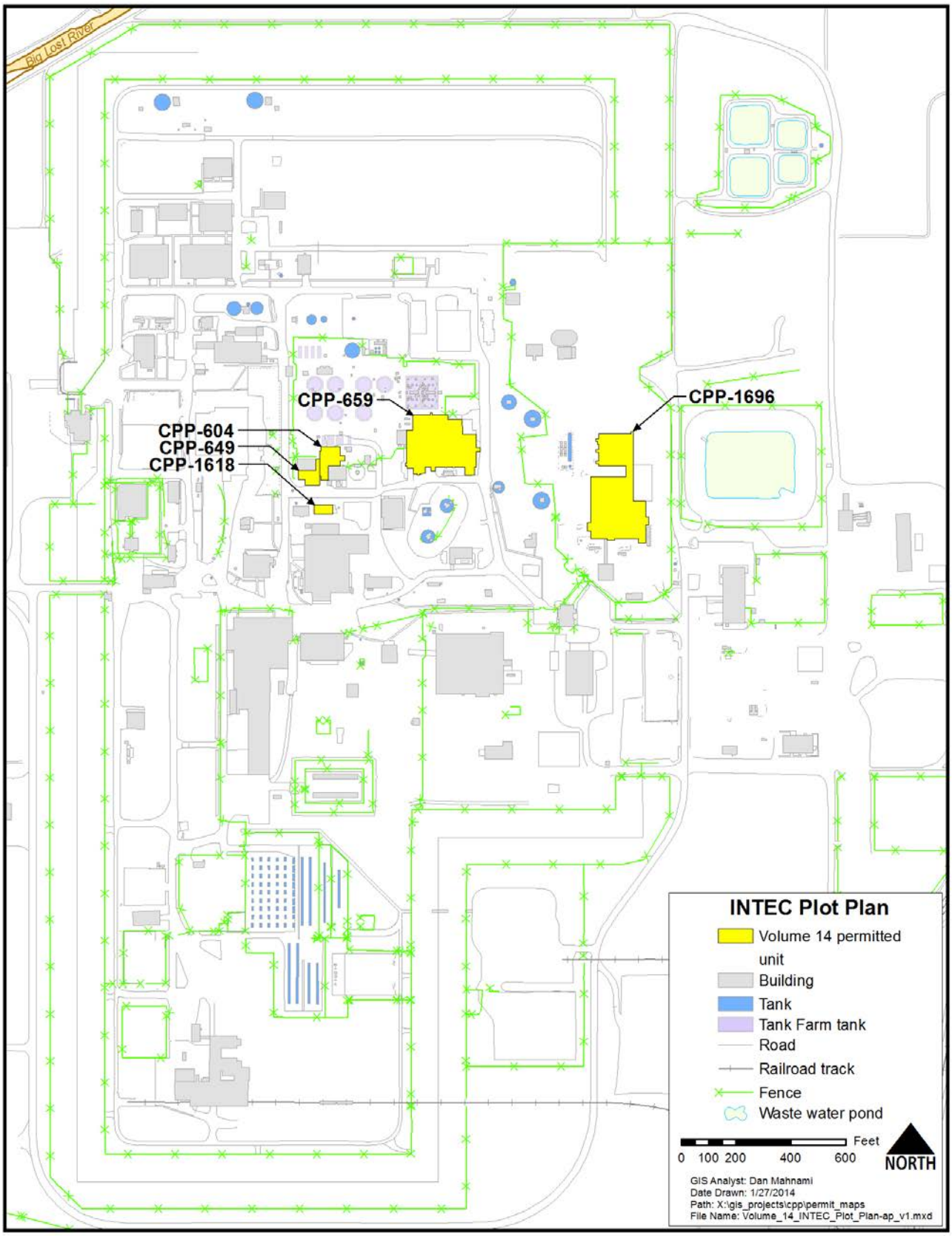


Exhibit B-2. Buildings CPP-604, CPP-659, CPP-1618, and CPP-1696 at the INTEC.

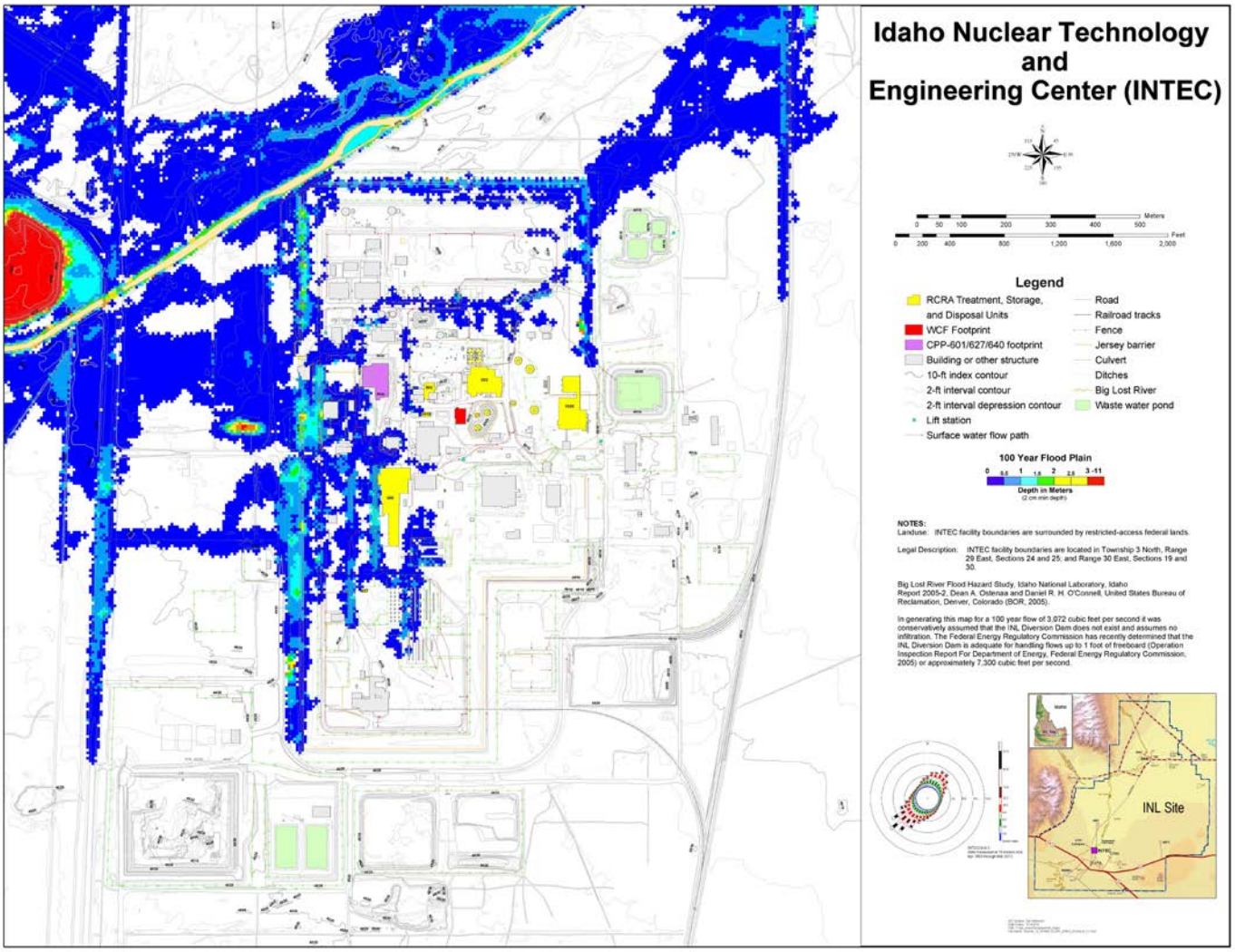


Exhibit B-3. Topographic map of the INTEC.

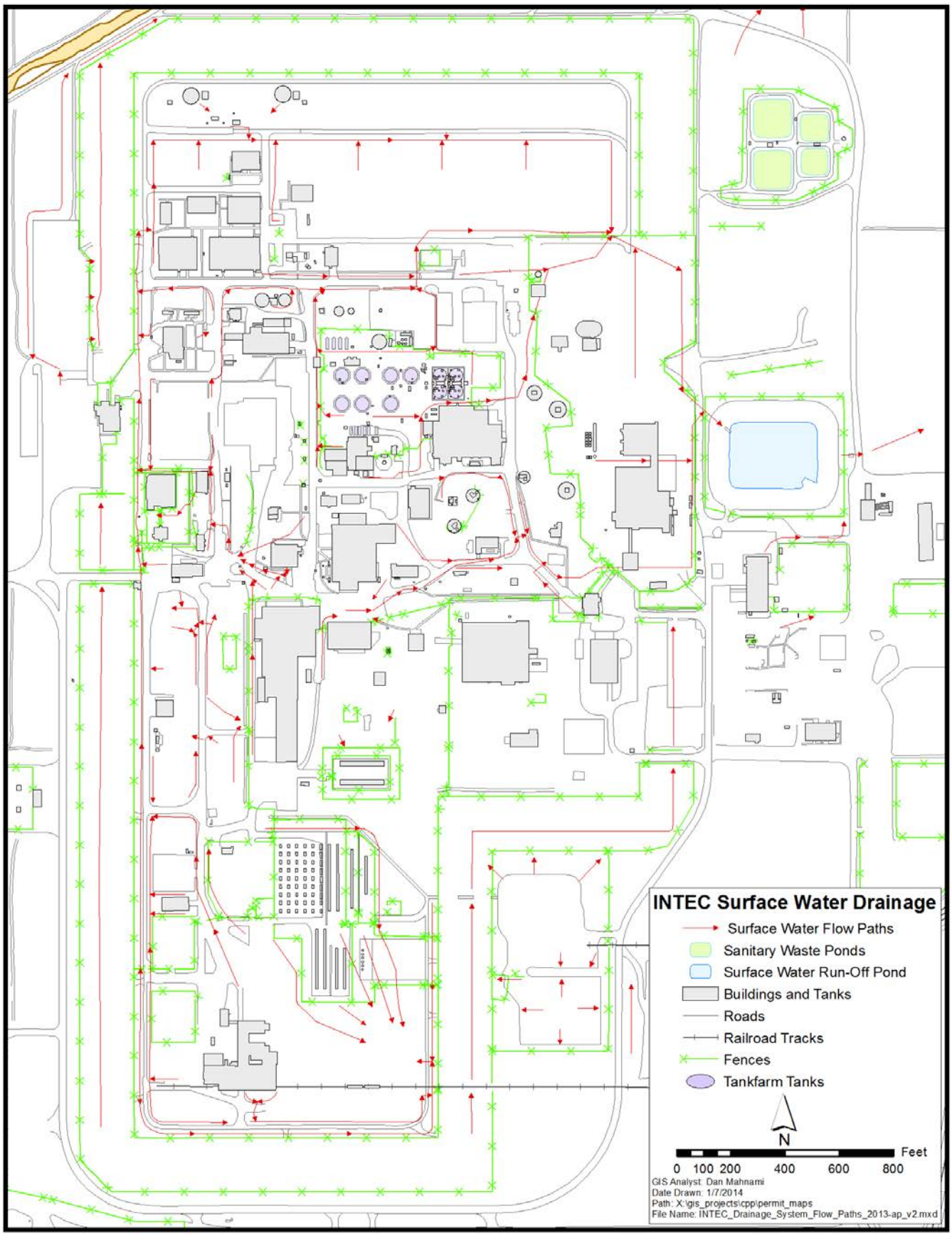


Exhibit B-4. Plant drainage system at INTEC .

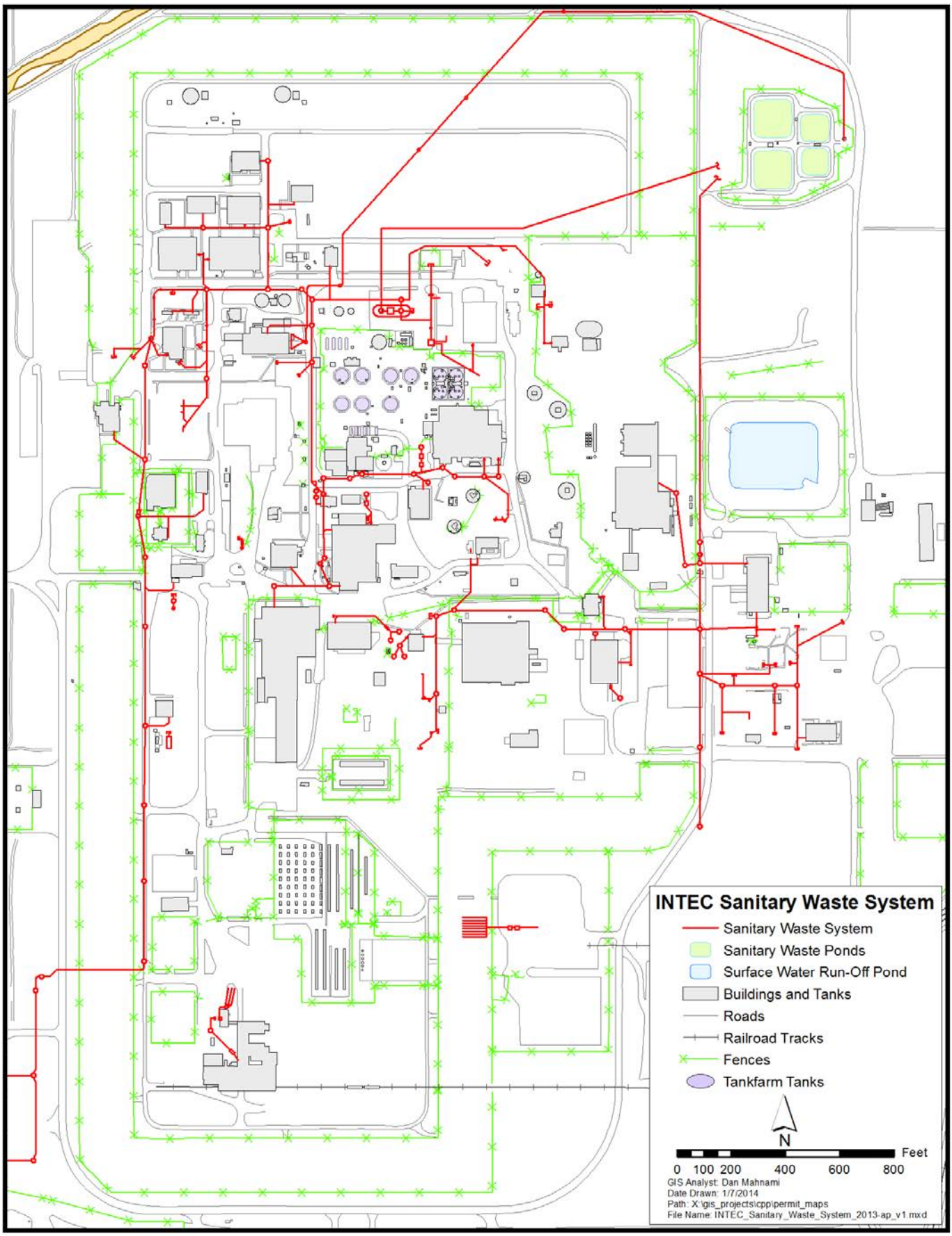


Exhibit B-5. Plant sanitary waste system at the INTEC.

PEWE System Storage and Treatment

The PEWE system reduces the volume of hazardous waste sent to the INTEC Tank Farm Facility (TFF). The PEWE system evaporates the wastes, producing concentrated wastes (bottoms) and vapor condensates (overheads). The overheads are transferred to the LET&D for further processing. The bottoms generated from the PEWE go to VES-WL-101 or VES-WL-111 or are recycled back to VES-WL-133 for further processing. From VES-WL-101 or VES-WL-111, the bottoms can be sent to the CPP-604 Tank Farm Tanks (TFT), VES-WM-100, VES-WM-101, and VES-WM-102, the TFF, or to the ETS.

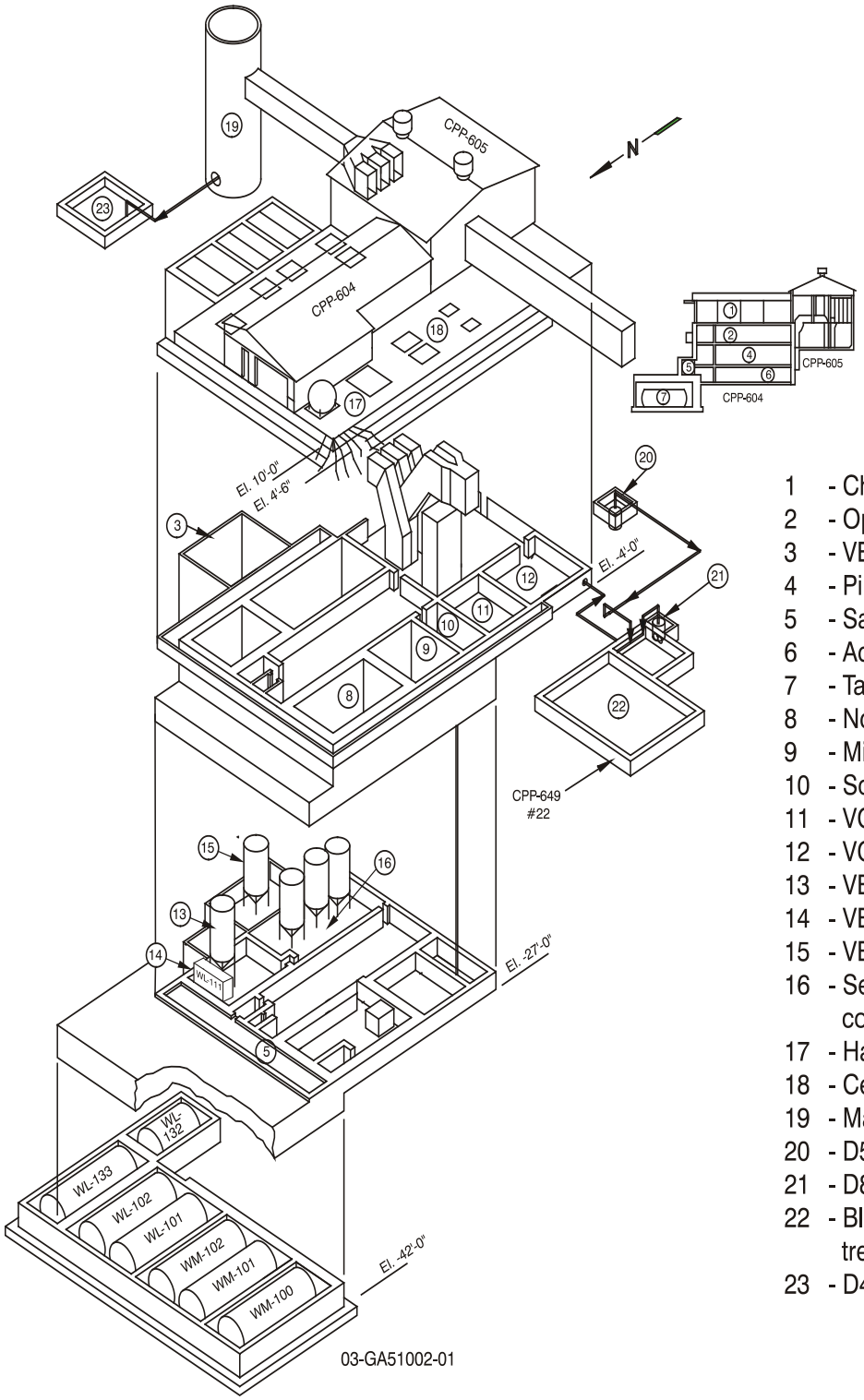
Building CPP-604

The Waste Treatment Building, CPP-604, contains equipment for treating INTEC liquid wastes. The Atmospheric Protection System (APS), Building CPP-649, contains equipment for further treatment of the PEWE and ETS offgas.

CPP-604 is located south of the TFF. Exhibit B-6 is an isometric drawing of CPP-604, showing the physical arrangement of the various cells, corridors, and other areas.

CPP-604 was originally constructed in the 1951 to 1953 timeframe. In the early 1970s, an additional evaporator, EVAP-WL-129, was installed. In the early 1980s, the Evaporator Feed Sediment Tank, VES-WL-132, and the new Feed Collection Tank, VES-WL-133, were installed. Finally, in the early 1990's the CPP-604 Bottoms Collection Tank, VES-WL-111, was added to the system. The main portion of CPP-604 is located below grade and is constructed of reinforced concrete. The building is approximately 115 ft wide on its widest end (north end) and 130 ft long on its longest side (west side). Drawings 400814 and 400815 in the drawing package (Appendix I) included with this permit represent the space occupancy floor plan for CPP-604.

The building CPP-604 consists of three primary areas (See Exhibit B-6) associated with this permit.



Legend

1 - Chemical Makeup Area
2 - Operating corridor
3 - VES-WL-129 evaporator cell
4 - Pipe corridor
5 - Sample corridor
6 - Access corridor
7 - Tank storage vault
8 - North cell
9 - Middle cell
10 - South cell
11 - VOG filter cell
12 - VOG blower cell
13 - VES-WL-161 Evaporator
14 - VES-WL-111
15 - VES-WL-129 Evaporator
16 - Separation and Condensation collection cell
17 - Hatch access to north cell
18 - Cell hatches
19 - Main exhaust stack
20 - D5 vault
21 - D8 vault
22 - Bldg. 649 process off-gas treatment area
23 - D4 vault

Building CPP-604

Exhibit B-6. Building CPP-604.

Evaporator Feed Collection/Feed Sediment Tank Vaults

The vaults for the Evaporator Feed Collection Tank, VES-WL-133, and the Evaporator Feed Sediment Tank, VES-WL-132, are connected by a doorway in a common wall. A ladder provides access to the VES-WL-133 vault from the VES-WL-132 vault, and a concrete hatch seals the VES-WL-132 vault from the above-grade portion of the building. The VES-WL-133 vault is in the northeast corner of the CPP-604 building. The vault has internal dimensions of 16 ft 6 in. by 42 ft. The VES-WL-132 vault is located just south of the VES-WL-133 vault and has internal dimensions of 16 ft 6 in. by 17 ft. The vault is constructed of reinforced concrete and the floor and lower 2 ft 6 in. of the walls are lined with stainless steel. This information is described in section, D-2f (1)(b), "Requirements for Secondary Containment and Leak Detection."

Evaporator Cells, Process Condensate Collection Cell, and Feed Pump Cell

The two evaporator cells contain the evaporators, EVAP-WL-161 and EVAP-WL-129. The process condensate collection cell contains the Process Condensate Collection Tanks (VES-WL-106, VES-WL-107, and VES-WL-163). The feed pump cell contains the two feed pumps, P-WL-228 and P-WL-229. The cells are all interconnected. Access to these cells is gained through a doorway into the condensate collection cell from the access corridor or by removing the cell hatches. The process condensate collection cell has internal dimensions of 21 ft by 46 ft. The EVAP-WL-161 evaporator cell is located just north of the process condensate collection cell; it has internal dimensions of 18 ft by 22 ft. The EVAP-WL-161 evaporator cell also houses VES-WL-111. The EVAP-WL-129 evaporator cell, located east of the condensate collection cell, has internal dimensions of 14 ft by 15 ft 8 in. The feed pump cell is located just north of the VES-WL-129 evaporator cell and has internal dimensions of 9 ft 2 in. by 14 ft 6 in. Drawings 155069, 155070, and 103171 show typical concrete installation, and Drawings 103180, 158768 and 162748 show the stainless steel liner installation (See Appendix I).

CPP-604 Tank Farm Tanks, VES-WM-100, VES-WM-101, and VES-WM-102 Vaults

The TFT system tanks are located in two connected and below-grade vaults at the north end of CPP-604.

The west vault, containing VES-WM-100, is constructed of reinforced concrete and is 17 ft wide, 43 ft long, and 16 ft high. The adjacent vault contains VES-WM-101 and VES-WM-102 and is 30 ft 6 in. by 43 ft by 16 ft high. The floors and lower 3 ft 6 in. of the walls in both vaults are lined with stainless steel. Drawing 400815 in the drawing package (Appendix I) included with the permit represents

the space occupancy floor plan for the CPP-604 building. Drawing 103171 shows the typical concrete and stainless steel liner installations (See Appendix I). Drawing 103544 shows the typical stainless steel floor and wall lining details for VES-WM-100 vault and VES-WM-101 and -102 vault (See Appendix I). Drawing 103530 shows the foundation and enclosure plans, sections, and details for the VES-WM-100 vault and the VES-WM-101/VES-WM-102 vault (See Appendix I).

Bottoms Tank (VES-WL-101) and Feed Collection Tank (VES-WL-102) Vault

The vault contains VES-WL-101 and VES-WL-102 and is constructed of reinforced concrete that ranges in thickness from 2 to 4 feet. This vault is 30 ft wide, 43 ft long, and 16 ft high.

The secondary containment is constructed of concrete floor lined with a Hypalon® membrane (registered trademark of DuPont), which extends three feet up the walls. The main body of the membrane has a 45-mil nominal thickness and is reinforced with denier polyester fabric scrim. Unreinforced membrane that is used for corner reinforcement and around the sump liner insert, which must be molded to fit, is 60-mil nominal thickness. The Hypalon® membrane conforms to the requirements of the National Sanitation Foundation Standard 54 (revised May 1991) Type 3-45, (industrial grade chlorosulfonated polyethylene). All seams in the secondary containment are heat-welded or adhesive bonded to avoid any cracks or gaps. The membrane is sealed around the tank saddles by silicone rubber sealant that is capable of withstanding the expected waste solutions for extended periods of time. Drawing 103530 shows the foundation and enclosure plans, sections, and details, and Drawings 370862, 370863, 370864, 370865, 370866, and 370867 show the liner installations and sections for the VES-WL-101/VES-WL-102 vault (See Appendix I).

Building CPP-1618 LET&D System Storage and Treatment

The LET&D treatment process reduces the volume of liquid waste by fractionating PEWE overhead condensates into saturated steam/offgas and acid fractions. The fractionators separate the waste solution into water (overheads) and nitric acid (bottoms).

Wastes are treated and stored in tanks in CPP-1618. The LET&D system includes tanks and ancillary equipment in the CPP-659 Annex and in CPP-1618. For a detailed description of the LET&D system, see Section D of this permit.

The Liquid Effluent Treatment and Disposal (LET&D) facility is currently used to concentrate nitric acid solutions. Construction of the facility was completed in 1992. System operability tests were completed and waste storage and treatment were started in January 1993.

The LET&D facility is a three-story, steel-frame, metal-sided structure. It has two reinforced concrete process cells. The Acid Fractionator Cells have internal dimensions of 17 ft by 14 ft 6 in. The cell walls are epoxy-coated, and the lower 3 ft of the walls and the floors are lined with stainless steel. The cells contain the Acid Fractionator Waste Feed Head Tank, VES-WLK-197; the acid fractionator units, FRAC-WLL-170 and FRAC-WLK-171; the Bottoms Tank, VES-WLL-195; and associated ancillary equipment. The remaining portions of the three-story structure contain the process offgas system, sample cell, and utility support systems. Drawing 092440 represents the space occupancy floor plan for CPP-1618 (see Appendix B-1 of the original application). Exhibit B-7 shows the equipment arrangement in the first floor plan of the LET&D facility. Drawings 347791, 347796, and 347798 (see Appendix I) illustrate the CPP-1618 concrete and liner details.

LET&D Acid Recycle Tank Building and Acid Head Tank (CPP-659 Annex)

The Acid Recycle Tank, VES-NCR-171, and Acid Head Tank, VES-NCR-173, are located in the CPP-659 Annex adjacent to the New Waste Calcining Facility (NWCF, CPP-659). The CPP-659 Annex is used to house a 22,500 gallon stainless steel tank which stores acid produced by the LET&D fractionation process. VES-NCR-173 is a stainless steel tank, which stores nitric acid prior to being transferred throughout the INTEC for reuse. The tank has capacity of approximately 90 gallons. A sump, 4 ft by 4 ft by 9 ft 9 in., is located in the corner of the annex. The vault has internal dimensions of 17 ft 4 in. by 41 ft 3 in., with a stainless steel wainscot 4 ft 8 in. high. The floor, sump, and walls are lined with stainless steel to a height of 4 ft 8 in., to contain leaks and spills. Drawing 176263 illustrates the CPP-659 Annex concrete and drawing 176265 (see Appendix I) illustrates the stainless steel liner.

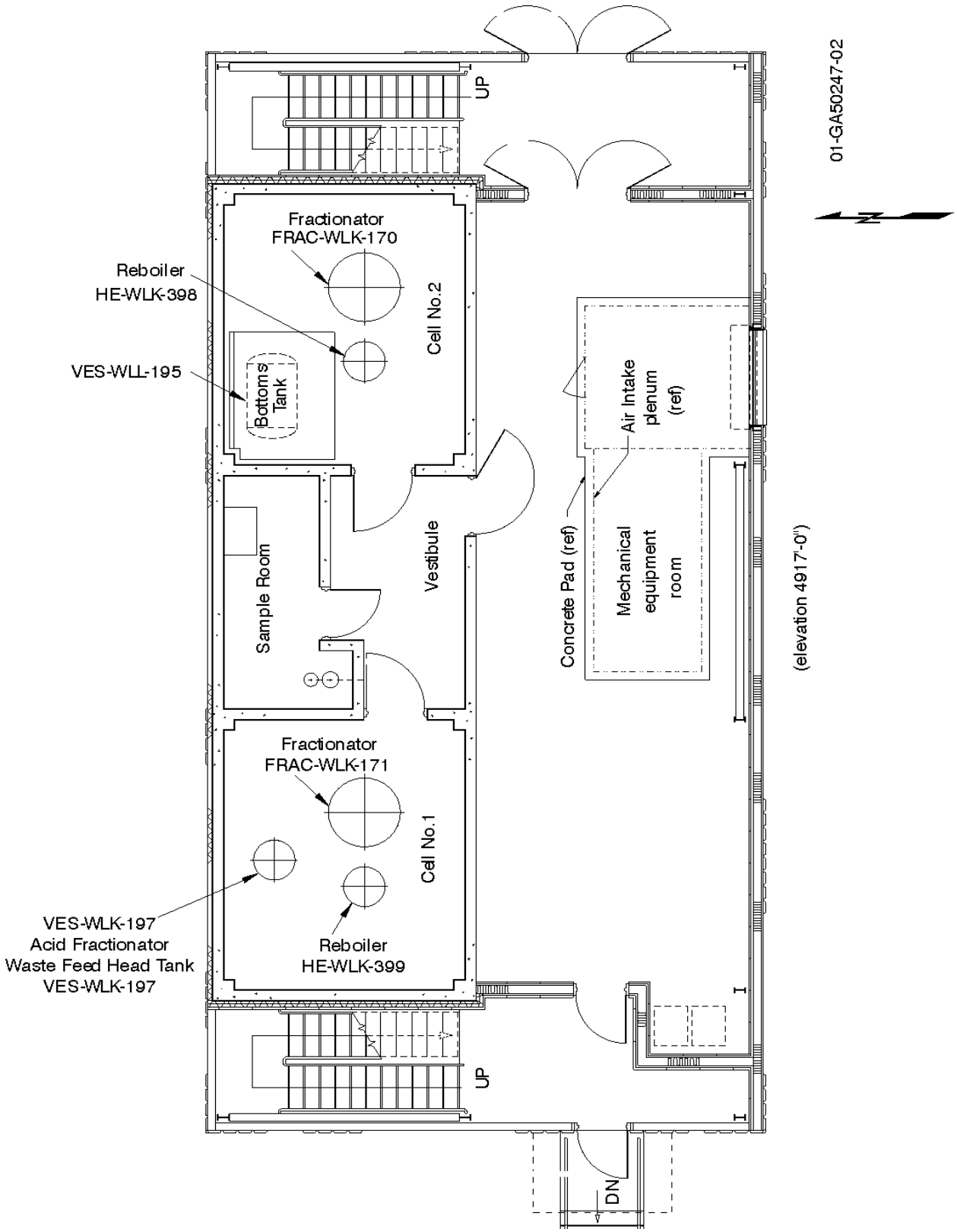


Exhibit B-7. LET&D facility first floor plan.

LET&D Cells and Vaults

LET&D Fractionator Cell 1

Acid Fractionator Cell 1 is 17 ft long and 14 ft 6 in. wide, with a stainless steel liner on the floor and 3-ft up the walls. The cell is constructed of steel-reinforced concrete. The cell has a door in the east wall. In front of the door is a step measuring 3 ft 10 in. by 3 ft 10 in. by 4 in. The floor is sloped toward a sump, which is located slightly to the northeast of the center of the cell. The cell walls are steel-reinforced concrete coated with epoxy.

LET&D Fractionator Cell 2

Acid Fractionator Cell 2 is 17 ft long and 14 ft 6 in. wide. The cell is constructed of steel-reinforced concrete with a stainless-steel liner on the floor and 3-ft up the walls. The cell has a door in the east wall. The floor is sloped toward a sump, which is located in the cell.

The vault containing the Bottoms Tank, VES-WLL-195 is located in northwest corner of Fractionator Cell 2. Although the floor of the fractionator cell does not slope directly to the Bottoms Tank vault, the vault would serve as the containment mechanism if a leak caused the sump to overflow. The vault containing the Bottoms Tank is completely lined with stainless steel. The floor of the Bottoms Tank vault slopes toward the west, where the vault sump is located.

Construction Specifications for CPP-604 and CPP-1618

Building CPP-604 was constructed using the same construction specifications (Specification RC-542). Concrete floors and walls were constructed in accordance with the “Concrete and Reinforced Concrete” section of that specification (included as Appendix B-2 of the original application). Painting was done in accordance with the “Painting” section (included as Appendix B-3 of the original application), and structural steel was fabricated and erected in accordance with the “Structural Steel” section (included as Appendix B-4 of the original application).

These specifications are typical of the specifications used for the construction of the PEWE system. Modifications were performed under very similar specifications, using standards applicable at the time of construction. A sample modification specification for the addition of the spare evaporator, EVAP-WL-129, is provided in Appendix B-7 of the original application.

Appendix I contains applicable structural drawings for the PEWE system. All of the PEWE system vaults are lined with stainless steel, except DVB-OGF-D8, and the VES-WL-101/VES-WL-102 vault. The valve box DVB-OGF-D8 is painted with acid resistant epoxy coating that is compatible with the waste. The VES-WL-101/VES-WL-102 vault is lined with a Hypalon® membrane, which is compatible with the waste being stored/treated. The containment and liners are further discussed in Section D-2f.

Building CPP-659 ETS Treatment and Storage

The ETS reduces the volume of hazardous waste sent to and stored in the INTEC TFF. The ETS evaporates the wastes, producing concentrated wastes (bottoms) and vapor condensates (overheads). The overheads are collected in VES-NCC-122 and transferred to the PEWE for further processing. The bottoms are collected in VES-NCC-119 and sent to the TFF. Other transfer routes are available for VES-NCC-119 and VES-NCC-122 as needed to meet operational requirements.

The ETS includes tanks and ancillary equipment in building CPP-659. For a detailed description of the ETS, see Section D of this permit. Drawing 057807, 057808, and 057812 represents the space occupancy floor plan for CPP-659 (see Appendix I to this permit). An isometric of the building is shown in Exhibit B-8. The cells are shown in the space occupancy floor plan for CPP-659. Drawings 132376 through 132383, 132390 through 132397, and 132444 through 132446 illustrate the CPP-659 concrete details (see Appendix I to this permit). Drawings 132358 through 132359, 132361, 134619 through 134624, and 383716 illustrate the CPP-659 liner details (see Appendix I to this permit).

Blend and Hold Cell

The blend and hold cell (room 215) is used to house the feed tanks for the ETS (VES-NCC-101, VES-NCC-102, VES-NCC-103), the constant head feed tank (VES-NCC-152), and EVAP-NCC-150 (includes VES-NCC-150, HE-NCC-351, HE-NCC-350). The blend and hold cell has a 32 ft 4 in. by 24 ft, floor area and is constructed of steel reinforced concrete with a stainless steel liner and a 3-ft high stainless-steel wainscot. The cells stainless-steel liner system slopes to a floor drain and provides secondary containment to the tanks. The floor drain is equipped with a valve that is normally closed and leak detection in the stainless steel piping that is connected to VES-NCC-119. The stainless steel is compatible with the waste and decontamination solutions received at the ETS.

Offgas Cell

The offgas cell (room 207) houses the Scrub Hold Tank (VES-NCC-108) and the scrub solution-recycle pumps. The offgas cell has a 33 ft 4 in. by 16 ft 3 in. floor area and is constructed of steel reinforced concrete with a stainless steel liner and a 3-ft-high wainscot. A sloped, 1-ft-deep gutter runs along the length of the east wall. The floor drain is equipped with a valve that is normally closed and leak detection in the stainless steel piping that is connected to VES-NCC-119. The stainless steel is compatible with the waste and decontamination solutions received at the ETS.

Adsorber Cell

The adsorber cell (room 206) houses the Vent Condenser Knockout Drum (VES-NCC-136), and the Mist Collector (VES-NCC-116 and associated heat exchangers. The adsorber cell has a 26.5 ft by 31.5 ft floor area constructed of steel reinforced concrete with a stainless steel liner and a 3-ft-high wainscot. The floor has a sump that is drained to VES-NCC-119. The stainless steel is compatible with the waste and decontamination solutions received at the ETS.

Hot Sump Tank Cell

The hot sump tank cell (room 101 and 102), located on the fourth level, house the two hot sump tanks (VES-NCC-119 and VES-NCC-122) and a recirculation pump. The hot sump tank cell is 24 ft 2 in. by 24 ft 6 in. with a height of 17ft 6 in and is constructed of steel reinforced concrete with a stainless steel liner. The valve access room is 19 ft 6 in. by 11 ft 10 in. and is constructed of steel reinforced concrete with a stainless steel liner and a 3-ft-high stainless-steel wainscot. The floor has a sump, which can be jetted to the fluoride hot sump tank. The cell floor is sloped to drain to a gutter on the west side of the cell, and the gutter drains to the south and into the sump.

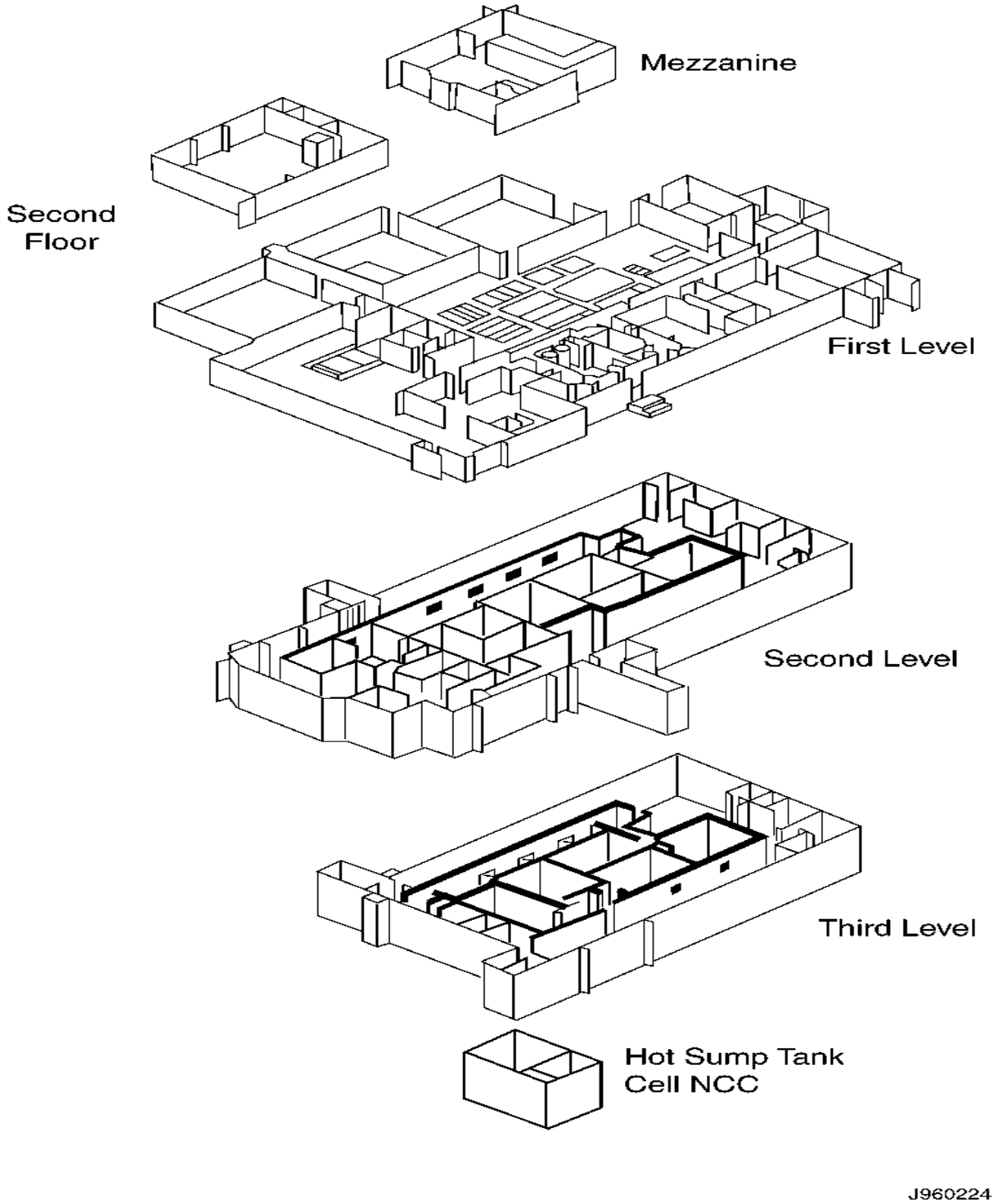


Exhibit B-8. Isometric View of Building CPP-659

Building CPP-1696 IWTU Treatment and Storage

Sodium bearing waste and newly generated liquid waste are transferred to the Waste Feed Tank, and fed to the first steam reformer, the Denitration and Mineralization Reformer (DMR). The DMR, operating in a chemically reducing mode, evaporates liquids, volatilizes trace organics, converts nitrates to nitrogen gas, and converts all nonvolatile constituents of the feed into a sodium carbonate-based, granular, solid treatment product. The reducing condition in the DMR is created by the injection of fluidizing steam, coal, and a small amount of oxygen to react with the coal to produce energy in the bed.

The solid product from the DMR is pneumatically transferred to the Product Receiver/Cooler before being drained from the process.

The process gas from the DMR; consisting mostly of steam, nitrogen, carbon dioxide, and hydrogen, with small amounts of carbon monoxide, nitrogen oxides (NO_x), short-chained organics, and acidic gases; is then filtered through the high temperature Process Gas Filter. This filtration removes the finely divided product solids and carbon fines that elutriate out of the DMR along with the process gas stream. The filtered gas stream is then introduced into the bottom of the second steam reformer, the Carbon Reduction Reformer (CRR). A measured quantity of oxygen/air is also introduced at three locations within the CRR fluidized bed through a set of distributors located at the same level and above the fluidizing process gas input distributors. The CRR, operating in a reducing mode in the bottom of the fluidized bed reduces a significant portion of the residual NOx in the process gas to nitrogen. The CRR operates in an oxidizing mode in the upper section of and above the fluidized bed that oxidizes the hydrogen, carbon monoxide, and organics in the gas stream to carbon dioxide and water. Carbon is required to maintain the CRR in the desired operating temperature range.

The CRR process gas stream, now almost entirely nitrogen, oxygen, water vapor, and carbon dioxide, is cooled in the Offgas Cooler, filtered in the Offgas Filter, passed through high efficiency particulate air (HEPA) filters and a granular activated carbon bed to remove mercury. The final offgas is monitored by a Continuous Emissions Monitoring System (CEMS), combined with HEPA-filtered building ventilation, and discharged to the stack.

Approximately 20 to 50% of the solid products produced in the DMR are elutriated to the Process Gas Filters as fines. The product fines collected in the Process Gas Filter are transferred to one of the Product Receiver/Coolers. Small quantities of solid materials may also be withdrawn from the Offgas Filter and collected in the Product/Receiver Coolers.

The IWTU includes tanks and ancillary equipment located in Building CPP-1696. CPP-1696 is a two-story, steel-frame, metal sided structure, with the exception of the lower 15 ft of the Vault Storage Area, which is constructed of reinforced concrete. The building is 380 ft 6 in. in its longest dimension (north-south) and 197 ft 6 in. in its widest dimension (west-east). The building contains a multi-tiered roof that is 75 ft at its tallest point. The building contains shielded process areas, some non-shielded filtration and air pollution control equipment, a covered link to the Vault Storage Area, and the container storage area itself. There is also a mezzanine adjacent to the process area that houses the Building Ventilation HEPA Filters. For a detailed description of the IWTU, see Section D of this permit. Drawings 632830 and 632831 represent the space occupancy floor plan for CPP-1696 (see Appendix I to this permit). Drawings 632451, 632452, 632503, 632504, 632512, and 632513 illustrate typical CPP-1696 concrete details (see Appendix I to this permit). Drawings 632483 and 632484 show typical CPP-1696 liner details (see Appendix I to this permit).

IWTU Process Cell

The IWTU Process Cell contains the Waste Feed Tank, Sump Tank, Clarifier Tank, DMR, Process Gas Filter, and Offgas Filter. The total floor space is 37 ft 2 in. by 34 ft 5 in. The IWTU Process Cell is constructed of steel reinforced concrete. The floor and lower 2 ft of the walls are lined with stainless steel. The walls above the lined containment are epoxy-coated.

The floor slopes to a collection trough along the north wall of the cell. The trough drains to a sump equipped with leak detection. Upon a sump alarm, the collected liquid is jetted to the Waste Feed Tank, VES-SRC-131, or the NWCF (VES-NCC-101, VES-NCC-102, or VES-NCC-103). Both the stainless-steel liner and the epoxy coating are compatible with the wastes and decontamination solutions managed at the IWTU.

Carbon Reduction Reformer Cell

The CRR cell houses the CRR and Offgas Cooler. The CRR cell has a 19 ft 6 in. by 34 ft 5 in. floor area and is constructed of steel reinforced concrete with a stainless steel liner that extends 1 ft 8 in. up the walls. The walls above the lined containment are epoxy coated. Both the stainless-steel liner and the epoxy coating are compatible with the wastes and decontamination solutions managed at the IWTU.

The floor slopes to a collection trough along the south wall of the cell. The trough drains to a sump equipped with leak detection. Upon a sump alarm, the collected liquid is jetted to the Waste Feed Tank, VES-SRC-131, or the NWCF (VES-NCC-101, VES-NCC-102, or VES-NCC-103). Both the stainless-steel liner and the epoxy coating are compatible with the wastes and decontamination solutions managed at the IWTU.

Canister Filling Cells

The Canister Filling Cells house the waste piles, the Product Receiver/Cooler tanks (above), the tank cooling/filtering loop, and the canister filling and capping stations (below). Each Canister Filling Cell has a 17 ft 6 in. by 23 ft 8 in floor area and is constructed of steel reinforced concrete with a stainless steel liner that extends 1 ft up the walls. The walls above the lined containment are epoxy-coated. The stainless-steel liner and epoxy coating are compatible with the wastes and decontamination solutions managed at the IWTU.

The floor slopes to a collection trough that drains to a sump equipped with leak detection. Upon a sump alarm, the collected liquid is jetted to the Waste Feed Tank, VES-SRC-131, or the NWCF (VES-NCC-101, VES-NCC-102, or VES-NCC-103).

Solids Sample Cell

The Solids Sample Cell contains the sample receiver. The cell has a 4 ft by 8 ft floor area and is constructed of steel reinforced concrete with a stainless steel liner that covers the floor and lower 1 ft of the walls. The walls above the lined containment are epoxy-coated. Both the stainless-steel liner and the epoxy coating are compatible with the wastes and decontamination solutions managed at the IWTU.

The floor slopes to a collection trough that drains to a sump equipped with leak detection. Upon a sump alarm, the collected liquid is jetted to the Waste Feed Tank, VES-SRC-131, or the NWCF (VES-NCC-101, VES-NCC-102, or VES-NCC-103).

Vault Storage Area

The vault storage area houses the storage vaults that contain the filled canisters. The filled canisters are placed in concrete vaults that can accommodate a 4X4 array of canisters. A concrete lid is placed on the vault and the vaults are then moved to the Vault Storage Area. The Vault Storage Area has a 114 ft by 123 ft 6 in. floor area constructed of steel reinforced concrete.

ATTACHMENT 1 - SECTION D - PROCESS INFORMATION

RCRA PERMIT

FOR THE

IDAHO NATIONAL LABORATORY

Volume 14
INTEC Liquid Waste Management System

Attachment 1, Section D
Process Information

Revision Date: September 5, 2019

CONTENTS

ACRONYMS v

D. PROCESS INFORMATION 1

D-1. Containers 39

D-1b Containers Without Free Liquids 40

D-1b(1) Test for Free Liquids 40
D-1b(2) Description of Containers 41
D-1b(3) Container Management Practices 41
D-1b(4) Container Storage Area Drainage 42

D-2 Tank Systems 42

D-2a Existing Tank Systems 42

D-2a(2) Existing Corrosion Practices 42

D-2b New Tank Systems 42

D-2b(1) Assessment of New Tank System's Integrity 43
D-2b(2) External Corrosion Protection 43
D-2b(3) Description of Tank System Installation and Testing Plans and Procedures 43

D-2c Dimensions and Capacity of Each Tank 43

D-2d Description of Feed Systems, Safety Cutoffs, Bypass Systems, and Pressure Controls 56

D-2e Diagrams of Piping, Instrumentation, and Process Flow 77

D-2f Containment and Detection of Releases 82

D-2f(1) Plans and Description of the Design, Construction, and Operation of the Secondary Containment System 82

D-2f(1)(a) Tank Age Determination 82
D-2f(1)(b) Requirements for Secondary Containment and Leak Detection 82

D-2g Controls and Practices to Prevent Spills and Overflows 101

D-3. Waste Piles 104

D-3a List of Wastes 104

D-3b Exemption from Liner and Groundwater Monitoring Requirements 104

D-3b(1) Enclosed Piles 104

D-8. Miscellaneous Units....105

D-8a. Description of Miscellaneous Units....105

D-8b Environmental Performance Standards for Miscellaneous Units....106

D-8b(1) Miscellaneous Unit Wastes....109
D-8b(2) Containment System....109
D-8b(3) Site Air Conditions....109
D-8b(4) Prevention of Air Emissions....110
D-8b(5) Operating Standards....111
D-8b(6) Site Hydrogeologic Conditions....114
D-8b(7) Site Precipitation....115
D-8b(8) Groundwater Usage....115
D-8b(9) Surface Waters and Surface Soils....115
D-8b(10) Area Land Use....115
D-8b(11) Migration of Waste Constituents....116
D-8b(12) Evaluation of Risk to Human Health and the Environment....116

EXHIBITS

Exhibit D-1. PEWE System flow diagram and inputs....12

Exhibit D-2. LET&D System flow diagram....15

Exhibit D-3. ETS Flow Diagram....18

Exhibit D-4. ETS Inputs....19

TABLES

Table D-1. PEWE Tanks....45

Table D-2. LET&D Tanks....48

Table D-3. ETS Tanks....49

Table D-4. IWTU Tanks....53

Table D-5. Tank Inputs & Outputs....56

Table D-6 IWTU Automatic Wastet Feed Cutoff....67

Table D-7. IWTU Pressure Relief Valves....76

Table D-8. List of ILWMS System Diagrams....79

Table D-9. Instrument Table....117

APPENDICES

Appendix D-1. Feed Pump P-SRC-231 Equipment Data Sheet IWTU

Appendix D-2. Sintered Metal Filter Elements - Equipment Data Sheets [Note: Data Sheets for F-SRC-153FE and F-SRC-160FE are considered OUO/CBI, this information is located in the OUO/CBI section of this Permit (Appendix VII).]

Appendix D-3. GAC Bed Adsorbers Breakthrough Calculations

Appendix D-4. Warm-up and Initiation of Feed to the IWTU

Appendix D-5. Risk Assessment for Air Emissions from the Integrated Waste Treatment Unit and INTEC Liquid Waste Management System

Appendix D-6. Modifications to Automatic Waste Feed Cut Off and Operating Parameter Limits During IWTU Shakedown, System Performance Testing, Post System Performance Testing and Normal Operations

ACRONYMS

AE	Architectural Engineer
API	American Petroleum Institute
APS	Atmospheric Protection System
ASME	American Society of Mechanical Engineers
AWFCO	Automatic Waste Feed Cutoff
CFR	Code of Federal Regulations
COPC	compounds of potential concern
CPP	Chemical Processing Plant
CRR	Carbon Reduction Reformer
DCS	Distributed Control System
DEQ	Department of Environmental Quality
DMR	Denitration and Mineralization Reformer
EPA	Environmental Protection Agency
ETS	Evaporator Tank System
gpm	gallons per minute
HEPA	high efficiency particulate air
HLLWE	High Level Liquid Waste Evaporator
HWMA	Hazardous Waste Management Act
INEEL	Idaho National Engineering and Environmental Laboratory
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IWTU	Integrated Waste Treatment Unit
ILWMS	INTEC Liquid Waste Management System
JB	junction box
LET&D	Liquid Effluent Treatment and Disposal (facility)

LRA	level recorder alarm
NGLW	newly generated liquid waste
NWCF	New Waste Calcining Facility
PE	professional engineer
PEWE	Process Equipment Waste Evaporator
P&ID	piping and instrumentation diagram
POG	process offgas
PWL	process waste liquid
RCRA	Resource Conservation and Recovery Act
RH	remote-handled (waste)
RSS	Rapid Shutdown System
SBW	Sodium Bearing Waste
SLRA	Screening Level Risk Assessment
TFF	Tank Farm Facility
TFT	Tank Farm Tank
TOC	Total Organic Carbon
TRU	Transuranic
VOG	vessel offgas
WC	water column

SECTION D. PROCESS INFORMATION

As defined under the Resource Conservation and Recovery Act (RCRA), the Idaho Hazardous Waste Management Act (HWMA), the Code of Federal Regulations (CFR), and IDAPA, there are five process codes associated with the regulated hazardous waste management units in the Idaho Nuclear Technology and Engineering Center (INTEC) Liquid Waste Management System (ILWMS). The process codes are S01 - container storage; S02 - tank storage; S03 - waste pile storage; T01 - tank treatment; and X99 - other miscellaneous treatment (fractionation, evaporation, steam reforming).

The system consists of the Process Equipment Waste Evaporator (PEWE) system, the Liquid Effluent Treatment and Disposal (LET&D) facility, the Evaporator Tank System (ETS), and the Integrated Waste Treatment Unit (IWTU). The system includes tanks and ancillary equipment in Buildings CPP-604, CPP-649, CPP-659, CPP-1618, CPP-1696, and associated valve boxes and junction boxes (JB) (C-30, C-32, C-37, C-38, C-40, A-7, B-1, B-2, B-4, B-5, B-9, B-10, B-11, D-4, D-5, D-8, JB-7, JB-8) at the INTEC. The equipment associated with these units is addressed separately within this permit. The PEWE system is discussed first, then the LET&D, the ETS, and finally the IWTU. The regulated tanks and ancillary equipment specific to the PEWE system are listed below:

- VES-WL-132, CPP-604 Evaporator Feed Sediment Tank (regulated under IDAPA as a storage/treatment tank)
- VES-WL-133, CPP-604 Evaporator Feed Collection Tank (regulated under IDAPA as a storage/treatment tank)
- VES-WL-102, CPP-604 Surge Tank for VES-WL-133 (regulated under IDAPA as a storage/treatment tank)
- VES-WL-109, CPP-604 Evaporator Head Tank (regulated under IDAPA as a storage tank)
- EVAP-WL-129, CPP-604 Evaporator Unit, including VES-WL-129, VES-WL-130, HE-WL-307, and HE-WL-308 (regulated under IDAPA as a miscellaneous unit with treatment/storage tanks)
- VES-WL-134, CPP-604 Process Condensate Surge Tank (regulated under IDAPA as a storage tank)
- EVAP-WL-161, CPP-604 Evaporator Unit, including VES-WL-161, VES-WL-162, HE-WL-300, and HE-WL-301 (regulated under IDAPA as a miscellaneous unit with treatment/storage tanks)

- VES-WL-131, CPP-604 Process Condensate Surge Tank (regulated under IDAPA as a storage tank)
- VES-WL-108, CPP-604 Process Offgas Condensate Knock-Out Pot (regulated under IDAPA as a storage tank)
- VES-WL-111, CPP-604 Bottoms Collection Tank (regulated under IDAPA as a storage/treatment tank)
- VES-WL-101, CPP-604 Bottoms Collection Tank (regulated under IDAPA as a storage/treatment tank)
- VES-WM-100, VES-WM-101, and VES-WM-102, CPP-604 Tank Farm Tanks (regulated under IDAPA as storage/treatment tanks)
- VES-WL-135 (DVB-OGF-D5), VES-WL-136 (DVB-OGF-D8) VES-WL-137 (CPP-649), VES-WL-138, VES-WL-139, VES-WL-142, VES-WL-144 and VES-WL-150 (CPP-604), Process Waste Liquid System (regulated under IDAPA as storage tanks)
- VES-WL-106, VES-WL-107, and VES-WL-163, CPP-604 Process Condensate Collection Tanks (regulated under IDAPA as treatment/storage tanks).

Functional descriptions of the regulated tanks and ancillary equipment specific to the PEWE system are listed below:

VES-WL-132, Evaporator Feed Sediment Tank

VES-WL-132 functions as a settling basin for solids that would otherwise settle out in the Evaporator Feed Collection Tank, VES-WL-133. When the waste stream enters VES-WL-132, it encounters a baffle-and-weir system. The solids settle out of the solution as it flows under the baffle and over the weir.

VES-WL-133, Evaporator Feed Collection Tank

VES-WL-133 serves both evaporators, EVAP-WL-129 and EVAP-WL-161, and receives wastes from various sources. Wastes are transferred from VES-WL-133 to either the Evaporator Head Tank, VES-WL-109, or directly to EVAP-WL-129.

VES-WL-102, Surge Tank for VES-WL-133

The original function of this tank was as a feed collection tank for the PEWE system. The PEWE system was upgraded, and VES-WL-133 now serves as the evaporator feed collection tank.

The current function of this tank is to provide surge capacity for VES-WL-133. It is also possible to feed the evaporators from this tank.

VES-WL-109, Evaporator Head Tank

The function of this tank is to provide a constant head for feed solution for EVAP-WL-161. Feed is pumped to this tank from the Evaporator Feed Collection Tanks, VES-WL-102 or VES-WL-133. The Evaporator Head Tank has an overflow that returns to VES-WL-102 or VES-WL-133.

EVAP-WL-129, Evaporator Unit (includes VES-WL-129, VES-WL-130, HE-WL-307 and HE-WL-308)

The function of the evaporator is to reduce the volume of waste sent to the INTEC Tank Farm Facility (TFF). The evaporator is composed of a flash column, VES-WL-129, a mist eliminator, VES-WL-130, a reboiler, HE-WL-307, and a condenser, HE-WL-308. The feed pumps draw waste from the Evaporator Feed Collection Tank, VES-WL-133, and transfer the waste to the evaporator. The evaporator uses steam to heat the solution in reboiler HE-WL-307. The solution is circulated from the reboiler through the flash column, where the liquid flashes and vapor is separated from the liquid. Liquid drops to the bottom of the flash column and is recycled back to HE-WL-307. Constituents of the waste that have a lower boiling point than the system temperature flash and produce vapor. The constituents with a higher boiling point remain liquid and are re-circulated through the evaporator.

The vapor rises in the flash column, passes a baffle and then passes through a coarse wire mesh to remove entrained liquid droplets from the vapor. The vapor then enters the mist eliminator, VES-WL-130, which contains a fine wire mesh to remove additional entrained liquid droplets (light constituents and water). The remaining vapors from the evaporator flow to condenser HE-WL-308. The condensates from HE-WL-308 are normally drained to VES-WL-131, the Process Condensate Surge Tank. The condensates can alternately be drained to VES-WL-134, the Process Condensate Surge Tank. The remaining non-condensable vapor is routed to the Vessel Offgas (VOG) system.

When the level in the Process Condensate Surge Tank, VES-WL-131, reaches a preset level, the liquid is transferred to one of the Process Condensate Collection Tanks (VES-WL-106, VES-WL-107, or VES-WL-163).

VES-WL-134, Process Condensate Surge Tank

VES-WL-134 collects condensate from the evaporator. VES-WL-134 provides the capability for the evaporators to be operated in series. For series operation, EVAP-WL-129 is operated until VES-WL-134 is full. The tank provides feed for EVAP-WL-161.

Future plans for this tank are to store nitric acid recovered from the LET&D process via VES-WLL-195 to allow more efficient operation of the process.

EVAP-WL-161, Evaporator Unit (includes VES-WL-161, VES-WL-162, HE-WL-300 and HE-WL-301)

The EVAP-WL-161 is similar to EVAP-WL-129 in both design and operation. A difference is that EVAP-WL-161 is fed from an Evaporator Head Tank, VES-WL-109, rather than receiving feed directly from the feed pumps. The feed pumps draw waste from the Evaporator Feed Collection Tank, VES-WL-133, and transfer the waste to VES-WL-109. The evaporator is fed by gravity from VES-WL-109. The evaporator is composed of a flash column, VES-WL-161, a separator, VES-WL-162, a reboiler, HE-WL-300, and a condenser, HE-WL-301.

The evaporator uses steam to heat the solution in reboiler HE-WL-300. The solution is circulated from the reboiler through the flash column, where the liquid flashes and vapor is separated from the liquid. Liquid drops to the bottom of the flash column and is recycled back to HE-WL-300. Constituents of the waste that have a lower boiling point than the system temperature flash and produce vapor. The constituents with a higher boiling point remain liquid and are re-circulated through the evaporator.

The vapor rises in the flash column, passes a baffle and then passes through a coarse wire mesh to remove entrained liquid droplets from the vapor. The vapor then enters the separator (mist eliminator), VES-WL-162, which contains a fine wire mesh to remove additional entrained liquid droplets (light constituents and water). The remaining vapors from the evaporator flow to condenser HE-WL-301. The condensates are normally drained to VES-WL-131, the Process Condensate Surge Tank. The remaining non-condensable vapor is routed to the VOG system.

When the level in VES-WL-131 reaches a preset level, the liquid is transferred to one of the Process Condensate Collection Tanks (VES-WL-106, VES-WL-107, or VES-WL-163).

VES-WL-131, Process Condensate Surge Tank

VES-WL-131 collects condensate from the evaporator. When the tank reaches a preset level, the contents are transferred to one of the Process Condensate Collection Tanks (VES-WL-106, VES-WL-107, or VES-WL-163). A heel of approximately 20 percent is maintained in the tank to protect the pumps.

VES-WL-108, Process Condensate Knock-Out Pot

The function of the Process Condensate Knock-Out Pot is to remove and collect condensed liquid from the evaporator VOG before the offgas is released to the plant VOG.

VES-WL-101 and VES-WL-111, Bottoms Collection Tanks

VES-WL-101 and VES-WL-111 are collection points for waste to be transferred from the PEWE system, TFF, or other facilities. These tanks collect, store, and/or treat the PEWE system concentrated bottoms.

VES-WM-100, VES-WM-101, and VES-WM-102, CPP-604 Tank Farm Tanks (TFT)

VES-WM-100, VES-WM-101, and VES-WM-102 are collection points for waste to be transferred to the PEWE system. These tanks can be used as surge capacity for the PEWE feed storage/treatment or for the storage/treatment of PEWE bottoms.

VES-WL-135, VES-WL-136, VES-WL-137, VES-WL-138, VES-WL-139, VES-WL-142, VES-WL-144, and VES-WL-150, Process Waste Liquid (PWL) Tanks and Sumps

The PWL system collects hazardous waste liquid from CPP-604, CPP-649, and associated valve boxes and transfers the waste to the PEWE system.

The PWL tanks and sumps are located in CPP-604, CPP-649, and associated valve boxes. The purpose of the system is to collect offgas condensate and liquid from floor drains and transfer the waste to the PEWE Evaporator Feed Collection Tank, VES-WL-133. The system is comprised of tanks VES-WL-135, -136, -137, -138, -139, -142, -144, -150, and various cell sumps. VES-WL-150 collects liquids from the floor drains and the other tanks collect offgas condensate. A sump or vault secondarily contains each of the tanks.

Sumps SU-WL-140, -143, -145, -146, -147 and -148 do not contain PWL tanks. Sumps SU-WL-140 and SU-WL-143 are located in the Rare Gas Plant in CPP-604. Since the Rare Gas Plant is no longer active there are no sources of waste that would be collected in either sump. Sump SU-WL-148 is located at the INTEC main stack. In the event of equipment failure, condensate from the main stack could collect in this sump. These sumps are emergency equipment and do not routinely collect waste; therefore, the sumps are exempt from requiring secondary containment. Sumps SU-WL-145, SU-WL-146, and SU-WL-147 are part of the secondary containment and leak detection system for the PEWE Condensate Collection Cell and PEWE EVAP-WL-161 Cell. As such, these sumps do not require the emergency structure exemption set forth in IDAPA 58.01.05.008 [40 CFR §264.1(g)(8)(i)].

The tanks and sumps are jetted upon high level detection. All are transferred into a common header and then transferred into VES-WL-133, except VES-WL-150, which is transferred into the Evaporator Feed Sediment Tank, VES-WL-132, which is a settling tank. The settling tank drains directly into VES-WL-133.

VES-WL-106, VES-WL-107, and VES-WL-163, CPP-604 Process Condensate Collection Tanks

The Process Condensate Collection Tanks (VES-WL-106, VES-WL-107, and VES-WL-163) collect the evaporator vapor condensate (overheads) from the PEWE process.

Tank Farm Valve Boxes

The reinforced concrete diversion valve boxes are buried underground in the TFF. Access to the diversion valve boxes is provided for inspection, repair, or upgrade to the valves, transfer lines, and associated equipment. Diversion valve boxes with radioactive waste transfer lines are equipped with stainless steel liners which extend 30 to 60 centimeters (12 to 24 inches) up the walls.

Diversion valve boxes with radioactive waste transfer lines are equipped with sumps for the collection of wastes that may leak from the line into its encasement or valves. The remaining diversion valve boxes are equipped with drains that discharge to diversion valve boxes equipped with sumps.

Leak detection systems are installed in the active diversion valve boxes. These systems consist of radiation monitors designed to detect changes in radiation levels, liquid level detection instrumentation, or cameras. For the radiation monitors, a background radiation level is determined at

the time of the calibration and alarms are set accordingly. An alarm indicates a possible leak into the sump of a diversion valve box.

During grouting of the VES-WM-181 vault to support TFF closure activities, grout was inadvertently introduced into valve boxes DVB-WM-PW-B4, DVB-WM-PW-B5, and DVB-WM-PW-B9. The operability of the radiation monitors, level instrumentation, sumps, and jets in these valve boxes became questionable when the grout was inadvertently introduced. Leak detection cameras have been installed in valve boxes DVB-WM-PW-B4, DVB-WM-PW-B5, and DVB-WM-PW-B9 to replace the level instrumentation. New liquid level detection instrumentation was also installed in DVB-WM-PW-B9. Likewise, a sump pump has been installed in valve box DVB-WM-PW-B9 to provide a means to remove any potential liquid accumulation in the valve box (both DVB-WM-PW-B4 and DVB-WM-PW-B5 gravity drain to DVB-WM-PW-B9).

Any liquid that might leak into either DVB-WM-PW-B4 or DVB-WM-PW-B5 would immediately gravity drain to DVB-WM-PW-B9; therefore only DVB-WM-PW-B9 is inspected on a daily basis for leaks (INTEC-8185, RCRA Tank Farm Daily Inspections and Process Monitoring Sheet). However, during waste transfers through these valve boxes, all three are monitored continuously for leaks using the leak detection cameras.

PEWE System Operation

The PEWE system reduces the volume of hazardous wastes sent to the TFF. The PEWE system evaporates the wastes, producing concentrated wastes (bottoms) and vapor condensates (overheads). The overheads are transferred to the LET&D facility for further processing. Bottoms generated from the PEWE go to VES-WL-101 or VES-WL-111. Solutions may be transferred back to VES-WL-133 and blended with other wastes for further evaporation when appropriate concentration of the waste has not been achieved (i.e., all available feed solutions have been processed, loss of utilities, etc.). Returning the waste to VES-WL-133 reduces the volume of waste being transferred to the TFF.

The evaporator is operated on a semi-continuous basis. While the evaporator is operating, feed is added to the evaporator to keep the liquid in the operating evaporator at a preset level. Feed is continuously added to make up for the liquid that is boiled off. The evaporator operates as a thermal siphon. Bubbles form and rise in the tubes as waste is boiled in the reboiler. This produces a motive force that pulls liquid from the evaporator into the reboiler tubes. The rising bubbles flow to the flash

column from the reboiler. At a predetermined level, based on density or temperature, the evaporator is shut down and the evaporator contents (bottoms) are transferred to either VES-WL-101 or VES-WL-111 or are recycled back to VES-WL-133 for further processing. From VES-WL-101 or VES-WL-111, the bottoms can be sent to the CPP-604 TFTs, (VES-WM-100, VES-WM-101, and VES-WM-102), to the TFF, or to the ETS. The overheads are sent to the LET&D for further processing. All of these tanks were designed and constructed to contain the types of solutions stored. The P.E. certifications for these units attest that the tank systems are adequately designed and are compatible with the waste(s) to be stored or treated in accordance with IDAPA 58.01.05.008 [40 CFR § 264.192(a)].

As described above, there may be instances where complete concentration of the waste feed does not occur. When this happens, the remaining feed may be blended with other wastes and reintroduced to the ILWMS. Depending on the characteristics of the new feed solution (e.g., high chlorides, fluorides, or radionuclide concentration), it may be appropriate to route the mixture to the ETS for processing, rather than the PEWE, to ensure optimum treatment and protection of equipment.

With the addition of the C-40 valve box, the PEWE bottoms (from both VES-WL-101 and VES-WL-111) can be transferred to the ETS, TFF, and the CPP-604 TFT. From the CPP-604 TFT, waste can be transferred to the TFF, the ETS, or the PEWE. The transfer lines are encased in stainless steel and equipped with leak detection. Drawings showing transfer routes are included in the Appendix II, Section D Diagram package for the permit.

Occasionally, PEWE process condensate does not meet the feed limits or operational constraints [e.g., fluorides, total organic carbon (TOC), radionuclide concentration] established for the LET&D facility, as identified in Attachment 1, Section D-8b(5) of this Permit. In these instances, the condensate is routed back to the evaporator feed tank and blended with other solutions for further processing.

The temperature of the evaporator liquid is controlled below 110° C. At much higher temperatures unstable chemical compounds can form. The temperature limit is further discussed in Attachment 1, Section D-2d of this permit.

The density of the waste in the evaporator is controlled to reduce the possibility that the heat exchanger tubes will scale up and eventually plug and to maintain heat transfer efficiencies. A solution density > 1.3 indicates the possibility of large quantities of dissolved solids. At very high

densities, the amount of dissolved solids could exceed the solubility of certain species in the solution. Dissolved solids (especially silicates, carbonates, and phosphates) form solid precipitates if the solution has too many dissolved solids. The precipitates can form in the heat exchanger tubes, where the waste is most concentrated, and coat the tubes with a thin layer of solids (scale). Over time, the scale will increase in thickness as more precipitates form. Eventually the scale can become so thick that it reduces heat transfer and evaporator efficiency and may even plug the heat exchanger tubes. One method to help prevent formation of scale is to control (limit) the solution density (specific gravity). When the solution in the evaporator approaches a specific gravity of approximately 1.2 to 1.3, the feed is shut off. The waste is further concentrated to a specific gravity of approximately 1.3 and drained to the Bottoms Collection Tanks, VES-WL-101 and VES-WL-111. From the Bottoms Collection Tanks, the waste can be transferred for storage or further treatment.

Feed flowing to the Evaporator Feed Collection Tank, VES-WL-133, may first pass through the Feed Sediment Tank, VES-WL-132, to allow potential solids to settle out of the stream. When the waste stream enters VES-WL-132, it encounters a baffle and weir system, which allows time for solids to settle out of the solution as the fluid flows under the baffle and over the weir. The waste is accumulated in the Evaporator Feed Collection Tank, VES-WL-133, before being fed to one of two evaporator units, EVAP-WL-129 or EVAP-WL-161. EVAP-WL-161 receives feed from the Evaporator Head Tank, VES-WL-109, and EVAP-WL-129 receives feed directly from the Evaporator Feed Collection Tank, VES-WL-133.

Normally, one evaporator is operated at a time. However, the system was designed so that the evaporators could be operated simultaneously (in series or parallel). The liquid waste is fed to the operating evaporator continuously, until the concentrated liquid reaches a procedurally designated specific gravity or temperature in the PEWE as previously discussed. The evaporators are shut down upon reaching one of the set points.

Other factors that could result in the PEWE being shut down are a lack of feed to the evaporators or a lack of available storage space in the Process Condensate Collection Tanks (VES-WL-106, VES-WL-107, and VES-WL-163). The remaining material in the flash column (bottoms) is concentrated and drained to one of the Bottoms Collection Tanks, VES-WL-101 or VES-WL-111, for temporary storage/treatment or recycled back through VES-WL-133. Sample analysis determines if the TOC limit may exceed LET&D processing parameters and therefore would be routed back to the Evaporator Feed Tank, VES-WL-133, and blended with other solutions for further treatment. From

VES-WL-101 or VES-WL-111 the waste may be transferred to the TFF. The liquid may be left in the evaporators until more feed is made available to continue evaporator operation.

When an evaporator is operating, liquid waste enters the flash column of the evaporator and circulates through the reboiler, where it is boiled in the operating reboiler, HE-WL-307 or HE-WL-300. The boiling waste (liquid/vapor phase) then flows into the flash column, where the liquid phase separates from the vapor phase and drops into the flash column. The liquid phase mixes with liquid waste in the flash column and is re-circulated through the reboiler.

The vapor rises in the flash column, passes a baffle, and then passes through a coarse wire mesh to remove entrained liquid droplets before exiting the flash column. The vapor then enters the mist eliminator, VES-WL-130 or VES-WL-162, which contains a fine wire mesh to further remove entrained liquid droplets. The vapors from the evaporator flow from the wire mesh to a condenser, HE-WL-308 or HE-WL-301, and the condensates drain to the Condensate Surge Tank, VES-WL-131.

When the liquid level in the surge tank reaches a preset level, the liquid is transferred by one of two pumps, to the Process Condensate Collection Tanks (VES-WL-106, VES-WL-107 and VES-WL-163). From the Process Condensate Collection Tanks, the waste is pumped to the Acid Fractionator Waste Feed Head Tank, VES-WLK-197. The waste in VES-WLK-197 is fed by gravity to the LET&D fractionators. Aluminum nitrate may be added in the condensate collection tanks to complex the fluorides to reduce corrosion in the downstream LET&D equipment. When one of the Process Condensate Collection Tanks becomes full, process samples are taken as described in Attachment 2, Section C of this permit. Depending on the results of this analysis, the contents are either routed to the LET&D facility for further processing or are returned to the Evaporator Feed Tank for re-evaporation.

When the evaporators are operated in series, waste is first concentrated in EVAP-WL-129. Condensate from this evaporator is collected in the Condensate Surge Tank, VES-WL-134, which is used for series operation. The condensate in VES-WL-134 is then used as feed for EVAP-WL-161. The condensate from evaporator VES-WL-161 is transferred to the Process Condensate Collection Tanks, via Condensate Surge Tank VES-WL-131.

The evaporators are equipped to allow demineralized water to be injected into the system during a run. The demineralized water is injected while the system is operated. This allows the system to strip acid into the condensate (overheads) more efficiently.

A process flow diagram for the PEWE system is presented in Exhibit D-1. The direct primary hazardous waste sources to the PEWE system are also shown in Exhibit D-1. In addition, the process flow for the PEWE system is represented on Piping and Instrumentation Diagram (P&ID) No. 096156 and 094276 (Sheets 1 – 4) in Appendix II of this permit.

CPP-604 Tank Farm Tanks (TFT)

The CPP-604 TFT system can receive wastes for temporary storage before they are transferred to PEWE feed tanks, the TFF, or the ETS, also known as the High Level Liquid Waste Evaporator (HLLWE), located in the New Waste Calcining Facility (NWCF). The CPP-604 TFT system includes VES-WM-100, VES-WM-101, and VES-WM-102. The process flow for the CPP-604 TFT system is represented on P&ID No. 057498 in Appendix II of this permit. VES-WM-100 receives the incoming waste.

VES-WM-100, VES-WM-101, and VES-WM-102 are also each equipped with a transfer jet that transfers waste from the CPP-604 TFT system to the PEWE, the ETS, and TFF, or back to the TFTs.

The jet, JET-WM-503, in VES-WM-100 has been isolated to prevent transfers to VES-WM-102, a jet in VES-WM-102 transfers solution to VES-WM-101, and the jet, JET-WM-504, in VES-WM-101 has been isolated to prevent transfers solution to VES-WM-100.

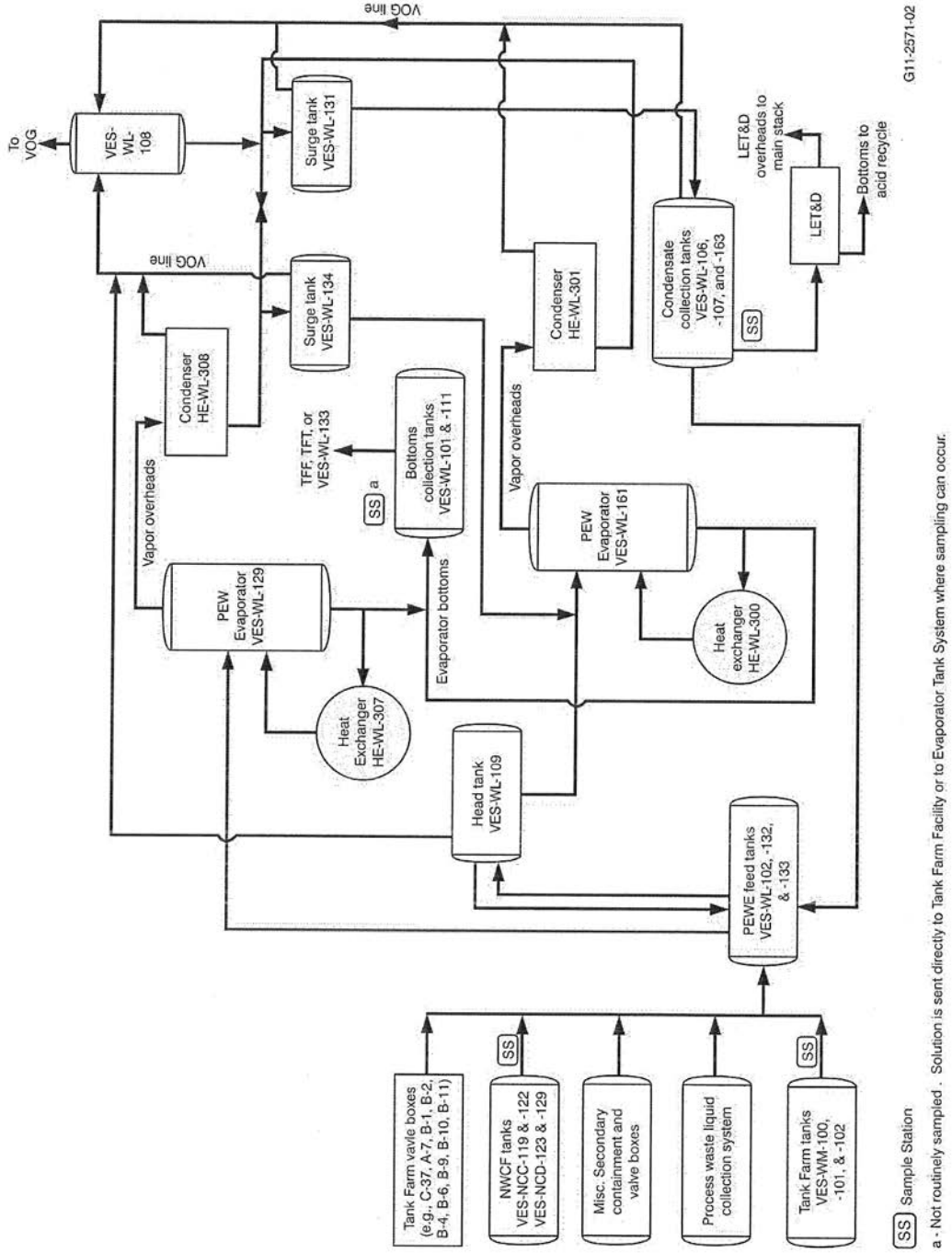


Exhibit D-1. PEWE System flow diagram and inputs.

CPP-1618 Liquid Effluent Treatment and Disposal Facility

The LET&D is part of the liquid waste treatment system at the INTEC. The LET&D system equipment functions very similarly to the PEWE system equipment. The LET&D processes the PEWE overhead condensate waste stream to recover nitric acid. Exhibit D-2 schematically shows the tanks and equipment that are included in the LET&D system. The regulated tanks and ancillary equipment specific to the LET&D system are listed below:

- VES-WLK-197, CPP-1618 Acid Fractionator Waste Feed Head Tank (regulated under IDAPA as a storage tank)
- FRAC-WLL-170, CPP-1618 Acid Fractionator, including FRAC-WLL-170, HE-WLL-391, HE-WLL-396, HE-WLL-398, and VES-WLL-198 (regulated under IDAPA as a miscellaneous unit with treatment/storage tanks)
- FRAC-WLK-171, CPP-1618 Acid Fractionator, including FRAC-WLK-171, HE-WLK-392, HE-WLK-397, HE-WLK-399, and VES-WLK-199 (regulated under IDAPA as a miscellaneous unit with treatment/storage tanks)
- VES-WLL-195, CPP-1618 Acid Fractionator Bottoms Tank (regulated under IDAPA as a storage tank)
- VES-NCR-171, CPP-659 Annex LET&D Nitric Acid Recycle Tank (regulated under IDAPA as a storage tank)
- VES-NCR-173, CPP-659 Annex Nitric Acid Head Tank (regulated under IDAPA as a storage tank).

Acid Fractionators System and Process

The LET&D treatment process reduces the volume of liquid waste by fractionating PEWE overhead condensates into saturated steam/offgas and acid fractions. The fractionators separate the waste solution into water (overheads) and nitric acid (bottoms). Normally, only one fractionator operates at a time.

The feed is transferred from the Process Condensate Collection Tanks to the Acid Fractionator Waste Feed Head Tank (VES-WLK-197) in Cell 1 of the LET&D. The waste is gravity fed to the fractionators, FRAC-WLL-170 or FRAC-WLK-171, via the Acid Fractionator Waste Feed Head Tank.

The feed is heated to its boiling point by introducing steam to the reboilers, HE-WLL-398 or HE-WLK-399. The vapors from the boiling liquid rise through several stacked sieve trays in VES-WLL-170 or VES-WLK-171. The sieve trays (perforated plates) installed in the fractionator column mix the

vapors and liquid. As the descending liquid cools the rising vapor, the nitric acid condenses and remains in solution on the trays, and flows to the bottom of the fractionator.

The bottoms retain approximately 99% of the acid contained in the feed. The density is controlled to produce an approximately 12 Molar nitric acid. When the density setpoint (specific gravity of approximately 1.2 to 1.3) of the nitric acid in the fractionator bottoms is reached, a portion of the solution is drawn off and collected in VES-WLL-195. The nitric acid is used for INTEC waste treatment and decontamination activities. The nitric acid solution stored in VES-WLL-195 is transferred to:

- the PEWE, VES-WL-133, to acidify the PEWE feed,
- VES-WL-101/111 to acidify the PEWE bottoms,
- VES-NCC-101, -102, -103 to acidify ETS or IWTU feed solutions,
- VES-NCR-171 for reuse at the INTEC, or
- the TFF.

The saturated steam offgas generated from the fractionation process is drawn through a condenser, HE-WLL-396 or HE-WLK-397, where it is partially condensed, producing a reflux stream and steam offgas. The steam and reflux flow through a liquid separator, VES-WLL-198 or VES-WLK-199, where the reflux is removed and returned to the top of the acid fractionator. The reflux flows downward through the upper trays as a final scrub. The remaining steam flows through the separator, and then is heated by a superheater, HE-WLR-394 or HE-WLR-395, is filtered through the High Efficiency Particulate Air (HEPA) filters (F-WLR-176 or F-WLR-177) for radioactive particles, and exhausted to the atmosphere via the INTEC Main Stack.

The Acid Recycle Tank (VES-NCR-171) and Acid Head Tank (VES-NCR-173) are located in the CPP-659 Annex adjacent to the New Waste Calcining Facility (NWCF, CPP-659). VES-NCR-171 has a capacity of approximately 22,500 gallons. The tank is a stainless steel tank that stores acid produced by the LET&D fractionation process. VES-NCR-173 is a stainless steel tank, which stores nitric acid. VES-NCR-173 has capacity of approximately 90 gallons.

Acid from VES-NCR-171 is airlifted into VES-NCR-173 and placed into a common header that can be routed for reuse throughout the INTEC.

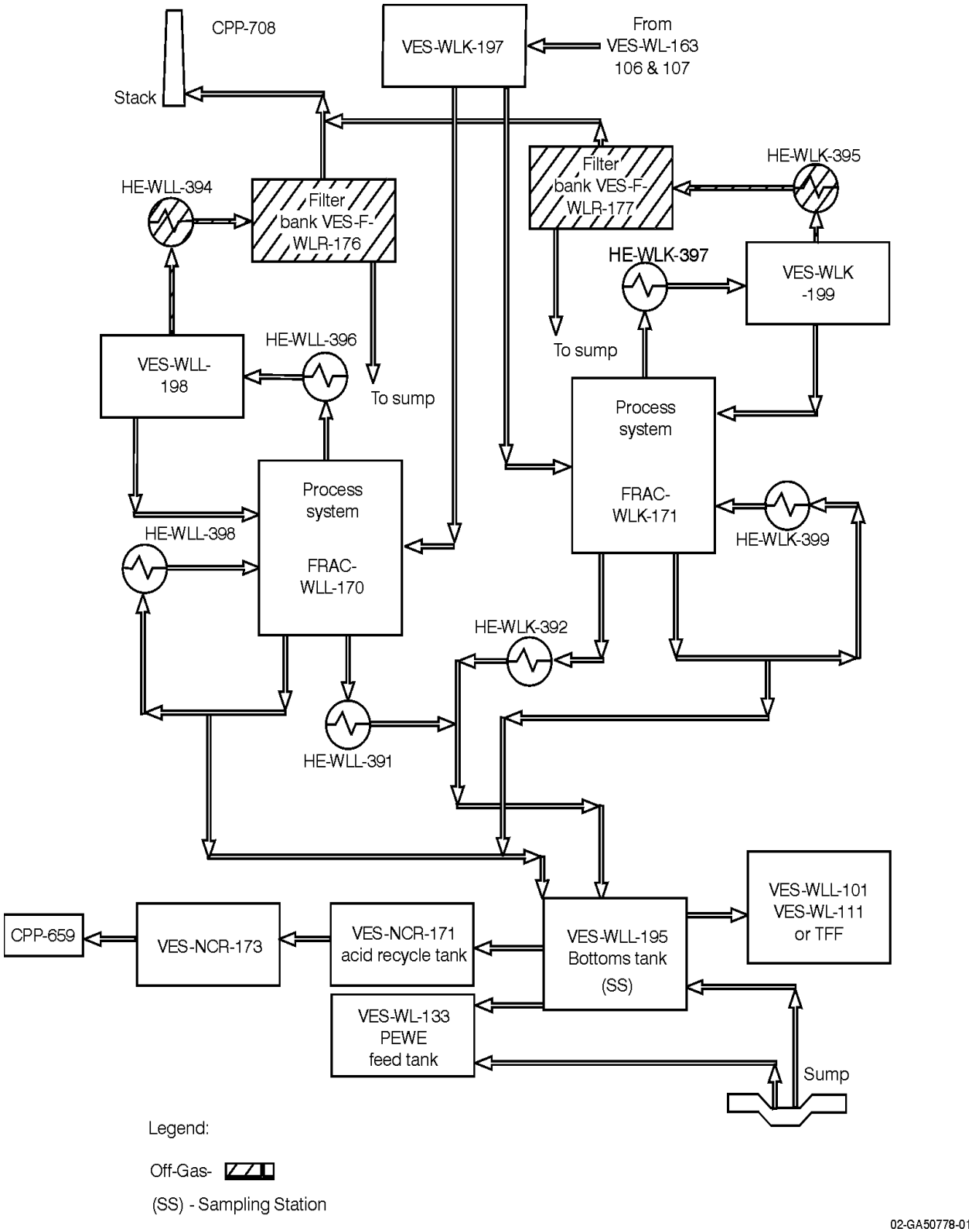


Exhibit D-2. LET&D System flow diagram.

CPP-659 Evaporator Tank System

The ETS equipment functions similarly to the PEWE system equipment. The purpose of the ETS is to reduce the volume of waste sent to and stored in the TFF.

A process flow diagram for the ETS is presented in Exhibit D-3. Exhibit D-4 schematically shows the tanks and equipment that are included in the ETS.

The regulated tanks and ancillary equipment specific to the ETS are listed below:

- VES-NCC-152, CPP-659 Constant Head Feed Tank (regulated under IDAPA as a storage tank)
- EVAP-NCC-150, CPP-659 Evaporator Unit (includes VES-NCC-150, HE-NCC-350, HE-NCC-351) (regulated under IDAPA as a miscellaneous treatment (evaporation) unit with tank storage
- VES-NCC-101, CPP-659 Blend/Hold Tank (regulated under the IDAPA as a storage/treatment tank)
- VES-NCC-102, CPP-659 Blend/Hold Tank (regulated under the IDAPA as a storage/treatment tank)
- VES-NCC-103, CPP-659 Blend/Hold Tank (regulated under the IDAPA as a storage/treatment tank)
- VES-NCC-119, CPP-659 Fluoride Hot Sump Tank (regulated under the IDAPA as a storage/treatment tank)
- VES-NCC-122, CPP-659 Non-Fluoride Hot Sump Tank (regulated under the IDAPA as a storage/treatment tank)
- VES-NCC-108, CPP-659 Scrub Hold Tank (regulated under the IDAPA as a storage/treatment tank)
- VES-NCC-136, CPP-659 Vent Condenser Knockout Drum (regulated under the IDAPA as a storage tank)
- VES-NCC-116, CPP-659 Mist Collector (regulated under the IDAPA as a storage tank)

ETS Operation

The function of the ETS is to concentrate liquid waste sent to and stored in the TFF. The overheads are condensed and transferred to the PEWE System for further treatment of the liquid waste. The ETS bottoms are concentrated and transferred to TFF, which reduces the overall volume of waste

stored in the TFF. Other transfer routes are available for VES-NCC-119 and VES-NCC-122 as needed to meet operational requirements.

To begin the evaporation process, the Constant Head Feed Tank (VES-NCC-152) is filled to operational capacity with liquid hazardous waste from the NWCF Blend Tank (VES-NCC-101). The waste is gravity fed from the Constant Head Feed Tank into the flash column (VES-NCC-150).

Once the waste has risen to the normal liquid level within the flash column, steam is introduced into the shell side of the Reboiler (HE-NCC-350) to create a thermal siphon effect. The thermal siphon effect draws the liquid waste from the bottom of the flash column, up through the tube side of the reboiler, vaporizing a portion of the liquid waste, and returning the vapor/liquid waste into the upper portion of the flash column. At this point, the liquid/vapor waste enters a cyclone separator that removes liquid droplets from the vapors, creating an overhead vapor waste stream. These overhead vapors then pass through a demister mesh pad and flow into the tube side of the Condenser (HE-NCC-351). The overhead vapors are condensed by a flow of cooling water through the shell side of the condenser and drained into the Non-Fluoride Hot Sump Tank (VES-NCC-122). The droplets removed from the vaporized waste fall towards the bottom of the flash column and mix with the liquid waste feed stream from the constant head feed tank.

The cycle is repeated until the specific gravity of the liquid waste in the flash column reaches a procedurally designated value. At this point the liquid waste feed stream from the constant head feed tank is turned off. The remaining contents are allowed to concentrate to the desired specific gravity, then the steam to the reboiler is shut off and the thermal siphon effect ends. Concentrated bottoms from the unit are drained into the Fluoride Hot Sump Tank (VES-NCC-119).

The concentration of liquid waste is accomplished in a manner similar to a distillery. The low boiling point materials in the waste are boiled and then condensed. This separates the feed in to the Non-Fluoride Hot Sump Tank (VES-NCC-122) for low boiling point materials and the Fluoride Hot Sump Tank (VES-NCC-119) for higher boiling point materials. The condensates are normally transferred to the PEWE system and the bottoms are transferred to the TFF. The material entering the system is separated in to the condensate tank or the bottom tanks. The PEWE system further processes the ETS condensates. The PEWE (overheads) condensates are transferred to the LET&D facility for processing and the PEWE bottoms can be routed back to VES-WL-133 for further processing or can be transferred to the TFF or ETS.

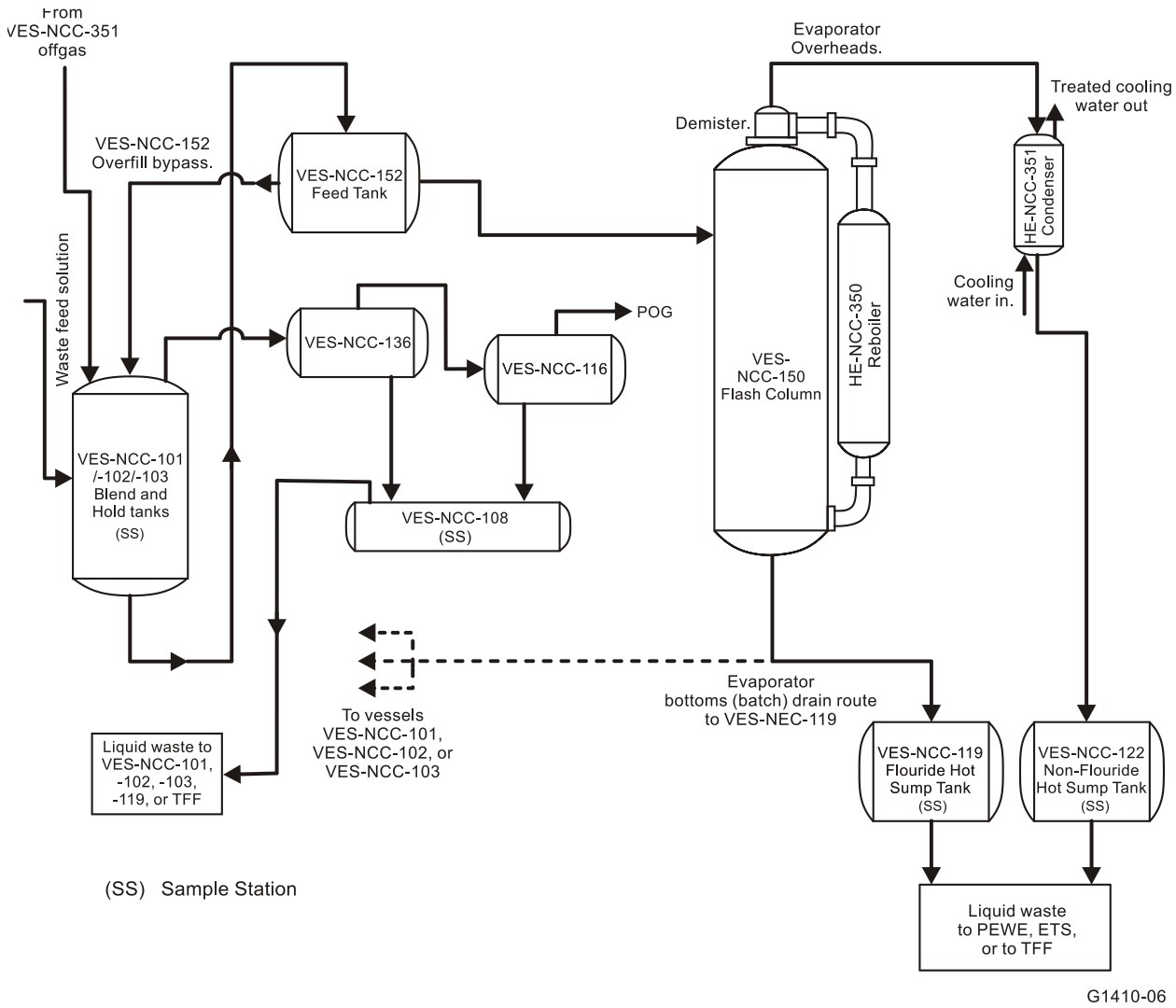


Exhibit D-3. ETS Flow Diagram.

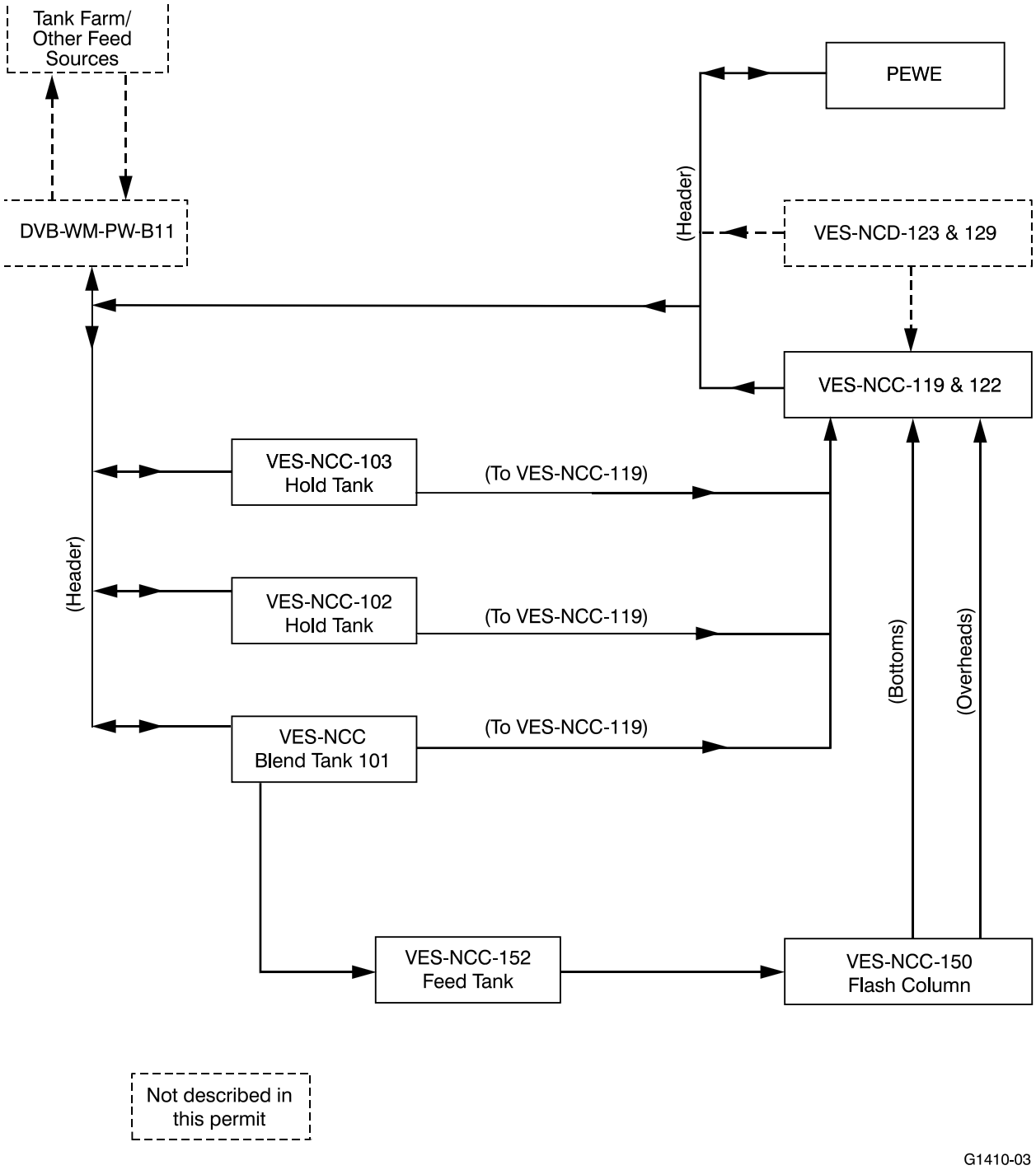


Exhibit D-4. ETS Inputs.

CPP-1696 Integrated Waste Treatment Unit

The IWTU utilizes dual fluidized bed steam reformers to convert liquid waste to a solid granular treatment product. The IWTU is classified as a miscellaneous unit under IDAPA 58.05.05.008 (40 CFR 264.600). The IWTU also utilizes eight storage tanks; one to manage liquid feed and IWTU process solutions, two tanks to cool and collect solid treatment product prior to loading it into canisters for storage and ultimate disposal, one to collect offgas condensate from the emission monitors and stack, one to collect treatment product samples, one tank to collect overflow from the waste feed tank and decontamination solutions, one tank to settle solids from the decontamination solutions, and one tank to collect fire water in the event of IWTU ventilation treatment system upset conditions. Two container storage areas are associated with the IWTU to allow storage of the canisters in portable concrete vaults. The vaults have a maximum storage capacity of 16 canisters and the storage areas allow for 43 vaults and an additional vault in the Vault Loading Area for a total capacity of 44 vaults containing up to 704 canisters. Two waste piles are associated with the IWTU to allow storage of wastes generated within the two Product Load-Out Cells. The cells have a maximum capacity of 32 cubic yards each (based on an available floor area of 11’ by 20’ by 4’).

The regulated tanks and ancillary equipment specific to the IWTU facility are listed below:

- VES-SRC-131, Waste Feed Tank, VES-SRC-133, Sump Tank, and VES-SRC-134, Clarifier Tank (regulated under IDAPA as storage/treatment tanks)
- VES-SRC-190 and -191, Product Receiver/Coolers (regulated under IDAPA as storage tanks)
- TK-SRE-196, Fire Water Collection Tank (regulated under IDAPA as a storage tank)
- TK-SRH-141, Condensate Collection Tank (regulated under IDAPA as a storage tank)
- Integrated Waste Treatment Unit (regulated under IDAPA as a miscellaneous treatment unit), which can be divided into the following two subsystems; 1) Sodium Bearing Waste (SBW) Treatment System, which manages the liquid and offgas phases of the process; and 2) Product Transfer and Loadout System, which deals with solids management. The components of each of these subsystems are identified below:
    - SBW Treatment System, includes VES-SRC-140 [Denitration and Mineralization Reformer (DMR)], F-SRC-153 (Process Gas Filter), VES-SRC-160 [Carbon Reduction Reformer (CRR)], COL-SRC-160 (Offgas Cooler), F-SRC-160 (Offgas Filter), BLO-SRH-260 A and B (Offgas Blowers), F-SRH-140 A, B, C, and D (Process HEPA Pre-filters and Process HEPA Filters), F-SRH-141 A and B (Mercury Adsorbers), and BLO-SRH-240 A and B (Process Exhaust Blowers);
    - Product Transfer and Loadout System, which includes AUG-SRC-440 (DMR Auger/Grinder), F-SRC-191 (Product Receiver Filter), VES-SRC-180 (Product Receiver Filter Product Pump), F-SRC-190 (Product Handling Vacuum Filter), and the Canister Filling Stations (2).

Process flow diagrams for the IWTU (diagrams 632750, 632752, 632753, and 632754) are included in Appendix II of this permit. Also included in Appendix II of this permit are diagram numbers 632756 and 632757, which contain IWTU typical piping and instrumentation diagram symbols and nomenclature.

IWTU Operations

The SBW Treatment System treats mixed liquid wastes; both SBW and newly generated liquid waste (NGLW) resulting from normal operations and facility deactivation and decommissioning activities. The mixed liquid wastes at the Idaho National Laboratory (INL) consist of radioactive, aqueous solutions with high concentrations of nitric acid, nitrates, alkali metals, aluminum, and a wide variety of other inorganic oxides. The SBW steam reforming process: 1) converts nitric acid, nitrates, and nitrites to nitrogen gas and a small quantity of NOx; 2) converts organic material in the SBW to carbon dioxide and water vapor; 3) converts the radionuclides, sodium, potassium, sulfate, chlorides, fluorides, and non-volatile heavy metals into a radioactive dry, solid mineral waste product.

SBW Feed System

The IWTU Feed System is shown on the following P&IDs; SBW Transfers, diagram numbers 632759, 635083, 635084, 637285, 637293, and IWTU Waste Feed Tank, diagram number 632760 (see Appendix II of this permit. [Note: Drawing 632760 is considered OUO/CBI, this information is located in the OUO/CBI section of this Permit (Appendix VII).]

The IWTU Feed System includes waste transfer equipment located in the New Waste Calcining Facility (NWCF), CPP-659, located at INTEC and waste feed equipment in the IWTU. Waste characteristics of the liquid waste that will be treated in the IWTU are presented in Attachment 2 of this permit.

SBW to be treated in the IWTU is transferred from the INTEC TFF to either of three NWCF Blend and Hold Tanks, VES-NCC-101, VES-NCC-102, or VES-NCC-103. The waste is adjusted, blended, and/or sampled, as necessary, in the NWCF before being pumped to the IWTU for treatment. The SBW is sent to the IWTU through a remote transfer operation controlled by IWTU personnel. Two of the three NWCF Hold Tanks, VES-NCC-102 and VES-NCC-103, are equipped with waste transfer pumps, which feed a common waste transfer pipe for transfer of SBW to the Waste Feed Tank, VES-SRC-131. The piping design also provides the capability of transferring SBW back from the Waste Feed Tank to NWCF or Tank Farm. The transfer line is comprised of stainless steel pipe-in-pipe construction to afford adequate and compatible secondary containment. The transfer line drains back to the NWCF Hold Tanks.

The secondary containment line, which is equipped with leak detection and alarm, drains to the Valve Cubicle sump in CPP-659.

The Waste Feed Tank is composed of 304L stainless steel and has a capacity of approximately 2,170 gallons. The Waste Feed Tank is provided with a stainless-steel feed pump, P-SRC-231, which pumps SBW to the DMR for processing and also provides tank recirculation. The waste may be adjusted by adding acid or water, as necessary, before being pumped to the DMR for treatment. The pump recirculates the waste feed to keep the anticipated fine heel solids in the SBW fully suspended in solution. A small slip stream is continuously drawn off the recirculation flow for processing in the reformer system. The Waste Feed Tank is provided with bubbler level probes for level measurement. This enables the level to be accurately determined even if the specific gravity of the tank contents varies. The Waste Feed Tank is also supplied with an emergency overflow vent through VES-SRC-134 to VES-SRC-133, Sump Tank.

The Process Cell contains the Waste Feed Tank, DMR, Process Gas Filter, Offgas Filter, Sump Tank, and Clarifier Tank. The shielding on the Process Cell and Canister Packaging Cells generally consists of 32-in.-thick concrete walls and steel roof hatches. The roof hatches of the Process Cell can be opened to allow access to the cell. Access doors are located to provide remote access to components that may need maintenance.

The Waste Feed Pump is equipped with a variable speed drive that provides the ability to control the tank recirculation rate and discharge pressure. The pump speed is controlled from the Distributed Control System (DCS). The specifications for the Waste Feed Pump are provided as Appendix D-1 to Section D of this permit.

The waste from the tank is pumped by the Waste Feed Pump into the DMR through three waste feed injectors. Three flow control valves control the waste feed to the gas cooled injectors at 0.5 to 1.75 gallons per minute (gpm) each, with a combined not-to-exceed total feed rate limit of 2.5 gpm. Feed pressure and waste flow in each of the DMR injector feed lines is monitored and alarmed to provide indications of either a restriction in flow or a line break. The waste enters the injectors and is atomized into the DMR with a controlled flow of compressed nitrogen and/or instrument air. The Waste Feed Injectors are provided with purge nitrogen connections to allow the line to be pressurized with nitrogen to clear any build-up of solids in the injector, should this occur. The three injectors can also be flushed with water, sodium hydroxide, oxalic acid, potassium permanganate, and/or nitric acid solution, if necessary.

The Waste Feed Tank is provided with a wash-down nozzle installed inside the tank to allow the tank to be flushed with water, sodium hydroxide, oxalic acid, potassium permanganate, and/or nitric acid solution to clean the system prior to any required maintenance or at the time of closure. In addition, the

bubbler level instruments can be purged with nitrogen, water, sodium hydroxide, oxalic acid, potassium permanganate, or nitric acid solutions to remove solids that may accumulate inside the bubbler tube.

Sump Tank and Clarifier Tank

The Sump Tank, VES-SRC-133, is constructed of 304L stainless steel and has a capacity of ~3,390 gallons. The Sump Tank will collect liquids used during shutdown periods for decontamination of the WFT, DMR, OGF and PGF. Overflow from the Waste Feed Tank passes through VES-SRC-134 to VES-SRC-133.

The Clarifier Tank, VES-SRC-134, is constructed of 304L stainless steel and has a capacity of ~494 gallons. The Clarifier Tank allows the solids from decontamination liquids to settle out and provides for the transfer of the solids through a hose connection to a container temporarily staged in secondary containment near the Process Cell south entrance. The liquids overflow the Clarifier Tank to the Sump Tank, VES-SRC-133.

Denitration and Mineralization Reformer and Carbon Reduction Reformer

The DMR and CRR, and related equipment, are shown on the following P&IDs; Denitration and Mineralization Reformer, diagram number 632762, Process Gas Filter, diagram number 632763, Carbon Reduction Reformer, diagram number 632764, Offgas Filter, diagram number 632765, and Offgas Cooler, diagram number 632766. [Note: diagrams 632762, 632763, 632764, 632765 and 632766 are considered OUO/CBI and are located in the OUO/CBI section of this Permit (Appendix VII).]

The DMR and CRR are the core of the IWTU processing system. In these two units, the waste feed is combined with co-reactants and low pressure superheated steam in a fluidized bed. The DMR volatilizes trace organic materials; nitric acid, nitrates, and nitrites are converted to nitrogen gas and small quantities of NOx; and inorganic constituents in the waste are converted to a radioactive dry, solid mineral product.

Denitration and Mineralization Reformer (DMR)

The DMR, VES-SRC-140, is a vertical cylindrical vessel constructed of Haynes 556 alloy. The DMR contains a steam and coal-heated fluidized bed that operates in an oxygen-starved or reducing environment to treat SBW and NGLW. The DMR is operated under reducing conditions throughout the bed and the entire zone above the bed.

Low-pressure superheated steam enriched with controlled quantities of nitrogen/oxygen/carbon dioxide is injected into the bottom of the DMR through four fluidizing gas distributors located at the same elevation and spaced evenly through the diameter of the vessel, providing the motive force for the bed. A fluidizing system near the bottom of the vessel aids in fluidizing the lower portion of the bed near the vessel wall.

Coal is added to the DMR at regular intervals via a hopper and air-lock at the top of the vessel. The coal provides a heat source to maintain bed temperature and reacts with the superheated steam to provide chemical reactants that promote destruction of nitrogen oxides (NOx). The coal can be added in an automatic mode using the transfer system from the additives room, manual mode initiated by an operator using the transfer system from the additives room, or by operators manually adding a measured amount to the additive air lock system.

The waste is fed into the DMR through three nitrogen/air cooled feed nozzles. Each nozzle is equipped with a water flush for purging. The flush system is used during startup to flush the nozzle prior to starting feed to clear any material in the line. The DMR system has a flush water system with a ball valve to control fluid flow. Because ball valves do not provide adequate flow control a globe valve was installed in the DMR waste feed water flush line (outside of the process cell) to provide the needed capability to adjust flow for startup. The flush system can also be used during operations to clear restrictions in the lines or nozzles. The three gas-atomized feed nozzles are located on the same side of the vessel. The waste feed is atomized into the vessel using nitrogen and instrument air, and is instantly evaporated and superheated to the bed temperature by the large mass of hot, fluidized treatment product solids. The resulting dried waste solids quickly heat to reaction temperatures. The organics in the feed are volatized, pyrolyzed, and steam reformed upon contact with the hot bed solids.

During start-up, the bed consists of alumina-based bed media. However, during operations, this material is replaced by carbonate-based treatment product, so that within approximately 4 to 5 days of operation, the original bed media is substantially converted to treatment product solids. The DMR generally operates between 2 and 8 psig in the area above the bed with an average bed temperature of 580°C - 680°C when producing a carbonate-rich treatment product.

The bed level in the DMR is calculated by the DCS using differential pressure instruments. The bed level is controlled between 40 and 68 inches. The range of acceptable bed levels is also a function of the bed composition where solids with a high density (alumina media) can be allowed to operate at a somewhat lower level above the downcomers and still prevent reverse flow up the cyclone downcomers.

A set of three cyclone separation devices internal to the upper head of the DMR serves to separate larger particles entrained in the gas, returning the captured particles to the bed via gravity drain through downcomer pipes and allowing the process gas to flow from the DMR to the Process Gas Filter.

A portion of the DMR bed solids are removed from the bottom of the DMR as necessary through an auger/grinder assembly and transferred to the Product Receiver/Coolers and Canister Packaging systems. The Auger/Grinder is not used for normal solids transfers but is used to breakup larger bed material. The DMR Auger/Grinder is constructed of Inconel 625 and Haynes 556 and consists of nine interchangeable six-tooth rotors and stator components that shear oversized material. The rotors rotate with the motor shaft to shear the material which will allow particles up to 1/2 in. to flow through to a collection pot. The DMR solids transfer eductor uses nitrogen to pneumatically

convey the solids to the Product Receiver/Coolers. After the required amount of solids have been removed, the transfer piping is isolated from the DMR and purged with nitrogen to facilitate complete solids removal from the system and branch lines to avoid plugging. The auger/grinder assembly is equipped with nitrogen purge lines. The nitrogen purge gas flow to the auger/grinder will be regulated as a function of the DMR fluidizing gas flow. As the fluidizing gas flow is changed, the nitrogen purge gas flow is adjusted to follow the fluidizing gas flow. For example, the full auger/grinder nitrogen purge will not be started until the minimum flow to the fluidizing system is established.

Process Gas Filter

The process gas from the DMR flows to the Process Gas Filter, F-SRC-153. The Process Gas Filter is comprised of sintered metal powder-type filter elements contained in a Haynes 556 vessel, provided to capture any DMR product fines carried over in the process gas. The filter elements were manufactured with a fuse installed. The fuse was designed to allow the isolation of individual filter elements if they fail by becoming permanently blinded. It was determined that these fuses were not necessary to be protective of human health and the environment and were removed. The Process Gas Filter operates at approximately 50º to 100°C below the DMR temperature and is constructed of appropriate high temperature alloy metals.

The Process Gas Filter is designed to remove 99 % of particles greater than 2.0 microns in size and includes a tube sheet comprised of bundles containing multiple filter elements that filter the process gas. Each filter bundle is equipped with a ceramic fiber core gasket using a ring of material cut from a thick mat of the high temperature ceramic fibers which eliminates any seams in the core of the gaskets. The gaskets are soaked in a water dispersion of vermiculite (a magnesium-aluminum-silicate mineral) to form a strong, multi-layer film, to enhance the seal ability of the gasket. Each bundle can be remotely removed and replaced if filter change-out is needed. The individual filter bundles are secured to the tube sheet using three couplers that bolt the venturi plates to the tubesheet to prevent lifting and resultant material carryover. The inlet pressure and outlet pressure of the Process Gas Filter are monitored, and the differential pressure across the filter is calculated. Upon high differential pressure across the filter, the filter can be cleaned online using pulse cleaning with nitrogen. Nitrogen is pulsed sequentially through the filter bundles and removed filter cake particulates drop by gravity to the bottom cone of the filter vessel for collection. The pulse cleaning cycle may also be initiated by a timer or manually by the operator. The filtered solids are fluidized into the Process Gas Filter Transfer Eductor, JET-SRC-553, using nitrogen to prevent bridging prior to and during pneumatic transfer to the Product Receivers/Coolers. The specifications for the sintered metal filter elements are provided in Appendix D-2

to Section D of this permit. [Note: Data Sheets for F-SRC-153FE and F-SRC-160FE are considered OUO/CBI, this information is located in the OUO/CBI section of this Permit (Appendix VII).]

To ensure only a limited amount of solids accumulate in the PGF, the vessel is operated to a defined process management control strategy. There is no one process parameter, action, or instrument reading that will limit the amount of solids in the vessels. This control strategy consists of key control parameters, prescriptive operating procedures, and Emergency Alarm Response procedures. The basic control strategy to minimize the amount of elutriated solids generated in the DMR is as follows: the coal and oxygen addition rate are controlled as a function of the DMR hydrogen concentration; the solids are transferred out of the PGF at least once every 24 hours; and the differential pressure across the PGF is monitored and there is an automatic waste feed cutoff (AWFCO) set at 81 inches of water column.

Carbon Reduction Reformer (CRR)

The CRR is a vertical, cylindrical, carbon steel vessel that is entirely refractory-lined. The refractory throughout the system is composed of hard-faced brick and castable high alumina/chrome oxide. The CRR is fluidized by the process gases from the DMR. Carbon is added to the reformer as the primary heat source and to provide further chemical reactions for the process. A stainless steel shroud that is offset from the outer surface of the CRR surrounds most of the vessel. The purpose of the shroud is to channel cooling air flow around the CRR outer shell to limit heat losses to the building. The CRR interior wall temperature is thereby regulated to prevent gases from condensing at the internal vessel walls. The piping between the CRR and Offgas Cooler is also refractory lined and encased within a shroud. Thermocouples monitor the external temperature of the vessel and/or piping and regulate the air flow through the shroud by adjusting damper positions that control the flow of air through the shroud and into the heating, ventilating, and air conditioning system.

The process gases from the DMR flow through the Process Gas Filter to the fluid gas inlet distributors of the CRR, VES-SRC-160, located near the bottom of the vessel. Carbon is added to the CRR at regular intervals via a hopper and air-lock at the top of the vessel. The carbon provides a heat source to maintain bed temperature and provides chemical reactants for the process. The carbon can be added in an automatic mode using the transfer system from the additives room, manual mode initiated by an operator using the transfer system from the additives room, or by operators manually adding a measured amount to the additive air lock system. Pure oxygen may be injected into the gas distributor

only during initial heat up or cool down and shall be disabled while adding waste feed to the DMR. Oxygen/air is fed into the CRR at three locations within the bed; at the elevation of the fluid gas inlet distributors, at the mid bed, and at the splash zone at the top of the bed. This creates distinct reducing and oxidizing zones in the CRR. In the reducing sections residual NOx from the DMR is further reduced to nitrogen gas. The temperatures throughout the fluidized bed are uniform and only minimal levels of thermal NOx are generated. Organic materials, hydrogen, and carbon monoxide are oxidized and steam reformed in the oxidizing zone (upper portions of the bed and above) of the CRR to produce carbon dioxide and water.

The average normal operating temperature of the CRR is maintained between 850°C - 1100°C. Under normal operating conditions the CRR operates under a vacuum of approximately –30" water column at the top of the bed.

The CRR fluidized bed media is a semi-permanent fluidized bed comprised of granular alumina. Since essentially all solids are removed from the DMR process gases before input as fluidizing gas in the CRR, the only increase in bed solids in the CRR is from planned additions from the additive feeder system. The additives consist of alumina and/or aluminum tri-hydrate from the additive feeder system to prevent agglomeration in the bed. Feed bed media is added only to make-up for bed media particle attrition and carryover (elutriation) of bed media particles to the offgas treatment system. The bed level in the CRR is calculated by the DCS using differential pressure instruments. The bed level is controlled between 38 and 60 inches.

Offgas Cooler

The Offgas Cooler, COL-SRC-160 is a vertically suspended vessel located adjacent to the CRR. The Offgas Cooler is constructed of allegheny-ludlum (AL-6XN®) for the upper shell, Hastelloy C276 for the lower cone, and Haynes 556 for the inner liner through the entire vessel.

The Offgas Cooler is designed to cool the treated offgas from the CRR to below 205°C. The cooling of the offgas is achieved by direct water cooling of the offgas vapor with a nitrogen-atomized water spray. All of the water is evaporated and is carried with the cooled offgas as water vapor to the Offgas Filter.

In order to protect downstream equipment in case of system upset, offgas cooling is provided by means of a pressurized water surge tank which discharges water into the Offgas Cooler through a manifold pipe into the cooling spray nozzle located inside the Offgas Cooler vessel. The Offgas Cooler

Surge Water Tank provides 200 gallons of plant water storage. Treated or demineralized water can be used for cooling.

Offgas Filter

The Offgas Filter is comprised of metal pleated fiber filter elements contained in an AL-6XN® stainless-steel vessel. These elements are provided to capture primarily carbon fines carried over from the CRR in the now cooled process gas in order to reduce loading on the downstream process HEPA filters. The filter elements were manufactured with a fuse installed. The fuse was designed to allow the isolation of individual filter elements if they fail by becoming permanently blinded. It was determined that these fuses were not necessary to be protective of human health and the environment and were removed. The filter is operated continuously at approximately -30 to -40 inch water column and 130-250°C. The filter and piping are insulated to maintain temperature in the offgas system. The metal filters are designed to remove 97 % of particles greater than 5.0 microns in size. The specifications for the metal filter elements are provided in Appendix D-2 to Section D of this permit. [Note: Data Sheets for F-SRC-153FE and F-SRC-160FE are considered OUO/CBI, this information is located in the OUO/CBI section of this Permit (Appendix VII).] Collected filter solids are pneumatically transferred using nitrogen to the Product Receiver/Coolers where the fines are combined with the granular solids removed from the bottom of the DMR.

The Offgas Filter includes a tube sheet comprised of multiple filter bundles that filter the process gas. Each bundle can be remotely removed and replaced if filter change-out is needed. Each filter bundle is equipped with a ceramic fiber core gasket using a ring of material cut from a thick mat of the high temperature ceramic fibers which eliminates any seams in the core of the gaskets. The gaskets are soaked in a water dispersion of vermiculite (a magnesium-aluminum-silicate mineral) to form a strong, multi-layer film to enhance the seal ability of the gasket. The individual filter bundles are secured to the tube sheet using three couplers that bolt the venturi plates to the tube sheet to prevent lifting and resultant material carryover. The inlet pressure and outlet pressure are monitored, and the differential pressure across the filter is calculated. Upon high differential pressure across the filter, the filter can be cleaned online using pulse cleaning with nitrogen. Nitrogen is pulsed sequentially through the filter bundles and removed filter cake particulates drop by gravity to the bottom cone of the filter vessel for collection. The pulse cleaning cycle may also be initiated by a timer or manually by the operator. The filtered solids are fluidized into the Offgas Filter Transfer Eductor, JET-SRC-560, using nitrogen blast nozzles to prevent bridging prior to and during pneumatic transfer to the Product Receivers/Coolers.

To minimize the amount of solids that accumulate in the OGF, the vessel is operated to a defined process management control strategy. There is no one process parameter, action, or instrument reading that will minimize the amount of solids in the vessels. This control strategy consists of key control parameters, prescriptive operating procedures, and Emergency Alarm Response procedures. The basic control strategy to minimize the amount of elutriated solids generated in the CRR is as follows: the petroleum coke and the lower ATG nozzles oxygen addition rate are controlled as a function of the CRR oxygen concentration and the CRR bed temperature: the solids are transferred out of the OGF at least once every 48 hours; and the differential pressure across the OGF is monitored and there is an AWFCO set at 81 inches of water column.

Offgas Blowers

Offgas Blowers, BLO-SRH-260 A/B provide vacuum for the Process Gas Filter, CRR, and Offgas Filter. One blower will operate and the other will act as an installed spare. These blowers are designed to generate a suction pressure of approximately –84" water column at 8,400 actual cubic feet per minute. The Offgas Blowers are provided with bleed in air to allow for proper operation of the blowers during startup and shutdown and to prevent surging. The bleed in air will be disabled when waste feed is being processed. The blowers are equipped with vibration monitors to detect excessive vibration for predictive maintenance purposes

The Offgas Blowers discharge pressure, temperature, and flow rate are monitored. Blower discharge is maintained at approximately –5" water column by the Process Exhaust Blowers, BLO-SRH-240 A/B, located downstream of the Process HEPA Filters and Mercury Adsorbers.

Process Exhaust System

The Process Exhaust System includes the Process HEPA Filters, the Mercury Adsorbers, and the Process Exhaust Blowers. The Process Exhaust System is shown on the following P&IDs; Process HEPA Filters, diagram number 632797, Mercury Adsorbers, diagram number 632798, and Process Exhaust Monitoring and Discharge, diagram number 632799 (see Appendix II of this permit).

The Process HEPA Filters, F-SRH-140 A/B/C/D, are located upstream of the Mercury Adsorbers and are provided to filter out any trace radioactive particulate components in the offgas. The Process HEPA Filter system consists of four filter tiers. The filter tiers are provided with individual inlet/outlet connections and inlet/outlet bubble-tight dampers and contain a pre-filter, test inlet section, primary HEPA filter, test combination section, secondary HEPA filter, and a test outlet section. The filter tiers are equipped with a firewater deluge system for fire control with isolation valves on the supply lines. The Process HEPA Filters provide a total of approximately 10,000 acfm filtration capacity. The filter tiers are

stacked vertically with the gas flow split equally between the tiers. All offgas piping and the Process HEPA Filters are insulated to maintain temperature in the offgas system above 130°C.

The total combined stream inlet temperature to the process HEPA Filters is monitored, as are the inlet pressure, outlet pressure, and the differential pressure across the process HEPA filters. The differential pressure across the process HEPA pre-filter is also monitored.

Mercury Adsorbers

The Mercury Adsorbers, F-SRH-141 A/B, utilize sulfur impregnated granular activated carbon (GAC) beds to remove vapor phase mercury that may be present in the process gas. The adsorber system is designed to operate the adsorbers in series and provides for vertical upflow through two vertical GAC beds of equal volume.

Each of the Mercury Adsorbers is conservatively designed with a 30 to 50 fpm face velocity and greater than a 7-second gas residence time at normal flow conditions.

Manufacturer specifications indicate that fully depleted GAC media can hold in excess of 20% by weight mercury. Pilot-scale testing based on the IWTU bed design confirms this level of mercury retention; demonstrating GAC adsorption approaching 20 weight percent (see Section 7.7.9.1 of *Pilot Plant Report for Treating Sodium-Bearing Waste Surrogates Carbonate Flowsheet*, Appendix VI of this permit). For purposes of determination of average mercury loading at the time of bed changeout, it is estimated that each bed of GAC media will hold approximately 4,300 lbs of mercury. This value is conservatively based on a bed loading of 15 weight percent. Calculation details are featured in Appendix D-3 to Section D of this permit.

Mercury sample nozzles are provided across each of the carbon beds and also across both combined beds. Mercury detection will be performed by obtaining samples and having the samples analyzed at a laboratory facility. When the mercury concentration in the offgas from the primary bed exceeds 50,000 µg/dscm, the feed will be stopped and GAC changeout will commence. Since the Mercury Adsorbers are configured in series, any mercury that passes through the primary bed upon breakthrough is captured in the secondary bed. Additional information regarding Mercury Adsorber sampling frequency and criteria necessitating changeout of spent GAC media is provided in Attachment 2, Section C-2c(3) of this permit.

Process Exhaust and Building Ventilation Exhaust Blowers

The Process Exhaust Blowers, BLO-SRH-240A/B, provide vacuum pressure to the Process HEPA Filters and the Mercury Adsorbers to inhibit leaking out of the process. Each blower is designed for approximately 8,400 acfm with a design static differential pressure of approximately -85 inches of water column. Normally, one blower will operate at a time at 100% capacity with a parallel installed spare. The blowers operating capacity is controlled via a variable frequency drive motor that operates under a constant flow controller. The pressure differential between blower inlet and outlet lines is continuously monitored. The blowers are equipped with vibration monitors to detect excessive vibration for predictive maintenance purposes. These blowers discharge to the Air Mixing Box, MIX-SRH-140.

Three Building Ventilation Exhaust Blowers, BLO-SRH-200A/B/C are provided for CPP-1696. To ensure 100% availability, two blowers will be in service and one in standby. Each blower is equipped with a variable frequency drive motor and designed for 30,000 acfm with approximately a 20 in water differential pressure. These blowers discharge to the Air Mixing Box, MIX-SRH-140.

Air Mixing Box

The Air Mixing Box, MIX-SRH-140, is designed to improve the blending of the process exhaust and building ventilation exhaust streams. The air mixing box provides and maintains the volume needed to contain the air exhausted from the two systems (process and building) and also supplies the greatest level of mixing in the shortest distance. The air mixing box is 8 ft 8 in x 8 ft 8 in x 16 ft and includes dampers, damper actuators, static mixers for each inlet stream, and a mixing section. The air mixing box discharges to the Stack, STK-SRE-140.

Stack

The Stack, STK-SRE-140, is constructed of carbon steel and designed to ensure that gases are exhausted in a safe manner. Stack height is approximately 120 ft, with a base diameter of approximately 8 ft and a diameter of approximately 5 ft at the discharge point.

Condensate occurring in the stack drains directly from the base of the stack to the Offgas Condensate Collection Tank, TK-SRH-141. The contents of this tank will be pumped to the Waste Feed Tank, VES-SRC-131.

Continuous Emissions Monitoring System (CEMS)

The discharge gas from the Process Exhaust Blowers, downstream of the Mercury Adsorbers, but upstream of the air mixing box, is continuously monitored for carbon monoxide and oxygen. The continuous gas sample stream is analyzed in the instrument, and the sample is discharged back into the process ductwork. Offgas condensate from operation of the CEMS is collected in the Offgas Condensate Collection Tank.

Additive Systems

Additives are used in the DMR and CRR to control fluidized bed temperature and fluidized bed chemistry. These additives include but are not limited to: coal, used in the DMR to help control temperature and the CRR to facilitate startup; carbon (petroleum coke), used to help maintain fluidized bed temperature in the CRR; fluidized bed media, which is granular alumina bead media of varying sizes for either the DMR or CRR and to provide seed particles for control of particle size distribution in the reformers; and alumina hydroxide to prevent alkali agglomeration in the CRR.

The additive system (see diagrams 632752, 632779, 632780, 632782, and 632783 in Appendix II of this permit) receives coal, carbon, fluidized bed media, and alumina hydroxide in bags, which are loaded into their respective storage bins with a bag loading system. A nitrogen-inert atmosphere is provided for the coal and carbon storage silos and transport systems. Two separate mechanical conveyor systems are provided: one each for the DMR and CRR. Additives are fed to the process by mechanical loss-in-weight systems.

The coal (granular, non activated carbon) additive system is designed to receive, store, and feed coal at a variable rate to a mechanical conveyor. The coal is received in bulk bags delivered by truck. The bags are emptied into the Coal Storage Silos that are designed to hold a minimum of 36 hour normal operation capacity. The mechanical conveyor delivers the coal to the DMR or CRR during initial heat-up. The coal additive system is purged with nitrogen to maintain an inert atmosphere.

The carbon (petroleum coke) additive system is designed to receive, store, and feed granular carbon at a variable rate to the mechanical conveyor. The carbon is received in bulk bags delivered by truck. The bags are emptied into the Carbon Storage Silo that is designed to hold a minimum of 36 hour normal operation capacity. The mechanical conveyor delivers the carbon to the CRR. The carbon additive system and mechanical conveyor is purged with nitrogen to maintain an inert atmosphere.

- The fluidized bed media (alumina/sintered bauxite) additive system is designed to receive, store, and feed fluidized bed media. A local loss-in-weight vibratory feeder feeds the media to the DMR and the CRR, as needed. The fluidized bed media is received in bulk bags. The bags are emptied into the storage bin located above the CRR or DMR depending on where it is needed.

The alumina hydroxide additive system is designed to receive, store, and feed granular alumina hydroxide to the CRR. The alumina hydroxide is received in bulk bags. The bags are emptied into the storage bin located above the CRR. A local loss-in-weight vibratory feeder is used to feed the alumina hydroxide to the CRR.

DMR bed seed particles (alumina/bauxite) may be added to the DMR during operation if the undissolved solids in the waste feed are not adequate to provide seed particles and maintain control of bed particle size. Clay and/or alumina hydroxide may be added to either fluidized bed to prevent agglomeration of low melting point alkali salts.

Product Transfer and Load-out System

The Product Transfer and Load-out System is shown on the following P&IDs (see Appendix II of this permit):

- Product Receiver and Canister Filling - Sheet 1, P&ID diagram number 632787
- Product Receiver and Canister Filling - Sheet 2, P&ID diagram number 632788
- Product Cooling, P&ID diagram number 632790
- Canister Vacuum, P&ID diagram number 632791
- Canister Handling, P&ID diagram number 632792.

The Product Transfer and Load-out System consists of the DMR Auger/Grinder, the Product Receiver/Coolers, a Product Receiver Filter and Product Receiver Filter Product Pump, a Product Handling Vacuum Filter, and mechanical equipment for handling, moving, capping, scanning, and decontaminating canisters of treated waste.

Product Receiver/Cooler and Cooling Loop

The Product Receiver/Coolers, VES-SRC-190/191 are 316 stainless-steel vessels that receive treatment product and elutriated fines from the DMR and CRR, the Process Gas Filter, and the Offgas Filter. Nitrogen is supplied to the Product Receiver/Coolers to cool the treatment product. Nitrogen supply to the Product Receiver Cooler fluidizing nozzles is not allowed during canister filling operations. Adding nitrogen to the fluidizing nozzles would cause the fines to be blown back to the Product Receiver Filter vessel. Nitrogen supply to the Product Receiver Cooler rails is not allowed during canister filling operations. Adding nitrogen to the rails would cause the fines to be blown back to the Product Receiver Filter vessel. Nitrogen flow is used on the transflo membrane located at the bottom of the Product Receiver Cooler vessel during canister filling operations. The nitrogen reduces the density of the solids close to the transflo membrane and creates an air slide to assist the solids to flow out of the Product Receiver Cooler vessel to the canister. Level detection is provided for the bottom cones of the receivers. When the solids cool to < 204°C to protect the silicon seals, the solids are transferred to a remote handled transuranic (RH-TRU) canister located below each Receiver/Cooler. The temperature of the solids accumulation section of the receiver/cooler is monitored by thermocouples.

From the Product Receiver/Coolers, the vent gas flows to the Product Receiver Filter, F-SRC-191, then to the offgas filter. Only one Product Receiver/Cooler is aligned with the nitrogen cooling flow at a time. The Product Receiver Filter is a 316 stainless-steel vessel containing high temperature-rated metal filter elements designed to remove 99.95 % of all solids greater than 0.5 microns in the loop stream. The filter elements were manufactured with a fuse installed. The fuse was designed to allow the isolation of individual filter elements if they fail by becoming permanently blinded. It was determined that these fuses were not necessary to be protective of human health and the environment and were removed. Each filter bundle is equipped with a ceramic fiber core gasket using a ring of material cut from a thick mat of the high temperature ceramic fibers which eliminates any seams in the core of the gaskets. The gaskets are soaked in a water dispersion of vermiculite (a magnesium-aluminum-silicate mineral) to form a strong, multi-layer film to enhance the seal ability of the gasket. Each bundle can be remotely removed and replaced if filter change-out is needed. The individual filter bundles are secured to the tube sheet using three couplers that bolt the venturi plates to the tube sheet to prevent lifting and resultant material carryover. The Product Receiver Filter is continuously monitored for temperature. The inlet pressure and outlet pressure are monitored, and the differential pressure across the filter is calculated. Upon high differential pressure the metal filter elements are cleaned online using pulse nitrogen cleaning. The pulse cleaning cycle may also be initiated by a timer or manually by the operator. Level detection is provided for the bottom cone of the filter. When the solids reach a predetermined level, the solids are transferred to

the Product Receiver Filter Product Pump, VES-SRC-180, and then transported to one of the Product Receiver Coolers, depending on the valve lineup. The specifications for the metal filter elements are provided in Appendix D-2 to Section D of this permit. [Note: Data Sheets for F-SRC-153FE and F-SRC-160FE are considered OUO/CBI, this information is located in the OUO/CBI section of this Permit (Appendix VII).]

Canister Fill Stations

The canister fill stations are two parallel trains of equipment to fill, cap, and decontaminate canisters. These canisters are filled with the waste treatment product collected in the DMR and the Process Gas and Offgas Filters. The filled canisters are transferred via the Transfer Bell/Crane and placed in canister storage vaults for interim storage in the Vault Storage Area for subsequent shipment and ultimate disposal. Each of the two parallel trains consists of the following: a shielded loading cell with overhead plug to allow the Transfer Bell to place and remove canisters from the canister loading cell, a canister fill station conveyor and lift, to move the canisters though the filling and capping process, a canister sealing nozzle to prevent leakage to the outside of the canister, and a canister decontamination station to swipe and decontaminate the canister surface using dry decontamination materials (liquids are prohibited in the cell when waste is present in waste pile storage). Also included is a vacuum system to draw air and potential product spills away from the canister and into a collection system. Included in the vacuum system is the Product Handling Vacuum Filter, F-SRC-190. This vessel is composed of 304 stainless steel and contains metal filter elements that are designed to remove 99.95 % of all solids greater than 0.5 microns in the vacuum flow. Each filter bundle is equipped with a ceramic fiber core gasket using a ring of material cut from a thick mat of the high temperature ceramic fibers which eliminates any seams in the core of the gaskets. The gaskets are soaked in a water dispersion of vermiculite (a magnesium-aluminum-silicate mineral) to form a strong, multi-layer film to enhance the seal ability of the gasket. Each bundle can be remotely removed and replaced if filter change-out is needed. The individual filter bundles are secured to the tube sheet using three couplers that bolt the venturi plates to the tube sheet to prevent lifting and resultant material carryover. The inlet pressure and outlet pressure are monitored, and the differential pressure across the filter is calculated. Upon high differential pressure the metal filter elements are cleaned online using pulse nitrogen cleaning. The pulse cleaning cycle may also be initiated by a timer or manually by the operator. The specifications for the sintered metal filter elements are provided in Appendix D-2. [Note: Data Sheets for F-SRC-153FE and F-SRC-160FE are considered OUO/CBI, this information is located in the OUO/CBI section of this Permit (Appendix VII).] After passing through the Product Handling Vacuum Filter the air is drawn through the Offgas Filter and subsequently to all down stream process gas air pollution control equipment.

Operators view and control operations through a shielded window and locally mounted control panel. The operator is also required to perform a number of tasks (e.g., canister swab for survey to release) and visualizations before initiating the next operational cycle.

Treatment product produced by the process is transferred to the Product Receiver/Coolers. The Product Receiver/Coolers fluidize and cool the treatment product through the introduction of nitrogen into the bottom the vessel.

An empty canister is placed in the cell on the canister cart using the Transfer Bell/Crane. The canister cart is moved to the pintle plug removal station. The canister cart lifting mechanism is activated and the canister is raised to engage the pintle plug removal system, which removes the plug. The pintle plug removal system retains the pintle plug and the canister cart lifting mechanism lowers the canister.

The canister cart is then moved to the filling station. The canister cart lifting mechanism is activated and the canister is raised to engage the canister fill port. Once the pressure seal between the canister and the canister fill port is verified, an operator lowers the canister filling feed nozzle and fills the canister. The canister fill level is verified and catalogued prior to disengaging the fill port.

The canister cart is then moved back to the pintle plug removal station and the pintle plug is re-inserted into the canister top. The canister cart lifting mechanism lowers the canister from the pintle plug removal system.

Next, the canister cart is moved to the canister entry/exit station. Operators survey and prepare the canister for exit from the filling cell by using the master/slave manipulators, the rotating canister cart platform, vacuum decontamination system, shield windows, closed circuit television, and double door pass-through (glovebox). Prior to removal there is verification that the pintle plug is in place.

The Transfer Bell Crane brings the Transfer Bell assembly into position over the entry portal of the filling cell and the Transfer Bell/Crane grapple is lowered into the filling cell and engages the canister pintle. The Transfer Bell Crane raises the canister into the Shielding Bell. The shield door on the bottom of the Shielding Bell closes to completely shield the canister.

The Transfer Bell Crane then moves the Shield Bell to the Vault Loading Area of the process building to either load the canister into a portable storage vault or into a RH-72B shipping cask for transport.

Solids Sample Cell

A Solids Sample Cell is provided adjacent to the Canister Packaging Cells to allow sampling of the treatment product. Limited analysis such as particle size and bulk density will be conducted in the sample cell.

Canisters

The canister that will be utilized for packaging the sodium carbonate treatment product from the IWTU is the remote handled transuranic RH-TRU canister. The IWTU treatment product is considered to be remote-handled waste due to the high radioactivity content.

Transfer Bell Assembly

The Transfer Bell is employed to transfer loaded waste containers (canisters) within the IWTU. The Transfer Bell is a bottom-loaded, shielded bell that is a fixed component on the dedicated transfer crane carrier. To accommodate construction and general tolerance differences, the Transfer Bell is fitted with an extendable shielded skirt mounted on the bottom. This skirt provides radiological protection during canister lifting/transfer activities. A dedicated rail bridge crane carrier, consisting of bridge and trolley, is configured for automatic and manual operation. Its travel is confined by physical configuration to cover only the necessary operations just above the canister fill and decontamination cell, storage vault loading, and the transportation cask-loading (truck) bay. Crane and Transfer Bell controls, along with video feed of the secondary positioning camera system are fed to a pedestal mounted control panel located near the loading vaults.

A separate maintenance crane is also provided for IWTU operations. This crane is used primarily to move hatch covers and equipment for remote maintenance. The maintenance crane spans the whole process area from west to east.

DMR Fluid Gas System

This system combines low pressure oxygen, carbon dioxide, steam, and nitrogen from their respective systems for the IWTU to use as fluidizing gas in the DMR. It also superheats these combined gases in a low-pressure superheater that heats the gases up to the desired process temperature, approximately 600°C. The DMR Fluid Gas System is shown on the following P&IDs; DMR Fluid Gas System, diagram number 632801, and Denitration and Mineralization Reformer, diagram number 632762. [Note: diagrams 632762 and 632801 are considered OUO/CBI and are located in the OUO/CBI section of this Permit (Appendix VII).]

Steam from the IWTU Steam System is mixed with oxygen and carbon dioxide downstream of the DMR Fluidizing Gas Superheater, HTR-SRB-365. The oxygen and carbon dioxide stream is provided from the IWTU Oxygen and Carbon Dioxide Systems.

The oxygen flow rate to enrich the steam flowing to the DMR is determined and set by the operating temperature conditions in the DMR. The oxygen flow rate in the superheated steam is one of the means of temperature control in the DMR during waste processing operations.

The steam flows through the DMR Fluidizing Gas Superheater, and oxygen and carbon dioxide are then added. The Fluidizing Gas Superheater is an in-line electric heater. The power supply cabinet for the superheater is temperature controlled to prevent over-temperature and alarms within the cabinet. The temperature and pressure of the DMR Fluidizing Gas feed to the unit is monitored. The temperature of the steam exiting the second in-line heating unit is monitored and controlled. Upon low-low temperature alarm of the steam exiting the superheater, the steam and oxygen and waste feed injection to the DMR will be shut down and the DMR fluidizing gas will be switched to nitrogen.

For start-up and upset conditions in the DMR, nitrogen is heated in the Fluidizing Gas Superheater, and is used in place of steam and/or steam/oxygen/carbon dioxide to fluidize the bed in the DMR. Nitrogen for the system is provided by the IWTU Nitrogen System.

IWTU Support Systems

Nitrogen

The IWTU Nitrogen System is comprised of a liquid nitrogen tank, ambient vaporizers and a receiver. The equipment is located on the west side of the IWTU.

Breathing Air

If required, breathing air can be supplied via dedicated portable compressors at INTEC or through portable self-contained breathing apparatus.

Carbon Dioxide

Carbon dioxide is supplied to the IWTU from a 30-ton portable tank.

Fire Water Collection Tank

Fire Water Collection Tank, TK-SRE-196, is provided to collect fire suppression water from the Process HEPA Filters, Building Ventilation HEPA Filters, and the Mercury Adsorbers.

Warm-Up and Initiation of Feed to the IWTU

A general protocol delineating activities required during warm-up and initiation of feed to the IWTU is provided as Appendix D-4 to Section D of this permit. These steps ensure that all process controls are functioning appropriately and that the system safely reaches predetermined operating parameters prior to initiating waste feed, thus ensuring protection of workers, the public, and the environment.

ILWMS Tank Treatment

Tank treatment (T01) may be conducted in any of the following tanks: VES-WL-133, VES-WL-102, VES-WL-101, VES-WL-111, VES-WM-100, VES-WM-101, VES-WM-102, VES-WL-106, VES-WL-107, VES-WL-163, VES-NCC-101, VES-NCC-102, VES-NCC-103, VES-NCC-119, VES-NCC-122, VES-NCC-108, VES-SRC-131, VES-SRC-133, and VES-SRC-134. Tank treatment consists of chemical addition and/or solids removal. Typical chemical additives used are described in Section C-2f of the permit. Tank treatment is also performed in the PEWE Feed Sediment Tank, VES-WL-132, which contains a baffle-and-weir system designed to separate solids from the PEWE waste feed stream.

D-1 CONTAINERS

A general building description of CPP-1696 is located in Section B of this permit. Supporting drawings are in the drawing package (see Appendix I of this permit). The container storage areas of CPP-1696 are located in the filling/capping area (Vault Loading Area) and the north end of CPP-1696 (Vault Storage Area).

The containers in this section are also referred to as canisters. These RH-TRU canisters are constructed of stainless steel and are compatible with the sodium carbonate-based granular solid that is produced by the IWTU. The treatment product is pneumatically transported using nitrogen to the canister filling stations. A canister is placed under one of the Product Receiver/Cooler tanks (VES-SRC-190/191), filled to its designated capacity, and capped. Afterwards, the canister is examined for external contamination, cleaned as necessary, monitored for surface dose, and visually inspected. The canister is

then conveyed by the Transfer Bell and carrier crane to a concrete portable storage vault in the Vault Loading Area.

The portable storage vaults are composed of concrete with a nominal thickness of approximately 2 ft along each side, including the bottom and the lid. The vault lid is removable via hydraulic jacks that slide beneath the lid overhang, approximately 8 in. on each side, and lift the lid straight above the vault. The inside of the vault contains a metal framework that divides the vault into sixteen discrete areas allowing each vault to contain up to 16 canisters. The vaults are transported via air pallets and portable tractors or forklifts.

The Vault Loading Area is comprised of a concrete cell that is approximately 15 ft 1 in. wide and 16 ft 3 in. deep. At the top of the cell are a series of 16 concrete plugs arranged in a 4x4 pattern to coincide with the 16 canister storage spaces inside the vault. To transfer canisters into or out of a portable storage vault, the vault is first positioned in front of the Vault Loading Area where the lid is removed via air jacks. The vault is then moved into the Vault Loading Area. Only one vault may be stored in the Vault Loading Area at a time. Using the Transfer Bell and crane, one of the concrete plugs at the top of the Vault Loading Area is removed. The Transfer Bell and crane are then used to load/unload a canister and the plug is replaced. Once the vault is full, the lid is lowered onto the vault and it is moved to the Vault Storage Area.

The Vault Storage Area is located at the north end of CPP-1696 and is designed to hold up to 36 storage vaults in a 6x6 configuration (see diagram 632359 in Appendix II of this permit). The vaults are transported using air pallets and a portable tractor or forklift. Upon approval for ultimate disposal, one vault at a time will be conveyed to the Vault Loading Area. Then one canister per shipment will be loaded into a shipping cask at the truck bay and sent to the ultimate disposal facility.

D-1b Containers without Free Liquids

D-1b(1) Test for Free Liquids: [IDAPA 58.01.05.012; 40 CFR 270.15(b)(1)]

Wastes to be stored in the Vault Storage or Loading Areas in CPP-1696 will not contain free liquids. This condition is assured through normal monitoring of IWTU operating conditions.

The following process information assures no free liquids are in the IWTU waste. The dry sodium carbonate-based granular waste treatment product is produced in steam reformers that operate at temperatures between 580 and 1150˚C. The treatment process drives off all liquids.

D-1b(2) Description of Containers: [IDAPA 58.01.05.008; 40 CFR 264.171 and 264.172]

The canisters that will be used for packaging the sodium carbonate-based granular treatment product from the steam reformers are RH-TRU canisters approved for shipment in a 72B cask to the ultimate disposal facility. The stainless-steel canisters are compatible with the sodium carbonate-based treatment product. Each canister is approximately 26 in. in diameter and 10 ft high and has a capacity of approximately 34 ft^3.

D-1b(3) Container Management Practices: [IDAPA 58.01.05.008; 40 CFR 264.173]

The containers (canisters) are vented through a HEPA filter while stored. Containers will be kept closed during storage, except when waste is being added or removed inside the shielded canister filling cells. Containers will not be opened, handled, or stored in a manner that may cause them to rupture or to leak. INTEC personnel follow established procedures designed to minimize the probability of waste container accidents.

The IWTU process operations are geared towards producing full canisters. Each canister may be slightly overfilled and then vacuumed down to achieve a “full” level condition. If a process anomaly occurs and there is insufficient treatment product inventory in the Receiver/Cooler vessel to completely fill a canister, then the canister will remain connected and sealed at the filling station within the cell until more treatment product is transferred and available to fill the canister. If it becomes necessary for personnel to enter the cell to perform system maintenance or repairs, then any partially filled canister will be capped and transferred to a storage vault prior to personnel entry.

Containers will be moved using equipment such as cranes, forklifts, and/or air pallets within CPP-1696. Inside the truck bay of CPP-1696 one canister per shipment will be loaded into an RH-72B transportation cask on a flatbed semi-trailer for shipment to the ultimate disposal facility. These shipments must comply with applicable U.S. Department of Energy, Department of Transportation, U.S. Environmental Protection Agency, U.S. Nuclear Regulatory Commission, and disposal facility requirements.

D-1b(4) Container Storage Area Drainage: [IDAPA 58.01.05.008, 012; 40 CFR 264.175(c)(2), 270.15(b)(2)]

As described earlier, the RH-TRU canisters are loaded into concrete portable storage vaults for shielding during storage. The Vault Storage and Loading Areas are located in an enclosed building that prevents accumulated liquid from precipitation coming in contact with the vaults that contain the canisters. The vaults are also equipped with approximately 8-inch shoes that would further prevent accumulated liquids from coming into contact with the waste containers.

D-2 TANK SYSTEMS

D-2a Existing Tank Systems

ILWMS existing tank systems are equipped with secondary containment and leak detection devices that are compatible with the types of waste managed. See Section D-2f for additional information regarding containment and detection of releases.

D-2a(2) Existing Corrosion Practices: [IDAPA 58.01.05.008; 40 CFR 264.191(b)(3)]

The Cathodic Protection System is inspected for proper operation at least annually; and all sources of impressed current are inspected and/or tested bi-monthly, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.195(g)(1) and (2)].

D-2b New Tank Systems

The IWTU is a new treatment system that contains seven tanks for storage. Five of these tanks are designed to store liquids.

The Waste Feed Tank, VES-SRC-131, is a new tank system. VES-SRC-131 stores liquid feed solutions for the DMR.

The Sump Tank, VES-SRC-133, is a new tank system. VES-SCR-133 stores liquid from decontamination of the WFT, DMR, OGF, and PGF. Overflow from VES-SRC-131 passes through VES-SRC-134 and is stored in the Sump Tank.

The Clarifier Tank, VES-SRC-134, is a new tank system. VES-SRC-134 separates solids from liquids from decontamination of the WFT, DMR, OGF, and PGF. VES-SRC-134 is designed to overflow to VES-SRC-133.

The Fire Water Collection Tank, TK-SRE-196, is a new tank system that stores used fire water in the event of an IWTU Process HEPA Filter, Building Ventilation HEPA Filter, or Mercury Adsorber fire.

The Condensate Collection Tank, TK-SRH-141, is a new tank system that stores condensate from the process off-gas and the IWTU stack.

The Product Receiver/Cooler Tanks, VES-SRC-190/191 store solid treatment product for cooling or transfer prior to loading the waste into canisters for ultimate disposal.

For a detailed description of these new tanks, see Attachment 1, Section D of this permit.

D-2b(1) Assessment of New Tank System's Integrity [IDAPA 58.01.05.008 and 58.01.05.012; 40 CFR 264.192 and 270.16(a)]

Written assessments, which were prepared, reviewed and certified by a qualified P.E., as to the structural integrity and suitability of the IWTU components for handling hazardous waste were submitted to the Idaho Department of Environmental Quality (DEQ) separately.

D-2b(2) External Corrosion Protection: [IDAPA 58.01.05.008; 40 CFR 264.192(f)]

The Cathodic Protection System is inspected for proper operation at least annually; and all sources of impressed current are inspected and/or tested bi-monthly, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.195(g)(1) and (2)].

D-2b(3) Description of Tank System Installation and Testing Plans and Procedures [IDAPA 58.01.05.008; 40 CFR 264.192(b)-(e) and 270.16(f)]

P.E. certification of IWTU design has been transmitted to DEQ as a separate submittal.

D-2c Dimensions and Capacity of Each Tank [IDAPA 58.01.05.012; 40 CFR 270.16(b)]

PEWE Tanks

Table D-1 lists the tank numbers and descriptions, the year operations began, materials of construction, and the design standards used for the tanks in the PEWE system. Many of the tanks were constructed to the current American Petroleum Institute (API) Standard or American Society of Mechanical Engineers (ASME) Section VIII standards of that time period, or qualified later as such, but were not stamped as such. Table D-1 identifies which tanks were certified.

Because the liquid waste solutions processed through the PEWE system are acidic (primarily nitric acid), the tank materials of construction were selected on the basis of their ability to withstand

corrosive attack by acidic nitrate solutions in the temperature range from ambient to boiling. Even at boiling temperatures, the stainless steel used is resistant to attack by acidic nitrate solutions.

Additionally, the relatively large quantities of nitric acid in the waste solutions in the PEWE system form a passive layer on the stainless steel in the tanks, thus minimizing the corrosion rates on the tanks.

Evaporator Feed Sediment Tank, VES-WL-132

VES-WL-132 is a flow-through vertical, cylindrical tank with domed ends. It measures 7 ft 9 in. from tangent to tangent, and has a 9-ft outside diameter. The tank has an approximate capacity of 4,700 gal. An internal baffle and weir system forces the water to drop particles before flowing out of the tank. Diagram 096156 in Appendix II of this permit depicts VES-WL-132.

Evaporator Feed Collection Tank, VES-WL-133

VES-WL-133 is a horizontal, cylindrical tank with domed ends. It has a 10-ft outside diameter, and measures 30 ft long from tangent to tangent. The tank has an approximate capacity of 19,000 gal. Diagram 096156 in Appendix II of this permit depicts VES-WL-133.

VES-WL-102

VES-WL-102 is a surge tank for VES-WL-133. It is a horizontal, cylindrical tank with domed ends. It has a 10-ft outside diameter, and measures 30 ft long from tangent to tangent. The tank has an approximate capacity of 18,400 gal. Diagram 096156 in Appendix II of this permit depicts VES-WL-102.

Process Offgas Condensate Knock-Out Pot, VES-WL-108

VES-WL-108 is the Process Offgas Condensate Knock-Out Pot in the offgas system. It is a vertical cylindrical tank with domed ends. It has a 24-in. outside diameter and measures 32 in. from tangent to tangent. The tank has an approximate capacity of 100 gals. Diagram 094276 Sheet 3 in Appendix II of this permit depicts this tank.

Table D-1. PEWE Tanks.

Tank Number/ Description	Year of Operation	Materials of Construction	Design Standards
VES-WL-132 Evaporator Feed Sediment	1983	Nitronic 50	ASME Section VIII Stamped
VES-WL-133 Evaporator Feed Collection	1983	Nitronic 50	ASME Section VIII Stamped
VES-WL-102 Surge Tank For VES-WL-133	1951	Type 347 SS	See Note *
VES-WL-109 Evaporator Head	1953	Type 347 SS	See Note *
VES-WL-129 Evaporator	1985	Nitronic 50	ASME Section VIII Stamped
VES-WL-161 Evaporator	1984	Nitronic 50	ASME Section VIII Stamped
VES-WL-131 Condensate Surge	1975	Type 304L SS	Unknown
VES-WL-134 Condensate Surge	1984	Type 304L SS	ASME Section VIII Stamped
VES-WL-111 Bottoms Collection	2001	Type 304L SS	ASME Section VIII Stamped
VES-WL-101 Bottoms Collection	1951	Type 347 SS	See Note *
VES-WM-100 CPP-604 TFT	1953	Type 347 SS	See Note *
VES-WM-101 CPP-604 TFT	1953	Type 347 SS	See Note *
VES-WM-102 CPP-604 TFT	1953	Type 347 SS	See Note *
VES-WL-106 Process Condensate Collection Tank	1953	Type 347 SS	See Note *
VES-WL-107 Process Condensate Collection Tank	1953	Type 347 SS	See Note *
VES-WL-108 Process Condensate Knock-out Pot	1951	Type 347 SS	See Note *
VES-WL-163 Process Condensate Collection Tank	1984	Type 304L SS	ASME Section VIII Division 1
VES-WL-135	1991	Type 304L SS	ASME Section VIII Division 1
VES-WL-136	1991	Type 304L SS	ASME Section VIII Division 1
VES-WL-137	1991	Type 304L SS	ASME Section VIII Division 1
VES-WL-138	1991	Type 304L SS	ASME Section VIII Division 1
VES-WL-139	1991	Type 304L SS	ASME Section VIII Division 1
VES-WL-142	1991	Type 304L SS	ASME Section VIII Division 1
VES-WL-144	1991	Type 304L SS	ASME Section VIII Division 1
VES-WL-150	1996	Type 304L SS	ASME Section VIII Division 1

Note *: Due to the age of these tanks, no documentation exists to confirm standards. Conversation with the vendor indicates the tanks were built to API or to ASME Standards. It is common practice for the vendor to maintain the documentation for 20 years.
Note **: Not Stamped – Built to ASME Section VIII. No code stamp required.

Condensate Surge Tank VES-WL-134

Tank VES-WL-134 is a vertical, cylindrical tank with domed ends. It has a 3 ft 6 in.-outside diameter and is 7 ft long from tangent to tangent. The tank has an approximate capacity of 500 gal. Diagram 094276, Sheet 3 in Appendix II of this permit depicts VES-WL-134.

Bottoms Collection Tank, VES-WL-101

VES-WL-101 is a horizontal-oriented, cylindrical tank with domed ends, measuring 10 ft by 30 ft. The tank has an approximate capacity of 18,400 gal. Diagram 096156 in Appendix II of this permit depicts VES-WL-101.

Bottoms Collection Tank, VES-WL-111

VES-WL-111 is designed as a rectangular, horizontal-oriented tank. It measures 12 ft long, 4 ft 8 in. wide, and 3 ft 6 in. high. The tank has an approximate capacity of 1,500 gal. Diagram 094276, Sheet 2 in Appendix II of this permit depicts VES-WL-111.

Evaporator Head Tank, VES-WL-109

VES-WL-109 is a vertical, cylindrical tank with domed ends. It has a 3-ft outside diameter, and measures 5 ft from tangent to tangent. The tank has an approximate capacity of 270 gal. Diagram 094276, Sheet 1 in Appendix II of this permit depicts VES-WL-109.

Evaporators VES-WL-129 and VES-WL-161

VES-WL-129 and VES-WL-161 are vertical cylindrical tanks with domed ends. The tanks have a 3-ft diameter and are 14 ft 9 in. long, from tangent to tangent. Both evaporators have an approximate capacity of 1,000 gal each. Diagram 094276, Sheet 1 in Appendix II of this permit depicts VES-WL-129 and VES-WL-161.

Condensate Surge Tank VES-WL-131

VES-WL-131 is a horizontal, cylindrical tank with domed ends. It has a 2-ft outside diameter and measures 2 ft 9 in. from tangent to tangent. The tank has an approximate capacity of 66 gal. Diagram 094276, Sheet 3 in Appendix II of this permit depicts VES-WL-131.

CPP-604 Process Condensate Collection Tanks, VES-WL-106, VES-WL-107, and VES-WL-163

Tanks VES-WL-106, VES-WL-107 and VES-WL-163 are vertical-oriented cylindrical tanks with domed ends. The tanks are each approximately 12 ft long and have an 8 ft diameter. The tanks have an approximate capacity of 5,000 gal each. Diagram 094276, sheet 3 in Appendix II of this permit depicts the tanks.

CPP-604 TFT, VES-WM-100, VES-WM-101, VES-WM-102

VES-WM-100, VES-WM-101, and VES-WM-102 are horizontal-oriented, cylindrical tanks with domed ends. All three tanks have an outside diameter of 10 ft and are 30 ft from tangent to tangent. Each tank has an approximate capacity of 18,400 gal. Diagram 103308 in Appendix II of this permit depicts these tanks.

VES-WL-135, VES-WL-136, VES-WL-137, VES-WL-138, VES-WL-139, VES-WL-142, and VES-WL-144 Process Waste Liquid (PWL) Tanks

Tanks VES-WL-135, VES-WL-136, VES-WL-139, and VES-WL-142 are vertical-oriented cylindrical tanks with domed ends. The tanks have approximately a 1 ft 6 in.-diameter and are approximately 8 in. from tangent to tangent. The tanks have an approximate capacity of 10 gal. Tanks VES-WL-137, VES-WL-138, and VES-WL-144 are vertical-oriented cylindrical tanks with domed ends. The tanks have approximately a 2 ft diameter and are approximately 1 ft from tangent to tangent. The tanks have an approximate capacity of 25 gal. Diagrams 368921, 368922, 368923, 368924, 368925, 368927, 368929, 368930, and 368931 in Appendix II of this permit depict the PWL tanks.

VES-WL-150 Tank

Tank VES-WL-150 is a vertical-oriented cylindrical tank with domed ends. The tank has approximately a 2 ft diameter and is approximately 2 ft from tangent to tangent. The tank has an approximate capacity of 50 gal. Diagram 179009 in Appendix II of this permit depicts the tank.

LET&D Tanks

This section provides the LET&D tank numbers, the year each tank was placed into service, the materials of construction, and the design standards. Table D-2 summarizes the LET&D tanks.

Fractionator Waste Feed Head Tank VES-WLK-197

The Acid Fractionator Waste Feed Head Tank is a horizontal tank with domed ends. The tank has an approximate 3-ft diameter and is 4 ft from tangent to tangent. The maximum capacity of the tank is 270 gal. The tank is located approximately 16 ft above the highest feed point of Acid Fractionator FRAC-WLL-170 or FRAC-WLK-171. Waste solutions are pumped from the Process Condensate Collection Tanks to this tank. This tank gravity feeds the fractionators. Diagram 356596, Sheet 10 in Appendix II of this permit depicts VES-WLK-197.

Acid Fractionators FRAC-WLL-170 and FRAC-WLK-171

The two acid fractionators are identical thermal siphon units, with an inside diameter of 42 in. and a height of approximately 24 ft from tangent to tangent. Both units consist of vertical-oriented, cylindrical tanks, with domed ends. The fractionator, associated equipment, and piping have a maximum capacity of 460 gallons. Hastelloy G-30 is used for equipment and piping in contact with the hot acid because of its strength and resistance to the corrosive solution. The fractionators separate the waste solution into water (overheads) and nitric acid (bottoms). Diagram 356596, Sheets 5 and 8 in Appendix II of this permit depict FRAC-WLL-170 and FRAC-WLK-171, respectively.

Table D-2. LET&D Tanks

Tank Number/ Description	Year of Operation	Materials of Construction	Design Standards
VES-WLK-197	1993	Type 304L SS	ASME Section VIII Division 1
VES-WLL-170	1993	Hastelloy G-30	ASME Section VIII Division 1
VES-WLK-171	1993	Hastelloy G-30	ASME Section VIII Division 1
VES-WLL-195	1993	Type 304L SS	ASME Section VIII Division 1
VES-NCR-171	1995	Type 304 SS	ASME Section VIII Division 1
VES-NCR-173	1995	Type 304L SS	Fabricated per Project Drawings

Acid Fractionator Bottoms Tank VES-WLL-195

The Bottoms Tank is a horizontal-oriented, cylindrical tank with domed ends. The tank has an inner diameter of 36 in. and a length of 4 ft from tangent to tangent. The maximum capacity of the tank is 270 gal. This tank stores nitric acid intended for use in the INTEC waste treatment processes. Diagram 356596, Sheet 3 in Appendix II of this permit depicts VES-WLL-195.

LET&D Nitric Acid Recycle Tank VES-NCR-171

The Acid Recycle Tank is a horizontal, cylindrical tank, 11 ft in diameter and 33 ft 8 in. long from end to end. The tank has a maximum capacity of 22,500 gal. This tank stores nitric acid intended for use in NWCF debris treatment, the filter leach process, and decontamination activities. Diagram 176274 in Appendix II of this permit depicts VES-NCR-171.

Nitric Acid Head Tank VES-NCR-173

The Nitric Acid Head Tank is a vertical cylindrical tank with flat ends. It has a 24-in. outside diameter and measures approximately 56 in. from end to end. It is constructed from 300 series stainless steel. The tank has an approximate capacity of 90 gallons. Diagram 176274 in Appendix II of this permit depicts VES-NCR-173.

ETS Tanks

This section provides the ETS tank numbers, the year each tank was placed into service, the materials of construction, and the design standards. Table D-3 summarizes the ETS tanks.

Table D-3. ETS Tanks.

Tank Number/ Description	Year of Operation	Materials of Construction	Design Standards
VES-NCC-101	1982	Nitronic 50	ASME Section VIII Division 1*
VES-NCC-102	1982	Nitronic 50	ASME Section VIII Division 1*
VES-NCC-103	1982	Nitronic 50	ASME Section VIII Division 1*
VES-NCC-119	1982	Nitronic 50	ASME Section VIII Division 1*
VES-NCC-122	1982	Nitronic 50	ASME Section VIII Division 1*
VES-NCC-150	1996	G-30 Hastelloy	ASME Section VIII Division 1
VES-NCC-152	1996	Nitronic 50	ASME Section VIII Division 1
VES-NCC-108	1982	Nitronic 50	ASME Section VIII Division 1*
VES-NCC-136	1982	Type 304 SS	ASME Section VIII Division 1*
VES-NCC-116	1982	Type 304 SS	ASME Section VIII Division 1*

Note *: Not Stamped – Built to ASME Section VIII. No code stamp required.

Blend Tank VES-NCC-101

The Blend Tank (VES-NCC-101) has an approximate diameter of 9 ft 6 in. and a height of 13 ft. It is a vertical, cylindrical tank with domed ends. The approximate capacity of the tank is 5,870 gallons. However, an overflow outlet 8.5 ft above the bottom tangent limits the operating volume to approximately 5,000 gallons. Diagram 133410 in Appendix II of this permit depicts VES-NCC-101.

Hold Tanks VES-NCC-102 and VES-NCC-103

The Hold Tanks (VES-NCC-102 and VES-NCC-103) have an approximate diameter of 8 ft and a height of 12 ft. These vertical cylindrical tanks are equipped with domed ends. The approximate capacity of each tank is 4,000 gallons. Each tank has an overflow outlet 8.5 ft above the tank bottom tangent. The overflow outlet limits the operating volume of each tank to approximately 3,500 gallons. Diagram 133411 and 133412 in Appendix II of this permit depicts VES-NCC-102 and VES-NCC-103 respectively.

Fluoride Hot Sump Tank VES-NCC-119

The Fluoride Hot Sump Tank (VES-NCC-119) is a horizontal, cylindrical tank with domed ends. It has an approximate diameter of 9 ft and a length of 16 ft. The tank has an approximate capacity of 6,500 gallons. Diagram 133409 in Appendix II of this permit depicts VES-NCC-119.

Non-fluoride Hot Sump Tank VES-NCC-122

The Non-fluoride Hot Sump Tank (VES-NCC-122) is a horizontal cylindrical tank with domed ends. It has an approximate diameter of 7 ft 6 in. and a length of 14 ft. The tank has an approximate capacity of 4,300 gallons. Diagram 133408 in Appendix II of this permit depicts VES-NCC-122.

VES-NCC-150

The evaporator consists of a flash column and a reboiler. The Flash Column (VES-NCC-150) has an approximate diameter of 5 ft 6 in. and a height of 21 ft 6 in. from bottom to the top 14 in. flange. This tank is vertical and cylindrical with domed ends. The approximate capacity of the tank is 2,600 gallons. Diagram 134251 Sheet 2 in Appendix II of this permit depicts EVAP-NCC-150.

Constant Head Feed Tank VES-NCC-152

The Constant Head Feed Tank (VES-NCC-152) has an approximate diameter of a 2 ft and a length of 9 ft. The tank is horizontally oriented, cylindrical and has domed ends. A feed outlet to VES-NCC-150 is centered at the bottom of one end of the tank. The approximate capacity of the tank is 200 gallons. VES-NCC-152 has an overflow line back to VES-NCC-101, which limits capacity to approximately 170 gallons. Diagram 134251 Sheet 3 in Appendix II of this permit depicts VES-NCC-150.

Scrub Hold Tank VES-NCC-108

The scrub hold tank (VES-NCC-108) is a horizontal, cylindrical tank with domed ends, an approximate diameter of 5 ft and a length of 12 ft. The capacity at overflow is approximately 2,000 gal. Diagram 133424 in Appendix II of this permit depicts VES-NCC-108.

Vent Condenser Knockout Drum VES-NCC-136

The vent condenser knockout drum (VES-NCC-136) is a vertical, cylindrical vessel with domed ends, an approximate 16 in. diameter and 6 ft in height. The approximate capacity of the tank is 60 gallons. Diagram 133428 in Appendix II of this permit depicts VES-NCC-136.

Mist Collector VES-NCC-116

The mist collector (VES-NCC-116) is a vertical, cylindrical vessel with domed ends, an approximate 3 ft 6 in. diameter and 7 ft 6 in. in height. It is designed to remove any liquid from the process and vessel offgas mixture entering the vessel. The approximate capacity of the tank is 500 gallons. Diagram 133428 in Appendix II depicts of this permit VES-NCC-116.

IWTU Tanks

Table D-4 lists the tank numbers and descriptions, the approximate year operations will begin, materials of construction, and the design standards used for the tanks in the IWTU. The tanks are constructed to the current American Society of Mechanical Engineers (ASME) Section VIII standards of that time period. Table D-4 identifies which tanks were certified.

Because the liquid waste solutions processed through the IWTU are highly acidic (primarily nitric acid), the tank materials of construction were selected on the basis of their ability to withstand corrosive attack by acidic nitrate solutions and acidic atmospheres in the IWTU operating temperature ranges. The materials of construction were evaluated by an independent professional engineer and were determined to

be appropriate for the waste and conditions of service as noted in RCRA Design Assessment and Certification of the IWTU.

Waste Feed Tank VES-SRC-131

The Waste Feed Tank is a vertical, cylindrical tank with domed ends, with an approximate diameter of 6 ft 1 in. and 10 ft in height. It is designed as the feed tank to the DMR. The approximate capacity of the tank is 2,170 gallons. Diagram 632760 depicts VES-SRC-131. [Note: diagram 632760 is considered OUO/CBI and is located in the OUO/CBI section of this Permit (Appendix VII).]

Sump Tank VES-SRC-133

The Sump Tank is a horizontal, cylindrical tank with domed ends, with an approximate diameter of 8 ft and is 10 ft 4 in. in length. It is designed to collect decontamination liquids from the WFT, DMF, OGF, and PGF. The approximate capacity is 3,390 gallons. Drawings 808190, 808191, and 808192 depict VES-SRC-133. Diagram 632823 provides the piping and instrumentation for VES-SRC-133 and VES-SRC-134.

Clarifier Tank VES-SRC-134

The Clarifier Tank is a Lamella clarifier tank with an approximate 2’ width, 7’ 7” height, and 8’ length. It is designed to separate solids from the decontamination liquids going to the Sump Tank. The approximate capacity is 494 gallons. Drawing 808193 depicts VES-SRC-134.

Steam Reforming System

The DMR is a vertical, cylindrical vessel with a domed top, a top expansion section that is approximately 5 ft 8 in. in diameter, a reducer mid-section, lower fluidized bed section that is 4 ft in diameter, and a total height of approximately 18 ft 9 in. The DMR is equipped with three feed nozzles that are constructed of Haynes stainless steel with a cast silicon carbide gas cap and a stellite covering on the heat shield. The operational tolerance of the nozzles will be established during the simulant runs and the System Performance Test (SPT). The tolerances will be added to the permit in the permit modification request to be submitted following the SPT. The bottom of the reformer is cone-shaped and is equipped with a fluidizing system. Attached to the bottom of the cone is a drain line that is used to remove liquids during decontamination activities. The drain line has a valve installed

which is normally kept closed, and a nitrogen purge line located between the valve and the cone to prevent or reduce plugging the drain line with solids. Attached to the solids transport line from the DMR is a drain line that is used to remove liquids during decontamination activities. The drain line has a valve installed which is normally kept closed, and a nitrogen purge line is located between the valve and the solids transport line to prevent or reduce plugging the drain line with solids. The DMR is designed to convert the liquid waste to a solid treatment product that is suitable for disposal at the ultimate disposal facility. The approximate capacity of the vessel is approximately 3,400 gallons. Diagram 632762 depicts VES-SRC-140. [Note: diagram 632762 is considered OUO/CBI and is located in the OUO/CBI section of this Permit (Appendix VII).] The 14-inch ID N3 nozzle on the lower fluidized section of the CRR has been modified to an 18-inch ID nozzle to allow access for inspection and maintenance.

Table D-4. IWTU Tanks

Tank Number Description	Expected Start of Operation	Materials of Construction	Design Standard(s)
VES-SRC-131 Waste Feed Tank	2019	Type 304L SS	ASME Section VIII Division 1*
VES-SRC-133 Sump Tank	2019	Type 304L SS	ASME Section VIII Division 1*
VES-SRC-134 Clarifier Tank	2019	Type 304L SS	ASME Section VIII Division 2*
VES-SRC-140 Denitration and Mineralization Reformer	2019	Haynes 556 Alloy	ASME Section VIII Division 1*
VES-SRC-160 Carbon Reduction Reformer	2019	Carbon Steel and High Alumina/Chrome Oxide Based Brick and Castable Refractory Lined	ASME Section VIII Division 1*
VES-SRC-190 and -191 Product Receivers/Coolers	2019	Type 316H SS	ASME Section VIII Division 1*
TK-SRE-196 Fire Water Collection Tank	2019	Carbon Steel (Double Wall)	N/A
TK-SRH-141 Condensate Collection Tank	2019	Polypropylene	ASTM F2389-07E1 or D4101-08

Note *: Not Stamped – Built to ASME Section VIII. No code stamp required.

The Process Gas Filter is a vertical cylindrical vessel with a domed top and conical bottom. It is approximately 8 ft 9 in. in diameter and 7 ft 9 in. high tangent to tangent. The conical bottom is approximately 8 ft 9 in. on top and tapering to 1 ft 6 in. on the bottom in diameter and 10 ft. high. The over all height of the filter vessel is approximately 19 ft 6 in. The filter is designed to remove particulate matter from the DMR offgas. The approximate capacity of the vessel is 2,300 gallons. Diagram 632763 depicts F-SRC-153. [Note: diagram 632763 is considered OUO/CBI and is located in the OUO/CBI section of this Permit (Appendix VII).]

The CRR is a vertical, cylindrical vessel with domed ends. The upper portion of the reformer is approximately 6 ft 4 in. in diameter. The lower portion of the reformer is approximately 4 ft 6 in. in diameter and a total of 24 ft 4 in. in height. In the lower part of the fluidized bed, any NOx gases from the first reformer are further reduced, and in the upper part of the fluidized bed residual organics, carbon monoxide and hydrogen are oxidized to carbon dioxide and water vapor. The approximate capacity of the vessel is approximately 4,300 gallons. Diagram 632764 depicts VES-SRC-160. [Note: diagram 632764 is considered OUO/CBI and is located in the OUO/CBI section of this Permit (Appendix VII).]

The Offgas Cooler is a vertical, cylindrical vessel with domed top and conical bottom. It is approximately 8 ft in diameter and total height of 16 ft 8 in. It is designed to cool the offgas from the CRR. The approximate capacity of the vessel is 2,300 gallons. Diagram 636766 in Appendix II of this permit depicts COL-SRC-160.

The Offgas Filter is a vertical cylindrical vessel with a domed top and conical bottom. It is approximately 8 ft 9 in. in diameter and 7 ft 9 in. high tangent to tangent. The conical bottom is approximately 8 ft 9 in. on top and tapering to 1 ft 6 in. on the bottom in diameter and 10 ft. high. The overall height of the filter vessel is approximately 19 ft 6 in. The filter is designed to remove particulate matter from the CRR offgas. The approximate capacity of the vessel is 3,250 gallons. Diagram 632765 depicts F-SRC-160. [Note: diagram 632765 is considered OUO/CBI and is located in the OUO/CBI section of this Permit (Appendix VII).]

The Mercury Adsorbers are identical vertical vessels with domed ends. They are approximately 12 ft in diameter and 15 ft 6 in. tall with an active bed depth of approximately 6 ft 6 in. deep and each contains a sulfur-impregnated granular activated carbon (GAC) bed. The adsorbers are designed to remove mercury from the offgas stream. The approximate capacity of the vessels is approximately 11,600 gallons each. Diagram 632798 in Appendix II of this permit depicts F-SRH-141A and B.

The Product Receiver/Coolers are vertical, cylindrical tanks with a domed top and cone-shaped bottom. They are approximately 4 ft in diameter and 7 ft 9 in. in height. They are equipped with fluidizing nozzles. New fluidizing nozzles have been designed and constructed with sintered metal material being placed in the middle between two stainless steel ends. The tanks are designed to receive and cool solids from the IWTU system and provide storage capacity until enough is stored to fill the canisters. The approximate capacity of each tank is 512 gallons. The coolers are equipped with piping and valves to allow the solids to be transferred between the two tanks. Diagrams 632787 and 632788 in Appendix II of this permit depict VES-SRC-190/191, respectively.

The Product Receiver Filter is a vertical, cylindrical vessel with a domed top and cone-shaped bottom. It is approximately 4 ft 6 in. in diameter and 8 ft 9 in. in height. The filter is designed to remove solids from the nitrogen gas used as the transfer and cooling gas in the cooling loop, collect them in the bottom cone section of the filter, and transfer the solids to the Product Receiver Filter Product Pump, VES-SRC-180. The approximate capacity of the filter vessel is 900 gallons. Diagram 632790 in Appendix II of this permit depicts F-SRC-191.

The Product Handling Vacuum Filter is a vertical, cylindrical vessel with a domed top and cone-shaped bottom. It is approximately 4 ft 5 in. in diameter and 8 ft 9 in. in height. The filter is designed to remove solids from the vacuum flow used to draw air and potential product spills away from the canisters and into a collection system. The approximate capacity of the filter vessel is 900 gallons. Diagram 632791 in Appendix II of this permit depicts F-SRC-190.

The Fire Water Collection Tank is a horizontal, cylindrical tank with domed ends. It is approximately 32 ft long and 9 ft in diameter. It is a double-walled tank with leak detection and equipped with the ability to remove liquid from the annulus. It is used to collect fire water from the Process and Building HEPA Filters and the Mercury Adsorbers during a fire incident. The approximate capacity of the tank is 15,000 gallons. Diagram 632822 in Appendix II of this permit depicts TK-SRE-196.

The Offgas Condensate Collection Tank is a double walled, horizontal, rectangular tank. It is approximately 4 ft x 2 ft x 2 ft in dimension. It is used to collect condensate from the stack and off-gas sampling equipment. The approximate capacity of the tank is 120 gallons. Diagram 632799 in Appendix II of this permit depicts TK-SRH-141.

D-2d Description of Feed Systems, Safety Cutoffs, Bypass Systems, and Pressure Controls [IDAPA 58.01.05.012; 40 CFR 270.16(c)]

Table D-5. Tank Inputs & Outputs

TANK NUMBER/ DESCRIPTION	DRAWING NUMBER	INPUTS	OUTPUTS
VES-NCR-171 Acid Recycle Tank	176274	Pumped	Air-Lifted
VES-NCR-173 Acid Recycle Head Tank	176274	Air-Lifted	Gravity
VES-WL-101 Bottoms Collection	096156	Gravity, Jetted, Pumped	Jetted
VES-WL-102 Surge Tank for VES-WL-133	096156	Gravity	Pumped
VES-WL-106 Process Condensate Collection Tank	094276-3	Pumped	Gravity/Pumped
VES-WL-107 Process Condensate Collection Tank	094276-3	Pumped	Pumped/Gravity
VES-WL-108 Waste Evaporator Condensate Knock-out Pot	094276-3	Offgas Condensate	Gravity
VES-WL-109 Evaporator Feed	094276-1	Jetted, Pumped	Gravity
VES-WL-111 Bottoms Collection Tank	094276-2	Gravity, Jetted, Pumped	Jetted
VES-WL-129 Evaporator	094276-1	Pumped	Gravity
VES-WL-131 Condensate Surge Tank	094276-3	Gravity	Pumped
VES-WL-132 Evaporator Feed Sediment Tank	096156	Jetted, Pumped	Gravity, Jetted
VES-WL-133 Evaporator Feed Collection Tank	096156	Gravity	Jetted, Pumped
VES-WL-134 Condensate Surge Tank	094276-3	Gravity	Pumped
VES-WL-135 Sump Tank	368921	Gravity	Jetted
VES-WL-136 Process Condensate Collection Tank	368922	Gravity	Jetted
VES-WL-137 Process Condensate Collection Tank	368923	Gravity	Jetted
VES-WL-138 Process Condensate Collection Tank	368924	Gravity	Jetted
VES-WL-139 Process Condensate Collection Tank	368925	Gravity	Jetted

Table D-5. Tank Inputs & Outputs (continued)

TANK NUMBER/ DESCRIPTION	DRAWING NUMBER	INPUTS	OUTPUTS
VES-WL-142 Process Condensate Collection Tank	368927	Gravity	Jetted
VES-WL-144 Process Condensate Collection Tank	368929	Gravity	Jetted
VES-WL-150 Process Condensate Collection Tank	096156	Jetted/Gravity	Jetted
VES-WL-161 Evaporator	094276-1	Gravity	Gravity
VES-WL-163 Process Condensate Collection Tank	094276-3	Pumped	Gravity
VES-WLK-171 Acid Fractionator	356596-8	Gravity	Gravity
VES-WLK-197 Fractionator Waste Feed Head Tank	356596-10	Pumped	Gravity
VES-WLL-170 Acid Fractionator	356596-5	Gravity	Gravity
VES-WLL-195 Acid Fractionator Bottoms Tank	356596-3	Gravity	Pumped
VES-WM-100 CPP-604 TFT	057498	Gravity, Jetted, Pumped	Jetted
VES-WM-101 CPP-604 TFT	057498	Gravity, Jetted, Pumped	Jetted
VES-WM-102 CPP-604 TFT	057498	Gravity, Jetted, Pumped	Jetted
VES-NCC-152 Constant Head Feed Tank	13425103	Air-Lifted	Gravity
VES-NCC-150	13425102	Gravity	Gravity, Jetted
VES-NCC-101 Blend Tank	133410	Gravity, Jetted, Air-Lifted, Pumped	Gravity, Air-Lifted, Jetted
VES-NCC-102 Hold Tank	133411	Gravity, Jetted, Pumped	Gravity, Jetted
VES-NCC-103 Hold Tank	133412	Gravity, Jetted, Pumped	Gravity, Jetted
VES-NCC-119 Fluoride Hot Sump Tank	133409	Gravity, Jetted, Pumped	Jetted, Pumped
VES-NCC-122 Non-Fluoride Hot Sump Tank	133408	Gravity, Jetted, Pumped	Jetted
VES-NCC-108 Scrub Hold Tank	133424	Gravity	Jetted
VES-NCC-136 Vent Condenser Knock Drum	133428	Offgas Condensate	Gravity
VES-NCC-116 Mist Collector	133428	Offgas Condensate	Gravity
VES-SRC-131 Waste Feed Tank	632760	Gravity, Jetted, Pumped	Pumped, Jetted

Table D-5. Tank Inputs & Outputs (continued)

TANK NUMBER/ DESCRIPTION	DRAWING NUMBER	INPUTS	OUTPUTS
VES-SRC-133 Sump Tank	632832	Gravity	Pumped, Gravity
VES-SRC-134 Clarifier Tank	632832	Pumped, Gravity	Pumped, Gravity
VES-SRC-140 Denitration and Mineralization Reformer	632762	Pumped, Gravity	Auger/Grinder, Pneumatic, Process Gas/Particulate
VES-SRC-160 Carbon Reduction Reformer	632764	Offgas, Gravity	Auger/Grinder, Pneumatic (nitrogen), Offgas
VES-SRC-190/191 Product Receiver/Coolers	632787, 632788, 632789	Pneumatic	Gravity
TK-SRE-196 Fire Water Collection Tank	632822	Gravity	Portable Pump
TK-SRH-141 Off-gas Condensate Collection Tank	632799	Gravity	Pumped

PEWE Feed Systems

The piping systems that feed to the PEWE system are designed to slope downward to the PEWE Feed Sediment and Feed Collection Tanks. Wastes flow by gravity or are jetted or pumped to VES-WL-132 or VES-WL-133.

Wastes passing through VES-WL-132 encounter a baffle and weir system, which allows time for solids to settle out of the solution, as the fluid flows under the baffle and over the weir. Waste in VES-WL-132 overflows to VES-WL-133.

From VES-WL-133, waste is pumped by one of two feed pumps either directly to EVAP-WL-129 or to Evaporator Head Tank VES-WL-109, which gravity-feeds to EVAP-WL-161. Additionally, a jet is available to transfer waste from VES-WL-133 to VES-WL-109.

The liquid flow to the evaporators is regulated by feed valves, which are controlled by level recorders/controllers in the control room. The feed valve for EVAP-WL-129 is located between the feed pumps and the evaporator. The feed valve for EVAP-WL-161 is located between Evaporator Head Tank, VES-WL-109, and the evaporator. Evaporator Head Tank VES-WL-109 will overflow back to VES-WL-102 or VES-WL-133.

The PWL tanks and sumps are located in CPP-604, CPP-649, and associated valve boxes. The purpose of the system is to collect offgas condensate and liquids from floor drains via gravity, and then

transfer the waste to the PEWE Evaporator Feed Collection Tank, VES-WL-133. The system is comprised of tanks VES-WL-135, -136, -137, -138, -139, -142, -144, and -150. A sump or vault secondarily contains each of the tanks. The tanks and sumps are jetted upon high level detection. All are transferred into a common header and then transferred into VES-WL-133, except for VES-WL-150, which is transferred into the Evaporator Feed Sediment Tank, VES-WL-132. VES-WL-132 drains directly into VES-WL-133.

PEWE Safety Cutoffs

The instruments for the PEWE system are located on control panels and the DCS in the Waste Processing Control Room. The control panels consist of instruments and alarms to detect system upsets. The DCS operating consoles display data from the instrumentation and transmit control actions, alarms, and shutoffs of the process control unit.

The DCS monitors and controls processes in the ILWMS. These processes include the LET&D, Service Waste, PEWE, Process Offgas (POG), Atmospheric Protection System (APS), PWL, VOG, and Main Stack Monitor processes or systems. The DCS is a microprocessor-based control system that uses a combination of free-standing operator consoles networked to electronic I/O interfaces to field devices.

To ensure a high degree of integrity, redundancy is used where possible. These include redundant controllers, power supplies, communications modules, consoles, and data highway cabling. This redundancy, along with utilization of equipment only from a vendor with documented previous experience of providing successful complex process control systems, and adherence to the vendor's recommended preventive maintenance practices provide the necessary assurance of reliability for meeting the requirements of Environmental Protection Agency(EPA) regulations, Technical Specifications/Standards, and plant mission.

Examples of other instruments that are monitored by the DCS include steam flow, water flow, instrument air pressure, and differential pressure across the HEPA filters.

The PEWE is manually shut down by the operator when the evaporator reaches a temperature of 108° C. This process includes eliminating the feed and isolating the steam supply to the reboiler. A temperature of 186° C is the theoretical threshold PEWE evaporator process temperature, at which under only the most “favorable” conditions, a potentially explosive self-sustaining tributyl phosphate (TBP)-nitric acid reaction could occur. To provide a significant margin of safety, 130° C is established as the safety limit to ensure that an explosion due to the rapid decomposition of organic nitrated complexes

cannot occur under any circumstances. A limiting control setting of 120° C is set to ensure that the 130° C temperature is never reached. As an added measure of safety, INTEC Waste Operations has established the operating limit of 110° C, to further minimize the possibility of an organic-nitric acid explosion. Upon reaching the evaporator process temperature of 110° C, the system alarms and undergoes automatic steam shutoff if the process has not already been halted manually, via the DCS for VES-WL-129 & VES-WL-161. Automatic safe shutdown at 110° C not only eliminates the possibility of an organic-nitric acid explosion, but also serves to limit scale formation in the evaporator reboiler.

On high temperature alarm, the steam to the reboiler is automatically shut off. As the boiling action stops, the level controllers shut off the feed. The air system controllers maintain a positive pressure on the shell (steam) side of the reboiler to prevent waste from entering the steam condensate system, in the event there is a leak in the reboiler tube bundle.

The Bottoms Collection Tanks, VES-WL-101 and VES-WL-111, are monitored from the DCS to control liquid volume and leak detection. Each tank has a high level alarm to alert operators before the tank overfills.

The ILWMS is monitored and controlled by the DCS. As part of the DCS, the field instrumentation interfaces to electronic hardware in process control unit cabinets. Operating consoles located in the Waste Processing Control Room display data from the instrumentation and transmit control actions to the process control unit. The consoles interface to the process control units over a system network.

The conditions that require operator response include high and low level in the evaporator, high temperature, high density, lack of feed, and/or loss of utilities.

The PWL tanks and sumps are considered part of the PEWE collection system. The tanks and sumps have high level alarms that, upon activation, are jetted to the appropriate tank. The tanks and sumps are monitored by the DCS located in the Waste Processing Control Room.

VES-WL-132, VES-WL-133, VES-WL-102, VES-WL-106, VES-WL-107, and VES-WL-163 all have high level alarms. VES-WL-109 has an overfill line that drains back to tanks VES-WL-133 or VES-WL-102. Upon high level alarm, the condition is investigated and appropriate action taken.

PEWE Bypass Systems

Waste can be transferred through the evaporators to VES-WL-101 or VES-WL-111 without operating the evaporators. Such transfers may occur when:

- The evaporators are not operable due to scheduled maintenance activities or are in need of repairs
- The system requires testing following repairs or maintenance (this minimizes waste by not introducing new materials to the system)
- The PEWE Feed Tanks can be emptied to allow additional storage capacity during periods of system maintenance and/or testing.

In the unlikely event that VES-WL-132 was to completely fill, solids would be carried over into VES-WL-133. As VES-WL-132 approached its capacity, solids would be detected as a result of plugging in the vessel's instrument lines. VES-WL-132 would then be immediately bypassed, diverting feed solutions directly to VES-WL-133. Once full of solids, VES-WL-132 is designed to be remotely removed/replaced. The full sediment tank will be managed as a RCRA solid waste and disposed in accordance with all applicable regulations. However, if the solids content in PEWE feed remains low, the INL may elect not to install a new feed sediment tank.

There are no bypass systems associated with the PWL tanks and sumps. No safety or waste treatment issues are associated with an inability to bypass these tanks or sumps.

PEWE Pressure Controls

Waste treatment and storage vessels at INTEC are connected to a gaseous waste treatment system called the VOG system. All ILWMS storage and treatment systems discharge gases such as instrument air purges (used in level, density, and pressure instrumentation), air spargers (agitators), and gases displaced from a vessel when it fills with liquid.

Gases from the PEWE and other INTEC processes, such as the Tank Farm and CPP-659 vessels, vent to the CPP-604 VOG system. The CPP-604 VOG system consists of a mist eliminator, superheater, and HEPA filter banks. The mist eliminator and superheater are included to protect and extend the life expectancy of the HEPA filters.

Several facility process and vessel offgas systems, including the CPP-604 VOG system, combine in the Process APS located in CPP-649. The Process APS is a back-up system that treats the combined process and vessel offgas streams from CPP-604, Tank Farm, and the NWCF. The Process APS treatment consists of a mist eliminator, superheater, and HEPA filters. Next, the process and vessel offgases are routed to the INTEC Main Stack (CPP-708) where they mix with building ventilation air and are exhausted to the atmosphere. The vessel and process offgas systems are maintained under a vacuum to control contamination. The system equipment and piping are fabricated from acid resistant stainless steel for corrosion resistance. Additionally, the Process Condensate Collection Tanks can be vented to the process condensate collection cells, which vent to the CPP-604 building ventilation system. The VOG and APS systems are described further in Attachment 1, Section D-8b of this permit.

Each PWL tank has an open vent line to prevent over pressurization.

CPP-604 TFT Feed Systems

Wastes are jetted or pumped to VES-WM-100. From VES-WM-100, waste may overflow to VES-WM-101, which in turn overflows to VES-WM-102. Additionally, each of the three tanks (VES-WM-100, VES-WM-101, and VES-WM-102) is equipped with a transfer jet that can transfer waste to a companion CPP-604 TFT system tank. A jet in VES-WM-100 transfers solution to VES-WM-102, a jet in VES-WM-102 transfers solution to VES-WM-101, and a jet in VES-WM-101 transfers solution to VES-WM-100. Additionally, each of the tanks can be jetted to the PEWE, the ETS, TFTs, or the TFF.

CPP-604 TFT Safety Cutoffs

If liquid accumulates in either of the two sumps associated with the CPP-604 TFT system, the accumulated liquid in the sump will initiate an alarm on the DCS. These sumps are equipped with steam jets to remove the liquid. Liquid accumulation in both sumps is jetted to the PEWE feed tanks or to the TFF.

The instruments for the CPP-604 TFT system tanks are monitored by the DCS from control panels in the Waste Processing Control Room. The instrumentation consists of instruments and alarms to detect system upset.

The purpose of the level drop alarms is to alert operators of potential leakage. The purpose of the high level alarms is to warn operators of the potential for tank overfilling. In the event of a level drop alarm or high level alarm for these tanks, the condition is investigated and appropriate action taken.

CPP-604 TFT Bypass Systems

The CPP-604 TFTs may be used to store dilute waste feed, concentrated evaporator bottoms, or for segregation of wastes. INTEC management decides on the type of waste stored in the tanks and the frequency of use based on plant operating conditions and needs. The CPP-604 TFTs may be used to segregate wastes based on chemical or radionuclide content. The CPP-604 TFTs can be used as surge tanks to store dilute evaporator feed solution should the normal feed collection be full or otherwise unable to receive additional waste. Likewise, the CPP-604 TFTs can also be used to store concentrated evaporator bottoms if the normal bottoms system is unable to receive waste. When used to segregate wastes or to store evaporator feed or bottoms solutions, the CPP-604 TFTs are used as surge tanks for additional waste storage. When surge capacity is not needed, the tanks may be bypassed. There are no safety or waste treatment issues associated with either using or bypassing the tanks.

CPP-604 TFT Pressure Controls

The CPP-604 TFT system tanks vent to the INTEC VOG System.

CPP-1618 LET&D Feed Systems

Waste accumulated in the condensation tanks at the PEWE is pumped directly to the Fractionator Waste Feed Head Tank, VES-WLK-197, in Fractionator Cell 1. The ancillary piping for VES-WLK-197 begins at the transfer pump from the PEWE overhead condensate tanks. From VES-WLK-197, the waste stream is gravity fed to either of the acid fractionators for treatment. There are no other feed systems for the LET&D.

Concentrated nitric acid recovered in the LET&D fractionators gravity drains to the Acid Fractionator Bottoms Tank, VES-WLL-195.

CPP-1618 LET&D Safety Cutoffs

The LET&D is operated from the DCS for waste side operations. The LET&D process control contains instrumentation and a control system to monitor process variables and provide for safe and efficient operation and shutdown of the process by remote control of process equipment. The control room is used to control both LET&D and PEWE process systems.

Conditions that may cause the fractionators to be shut down or feed to the fractionators to be discontinued are high and low level in the fractionator, low vacuum in the fractionator, low fractionator

differential pressure, high Tray 1 temperature, high separator level, high differential pressure across HEPA filters, lack of feed, and/or loss of utilities.

The systems that the DCS monitors and controls include PEWE waste transfers to the LET&D feed tank, fractionation, bottoms tank transfers to CPP-604 or the Acid Recycle Tank, and building ventilation. Indication of transfer to the Acid Recycle Tank is also provided in the NWCF control room.

VES-WLL-195 is equipped with a high level alarm. Upon high alarm the recovered nitric acid is transferred to VES-NCR-171, VES-WL-133, VES-WL-101, or the TFF.

CPP-1618 LET&D Bypass Systems

There are no bypass systems at the LET&D facility. No safety or waste treatment issues are associated with an inability to bypass this facility.

CPP-1618 LET&D Pressure Controls

The LET&D is vented to the Main Stack via its offgas system.

CPP-659 Annex Acid Recycle System (VES-NCR-171, VES-NCR-173) Feed Systems

VES-NCR-171 receives recovered nitric acid, which is pumped from VES-WLL-195 via the LET&D facility. The acid is then airlifted to VES-NCR-173 and distributed into a header for use elsewhere at the INTEC.

CPP-659 Annex Acid Recycle System Safety Cutoffs

VES-NCR-171 is equipped with a high level alarm. Transfers to the vessel are stopped when the high level alarm is reached. In the case of a high liquid level alarm, the condition will be investigated and appropriate action taken.

VES-NCR-173 is equipped with an overflow that returns the concentrated nitric acid to VES-NCR-171.

CPP-659 Annex Acid Recycle System Bypass Systems

There are no bypass systems associated with the Acid Recycle Tanks system. No safety or waste treatment issues are associated with an inability to bypass these tanks.

CPP-659 Annex Acid Recycle System Pressure Controls

VES-NCR-171 and VES-NCR-173 are vented to the NWCF VOG system.

CPP-659 ETS Feed Systems

The feed for the ETS is jetted from VES-NCC-101 to VES-NCC-152. The excess feed overflows back to VES-NCC-101. Feed from VES-NCC-152 is gravity fed to the evaporator (VES-NCC-150). The liquid level in the evaporator is controlled by a combination of a flow control valve located in the feed line and evaporation of the liquid.

CPP-659 ETS Safety Cutoffs

The ETS is operated from the DCS located in the control room, Building CPP-659. The ETS process control contains instrumentation and a control system to monitor process variables and provide for safe and efficient operation and shutdown of the process by remote control of process equipment**.**

The VES-NCC-150 is equipped with redundant thermo-wells at the following points:

- Bottom of VES-NCC-150.
- One foot above sparging airline.
- One foot below operating liquid level.
- Below the lower de-mister mesh.
- Above the upper de-mister mesh.

If any of the above points reach a high temperature, an alarm will sound on the DCS. At a high-high temperature alarm, the steam supply to HE-NCC-350 is automatically shut off. Steam supply to HE-NCC-350 is also automatically shut off if a low flow on the cooling water supply to HE-NCC-351 is detected.

The instrumentation for VES-NCC-150 liquid level and density is located on the DCS. The level instrument controls the level control valve on the feed line from VES-NCC-152. The level instrument will also sound an alarm if a high- or low-level is detected. The density instrument sounds an alarm when high density is indicated.

A flow control valve (remotely operated) and flow-sensing element are provided on the steam supply line to HE-NCC-350. The steam flow control valve and the level control valve are automatically

shut under the following conditions (with the provision that the listed shutdown conditions may be overridden if required to place the evaporator in a safe configuration):

- High-high alarm on any of the ten thermocouples on VES-NCC-150 as read on T150-1C through T150-10C (this cannot be overridden)
- High-high/low-low liquid level in VES-NCC-150 as read on L150-1C
- High density in VES-NCC-150 as read on D150-1C
- VES-NCC-150 high-high-pressure as read on P150-1C (this cannot be overridden)
- VES-NCC-351 low cooling water flow-rate as read on F351-1C
- Manual activation of Rapid Shutdown System (this cannot be overridden)

Shutdown conditions for any of the above will also activate an air pressure system on HE-NCC-350 except for loss of plant air. The air pressure system keeps a positive pressure on the HE-NCC-350 steam chest, preventing leaking from the HE-NCC-350 tubes into the steam side of the bundle.

CPP-659 ETS Bypass Systems

There are no bypass systems at the ETS. No safety or waste treatment issues are associated with an inability to bypass this facility.

CPP-659 ETS Pressure Controls

This unit is vented to the NWCF process offgas system. For more information regarding the NWCF process offgas system refer to Section D-8b.

CPP-1696 IWTU Feed Systems

The transfer line from the NWCF is secondarily contained in a stainless steel pipe. The IWTU Waste Feed Tank is provided with a bubbler type level instrument, L-C-131-2. The tank level is read on the DCS and automatically stops the waste feed pump when the waste level in the tank reaches the low-low level set point. The tank inlet valve, LV-SRC-131-003, will shut at the high-high level set point. The IWTU Waste Feed Tank is supplied with an overflow through the Clarifier Tank to the Sump Tank. In addition to the tank level control logic, the waste feed pump is equipped with a variable speed drive and a current indicator to provide required flows and pressures. Each waste feed line is also equipped with a flow meter near the injector to allow monitoring of the feed rate of each line.

Feed pressure in each of the DMR injector feed lines is monitored and alarmed for high and low pressure on instruments located on the DCS to provide indication of plugging of the injector or line break.

If a high pressure alarm occurs, it is an indication that the associated waste feed injector may be plugged with solids. The waste feed injectors are provided with water and acid purge and nitrogen connections to allow the line to be pressurized with acid, water, or nitrogen to clear any built up solids in the injector, should this occur. If a low pressure alarm occurs, the waste feed to the DMR is stopped by closing the DMR feed valves. The waste feed pump will remain in tank recirculation mode.

CPP-1696 IWTU Safety Cutoffs

There are numerous alarm conditions that result in automatically cutting off the waste feed and associated systems dependent upon the particular alarm condition. Some of the major components are described in the following sections. Additionally, alarm conditions that result in automatically cutting off the waste feed are identified below in Table D-6. Liquid waste feed shall not be initiated until all the conditions in the table are in a satisfactory state.

Table D-6. IWTU Automatic Waste Feed Cutoff

DCS Instrument	Function	AWFCO Actuation
YS-C-401-11	Hydrogen deflagration protection	Tripped
YS-C-402-21	High temperature protection system	Tripped
YS-H-403-31	High CO detection system	Tripped
L-C-231-3	Seal water tank level	≤9 inches WC
FY-C-140-1	Total feed rate	≥2.5 gpm
VOL-C-131-2	Waste feed tank volume	≤200 gal
P-C-131-1A/B	Feed pump discharge pressure (one pressure instrument in use, one on standby)	≤20 PSIG
TC-C-140-9	DMR average bed temperature	≤580 °C
TC-C-140-9	DMR average bed temperature	≥680 °C
TDY-C-140-9	Temperature difference across DMR bed	≥50 °C
P-C-140-1/7	DMR freeboard pressure (both)	≥10 PSIG (10 second delay)

Table D-6. IWTU Automatic Waste Feed Cutoff (continued)

DCS Instrument	Function	AWFCO Actuation
AC-C-153-1	Hydrogen in DMR/PGF off-gas average	≤1.5% (rolling 10 minute average dry basis)
AC-C-153-1	Hydrogen in DMR/PGF off-gas average	≥15% (rolling 10 minute average dry basis)
FY-B-365-1	SSV	≤0.4 ft/sec (10 second delay)
FY-B-365-1	SSV	≥1.6 ft/sec (10 second delay)
P-B-365-11A	N2/steam pressure to fluidizing gas superheater	≥45 PSIG
T-B-365-17	DMR fluidizing gas temperature average	≤430 °C
P-C-153-11	PGF rupture Disk pressure	≥12 PSIG
PD-C-153-1	Differential Pressure across the PGF	≥81 in. W.C. (10 second delay)
TC-C-160-4	CRR average bed temperature	≥1100 °C
TC-C-160-4	CRR average bed temperature	≤850 °C
TDY-C-160-4	Temperature difference across CRR bed	≥50 °C
P-C-760-10/16	CRR Exit Gas Pressure (both)	≥0 (10 second delay)
AC-C-760-1	O2 concentration in the CRR off-gas outlet (AVG)	≥8 Vol% (average wet basis)
AC-C-760-1	O2 concentration in the CRR off-gas outlet (AVG)	≤1.0 Vol% (average wet basis)
PD-C-160-3	Differential Pressure across the OGF	≥81 in. W.C. (10 second delay)
T-C-160-1A/1B	Temperature after the off-gas cooler (either)	≥205 °C
T-C-160-1A/1B	Temperature after the off-gas cooler (either)	≤130 °C
PSH-H-160-13	OGC rupture disk pressure	Tripped
I-H-260-1A/B	Off-gas blowers current (both)	≤35 amps (after 10 second delay)

Table D-6. IWTU Automatic Waste Feed Cutoff (continued)

DCS Instrument	Function	AWFCO Actuation
T-H-140-3A/B	Temperature at outlet of process HEPA/Inlet to GAC beds (Average)	≤105 °C
T-H-140-3A/B	Temperature at outlet of process HEPA/Inlet to GAC beds (Average)	≥175 °C
T-H-140-2	Temperature at inlet to process HEPA pre-filter inlet	≤130 °C
PD-H-140-4A/B/C/D	Process HEPA pre-filter differential pressure (any)	≥8 inches WC
PSH-H-140-8	HEPA filter inlet rupture disk pressure	Tripped
PSH-H-140-9	HEPA filter inlet rupture disk pressure	Tripped
T-H-141-7A/B	GAC outlet temperature (both)	≥200 °C
P-H-141-7A	GAC bed A rupture disk pressure	≥0.5 PSIG
P-H-141-7B	GAC bed B rupture disk pressure	≥0.5 PSIG
I-H-240-10A/B	Process exhaust blowers current (both)	≤35 amps (after 10 second delay)
L-E-121-5	N2 Tank Level	≤25 inches
P-B-357-2A/2B	Loss of N2 (both)	≤80 PSIG
P-B-146-3A/3B	Loss of O2 (both)	≤75 PSIG
L-E-124-5	O2 Tank Level	≤30 inches
A-H-941-3A/B	CO concentration Hourly rolling ave 2 instruments	≥ 100 PPM
JS-B-120-1	PDC power loss	NA
P-B-166-2A/B	Loss of compressed air pressure (both)	≤70 PSIG
XSH023-1CXSH023-2C	Seismic event (both)	NA

DMR

The DMR is provided with the following instrumentation to provide safe, reliable operation:

- Multiple pressure indication
- Multiple redundant temperature indication at different levels throughout the fluidized bed
- Redundant hydrogen monitors in the offgas

If the average bed temperature in the DMR drops below 580°C, the waste feed injection will be stopped.

If the average bed temperature increases above 680˚C, the waste feed injection and oxygen flow rates to the DMR are automatically stopped.

The DCS provides the average temperature of the DMR bed as measured by the operable in-bed thermocouples (a minimum of seven) as listed in Table D-9. If one of the in-bed thermocouples differs from the average temperature by more than 50°C, then feed will automatically be cutoff and corrective action will be taken, including as necessary:

- Checking the operability of the varying thermocouple;
- Modifying process parameters such as decreasing operating temperature, decreasing or isolating injection lines, and/or increasing the steam fluidizing gas rate to control any temperature variation in the fluidized bed;
- Replacing steam and oxygen fluidizing gas flow with nitrogen.

For IWTU purposes, average is defined as the mean temperature of the operable in-bed thermocouples as calculated by the DCS. When a thermocouple indication varies from the mean, the DCS will continue to use the data in its calculation of the average until such time that the thermocouple is determined to be inoperable and is taken out of service.

DMR pressure will normally float between 2 and 8 psig depending on the pressure losses in the Process Gas Filter and the CRR. If the pressure above the bed of the DMR exceeds 10 psig, an automatic waste feed cutoff will be initiated, and steam/oxygen fluidization will be isolated and the DMR will be purged with nitrogen at varying rates depending on process conditions.

The IWTU will be shut down if the nitrogen supply falls below five system volume equivalents, so that adequate nitrogen supply is available to supply nitrogen purge in the event of a system upset.

Process Gas Filter

The Process Gas Filter utilizes sintered metal filter elements. The filter elements were manufactured with a fuse installed. The fuse was designed to allow the isolation of individual filter elements if they fail by becoming permanently blinded. It was determined that these fuses were not necessary to be protective of human health and the environment and were removed. The filter elements are arranged in bundles for ease of installation and removal. Each filter bundle is equipped with a ceramic fiber core gasket using a ring of material cut from a thick mat of the high temperature ceramic fibers which eliminates any seams in the core of the gaskets. The gaskets are soaked in a water dispersion of vermiculite (a magnesium-aluminum-silicate mineral) to form a strong, multi-layer film to enhance the seal ability of the gasket. The individual filter bundles are secured to the tube sheet using three couplers that bolt the venturi plates to the tube sheet to prevent lifting and resultant material carryover. The sintered filters are pulse-cleaned by high pressure nitrogen. The cleaning period is adjusted by monitoring the pressure drop across the Process Gas Filter during operation on the DCS.

CRR

The CRR is provided with the following instrumentation to provide safe, reliable operation:

- Multiple pressure indication
- Multiple redundant temperature indication at different levels throughout the bed
- Redundant oxygen monitors in the offgas

If the average bed temperature decreases below 850˚C, the waste feed injection to the DMR will be stopped and the DMR will be switched from steam to nitrogen fluidization.

If the average bed temperature increases above 1,100˚C, waste feed injection is automatically stopped.

The DCS provides the average temperature of the CRR bed as measured by the operable in-bed thermocouples (a minimum of 3) as listed in Table D-9. If one of the in-bed thermocouples differs from the average temperature by more than 50°C, then feed will automatically be cutoff and corrective action will be taken, including as necessary:

- Checking the operability of the varying thermocouple;

- Modifying process parameters such as decreasing operating temperature, decreasing or isolating injection lines, and/or increasing the steam fluidizing gas rate to control any temperature variation in the fluidized bed;

- Replacing steam and oxygen fluidizing gas flow with nitrogen.

In the event of a high-high offgas temperature alarm, the IWTU is shut down and the reformers and offgas system are purged with nitrogen.

If the pressure above the bed in the CRR exceeds 0 psig (0" water column vacuum), the liquid waste feed will be shutdown.

Offgas Cooler

To protect downstream equipment from above-design temperatures, emergency offgas cooling is provided by means of pressurized water surge tank which discharges water into the Offgas Cooler through the cooling spray nozzle located inside the Offgas Cooler. The Offgas Cooler Surge Water Tank provides approximately 200 gallons of storage. Treated or demineralized water can be used for cooling.

Offgas Filter

The Offgas Filter utilizes metal filter elements. The filter elements were manufactured with a fuse installed. The fuse was designed to allow the isolation of individual filter elements if they fail by becoming permanently blinded. It was determined that these fuses were not necessary to be protective of human health and the environment and were removed. The filter elements are arranged in bundles for ease of installation and removal. Each filter bundle is equipped with a ceramic fiber core gasket using a ring of material cut from a thick mat of the high temperature ceramic fibers which eliminates any seams in the core of the gaskets. The gaskets are soaked in a water dispersion of vermiculite (a magnesium-aluminum-silicate mineral) to form a strong, multi-layer film to enhance the seal ability of the gasket. The individual filter bundles are secured to the tube sheet using three couplers that bolt the venture plates to the tube to prevent lifting and resultant material carryover. The filters are pulse-cleaned by high pressure nitrogen. The cleaning period is adjusted by monitoring the pressure drop across the Offgas Filter during operation on the DCS.

Process HEPA Filters and Mercury Adsorbers

The total combined stream inlet temperature to the Process HEPA Filters is monitored. The IWTU will be shut down upon a low-low temperature alarm in this vent line.

The differential pressure of the process HEPA pre-filters is monitored. If the differential pressure on any process HEPA pre-filter exceeds 6.5" water column the affected process HEPA filter bank must be isolated and the process HEPA pre-filter replaced. If more than one HEPA filter has a rapid increase to above 6.5" water column, the operators will initiate a controlled shutdown.

If the differential pressure on any process HEPA pre-filter reaches 8" water column the IWTU liquid waste feed is shutdown.

Filter elements will be changed when pressure drop across the process HEPA filter element exceeds 5" water column or when testing indicates loss of collection efficiency. To change filter elements, the inlet damper for the filter bank to be changed out is closed, the outlet damper is throttled back to maintain a slight vacuum for radiological control, and the element replaced. This is repeated until all filters have been changed.

Thermocouples are provided in the supply and exhaust duct for the Mercury Adsorbers. The IWTU will be shut down if a high-high alarm set point of 175°C is reached at the inlet to the Mercury Adsorbers. If a low-low temperature alarm set point of 105˚C is reached the IWTU will be shut down or the Mercury Adsorber can be temporarily bypassed. If a high-high differential alarm set point is reached, the waste feed to the DMR will be stopped and the system is purged with nitrogen.

The Mercury Adsorbers are also bypassed by the Rapid Shutdown System (RSS) under the following conditions:

- There will be a time delay of 300 seconds before the Mercury Adsorbers are bypassed to ensure that all the Mercury in the system has passed through the Mercury Adsorbers prior to being bypassed. The following are on a time delay after an Rapid Shutdown System (RSS) trip:
    - Low-Low Oxygen Concentration in the CRR off-gas outlet
    - High-High Oxygen Concentration in the CRR off-gas outlet
    - Seismic Switch
    - Low-Low INTEC Supplied Compressed Air Pressure
    - Low-Low SBW Off-gas Blower Motors Current
    - Low-Low Process exhaust blower motors current

- Low-Low temperature at outlet of Process HEPA filter
- High-High temperature after the GAC beds
- Pressure relief activation of GAC bed rupture disk
- Low low CRR average bed temperature
- Manual Shutdown Switch

- The following are the RSS trips that are concerned with personnel safety and protecting equipment and require immediate bypass of the Mercury Adsorbers with no time delay:

  - High-High DMR Pressure
  - Low-Low DMR Fluidizing Gas Flow
  - Low-Low Temperature in the CRR (SIF-1)
  - High-High CO at Outlet of Mercury Adsorber
  - High-High Temperature in Outlet Process HEPA Filter/Inlet to Mercury Adsorbers
  - Loss of Nitrogen
  - Loss of Electrical Power
  - Pressure Relief Disk Release DMR & Process Gas Filter
  - High-High-High DMR Pressure
  - High-High-High Process HEPA Pre-Filters Differential Pressure
  - High-High Fluidizing Gas Pressure to DMR
  - High-High-High CRR Pressure
  - High-High Temperature Off-gas Cooler Outlet
  - Pressure Relief Disk Activated Off-gas Cooler Outlet
  - Pressure Relief Disk Activated process HEPA Filter Inlet.

The above trips require immediate bypass of the Mercury Adsorbers to allow purging with nitrogen to prevent condensation or support fire suppression. The rest of the IWTU would be purged and cooled slowly to prevent thermal shock and possible failure of the equipment.

Product Receiver/Coolers and Cooling Loops

The Product Receiver Filter is continuously monitored for temperature with a thermocouple. The Product Receiver Filter utilizes metal filter elements. The filter elements were manufactured with a fuse installed. The fuse was designed to allow the isolation of individual filter elements if they fail by becoming permanently blinded. It was determined that these fuses were not necessary to be protective of human health and the environment and were removed. The filter elements are arranged in bundles. The individual filter bundles are secured to the tube sheet using three couplers that bolt the venturi plates to the tube sheet to prevent lifting and resultant material carryover. Each filter bundles is equipped with a ceramic fiber core gasket using a ring of material cut from a thick mat of the high temperature ceramic fibers which eliminates any seams in the core of the gaskets. The gaskets are soaked in a water dispersion of vermiculite (a magnesium-aluminum-silicate mineral) to form a strong, multi-layer film to enhance the seal ability of the gasket. Each bundle can be remotely removed and replaced if filter change-out is

needed. The inlet pressure and outlet pressure is continuously monitored, and the differential pressure across the filter is calculated by the DCS. Upon high differential pressure the metal filter elements are cleaned on-line using pulse nitrogen cleaning. Level detection is provided for the bottom cone of the filter. When the solids reach a predetermined value, the solids are transferred to the Product Receiver Filter Product Pump.

The Product Handling Vacuum Filter is monitored for differential pressure. The Product Handling Vacuum Filter utilizes metal filter elements. The filter elements were manufactured with a fuse installed. The fuse was designed to allow the isolation of individual filter elements if they fail by becoming permanently blinded. It was determined that these fuses were not necessary to be protective of human health and the environment and were removed. The filter elements are arranged in bundles. The individual filter bundles are secured to the tube sheet using three couplers that bolt the venturi plates to the tube sheet to prevent lifting and resultant material carryover. Each filter bundle is equipped with a ceramic fiber core gasket using a ring of material cut from a thick mat of the high temperature ceramic fibers which eliminates any seams in the core of the gaskets. The gaskets are soaked in a water dispersion of vermiculite (a magnesium-aluminum-silicate material) to form a strong, multi-layer film to enhance the seal ability of the gasket. Each bundle can be remotely removed and replaced if filter change-out is needed.

CPP-1696 IWTU Bypass Systems

The Mercury Adsorbers have valves available to bypass the GAC beds in the event of a system upset. Feed is stopped prior to any GAC bed bypass stopping all mercury addition into the process gas system. Before a bypass of the Mercury Adsorbers occurs, sufficient time (approximately 5 minutes) will be allowed to elapse to ensure the process offgas is appropriately treated.

The Mercury Adsorbers may also be bypassed immediately if the system upset threatens personnel safety or equipment damage.

CPP-1696 IWTU Pressure Controls

Table D-7 includes the pressure relief valves (PRV) or rupture disks installed on key IWTU equipment for protection from being subjected to pressures that exceed their design limits. The spring activated PRVs installed at IWTU are set to open at a predetermined set pressure. When the set pressure is exceeded, the relief valve becomes the “path of least resistance” as the valve is forced open and a portion of the air/gases is diverted through an auxiliary route. As the air/gases are diverted, the pressure

inside the vessel or system will drop. Once it reaches the valve's reseating pressure, the valve will close. The rupture disks installed at IWTU are non-reclosing pressure relief devices.

If the set pressure on the individual pressure relief system is exceeded for the Process Gas filter, outlet to the Off Gas Cooler, or the inlet to the HEPA filters, an automatic waste feed cutoff is initiated. These AWFCO are included in the AWFCO Table D-6. If the set pressure is exceeded for outlet on either of the two GAC beds, flow is manually stopped to the GAC beds and the GAC beds are bypassed.

Table D-7. IWTU Pressure Relief Valves

Description	**Vent to**	**Drawing**
Process Gas Filter pressure relief valve PSV-SRC-153-011	Building HVAC Duct	632763
Off-Gas Cooler and CRR pressure relief valve PSV-SRC-160-013	Building HVAC Duct	632766
Product Receiver Cooler pressure relief valve PSV-SRC-190-011	Vacuum Filter	632787
Canister Fill Port pressure relief valve PSV-SRC-890-010	Vacuum Filter	632787
Product Receiver pressure relief valve PSV-SRC-190-012	Building HVAC Duct	632787
Product Receiver Cooler pressure relief valve PSV-SRC-191-011	Vacuum Filter	632788
Canister Fill Port pressure relief valve PSV-SRC-891-012	Vacuum Filter	632788
Product Receiver Filter pressure relief valve PSV-SRC-191-005	Vacuum Filter	632790
Process HEPA Filters pressure rupture disks PSE-SRH-140-008 and PSE-SRH-140-009	Building HVAC Duct	632797
Mercury Adsorber pressure relief valve PSV-SRC-141-007A/B	IWTU Stack	632798
Product Receiver pressure relief valve PSV-SRC-191-002	OGF	632790
Vacuum Filter pressure relief valve PSV-SRC-190-002	OGF	632791

The IWTU gas flow and pressure is maintained by the Offgas Blowers that pull gases through the IWTU. The flows are controlled using instrumentation and valves as described above.

D-2e Diagrams of Piping, Instrumentation, and Process Flow [IDAPA 58.01.05.012; 40 CFR 270.16(d)]

The permitted piping systems with the PEWE include the piping and tanks depicted in Exhibit D-1. The permitted piping systems with the LET&D system include the piping and tanks depicted in Exhibit D-2. The permitted piping system with the ETS includes the piping and tanks depicted in Exhibit D-3. The permitted piping system with the IWTU includes the piping and tanks depicted in diagrams 632750, 632753, and 632754 in Appendix II of this permit.

Ancillary piping and equipment associated with the ILWMS are included in this permit, except the piping and equipment identified below:

- This permit does not include piping and equipment associated with the TFF. The piping and equipment associated with the TFF will be operated under interim status/Consent Order and will be RCRA closed with the tank farm closure.
- This permit does not include piping and equipment associated with CPP-666. The CPP-666 (Fluorinel Dissolution Process) lines are not included because they carry only radioactive waste.

The ancillary piping and equipment upstream of the collection tanks are included in the Diagram Package, Appendix II of this permit.

The INTEC was designed and built using a variety of Architectural Engineers (AE) over the past 50 years. Those AEs used different line identifiers, instrumentation identifiers, etc. As buildings were designed and constructed, the current architectural engineering standards for the time period were used. The diagrams of the processes submitted to the DEQ span more than 50 years. Therefore, when looking at these diagrams, careful attention must be paid to the identifiers to ensure proper interpretation.

The following is an explanation of the symbols the Idaho National Laboratory (INL) has chosen to identify the RCRA-regulated tank systems associated with the INTEC on the diagrams:

R Indicates an active RCRA-regulated liquid transport line requiring secondary containment and inspections.

E Indicates that the lines in question are not used to routinely manage hazardous waste. They would only receive hazardous waste if an unplanned spill or release occurred. As such, the lines are not subject to secondary containment, daily inspections, or closure. Where drains are located with the secondary containment system for regulated units, they are considered an integral part of a secondary containment system and subject to applicable regulatory requirements associated with secondary containment systems.

O Indicates an active evaporator/fractionator offgas line.

C Indicates an inactive transfer line. The line may have been used for the RCRA waste in the past but is no longer being used.

The design drawings for the IWTU do not contain the line designations presented above. These symbols may be added to the drawings at the time the facility is constructed.

Drawings depicting the standard symbols and nomenclature used on facility diagrams are provided in Appendix II to this permit. These legends do not include all symbols used at the INTEC. The symbols may differ, depending on the timeframe in which the buildings/processes were designed and built. The diagram list for the ILWMS is provided in Table D-8. DEQ selected drawings for the permit are included in Appendix II of this permit. [Note: drawings that are considered OUO/CBI are located in the OUO/CBI section of this Permit (Appendix VII).]

Table D-8. List of ILWMS Diagrams

Diagram Number	System
057498	Process Flow for CPP-604 Tank Farm Primary Waste Collection and Storage Facilities Flowsheet
057499[a]	CPP-Area Tank Farm CPP Primary Waste Collection and Storage Facilities Flowsheet, Sheet 2 of 6.
094276 Sheets 1-4	CPP-604 PEWE Evaporators Process P&ID
096156	CPP-604 PEW Evaporators Collection Tanks
103308	CPP-604 Sampler Flowsheet Waste Storage Tanks
103589	CPP-604 Waste Treatment Building Drain & Service Waste Flowsheet
133400	CPP-659 Utility Flow Diagram Process & Utility Drain Lines Level No. 1, 2, and 3 NWCF
133401	CPP-659 Utility Flow Diagram Process & Utility Drain Lines At Levels No. 1, 2, and 3 NWCF
133402	CPP-659 Utility Flow Diagram Process & Utility Drain Lines Levels No. 1, 2, and 3 NWCF
133406	CPP-659 Outside Yard Piping Flow Diagram
133407	CPP-659 Outside Yard Piping Flow Diagram NWCF
133408	CPP-659 Mechanical P & ID Hot Sump Tanks Cell NWCF
133409	CPP-659 Mechanical Flow Diagram Hot Sump Tanks Cell NWCF
133410	CPP-659 NWCF Mechanical P & ID Blend & Hold Cell & Valve Cubicle Sheet 1 of 4
133411	CPP-659 Mechanical Flow Diagram Blend & Hold Cell & Valve Cubicle NWCF
133412	CPP-659 NWCF Mechanical Flow Diagram Blend & Hold Cell & Valve Cubicle
133413	CPP-659 Mechanical Flow Diagram Blend & Hold Cell & Valve Cubicle NWCF
133417	CPP-659 Mechanical Flow Diagram Calciner Cell & Flow Meter Cubicle Sheet 4 of 8 NWCF
133418	CPP-659 Mechanical Flow Diagram Calciner Cell And Flow Meter Cubicle Sheet 5 of 8 NWCF
133420	CPP-659 Mechanical P & ID Calciner Cell & Flow Meter Cubicle NWCF Sheet 7 of 8 NWCF
133423	CPP-659 Mechanical Flow Diagram Offgas Cell Sheet 2 of 4 NWCF
133424	CPP-659 Mechanical Flow Diagram Offgas Cell Sheet 3 of 4 NWCF
133425	CPP-659 Mechanical Flow Diagram Offgas Cell Sheet 4 of 4 NWCF
133426	CPP-659 Mechanical Flow Diagram Adsorber Cell & Valve Cubicle Sheet 1 of 3 NWCF
133427	CPP-659 Mechanical Flow Diagram Adsorber Cell & Valve Cubicle Sheet 2 of 3 NWCF
133428	CPP-659 Mechanical Flow Diagram Adsorber Cell & Valve Cubicle Sheet 3 of 3 NWCF
134251	CPP-659 High Level Liquid Waste Evaporator P&ID Sheets 1, 2, & 3 of 5
176274	CPP-659 LET&D Acid Recycle System P&ID

Table D-8. List of ILWMS Diagrams (continued)

Diagram Number	System
176275	CPP-659 LET&D Acid Recycle System P&ID
179009	CPP-604 Vessel VES-WL-150 P&ID
347791	LET&D Facility Notes & Abbreviations
356596 Sheets 1-11	CPP-1618 Liquid Effluent Treatment and Disposal Facility P&ID
368921	CPP-604 and CPP-649 PWL Collection System Process and Instrument Diagram DVB-OGF-DG-D5 Vault
368922	CPP-604 and CPP-649 PWL Collection System Process and Instrument Diagram DVB-OGF-DG-D8 Vault
368923	CPP-604 and CPP-649 PWL Collection System Process and Instrument Diagram APS Process
368924	CPP 604and CPP-649 PWL Collection System and Instrument Diagram Offgas Blower Cell
368925	CPP-604 and CPP-649 PWL Collection System P&ID Offgas Filter Cell
368926	CPP-604 and CPP-649 PWL Collection System P&ID South Cell
368927	CPP-604 and CPP-649 PWL Collection System Middle Cell P&ID
368928	CPP-604 and CPP-659 PWL Collection System Pump Pan Enclosure P&ID
368929	CPP-604 and CPP-649 PWL Collection System North Cell P&ID
368930	CPP-604 and CPP-649 PWL Collection System Separation/Condensation P&ID
368931	CPP-604, CPP-605, CPP-649, and CPP-708 PWL Collection System Process & Instrument Diagram Main Stack & 161 Evaporator Cell
632359	Arch General Arrangements Product Storage Building Floor Plan
632750	Process Flow Diagram Sodium Bearing Waste Treatment Carbonate HS Case Sheet 1
632752	Process Flow Diagram Additive Feed Carbonate HS Case Sheet 1
632753	Process Flow Diagram SBW Product Transfer and Loadout Carbonate HS Case Sheet 1
632754	Process Flow Diagram Process Exhaust & Building Ventilation Carbonate HS Case Sheet 1
632755	CPP-1696 Rapid Shutdown System (RSS) Process Flow Diagram Sheets 1-5 of 5
632756	Piping & Instrument Diagram Symbols and Nomenclature Sheet 1 (OUO/CBI)
632757	Piping & Instrument Diagram Symbols and Nomenclature Sheet 2
632758	INTEC CPP-1696 Integrated Waste Treatment Unit Piping & Instrument Diagram Typical Details
632759	CPP-1696 Piping & Instrument Diagram SBW Waste Transfer
632760	CPP-1696 Piping & Instrument Diagram SBW Waste Feed System (OUO/CBI)
632762	CPP-1696 Piping & Instrument Diagram Denitration Mineralization Reformer (OUO/CBI)
632763	CPP-1696 Piping & Instrument Diagram Process Gas Filters (OUO/CBI)
632764	CPP-1696 Piping & Instrument Diagram Carbon Reduction Reformer (OUO/CBI)

Table D-8. List of ILWMS Diagrams (continued)

Diagram Number	System
632765	CPP-1696 Piping & Instrument Diagram SBW Offgas (OUO/CBI)
632766	Piping & Instrument Diagram Offgas Cooler (OUO/CBI)
632779	Piping & Instrument Diagram Reformer Additives Sheet 1
632780	Piping & Instrument Diagram Reformer Additives Sheet 2
632782	Piping & Instrument Diagram DMR Additive Bin
632783	Piping & Instrument Diagram CRR Additive Bin (OUO/CBI)
632787	CPP-1696 Piping & Instrument Diagram Product Receiver and Canister Filling-Sheet 1
632788	CPP-1696 Piping & Instrument Diagram Product Receiver and Canister Filling-Sheet 2
632790	CPP-1696 Piping & Instrument Diagram Product Cooling
632791	CPP-1696 Piping & Instrument Diagram Canister Vacuum
632792	CPP-1696 Piping & Instrument Diagram Canister Handling
632793	CPP-1696 Piping & Instrument Diagram Sample Transfer
632797	CPP-1696 Piping & Instrument Diagram Process HEPA Filters
632798	CPP-1696 Piping & Instrument Diagram Mercury Adsorbers
632799	CPP-1696 Piping & Instrument Diagram Process Exhaust Monitoring & Discharge
632801	CPP-1696 Piping & Instrument Diagram DMR Fluid Gas System (OUO/CBI)
632821	CPP-1696 Piping & Instrument Diagram Drains and Sumps Sheet 1
632822	CPP-1696 Piping & Instrument Diagram Drains and Sumps Sheet 2
635083	INTEC IWTU Modifications to NWCF Valve Cubicle P&ID
635084	INTEC IWTU Modifications to NWCF Valve Cubicle Installation Plan
637285	INTEC IWTU Infrastructure Piping Tie-Ins Process Line Plan and Profile
637293	INTEC IWTU Modifications to NWCF Valve Cubicle Installation Plan Sheet 2
781895	IWTU Canister Filling and Decon Cell Product Receiver Cooler Rail Assembly Sheets 1-2
781896	IWTU Canister Filling and Decon Cell Product Receiver Outer Rail Assembly Sheets 1-2
632818	P&ID Steam Distribution
570000 Sheets 1-2	CPP-1696 IWTU DMR Cell & Filling Station OGF Bundle Configuration & Details
570001 Sheets 1-2	CPP-1696 IWTU DMR Cell & Filling Station PGF Bundle Configuration & Details
632823	INTEC CPP-1696 IWTU P&ID Sump Tank System
804020	INTEC CPP-1696 IWTU SMR Vessel Manway Nozzle Assembly Sheets 1-3
808190	INTEC CPP-1696 IWTU 4-Pack Sump Tank Assembly
808191	INTEC CPP-1696 IWTU 4-Pack Sump Tank VES-SRC-133 Assembly
808192	INTEC CPP-1696 IWTU 4-Pack Sump Tank Saddle Assembly
808193	INTEC CPP-1696 IWTU 4-Pack Clarifier Assembly VES-SRC-134

a. Drawing identifies ancillary equipment upstream of the collection tanks.

D-2f Containment and Detection of Releases

D-2f(1) Plans and Description of the Design, Construction, and Operation of the Secondary Containment System [IDAPA 58.01.05.012 and 008; 40 CFR 270.16(g) and 264.193]

D-2f(1)(a) Tank Age Determination [IDAPA 58.01.05.008; 40 CFR 264.193(a)]

Tables D-1, D-2, D-3, and D-4 list the tank numbers and descriptions, the year operations began, materials of construction, and the design standards used for the tanks in the PEWE, LET&D, ETS, and IWTU.

D-2f(1)(b) Requirements for Secondary Containment and Leak Detection [IDAPA 58.01.05.012 and 008; 40 CFR 270.16(g) and 264.193]

Details regarding construction specifications for the concrete, stainless steel liners, Hypalon® membranes, and paint are located in Attachment 1, Section B, of this permit.

Water stops were installed during construction of buildings, vaults, and cells associated with the PEWE, LET&D, and ETS where required. The IWTU will be constructed following the same considerations to prevent run-on to the regulated units or run-off of hazardous wastes in the event of equipment failures.

Level data for all of the sumps/tanks are recorded at least once every 24 hours. For further discussion on PEWE, LET&D, ETS, and IWTU inspections, see Section F, Procedures to Prevent Hazards.

Since the requirements of IDAPA 58.01.05.008 (40 CFR § 264.196) apply to spills or leaks that constitute a threat to human health or the environment, the following activities will be performed in response to the detection of system discharges in order to determine whether the requirements cited above will be implemented.

- Evaluate the system to determine if an integrity issue exists (this may not involve entering the radiological area). In making this determination, facility personnel will consider whether a discharge has migrated or could potentially migrate and whether it constitutes or could constitute a threat to human health or the environment. Any system discharge that is indicative of an integrity issue will trigger a response under

40 CFR § 264.196. Examples of system discharges that might indicate an integrity issue include pipe breaks, through-wall failures of tank or component boundaries, and system breeches resulting from incorrect maintenance (e.g., pipe or component not reinstalled). A system discharge that is not indicative of an integrity issue will not trigger a response under 40 CFR § 264.196. Examples include discharges caused by opening a pipe system and discharging residual liquids, pump and valve package discharges, mechanical joint and fitting discharges, discharges resulting from transients or maintenance activities that cause pressure surges, discharges from openings in systems where normal operations are at vacuum, and planned decontamination activities.

- Integrity assessments will be conducted in accordance with written and approved procedures
- Results of integrity assessments will be documented in the facility operating record
- For discharges into secondary containment, the liquids will be transferred to compliant storage areas within 24 hours or at the earliest practicable time.

Upon detection of spilled or leaked materials, the following actions are taken:

- Within 24 hours, remove as much of the waste as is necessary to prevent further releases of hazardous waste to the environment and to allow inspection and repair of the treatment system, in accordance with IDAPA 58.01.05.008 [40 CFR § 264]
- Prevent migration of and remove visible contamination from soil or surface water, in accordance with IDAPA 58.01.05.008 [40 CFR § 264]
- If the collected material is an HWMA/RCRA-regulated material, manage it in accordance with all applicable requirements of IDAPA 58.01.05.005 through 58.01.05.008 [40 CFR Parts 261 through 264].

The offgas piping for the ILWMS, while subject to HWMA/RCRA regulations as ancillary equipment to the regulated unit, does not require secondary containment because it is not intended to manage free liquids. However, any liquid condensate from such a gas/vapor stream may be subject to RCRA requirements (December 11, 1989, 54 FR 50968). The ILWMS is designed to remove condensable liquids from offgas. These condensable liquids are collected in tanks equipped with secondary containment and leak detection devices.

The offgas systems at the INTEC are designed, constructed, and managed in a manner that protects human health and the environment. Through a series of control devices (e.g., mist eliminators, condensers, superheaters, piping insulation, and heat traces) the offgas systems are designed to remove condensate from the offgas stream, thereby minimizing the potential for failure of downstream offgas equipment and releases to the environment. While the offgas systems are designed to remove condensate from the offgas streams, the systems are designed to handle liquids, should they form. The offgas lines are constructed of Series 300 stainless steel or Inconel®. Each of these alloys provides excellent corrosion and temperature resistance. Additionally, the offgas piping is sloped to drain to low spots located throughout the offgas system. Each low spot where hazardous waste may accumulate is equipped with a drain line that drains to an HWMA/RCRA-regulated tank system and each drain line is secondarily contained. Prior to discharge to the INTEC Main Stack (CPP-708) or IWTU dedicated stack, each offgas stream is passed through a series of HEPA filters to minimize the potential release of airborne radioactive contamination.

With the exception of the 12-in. offgas line exiting the LET&D, each ILWMS out-of-cell offgas line manages a dry offgas stream. The formation of condensate within these lines would be detected via collection of liquids in downstream condensate collection tanks or high differential pressure across associated HEPA filters. Formation of condensate in these offgas lines or an increase in the pressure differential across associated HEPA filters could constitute an off-specification or upset condition. Such upset conditions are noted in the facility operating record and corrective actions taken, as appropriate.

Moist offgas from the LET&D first passes through a superheater, followed by a HEPA filter, prior to discharging to the heat-traced, insulated, out-of-cell offgas piping to the INTEC Main Stack. The offgas stream is maintained at an elevated temperature to minimize the potential formation of condensate. Off-specification and upset conditions are detected via an increase in the pressure differential across the LET&D HEPA filters and via monitoring of the heat trace. Any upset conditions are recorded in the facility operating record and corrective actions taken, as appropriate.

PEWE System Feed Sediment and Feed Collection Tank Vaults

The PEWE Feed Sediment and Feed Collection Tanks, VES-WL-132 and VES-WL-133, are located in connected underground vaults at the north end of CPP-604. Although these vaults are located at different floor elevations, they share a common sump for leak detection.

The VES-WL-132 vault is constructed of reinforced concrete and is 17 ft long, 16 ft 6 in. wide, and 13 ft 8 in. high. The floor and lower 2 ft 6 in. of the walls are lined with stainless steel.

The VES-WL-133 vault is constructed of reinforced concrete and is 42 ft long, 16 ft 6 in. wide, and 17 ft high. The floor of the cell and the lower 5 ft of the walls are lined with stainless steel.

The floor of the VES-WL-133 vault slopes to a sump along the west wall of the cell, which measures 2 ft by 2 ft by 2 ft. The floor of the VES-WL-132 vault slopes to a 3-in. drain line that leads to the VES-WL-133 vault sump. Liquid accumulation in this sump is monitored and, upon high alarm, liquid is jetted to the inlet line to VES-WL-132.

VES-WL-135, -136, -137, -138, -139, -142, -144, and -150

The PWL tanks are located in sumps in CPP-604, CPP-649, and associated valve boxes. The system is comprised of tanks VES-WL-135, -136, -137, -138, -139, -142, -144, and -150. VES-WL-136, -139, and -142 are located in sumps with measurements of 2 ft by 2 ft by 1 ft 8 in. VES-WL-137, -138, and -144 are located in sumps with measurements of 2 ft 6 in. by 2 ft 6 in. by 2 ft. VES-WL-135 is located in valve box D5, with measurements of 6 ft by 8 ft by 11 ft 9 in. VES-WL-150 is located in the VES-WL-101/102 cell with measurements of 30 ft 6 in. wide, 43 ft long, and 16 ft high. Upon high alarm, the tanks/sumps are jetted as part of the PWL collection system to VES-WL-133 or VES-WL-132.

VES-WL-101 and VES-WL-102 Cell

The vault floor, walls, and ceiling of the VES-WL-101/VES-WL-102 cell are constructed of reinforced concrete that range in thickness from two to four feet. The vault is 30 ft 6 in. wide, 43 ft long, and 16 ft high.

The secondary containment consists of the concrete floor lined with a Hypalon® membrane that extends four feet up the walls.

This cell drains to a stainless-steel-lined floor sump in the center of the cell. Upon high alarm, the sump is jetted to the PWL collection system VES-WL-150 and then to VES-WL-132.

EVAP-WL-161 Cell

The EVAP-WL-161 cell is located on the northeast side of CPP-604. The cell is constructed of reinforced concrete and is 22 ft long, 18 ft wide, and 34 ft high. The cell floor and lower 3 ft of the walls are lined with stainless steel. The Evaporator Head Tank, VES-WL-109, and the Bottoms Collection Tank, VES-WL-111, are also located in this cell. This cell drains to a stainless-steel-lined floor sump

(SU-WL-147) 10 in. in diameter and 1 ft deep, in the northwest corner of the cell. Upon high alarm, the sump is jetted as part of the PWL collection system to VES-WL-133.

There are known defects (cracks) in the CPP-604 EVAP-WL-161 Evaporator cell concrete walls. INTEC structural engineering personnel have evaluated the condition of the WL-161 Evaporator cell and have determined the cell to be structurally sound. RCRA regulations [40 CFR § 264.15(c)] require repair of structures to ensure the problem does not lead to an environmental or human health hazard. The existing condition of the WL-161 cell does not pose a hazard to the environment or to human health. The portion of the cell that provides secondary containment and leak detection is the lower three-foot stainless steel cell liner, which has no defects. The defects in the cell are only in portions of the concrete walls located above the cell liner. Any leaks from the process vessels or ancillary piping will be completely contained within the stainless steel liner and will not subject the concrete wall to any sustained exposure to hazardous waste. The cell is maintained under negative pressure. Any offgas from a leak or spill would be collected in the CPP-604 VOG system. Inspections of the cell during periods of maintenance or repair are made to ensure that deterioration of the concrete does not lead to an environmental or human health hazard.

EVAP-WL-129 Cell and Feed Pump Cell

The EVAP-WL-129 cell and the feed pump cell are located on the east side of CPP-604. Access to both cells is gained through the condensate collection cell. Both cells are constructed of reinforced concrete. The EVAP-WL-129 cell has internal dimensions of 14 ft by 21 ft 4 in. (including the access area) by 34 ft high (the access area is only 8 ft high). The EVAP-WL-129 cell floor and walls are lined with stainless steel. The access area floor and lower 1 ft of the walls are lined with stainless steel. The EVAP-WL-129 cell floor slopes to a 2-in. floor drain that drains to the feed pump cell sump.

The feed pump cell is located just north of the EVAP-WL-129 cell and has internal dimensions of 9 ft 2 in. by 14 ft 6 in. by 8 ft high. The cell floor and lower 1 ft of the walls are lined with stainless steel. The feed pump cell floor also slopes to a 2-in. floor drain that drains to the sump in the northeast corner of the cell. This sump has dimensions of 1 ft 6 in. by 1 ft 6 in. by 2 ft 6 in. Upon high alarm, the sump is jetted to VES-WL-133.

If liquid accumulates in one of the above-mentioned sumps, the accumulated liquid in the sump will initiate an alarm in the Waste Processing Control Room. These sumps are all equipped with steam jets to remove the waste from the secondary containment systems.

Process Condensate Collection Cell

Tanks VES-WL-106, VES-WL-107, and VES-WL-163 are located in the process condensate collection cell. The Condensate Surge Tanks, VES-WL-131 and VES-WL-134, are located in this cell as well. This cell is located on the east side of CPP-604. The cell is constructed of reinforced concrete and has dimensions of 46 ft by 21 ft by 35 ft 6 in. high. The cell floor and lower 1 ft of the walls are lined with stainless steel, which is sealed to the concrete walls to prevent liquid from getting between the liner and the walls. This configuration is common to all stainless steel liners in the ILWMS. A 6-in.-high barrier is located in front of the condensate collection cell door to prevent leakage to the access corridor. This cell drains to either of two sumps, both of which are 10 in. diameter and 1 ft deep. Upon high alarm, the sumps (SU-WL-145 and SU-WL-146) are jetted as part of the PWL collection system to VES-WL-133.

Level data for all of the above-mentioned sumps are recorded at least once every 24 hours. For further discussion on PEWE system inspections, see Section F, Procedures to Prevent Hazards, of this permit .

If liquid accumulates in one of the above-mentioned sumps, the accumulated liquid in the sump will initiate an alarm in the Waste Processing Control Room. These sumps are all equipped with steam jets to remove the waste from the secondary containment systems.

CPP-604 TFT Vaults

The CPP-604 TFT system tanks are located in two underground connected vaults at the north end of CPP-604.

The west vault, containing VES-WM-100, is constructed of reinforced concrete and is 17 ft wide, 43 ft long, and 16 ft high. The vault adjacent to it on the east contains VES-WM-101 and VES-WM-102, and is 30 ft 6 in. wide, 43 ft long, and 16 ft high. The floors and lower 3 ft 6 in. of the walls in both vaults are lined with stainless steel.

The VES-WM-100 vault slopes to a sump that is 2 ft by 2 ft by 4 ft-deep along the east wall of the vault. The VES-WM-101/VES-WM-102 vault slopes to a sump that is 2 ft by 2 ft by 4 ft deep in the center of the vault. Upon high alarm the sump is jetted to VES-WL-132.

PEWE Secondary Containment System Calculations

The secondary containment structures for the regulated tanks within the PEWE will contain 100 percent of the capacity of the largest tank, and are lined with stainless steel, Hypalon® or equivalent materials.

PEWE System Feed Sediment and Feed Collection Vault

In the event that VES-WL-132 was to fail, its contents would drain to the VES-WL-133 vault. The VES-WL-133 vault will contain 100 percent of the capacity of the largest tank, which is 19,000 gallons, within this secondary containment system. The volume of the VES-WL-133 secondary containment system is 3,465 ft^3 or 25,918 gal.

Equation 1: (42 ft × 16 ft 6 in × 5 ft)

= 3,465 ft^3

= 25,918 gal

VES-WL-101 and VES-WL-102 Cell

The vault will contain 100 percent of the capacity of the largest tank (18,400 gal) within this secondary containment system. This vault also contains VES-WL-150. The volume of the secondary containment system is 3,935 ft^3 or 29,432 gal.

Equation 2: (43 ft × 30 ft 6 in. × 3 ft)

= 3,935 ft^3

= 29,432 gal

Evaporator 161 Cell, EVAP-WL-129, the Feed Pump Cell, Condensate Cell, and the Access Area

40 CFR 264.193(e)(1)(i) and 264.193(e)(2)(i), state that external liner systems and vault systems must be designed or operated to contain 100 percent of the capacity of the largest tank within its boundary.

EVAP-WL-161, EVAP-WL-129, the Feed Pump Cell, the Condensate Cell, and the access area are considered to be contained within one boundary. They are separated by personnel doorways or labyrinths, which only provide personnel protection from radiation exposure and do not act as liquid containment.

In the event that the largest tank within this secondary containment system boundary was to fail, its contents would drain to the Condensate Collection Cell sumps. The floor linings in the Condensate Cell, the pump pit, and the access area slope uniformly towards these sumps. The stainless steel liner in the lower portion of the cell would contain 100 percent of the contents of the largest tank (5,000 gallons) in the cell.

Equation 3:

Total Volume = condensate collection cell volume [*equation 3(a)*] +
evaporator VES-WL-129 cell volume [*equation 3(b)*] +
feed pump cell volume [*equation 3(c)*] +
access area volume [*equation 3(d)*] +
feed pump cell sump volume [*equation 3(e)*] +
VES-WL-161 cell volume [*equation 3(f)]*

Total Volume = 483 ft^3 + 109.6 ft^3 + 66.5 ft^3 + 23.3 ft^3 + 5.6 ft^3 + 198 ft^3

Total Volume = 886 ft^3 or 6,627 gal

Equation 3(a):

Condensate Collection Cell Volume = 46 ft × 21 ft × 6 in.

Condensate Collection Cell Volume = 483 ft^3

Equation 3(b):

Evaporator VES-WL-129 Cell Volume = 15 ft 8 in. × 14 ft × 6 in.

Evaporator VES-WL-129 Cell Volume = 109.6 ft^3

Equation 3(c):

Feed Pump Cell Volume = 14 ft 6 in. × 9 ft 2 in. × 6 in.

Feed Pump Cell Volume = 66.5 ft^3

Equation 3(d):

Access Area Volume = 14 ft × 3 ft 4 in. × 6 in.

Access Area Volume = 23.3 ft^3

Equation 3(e):

Feed Pump Cell Sump Volume = 1 ft 6 in. × 1 ft 6 in. × 2 ft 6 in.

Feed Pump Cell Sump Volume = 5.6 ft^3

Equation 3(f):

161 cell volume = 18 ft × 22 ft × 6 in.

161 cell volume = 198 ft^3

CPP-604 TFT Secondary Containment System Calculations

Both of the stainless-steel liner systems that provide secondary containment for the regulated tanks within the CPP-604 TFT system will contain 100 percent of the capacity of the largest tank (18,400 gal.) within the secondary containment systems.

VES-WM-100 Vault

The VES-WM-100 vault will contain 100 percent of the capacity of the largest tank (18,400 gal) within this secondary containment system. The volume of the VES-WM-100 secondary containment system is 2,558 ft^3 or 19,135 gal.

Equation 4: (17 ft × 43 ft × 3 ft 6 in.)

= 2,558 ft^3

= 19,135 gal

VES-WM-101/VES-WM-102 Vault

The VES-WM-101/VES-WM-102 vault will contain 100 percent of the capacity of the largest tank (18,400 gal) within this secondary containment system. The volume of the VES-WM-101/VES-WM-102 secondary containment system is 4,590 ft^3 or 34,335 gal.

Equation 5: (30 ft 6 in. × 43 ft × 3 ft 6 in.)

= 4,590 ft^3

= 34,335 gal

PWL Tanks Containment System Calculations

VES-WL-135, Vessel in Sump SU-WL-135

This tank collects offgas condensate. The tank is located in the D5 Valve Box. The tank has an approximate capacity of 10 gallons. The approximate capacity of the secondary containment including the sump is 1,346 gallons.

Equation 8: $6.0\text{ft} \times 8.0\text{ft} \times 3\text{ft } 9\text{in} = 180\text{ft}^3$

$180\ \text{ft}^3 = 1{,}346$ gallons

VES-WL-136, Vessel in Sump SU-WL-136

This tank collects offgas condensate. The tank is located in the D8 Valve Box. This tank has an approximate capacity of 10 gallons. The approximate capacity of the sump is 50 gallons.

Equation 9: $2\text{ft} \times 2\text{ft} \times 1\text{ft } 8\text{in} = 6.67\text{ft}^3$

$6.67\text{ft}^3 = 50$ gallons.

VES-WL-137, Vessel in Sump SU-WL-137

This tank collects offgas condensate. The tank has an approximate capacity of 25 gal. The approximate capacity of the sump is 93 gallons.

Equation 10: $2\text{ft } 6\text{in} \times 2\text{ft } 6\text{in} \times 2\text{ft} = 12.5\text{ft}^3$

$12.5\text{ft}^3 = 93$ gallons.

VES-WL-138, Vessel in Sump SU-WL-138

This tank collects condensate from the vessel offgas system. The tank has an approximate capacity of 25 gal. The approximate capacity of the sump is 93 gallons.

Equation 11: $2\text{ft } 6\text{in} \times 2\text{ft } 6\text{in} \times 2\text{ft} = 12.5\text{ft}^3$

$12.5\text{ft}^3 = 93$ gallons.

VES-WL-139, Vessel in Sump SU-WL-139

This tank collects offgas condensate. The tank has an approximate capacity of 10 gal. The approximate capacity of the sump is 50 gallons.

Equation 12: $2ft \times 2ft \times 1ft\ 8in = 6.67ft^3$

$6.67ft^3 = 50$ gallons.

VES-WL-142, Vessel in Sump SU-WL-142

This tank collects offgas condensate. The tank has an approximate capacity of 10 gal. The approximate capacity of the sump is 50 gallons.

Equation 13: $2ft \times 2ft \times 1ft\ 8in = 6.67ft^3$

$6.67ft^3 = 50$ gallons.

VES-WL-144, Vessel in sump SU-WL-144

This tank currently collects liquids released to the pump pit enclosure sump. The tank has an approximate capacity of 25 gal. The approximate capacity of the sump is 93 gallons.

Equation 14: $2ft\ 6in \times 2ft\ 6in \times 2ft = 12.5ft^3$

$12.5ft^3 = 93$ gallons.

LET&D Cells and Vaults

LET&D Fractionator Cell 1

For discussion on LET&D system inspections, see Section F, Procedures to Prevent Hazards.

Acid Fractionator Cell 1 is 17 ft long and 14 ft 6 in. wide. The cell is constructed of steel-reinforced concrete with a stainless-steel liner that is 3 ft high. The cell has a door in the east wall. In front of the door is a step measuring 3 ft 10 in. by 3 ft 10 in. by 4 in. The floor is sloped toward a sump, which is located slightly to the northeast of the center of the cell. The cell walls are steel-reinforced, concrete. The stainless steel is compatible with the waste and decontamination solutions received at the LET&D.

The floor sump is provided with liquid level detection. The liquid level detection transmits an alarm to the DCS, which alerts the operator to the presence of any liquid that has spilled and drained to the sump, which is the low point in the cell. The sump is provided with a steam jet to remove accumulated material from the sump. These wastes are jetted to the Bottoms Tank, VES-WLL-195, PEWE tanks, VES-WL-101 and VES-WL-133, or the Acid Recycle Tank, VES-NCR-171.

LET&D Fractionator Cell 2

Acid Fractionator Cell 2 is 17 ft long and 14 ft 6 in. wide. The cell is constructed of steel-reinforced concrete with a stainless-steel liner that is 3 ft high. The cell has a door in the west wall. The floor is sloped toward a sump, which is located in the cell.

The floor is sloped to drain toward the sump. In the northwest corner of Fractionator Cell 2 is the vault containing the Bottoms Tank, VES-WLL-195. Although the floor of the fractionator cell does not slope directly to the bottoms tank vault, the vault would serve as the containment mechanism if a leak caused the sump to become full. The vault containing the Bottoms Tank is completely lined with stainless steel. The floor of the bottoms tank vault slopes toward the west, where the vault sump is located.

A floor sump is provided in the acid fractionator cell. Level transmitters actuate alarms on the DCS and alert the operator to the presence of any liquid that has spilled and drained to the sump, which is the low point in the cell. In addition, the bottoms tank vault sump is equipped with level instrumentation monitored by the DCS.

The sumps in the cell are provided with steam jets to remove any spilled material from the sumps promptly. The liquid wastes that accumulate in either of the sumps are removed via a steam jet to the Bottoms Tank, VES-WLL-195, PEWE tanks, VES-WL-101 and VES-WL-133, or the Acid Recycle Tank, VES-WL-171.

Acid Recycle Tank Vault

The Acid Recycle Tank, VES-NCR-171, and Head Tank, VES-NCR-173, are located in the CPP-659 Annex. The Annex is approximately 17 ft wide and 42 ft long, with a stainless-steel liner that is 4 ft 8 in. high. In the southeast corner of the vault is a large sump, which conservatively is not included in the capacity calculation.

The floor is sloped to drain to the gutter on the south side of the vault. The gutter drains to the southeast into the sump unit.

A floor sump is provided at the southeast corner of the vault. The liquid level detector is a pneumatic system that measures leaks using differential pressure. The detector transmits a signal to the NWCF DCS system. Any leaks will initiate an alarm on the DCS and alert the operator to the presence of any liquid that has spilled and drained to the sump, which is the low point in the vault. The sump in the vault is provided with a steam jet to remove any spilled material from the sump promptly. The liquid wastes that accumulate in the sump are jetted to appropriate tanks.

LET&D and Acid Recycle Tank Vault Secondary Containment System Calculations

Most of the ancillary equipment and piping for the tank systems in the LET&D system are contained in the same cells as the waste tanks. Those process piping systems that are not located within cells with secondary containment are underlain with drip troughs comprised of stainless steel, which has been shown to be compatible with the types of wastes exiting the cells. The lines in the pipe bridge are equipped with leak detection that alarms on the DCS. Drip troughs and collection bottles are discussed in greater detail later in this section.

The acid recycle line from the Bottoms Tank to the Acid Recycle Tank has full secondary containment. The waste and secondary containment pipe are both stainless steel. Any leaks in the acid recycle line will gravity drain toward the acid recycle vault sump.

Acid Fractionator Cell 1

Cells 1 and 2 have the same dimensions. Acid Fractionator Cell 1 has a 17-ft by 14 ft 6 in.-floor area. The cell is constructed of steel-reinforced concrete with a stainless-steel liner that is 3 ft high. The cell has a door in the east wall. In front of the door is a step measuring 3 ft 10 in. by 3 ft 10 in. by 4 in. The floor is sloped toward a sump, which is located slightly to the northeast of the center of the cell.

The Acid Fractionator (FRAC-WLK-171) and associated equipment in Cell 1 have a maximum capacity of 460 gal. The capacity of the secondary containment system is 577 gal. The cell will contain 100 percent of the capacity of the Acid Fractionator. This cell also contains VES-WLK-197. The maximum capacity of the tank is 270 gal.

The secondary containment system capacity exceeds the capacity of the Acid Fractionator (460 gal).

Equation 16: (cell – step off pad)

(17 ft × 14 ft 6 in. × 4 in.) – (3 ft 10 in. × 3 ft 10 in. × 4 in.)

= 82.17 ft^3 – 4.9 ft^3 = 77.19 ft^3

= 577 gal

Acid Fractionator Cell 2

Acid Fractionator Cell 2 has a floor area of 17 ft by 14 ft 6 in. The cell is constructed of steel-reinforced concrete with a stainless-steel liner that is 3 ft high. The cell has a door in the east wall. The floor is sloped toward a sump, which is in the cell.

The Acid Fractionator (FRAC-WLL-170) and associated equipment in Cell 2 have a maximum capacity of 460 gal. The capacity of the secondary containment system is 2,103 gal. The cell will contain 100 percent of the capacity of the Acid Fractionator. This cell also contains VES-WLL-195, which is located in a pit. VES-WLL-195 has a maximum capacity of 270 gal. The pit volume minus VES-WLL-195 volume will contain 100 percent of the capacity of the Acid Fractionator.

Equation 17: (PIT – VES-WLL-195)

(7 ft 10 in. × 6 ft 9 in. × 6 ft) – 36.1 ft^3

= 317.2 ft^3 – 36.1 ft^3 = 281.1 ft^3

= 2,103 gal

Acid Recycle Tank Vault

The Acid Recycle Tank, VES-NCR-171, and Head Tank, VES-NCR-173, vault is 17 ft 4 in. wide and 41 ft 3 in. long and has a stainless-steel liner that is 4 ft 8 in. high. In the southeast corner of the vault is a large sump, which conservatively is not included in the capacity calculation. The overall capacity of the vault is 24,955 gallons.

The capacity of the secondary containment in the acid recycle vault will contain 100 percent of the capacity of the largest tank (22,500 gal).

Equation 18: (17 ft × 41 ft 7 in. × 4 ft 8 in.)

= 3,299 ft^3

= 24,676 gal

ETS Cells

Blend and Hold Cell

The blend and hold cell contains the feed blend tank (VES-NCC-101), the feed hold tanks (VES-NCC-102, VES-NCC-103), the evaporator flash column (VES-NCC-150), and the constant head feed tank (VES-NCC-152). It has a 32 ft 4 in. by 24 ft, floor area and a 3-ft high stainless-steel liner. The capacity of the stainless-steel lined secondary containment is approximately 17,400 gal. The capacity of the largest tank (VES-NCC-101) is approximately 6,000 gallons.

The cell is equipped with a stainless-steel liner system, which slopes to a floor drain and serves as secondary containment to the tanks. The drains are equipped with instrumentation (e.g., bubbler probe) to detect leaks. An alarm sounds when liquid is detected. Floor drains are connected to VES-NCC-119 or VES-NCC-122 with stainless-steel piping. The stainless steel is compatible with the waste and decontamination solutions received at ETS.

Offgas Cell

The offgas cell houses the Scrub Hold Tank (VES-NCC-108) and the scrub solution-recycle pumps. The Scrub Hold Tank (VES-NCC-108) is the largest tank in the cell. The capacity of VES-NCC-108 is approximately 2,000 gallons.

The offgas cell has a 33 ft 4 in. by 16 ft 3 in. floor area and a 3-ft-high stainless-steel liner. A sloped, 1-ft-deep gutter runs along the length of the east wall. The capacity of the stainless-steel lined secondary containment is approximately 12,200 gal.

The floor drain line is equipped with a liquid level indicator and an alarm provides primary indication of a breach of primary containment. Containment of solution is provided by the floor drain, which directs solution to VES-NCC-119. The stainless steel is compatible with the waste and decontamination solutions received at ETS.

Adsorber Cell

The Adsorber cell houses VES-NCC-116 and VES-NCC-136 and associated heat exchangers. The adsorber cell has a 26 ft 6 in. by 31 ft 6 in. floor area and a 3-ft-high stainless-steel liner. The capacity of VES-NCC-116 is approximately 500 gallons, which is the largest operational tank in the cell.

The floor and walls are lined with stainless steel. The floor has a sump with leak detection. Upon alarm, the collected liquid is drained to VES-NCC-119. The capacity of the stainless-steel lined

secondary containment is approximately 18,700 gal. The stainless steel is compatible with the waste and decontamination solutions received at ETS.

Hot Sump Tank Cell

The hot sump tank cell (102), located on the forth level, houses the two hot sump tanks (VES-NCC-119 and VES-NCC-122) and a recirculation pump. The hot sump tank cell is 24 ft 2 in. by 24 ft 6 in. with a 17 ft 6 in.-high stainless steel liner. The valve access room is 19 ft 6 in. by 11 ft 10 in. with a 3-ft-high stainless-steel liner.

The floor has a sump, which can be jetted to the fluoride hot sump tank. The cell floor is sloped to drain to a gutter on the west side of the cell, and the gutter drains to the south and into the sump. The capacity of the secondary containment system encompassing the sump tanks cell, entry corridor, and the valve access room is approximately 19,800 gallons. The largest tank in the cell is the Fluoride Hot Sump Tank (VES-NCC-119), which holds approximately 6,500 gal.

ETS Secondary Containment System Calculations

Blend and Hold Cell

The Blend and Hold Cell has a 32 ft 4 in. by 24 ft floor area. The cell is constructed of steel-reinforced concrete with a stainless-steel liner on the floor and 3 ft up the walls. The floor is sloped toward a sump.

The capacity of the secondary containment exceeds the capacity of the largest tank (VES-NCC-101) in the cell, which holds approximately 5,870 gal.

Equation 19: (32.3 ft x 24 ft x 3 ft)

$= 2{,}326\ ft^3$

= 17,400 gallons

Offgas Cell

The offgas cell has a 33 ft 4 in. by 16 ft 3 in. floor area and a 3-ft-high liner (from the high point of the floor). The low point of the floor is 4 in. below the high point. A sloped, 1-ft-deep gutter runs along the length of the east wall. The capacity of the stainless-steel liner system that provides secondary containment is 1625 ft^3 or approximately 12,156 gal.

The largest tank in the cell VES-NCC-108 scrub hold tank holds approximately 2,000 gallons. The secondary containment system capacity exceeds the capacity of the scrub hold tank.

Equation 20: (16.25 ft × 33.33 ft × 3 ft)

= 1,625 ft^3

= 12,156 gal.

Adsorber Cell

The Adsorber cell houses VES-NCC-116 and VES-NCC-136 and associated heat exchangers. The adsorber cell has a 26 ft 6 in. by 31 ft 6 in. floor area and a 3-ft-high stainless-steel liner. The capacity of VES-NCC-116 is approximately 500 gallons, which is the largest operational tank in the cell.

The largest tank in the cell VES-NCC-116 mist collector holds approximately 500 gal. The secondary containment system capacity exceeds the capacity of the mist collector.

Equation 21: (26.5 ft × 31.5 ft × 3 ft)
= 2504 ft^3
= 18,731 gal.

Hot Sump Tank Cell

The hot sump tanks cell and the valve access room are connected. The hot sump tank cell is 24 ft 2 in. by 24 ft 6 in. with a 17 ft 6 in.-high stainless steel liner. The valve access room is 19 ft 6 in. by 11 ft 10 in. with a 3-ft-high stainless-steel liner. A sloped entry corridor from the valve access room to the hot sump tanks cell is about 4 ft by 11 ft 10 in. with a 3-ft-high stainless-steel liner. The capacity of the secondary containment system encompassing the sump tanks cell, entry corridor, and the valve access room is approximately 19,800 gallons.

The largest tank in the cell, VES-NCC-119 fluoride hot sump tank, holds approximately 6,500 gal. The capacity of the secondary containment system exceeds the capacity of the fluoride hot sump tank.

Equation 22: volume valve access room and doorway
(19.5 ft × 11.83 ft × 3) = 692 ft^3

Equation 23: volume entry corridor
(4 ft × 14.83 ft × 3 ft) = 178 ft^3

Equation 24: volume hot sump tanks cell

$(24.5 \text{ ft} \times 24.17 \text{ ft} \times 3 \text{ ft}) = 1{,}777 \text{ ft}^3$

Equation 25: total volume

$(692 \text{ ft}^3 + 178 \text{ ft}^3 + 1777 \text{ ft}^3) = 2{,}647 \text{ ft}^3$

$= 19{,}800$ gal

IWTU Process Cell

The IWTU Process Cell contains the Waste Feed Tank, Sump Tank, Clarifier Tank, DMR, Process Gas Filter, and the Offgas Filter. The total floor space is approximately 37 ft 2 in. by 34 ft 5 in. The sump measures approximately 1 ft 6 in. by 1 ft 6 in. by 1 ft 6 in. The floor and lower 2 ft of the walls are lined with stainless steel. The capacity of the Waste Feed Tank, VES-SRC-131, is approximately 2,170 gallons, which is the largest liquid containing tank in the cell.

The floor drains to a sump that has leak detection. Upon alarm, the collected liquid is jetted to the NWCF, Tank Farm, or VES-SRC-131. The sump is not jetted to VES-SRC-131 if this tank is the source of the liquid. The capacity of the stainless-steel lined secondary containment is approximately 19,170 gal. The stainless steel is compatible with the waste treated and decontamination solutions used at the IWTU.

IWTU Secondary Containment System Calculations

Process Cell

The Process Cell floor and sump will contain 100 percent of the capacity of the largest tank, which is approximately 3,390 gallons, within this secondary containment system. The volume of the Process Cell secondary containment system is approximately 19,000 gal.

Equation 26 floor: (37 ft 2 in. × 34 ft 5 in. × 2 ft)

$= 2{,}558 \text{ ft}^3$

$= 19{,}137$ gal

Equation 27 sump: (1 ft 6 in. x 1 ft 6 in. x 1 ft 6 in.)

$= 3 \text{ ft}^3$

$= 25$ gal

Offgas Condensate Collection Tank

The Offgas Condensate Collection Tank is a polypropylene horizontal, rectangular, double walled tank, measuring approximately 4 ft x 2 ft x 2 ft in dimension. A breach of the primary containment would be detected and collected in the tank annulus. The collected liquids will be removed and the source of the leak identified. The tank will either be repaired, replaced, or other provisions made prior to restarting affected IWTU process equipment.

Fire Water Collection Tank

The Fire Water Collection Tank is a double walled tank. A breach of the primary containment would be detected and collected in the tank annulus. The collected liquids will be removed and the source of the leak identified. The tank will either be repaired, replaced, or other provisions made for fire water collection prior to restarting affected IWTU process equipment.

Transfer Line Secondary Containment

Sections of ILWMS transfer lines not located within buildings are secondarily contained inside piping that is compatible with the types of waste being managed. The secondary containment piping slopes to either a cell within a building or a valve box equipped with a stainless steel liner and leak detection instrumentation (e.g., radiation monitors, level indicating instrumentation). These cells and valve boxes contain sumps equipped with steam jets to remove the waste from the secondary containment systems.

The transfer line from the NWCF to the IWTU Waste Feed Tank is secondarily contained in a stainless steel pipe. The transfer line is sloped back to the NWCF. The secondary containment pipe is sloped back to the NWCF valve cubicle where any liquid would be collected, detected, and removed.

The transfer line from CPP-1696 to the Fire Water Collection Tank is equipped with secondary containment and sloped to the Fire Water Collection Tank. Any leak from the transfer line to the secondary containment piping is routed to the tank annulus, which is equipped with leak detection.

The transfer line from CPP-1696 stack to the Offgas Condensate Collection Tank is equipped with secondary containment and sloped to the Offgas Condensate Collection Tank. Any leak from the transfer line to the secondary containment piping is routed to the tank secondary containment, which is equipped with leak detection.

ILWMS transfer lines located within buildings are contained in cells that are lined with barriers compatible with the types of waste being managed. Cell floors slope toward sumps equipped with leak detection instrumentation. These sumps are also equipped with steam jets to remove the waste from the secondary containment systems.

Drip troughs are located beneath process transfer lines within CPP-604, CPP-605, and CPP-1618. A drip trough also extends below the pipe bridge that spans from CPP-605 to the LET&D facility. The troughs are designed to collect liquid (e.g., recovered nitric acid) in the event of a leak from the process transfer lines. These drip troughs are sloped and drain to collection bottles located within each system.

The drip troughs located within the LET&D facility are not equipped with leak detection devices. Therefore, LET&D collection bottles are inspected daily for the presence of liquid when the fractionators are operating. These inspections are noted on Form INTEC-4055, which is included in Appendix F-1. Documentation of all inspections is maintained in the facility operating record.

All drip troughs located in CPP-604, CPP-605, and the pipe bridge are equipped with leak detection cables that are continuously monitored by the DCS.

Upon alarm, or when liquids are discovered in the LET&D collection bottles, samples are taken to determine whether the source of the liquid is a hazardous waste (e.g., pH, acidity). If the liquid is hazardous, it is characterized as described in Section C of this permit and managed appropriately.

Run-on or Infiltration of Precipitation

This is addressed in Attachment 6, Section F-4b of this permit.

D-2g Controls and Practices to Prevent Spills and Overflows [IDAPA 58.01.05.012 and 008; 40 CFR 270.16(i) and 264.194(b)]

Overfilling of the Feed Collection Tank, evaporators, Condensate Surge Tanks, Bottoms Collection Tank, Process Condensate Collection Tanks, the Acid Fractionator Waste Feed Head Tank, the IWTU Waste Feed Tank, the Sump Tank, the Clarifier Tank, and Fire Water Collection Tank is prevented by instrumentation in the Control Room that monitors liquid levels and by operators controlling liquid flow accordingly.

In addition to these operating controls, liquid level instrumentation for the Feed Collection Tank, evaporators, Condensate Surge Tanks, Bottoms Collection Tank, and Waste Feed Tank will alarm upon high level (or high-high level, if equipped). In the case of a high (or high-high) liquid level alarm, the condition will be investigated and appropriate action taken.

Facility personnel monitor the processes for the tank systems addressed in this permit. System instrumentation and alarms are monitored to ensure that no errors have been made or process changes have occurred. Administrative controls are implemented to ensure that the processes are performed safely.

To prevent hazardous waste spills and overflows, facility personnel visually inspect or monitor instrumentation for tanks, piping, valves, and secondary containment devices on a daily basis when these tank systems are in use. For more information regarding inspections and monitoring, refer to Attachment 4, Section F of this permit.

CPP-604 TFT System

The overflow lines that are connected between VES-WM-100 to VES-WM-101 have been administratively removed from service. The alarm set point has been established that prevents overflow between the tanks. Monitoring level instrumentation located in the CPP-604 alerts the operators to prevent overfilling of VES-WM-102. In addition to these operating controls, liquid level instrumentation for VES-WM-102 will alarm in the Waste Processing Control Room upon high level. In the case of a high liquid level alarm, the condition will be investigated and appropriate action taken.

The PWL Tanks, VES-WL-150, and the Acid Recycle Storage Tank

Overfilling of the collection tanks is prevented by monitoring the level instrumentation in the waste processing DCS via a combination of tank level instrumentation and monitoring of the secondary containment system. Any leaks or spills from the unit would be detected in the sumps and removed upon high-level alarm. In the case of a high liquid level alarm, the condition will be investigated and appropriate action taken.

CPP-1618 LET&D

Spills and overflows in the LET&D facility are controlled and prevented by administrative and DCS process control systems. The Acid Fractionator Waste Feed Head Tank, VES-WLK-197, has a high level alarm on the DCS to alert the operators of a potential overfill condition and a high-high alarm that automatically shuts down the feed inlet valve and pump. The feed tank is equipped with a line that drains into the Bottoms Tank. The fractionators and associated separators have high level alarms on the DCS, which will alert the operators and a high-high level alarm that automatically shuts the system down. The Bottoms Tank has a high level alarm on the DCS to alert the operators of a potential overfill condition and the need to transfer the waste. Fractionators have low and low-low alarms, which would alert the

operators to a possible leak. In the case of a high liquid level alarm, the condition will be investigated and appropriate action taken.

CPP-659 Annex LET&D Nitric Acid Recycle Tank

Spills and overflows in the CPP-659 Annex LET&D Nitric Acid Recycle Tank are controlled and prevented by administrative and DCS process control systems. Prior to a transfer to VES-NCR-171, the level indicator is checked to verify adequate capacity to accept a transfer. As an added measure of protection, a high level alarm for VES-NCR-171 notifies facility personnel when a predetermined set point is reached. Upon high alarm, all transfers to VES-NCR-171 are discontinued and no further transfers to the tank are made. The condition will be investigated and appropriate action will be taken.

CPP-659 Annex VES-NCR-173, Acid Head Tank

CPP-659 Annex VES-NCR-173, Acid Head Tank, has an overflow line that drains back to VES-NCR-171. VES-NCR-173 has no instrumentation installed in the vessel.

CPP-659 ETS

Overfilling of the ETS tanks is prevented by observing instrumentation in the NWCF Control Room that monitors liquid levels and by operators controlling liquid flow accordingly. In addition to these operating controls, liquid level instrumentation for the ETS tanks will alarm in the control room upon high level or high-high level. In the case of a high or high-high liquid level alarm, the condition will be investigated and appropriate action taken.

To prevent hazardous waste spills and overflows, facility personnel visually inspect or monitor instrumentation for tanks, piping, valves, and secondary containment devices on a daily basis when the evaporator is in use. For more information regarding inspections and monitoring, refer to Section F of this permit.

CPP-1696 IWTU

Overfilling of the IWTU Waste Feed Tank, Sump Tank, Clarifier Tank, Offgas Condensate Collection Tank, and Fire Water Collection Tank is prevented by observing instrumentation in the CPP-1696 Control Room that monitors levels and by operators controlling flows accordingly. In addition to these operating controls, level instrumentation for the IWTU tanks will alarm in the control room upon low, low-low, high, or high-high

level. In the case of a low, low-low, high, or high-high level alarm, the condition will be investigated and appropriate action taken.

To prevent hazardous waste spills and overflows, facility personnel visually inspect or monitor instrumentation for tanks, piping, valves, and secondary containment devices on a daily basis when the IWTU is in use. For more information regarding inspections and monitoring, refer to Section F of this permit.

D-3. WASTE PILES [IDAPA 58.01.05.012 AND 58.01.05.008; 40 CFR 270.18 AND 264.250]

D-3a. List of Wastes [IDAPA 58.01.05.012; 40 CFR 270.18(a)]

Waste is stored within product load-out cells (rooms 112 and 113) of CPP-1696 in waste piles. This unit carries the process code of S03 (waste pile). Wastes to be stored include hazardous and/or mixed waste, such as dry decontamination materials and plastic covers from canisters. The waste will be removed whenever a cell entry is required for maintenance of equipment.

D-3b. Exemption from Liner and Groundwater Monitoring Requirements [IDAPA 58.01.05.012; 40 CFR 270.18(b)]

D-3b(1) Enclosed Piles [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.18(b) and 264.250(c)]

The standards of 40 CFR 264.250(c) are met as the waste piles located in CPP-1696, rooms 112 and 113 are located inside a structure that provides protection from precipitation so that neither run-off nor leachate is generated, and the waste pile is protected from wind dispersion. Additionally, liquids or materials containing free liquids are prohibited in the waste pile storage area, the piles are protected from surface water run-on by the facility structure, and the waste piles will not generate leachate through decomposition or other reactions. Therefore, the waste piles are exempted from the design requirements of 40 CFR 264.251 and 40 CFR 264 Subpart F.

D-8. MISCELLANEOUS UNITS [IDAPA 58.01.05.012 AND 58.01.05.008; 40 CFR 270.23 AND 264.601]

D-8a. Description of Miscellaneous Units [IDAPA 58.01.05.012; 40 CFR 270.23(a)(1) and (2)]

The ILWMS buildings are described in the Facility Description in Attachment 1, Section B and the processes are described in the Attachment 1, Process Information section of Section D of this permit.

The miscellaneous units are:

- PEW evaporator EVAP-WL-129, which includes flash column (VES-WL-129), a mist eliminator (VES-WL-130), a reboiler (HE-WL-307), and a condenser (HE-WL-308);
- PEW evaporator EVAP-WL-161, which includes flash column (VES-WL-161), a separator (VES-WL-162), a reboiler (HE-WL-300), and a condenser (HE-WL-301);
- FRAC-WLL-170, which includes the fractionator, a condenser (HE-WLL-396), a reboiler (HE-WLL-398), and a separator (VES-WLL-198);
- FRAC-WLK-171, which includes the fractionator, a condenser (HE-WLK-397), a reboiler (HE-WLK-399), and a separator (VES-WLK-199);
- EVAP-NCC-150, which includes flash column (VES-NCC-150), reboiler (HE-NCC-350), and a condenser (HE-NCC-351);
- Integrated Waste Treatment Unit, which can be divided into the following two subsystems; 1) SBW Treatment System, which manages the liquid and offgas phases of the process; and 2) Product Transfer and Loadout System, which deals with solids management. The components of each of these subsystems are identified below:
    - SBW Treatment System, includes VES-SRC-140 [Denitration and Mineralization Reformer (DMR)], F-SRC-153 (Process Gas Filter), VES-SRC-160 [Carbon Reduction Reformer (CRR)], COL-SRC-160 (Offgas Cooler), F-SRC-160 (Offgas Filter), BLO-SRH-260 A and B (Offgas Blowers), F-SRH-140 A, B, C, and D (Process Pre-filters and Process HEPA Filters), F-SRH-141 A and B (Mercury Adsorbers), and Process Exhaust Blowers BLO-SRH-240 A and B

- Product Transfer and Loadout System, which includes AUG-SRC-440 (DMR Auger/Grinder), F-SRC-191 (Product Receiver Filter), VES-SRC-180 (Product Receiver Filter Product Pump), F-SRC-190 (Product Handling Vacuum Filter), and the Canister Filling Stations (3).

See "Pilot Plant Report for Testing Sodium-Bearing Waste Surrogates Carbonate Flowsheet," Document No. RT-ESTD-PMR-001, Revision 0, October 2006, in Appendix VI to this permit for background information on the IWTU including: metallurgy data utilized to select materials of construction; design basis information for certain process components; laboratory data demonstrating the effectiveness of the treatment process; and supporting information used to determine operating procedures, process limits, monitoring strategies, and maintenance techniques.

D-8b Environmental Performance Standards for Miscellaneous Units [IDAPA 58.01.05.008 and 58.01.05.012; 40 CFR 264.601 and 270.23(c)]

No viable pathway exists for migration of hazardous waste or hazardous constituents from the waste treated in the PEWE, LET&D, ETS, or IWTU to the soil, ground water, and/or surface water.

A potential pathway for release of waste constituents is through exhaust air either from the PEWE, LET&D, ETS, or IWTU. Any release would be limited to the period during which the PEWE, LET&D, ETS, or IWTU are operating.

The potential for a release through the exhaust air system of hazardous constituents that could potentially have adverse effects on human health or the environment is minimized by the PEWE, LET&D, ETS, or IWTU offgas systems.

The PEWE system condenses and collects the process offgas (POG) and transfers it to the LET&D system for further treatment as discussed previously. The only releases from the PEWE system are non-condensables such as instrument air. The PEWE offgas is routed to the VOG system, the APS, and then is released to the atmosphere via the Main Stack. The LET&D POG is HEPA filtered before it is released to the Main Stack. Although they are not specifically designed to trap organic constituents, HEPA filters trap any particulates that may contain hazardous constituents. The process will contain the waste constituents in the liquid and, thus, only minute amounts of waste constituents can potentially escape the process. The ETS condenses and collects the POG and transfers it to the PEWE system for further treatment as discussed previously. The only releases from the ETS are non-condensables such as instrument air. The ETS offgas is routed to the APS and then is released to the atmosphere via the main

stack. The IWTU utilizes steam reformers to convert organics and nitrogen oxides into carbon dioxide, elemental nitrogen, and water vapor. The IWTU offgas is filtered then treated in mercury adsorbers prior to release from its dedicated stack. The PEWE, LET&D, ETS, and IWTU exhaust air systems are discussed below.

Vessel Offgas (VOG) System and Process Atmospheric Protection System

The PEWE system tanks vent to the INTEC VOG system. The system provides vacuum and HEPA filtration for the offgas from the tanks in the connected facilities. The ETS utilizes the existing NWCF VOG and POG systems for the ETS offgas. The VOG and POG systems flow to the process APS, which is located in CPP-649. The process APS system provides additional HEPA filtration to the VOG and POG systems. From the APS, the offgas is exhausted to the INTEC Main Stack.

When the LET&D system is operating, the tanks vent to the INTEC Main Stack through the LET&D process offgas HEPA filters. When the LET&D is not operating, the tanks vent to the Ventilation Atmospheric Protection System.

The ETS offgas is connected to the NWCF VOG. The vent from VES-NCC-351 connects to the VES-NCC-101 overfill line into the vapor space of VES-NCC-101. The ETS offgas combined with VES-NCC-101 offgas are condensed by HE-NCC-336. Any remaining liquids in the offgas enter the NWCF POG and are removed in mist eliminators, VES-NCC-136 and VES-NCC-116. The offgas then passes through HEPA filters prior to being discharged to the APS and main stack.

The IWTU Waste Feed Tank is vented to the Process Cell. The process gas is steam reformed, filtered, treated in a mercury adsorber, monitored, and then exhausted through a dedicated stack.

Ventilation Atmospheric Protection System Sources

The ventilation air system for the PEWE, LET&D, and ETS is composed of ventilation air from CPP-604, -640, -649, and -1618. This air is used to heat, to ventilate, and to provide contamination control for the above facilities. The ventilation air, which is the bulk of the flow to the Main Stack, flows from the occupied office/laboratory areas, through the operating corridors, through the cells, and finally, passes through the Ventilation Atmospheric Protection System.

The ventilation offgas cleanup system consists of a fiberglass bed prefilter (CPP-756) and HEPA filters arranged in 26 parallel banks of four parallel filters. The ventilation air is exhausted to the Main Stack through blowers.

Building CPP-1696 is equipped with its own dedicated building ventilation system. Ventilation is directed from areas of lower potential contamination, such as the intermediate zoned area for maintenance and truck bay and eventually to areas of higher potential contamination, such as the Process Cell. Building ventilation inlet air is filtered, as is the ventilation air entering the Process Cell and other shielded cells. The air from the shielded cells is then routed through the Building Ventilation HEPA Filters and ultimately combined with process offgas in the Air Mixing Box downstream of the Continuous Emissions Monitoring System and exhausted through the IWTU stack.

IWTU Shakedown and System Performance Testing

Following fabrication of the IWTU, the full-scale process components were transported to INTEC and assembled in CPP-1696. Once assembled, the system underwent necessary tightness testing to verify proper construction. Component testing was then conducted to ensure proper operation of subsystems and integrated testing on hot nitrogen and water were completed.

IWTU Shakedown and System performance testing will be performed as two distinct phases. Phase I (Shakedown) will direct the plant startup and required testing to validate proper operation of the facility compared to the current operating parameters in Table D-6.

Once it is determined that the process components meet the desired specifications and system operability has been demonstrated, Phase II System Performance Test (SPT) will be conducted in two parts. Part 1 will be conducted on non-radioactive surrogate and Part 2 will be conducted on actual Sodium Bearing Waste (SBW) to gauge system performance, demonstrate effective treatment, and verify/revise final operating parameters. The IWTU System Performance Test plan (PLN-3298) will document the test objectives and criteria, quality assurance requirements, sampling and analysis protocol, recordkeeping and reporting for both Parts 1 and 2 of the System Performance Test.

During Phase I (IWTU Shakedown) and Phase II, Parts 1 and 2 (System Performance Testing), the operating parameters identified in Table D-6 will be followed. During Phase I and II, if the operating parameters cannot be maintained as identified in Table D-6, the process documented in Appendix D-6 of this permit will be followed so IWTU Shakedown and Phase II System Performance Testing can be completed. Following the SPT, the reduced IWTU Operating parameters as identified in Table D-6 with a reduced feed rate of 2.5 gal/min total of online feed nozzles will be applicable until the SPT report and Class 2 Permit Modification Request to update IWTU information such as any affected conditions, as necessary, reflecting results of performance testing to ensure compliance with IDAPA 58.01.05.008 [40

CFR Part 264, Subparts B, C, D, and X]. The Class 2 PMR must be submitted forty five (45) days after the System Performance Test (SPT) Report is submitted to the DEQ.

During Phase II, Part 2 (System Performance Testing on SBW), all RCRA inspections will be performed twice as frequently as the permit requires during normal operations.

D-8b(1) Miscellaneous Unit Wastes [IDAPA 58.01.05.008; 40 CFR 264.601(a)(1), 264.601(b)(1), and 264.601(c)(1)]

The chemical characteristics of the wastes are described in Attachment 2, Section C of this permit.

D-8b(2) Containment System [IDAPA 58.01.05.008 and 58.01.05.012; 40 CFR 264.601(b)(2) and 270.23(a)(2)]

The containment systems are described in Attachment 1, Section D-2f of this permit. The structure of the building is described in Section B, and run-on or infiltration of precipitation is addressed in Attachment 6, Section F-4b of this permit.

D-8b(3) Site Air Conditions [IDAPA 58.01.05.008 and 58.01.05.012; 40 CFR §§ 264.601(c)(4) and (5), and 270.23(b)]

The climatology and meteorology at the INL are addressed in the *DOE Programmatic Spent Nuclear Fuel Management and INEEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS –0203F, Volume 1, Appendix B). A copy of this document has already been provided to DEQ.

D-8b(4) Prevention of Air Emissions [IDAPA 58.01.05.008 and 58.01.05.012; 40 CFR §§ 264.601(c) and 270.23(b)]

The NWCF Screening Level Risk Assessment [(SLRA) INEEL, 1999c, *Screening Level Risk Assessment for the New Waste Calcining Facility*, INEEL/EXT-97-000686, Rev. 5a, May] conservatively assessed potential atmospheric releases of all known and potentially present compounds of potential concern (COPC) in the INTEC liquid waste system (including the PEWE, LET&D, and ETS). The emission rate calculations assumed that 100 percent of the inventory (total mass) of organic COPCs in the total tank farm volume of 1,400,000 gallons of liquid waste was released out the INTEC main stack over a period of a year (a few compounds were assumed to have 99% thermal destruction in the calciner). Conservative modeling results indicated that human health and ecological impacts from all organic compounds were significantly less than EPA acceptance criteria for combustion units (1×10^{-5} total risk and 0.25 total hazard index for all COPCs). The majority of these calculated risks resulted from calculated Products of Incomplete Combustion emissions formed by combustion of the kerosene fuel in the calciner and chlorine in the offgas, not from organic constituents present in the feed. Since the potential mass of COPCs managed by the PEWE, LET&D, and ETS in a year is significantly less than the 1,400,000 gallons of liquid waste assumed to be released in the SLRA, the potential COPC emission rates and resulting environmental impacts from these units' operations will be significantly less than the acceptable values calculated in the NWCF SLRA.

A Risk Assessment that builds upon the existing "Human and Ecological Risk Assessment of Air Emissions from the INTEC Liquid Waste Management System" is included as Appendix D-5 to this permit. Upon agreement by the DEQ with the actions identified in the Risk Assessment Work Plan, a risk assessment was prepared to include emissions from the IWTU and submitted to the DEQ.

An assessment of the risk posed by the IWTU has been prepared and is provided as Appendix D-5 to this permit. The assessment estimates the risk posed by the IWTU and adds it to the combined risk for existing emission sources identified in "Risk Assessment for Air Emissions from the Integrated Waste Treatment Unit and INTEC Liquid Waste Management System," RPT-354, April 2007, to estimate risk to human health and the environment following initiation of operations at the IWTU. The assessment concludes that the risks posed by IWTU emissions and other contributing sources are less than EPA target criteria and that operation of the IWTU will not adversely affect human health or the environment.

D-8b(5) Operating Standards [IDAPA 58.01.05.008 and 58.01.05.012; 40 CFR 264.601(c)(3) and 270.23(a)(2)]

In order to ensure safe and effective operation of the miscellaneous treatment units, the following physical and chemical operational constraints and tolerance limits have been imposed. A list of items prohibited from treatment by these miscellaneous treatment units is provided in Attachment 2, Section C-2a(1) of this permit. The list of instruments to be monitored to ensure operating limits are not exceeded is located in Table D-9, Instrument Table. These instruments are monitored and recorded in the operating record.

Process Equipment Waste Evaporators (EVAP-WL-129 and EVAP-WL-161)

Operational Limits

Total suspended solids	≥ 10% must be transferred through VES-WL-132

Feed Limits

If the feed contains ≥ 50 ppm chlorides the following equation applies:
$[No_3]$ (in *M*olar) ≥ [Cl] (in ppm) x 0.006 + 0.1

Fluoride	maintain at least a 1:1 mole ratio of aluminum to fluoride, as fed
Sulfate	≤ 500 ppm, as fed
Mercury	≤ 260 ppm
Total organic carbon	≤ 800 ppm

Operational Constraints – shutdown of the process is initiated when:

Evaporator operating temperature exceeds 110° C

Specific gravity in the evaporator exceeds 1.3

Liquid Effluent Treatment and Disposal Facility Fractionators (FRAC-WLL-170, FRAC-WLK-171)

Feed Limits

Fluoride	maintain at least a 1:1 mole ratio of aluminum to fluoride, as fed
Mercury	≤ 260 ppm
Total organic carbon	≤ 800 ppm

Operational Constraints – shutdown of the process is initiated when:

Fractionator level drops below 10 in. water column (WC)

Fractionator level rises above 40 in. WC

Differential pressure across the fractionator exceeds 30 in. WC

Temperature on Tray #1 exceeds 265° F

Separator level exceeds 10 in. WC

Differential pressure across each HEPA filter stage exceeds 5 in. WC

Evaporator Tank System (EVAP-NCC-150)

Feed to the ETS originates from liquid wastes stored in the INTEC Tank Farm or from liquid waste newly generated in CPP-659 processes, such as debris treatment, decontamination rinses of process equipment, and moisture de-entrained from tank offgas systems. Feed streams are collected and sampled in VES-NCC-101, -102, -103, -108, -119, or VES-NCD-123 or -129, then analyzed. Laboratory analytical results are then analyzed using a computer model that is based on an industry-standard computer program. By inputting actual INTEC data and confirming accurate output the model has been validated. The model predicts concentrations of chemical species in the evaporator bottoms and overheads during the evaporation process. Iterative runs of the computer model allow determination of the point at which ETS batch operation should end based on prevention of precipitation in the evaporator bottoms in the ETS or after transfer to the Tank Farm. The operating end point is usually defined as a value of specific gravity for the evaporator bottoms.

Modeled concentrations in the evaporator bottoms and overheads are also evaluated for the potential to cause excessive corrosion of the ETS tanks, the Tank Farm tanks, and the offgas system components. Additional iterations of computer modeling are performed, if necessary, to adjust the operating endpoint such that corrosion is minimized. The general basis for the corrosion evaluation is knowledge of the corrosion properties of materials used to fabricate the tanks and components in the service environment. This basis is augmented by specific corrosion studies performed at the INL and elsewhere.

Finally, the modeled evaporator overheads are evaluated to determine what adjustments may be necessary before treatment in the PEWE. The evaporator overheads are sampled after generation to confirm acceptability into the PEWE feed tanks. Final adjustments may be made in the PEWE feed tanks prior to processing the waste through the PEWE.

Once an operating endpoint that optimizes both the precipitation stability and corrosion minimization has been determined, technical personnel document the endpoint and other model output parameters to recommend operation within the defined parameters.

Feed Limits

Fluoride	Maintain at least a 1:1 mole ratio of aluminum to fluoride, as fed, if fluoride is present in the feed
Chlorides	Waste containing > 5,000 ppm chlorides will not be processed in the ETS
Sulfates	Maintain at least a 2:1 mole ratio of sodium to sulfate, as fed if the feed contains ≥ 500 ppm sulfate
Mercury	Waste containing ≥ 3,000 ppm mercury will not be processed in the ETS

Operational Constraints – shutdown of the process is initiated:

When Evaporator operating temperature exceeds 117° C

Before the specific gravity of the liquids in the evaporator equals or exceeds 1.4 as read on D150-1C

IWTU

The IWTU is designed to process wastes currently stored in the INTEC tank farm and any waste that may be generated as NGLW.

Feed Limits

Chloride	Waste containing greater than 5,000 ppm chloride in solution will not be processed in the IWTU;
Fluoride	Waste containing greater than 3,000 ppm fluoride in solution will not be processed in the IWTU;
Mercury	Waste containing greater than 3,000 ppm mercury in solution will not be processed in the IWTU.

Operational Constraints – Waste feed is terminated and other actions initiated under numerous alarm conditions. The automatic waste feed cutoffs and alarm triggers are identified in Table D-6.

Additionally, the differential pressure of the process HEPA pre-filters is monitored. If the differential pressure on any process HEPA pre-filter exceeds 6.5" water column or suddenly decreases unexpectedly, the affected process HEPA filter bank must be isolated and the process HEPA pre-filter is replaced (does not require termination of waste feed). If more than one HEPA pre-filter has a rapid increase above 6.5" water column, the operators will initiate a controlled shutdown.

If the differential pressure of any Process HEPA filter element exceeds 5" water column or suddenly decreases unexpectedly, the affected HEPA filter bank must be isolated and the filter replaced (does not require termination of waste feed);

D-8b(6) Site Hydrogeologic Conditions [IDAPA 58.01.05.008 and 58.01.05.012; 40 CFR 264.601(a)(2), (3), and (4), 264.601(b)(3) and (5), and 270.23(b)]

The hydrology conditions at the INL are addressed in the *DOE Programmatic Spent Nuclear Fuel Management and INEEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS - 0203F, Volume 1, Appendix B). A copy of this document has already been provided to DEQ.

D-8b(7) Site Precipitation [IDAPA 58.01.05.008; 40 CFR 264.601(b)(4)]

Site precipitation is addressed in *DOE Programmatic Spent Nuclear Fuel Management and INEEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS - 0203F, Volume 1, Appendix B). A copy of this document has already been provided to DEQ.

D-8b(8) Groundwater Usage [IDAPA 58.01.05.008; 40 CFR 264.601(a)(5)]

The ground water usage is addressed in *DOE Programmatic Spent Nuclear Fuel Management and INEEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS - 0203F, Volume 1, Appendix B). A copy of this document has already been provided to DEQ.

D-8b(9) Surface Waters and Surface Soils [IDAPA 58.01.05.008; 40 CFR 264.601(b)(6), (7), and (8)]

The surface waters and surface soils are addressed in *DOE Programmatic Spent Nuclear Fuel Management and INEEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS - 0203F, Volume 1, Appendix B). A copy of this document has already been provided to DEQ.

D-8b(10) Area Land Use [IDAPA 58.01.05.008 and 58.01.05.012; 40 CFR 264.601(a)(6) and (b)(9), and 270.23(b)]

The area land uses is addressed in *DOE Programmatic Spent Nuclear Fuel Management and INEEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS - 0203F, Volume 1, Appendix B). A copy of this document has already been provided to DEQ.

D-8b(11) Migration of Waste Constituents [IDAPA 58.01.05.008; 40 CFR 264.601(a)(7)]

The PEWE, LET&D, ETS, and IWTU are not land treatment facilities and do not involve surface or subsurface soils; hence, application of this section is not appropriate.

D-8b(12) Evaluation of Risk to Human Health and the Environment [IDAPA 58.01.05.008; 40 CFR 264.601(a)(8) and (9), 264.601(b)(10) and (11), and 264.601(c)(6) and (7)]

For information on the risk to human health and the environment, see Section D-8b(4).

Table D-9. Instrument Table

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
Evaporator VES-WL-161	L-WL-161	094276-1	Level	Level Controller WL-161 Evaporator	Yes	a
	D-WL-161	094276-1	Density	Density WL-161 Evaporator	Yes	a
	F-WL-300	094276-1	Flow	Steam Flow for HE WL-300	Yes	a
	T-WL-161-1	094276-1	Temperature	WL-161 Liquid Temperature	1 of 3 Instruments must be in service to operate.	a
	T-WL-161-2	094276-1	Temperature	WL-161 Vapor temperature		a
	T-WL-161-3	094276-1	Temperature	WL-162 Vapor temperature		a
	T-WL-301-1	094276-3	Temperature	WL-301 Condensate Out Temperature	Yes	a
	R-WL-156	094276-4	Radiation	Radiation of 604 Steam Condensate	Yes	a
Evaporator VES-WL-129	D-WL-129	094276-1	Density	WL-129 Evaporator Density	Yes	a
	L-WL-129	094276-1	Level	WL-129 Evaporator Level / Controller	Yes	a
	F-WL-307	094276-1	Flow	Steam to WL-307 Reboiler	Yes	a
	T-WL-129-1	094276-1	Temperature	WL-129 Liquid Temperature	1 of 3 Instruments must be in service to operate.	a
	T-WL-129-2	094276-1	Temperature	WL-129 Vapor temperature		a
	T-WL-129-3	094276-1	Temperature	WL-130 Vapor temperature		a
	T-WL-308-1	094276-1	Temperature	WL-308 Condensate Out Temperature	Yes	a
	R-WL-156	094276-1	Radiation	Radiation of 604 Steam Condensate	Yes	a
LET&D HVAC and Utilities	P WLR 389-2	356640/1	Pressure	HP Steam to Air Preheater	Yes	a
LET&D FRAC-WLK-171	D-WLK- 171-2	356596-8	Density	Fractionator #1 Bottoms Density	Yes	a
	L- WLK- 171-1	356596-8	Level	Fractionator #1 Level	Yes	a
	L- WLK- 171-39	356596-9	Level	Cell #1 Sump Level	Yes	a
	L- WLK- 197-2	356596-10	Level	Feed Tank Level	Yes	a
	P- WLK- 171-3	356596-8	Pressure	Fractionator #1 Vacuum	Yes	a
	T- WLK- 171-19	356596-8	Temperature	Temperature of Fractionator #1 Tray #1	1 of 2 must be in service to operate	a
	T- WLK- 171-21	356596-8	Temperature	Temperature of Fractionator #1 Bottoms		a
	T- WLK- 199-2	356596-7	Temperature	Temperature of Separator #1	Yes	a
	R- WL- 604-1	094276-4	Radiation	Radiation of 604 Process Condensate	1 of 2 must be in service to operate	a
	R- WL- 604-2	094276-4	Radiation	Radiation of 604 Process Condensate		a

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
LET&D FRAC-WLL-170	D- WLL- 170-2	356596-5	Density	Fractionator #2 Bottoms Density	Yes	a
	L-WLL-170-1	356596-5	Level	Fractionator #2 Level	Yes	a
	L- WLL- 169-1	356596-3	Level	Bottoms Tank Sump Level	Yes	a
	L- WLL- 170-38	356956-6	Level	Cell #2 Sump Level	Yes	a
	L- WLL- 195-2	356596-3	Level	Bottoms Tank Level	Yes	a
	P- WLL- 170-3	356596-5	Level	Fractionator #2 Vacuum	Yes	a
	T- WLL- 170-19	356596-5	Temperature	Temperature of Fractionator #2 Tray #1	1 of 2 must be in service to operate	a
	T- WLL- 170-21	356596-5	Temperature	Temperature of Fractionator #2 Bottoms		a
	R- WL- 604-1	172280	Radiation	Radiation of 604 Process Condensate	1 of 2 must be in service to operate	a
	R- WL- 604-2	172280	Radiation	Radiation of 604 Process Condensate		a
LET&D off-gas Train #2	PD- WLR- 176-1	356596-1	Pressure Diff	Vapor HEPA Filter #2 Differential Pressure	Yes	a
	PD- WLR- 176-2	356596-1	Pressure Diff	Vapor HEPA Filter #2 Differential Pressure	Yes	a
	T- WLR- 394-1	356596-1	Temperature	Superheater #2 Outlet Temperature	Yes	a
	P- WLR- 394-3	356640-1	Pressure	HP Steam to Superheater #2	Yes	a
	T- WLR- 176-5	356596-5	Temperature	Vapor HEPA Filter #2 Outlet Temperature	Yes	a
	T- WLQ- 298-5	356596-1	Temperature	Temperature of Vapor to Stack	Yes	a
LET&D off-gas Train #1	PD- WLR- 177-1	356596-2	Pressure Diff	Vapor HEPA Filter #1	Yes	a
	PD- WLR- 177-2	356596-2	Pressure Diff	Vapor HEPA Filter #1	Yes	a
	T- WLR –395-1	356596-2	Temperature	Superheater #1 Outlet Temperature	Yes	a
	T- WLR 177-5	356596-2	Temperature	Vapor HEPA Filter #1 Outlet Temperature	Yes	a
	P- WLR 395-3	356640-1	Pressure	HP Steam to Superheater #1	Yes	a
	T- WLQ 298-5	356596-1	Temperature	Temperature of Vapor to Stack	Yes	a

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
Evaporator Feed Sediment Tank VES-WL-132	L-WL-132-1	057947	Level	WL-132 Level	Yes	a
Evaporator Feed Collection Tank VES-WL-133	L-WL-133-2	057947	Level	WL-133 Level	Yes	a
Vault Sump for VES-WL-132/133	L-WL-132/133S	057947	Level	WL-132 /-133 Vault Sump Level	Yes	a
Bottoms Tank VES-WL-101	L-WL-101-1	057946	Level	WL-101 Level	Yes	a
Surge Tank VES-WL-102	L-WL-102	057946	Level	WL-102 Level	Yes	a
Vault Sump for VES-WL-101/102	L-WL-101/102S	057946	Level	WL-101/102 Vault Sump Level Gauge	Yes	a
Evaporator Head Tank VES-WL-109	L-WL-109	094276	Level	WL-109 Level	Yes	a
Sump for EVAP-WL-129 (WL-129 Pump Pit)	L-WL-528	094276	Level	Pump Pit Sump Level	Yes	a
Process Condensate Surge Tank VES-WL-134	L-WL-134	094276-3	Level	WL-134 Level	Yes	a
Sump for EVAP-WL-161 (SU-WL-147)	L-WL- 147- 1	368931	Level	SU-WL-147 Level for Evaporator Cell	Yes	a

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
Process Condensate Surge Tank VES-WL-131	L-WL- 131	094276-3	Level	WL-131 Level	Yes	a
Process Off-Gas Condensate Knock-Out Pot VES-WL-108	T-WL-108	094276-3	Temperature	WL-108 Liquid Temperature	Yes	a
Bottoms Collection Tank VES-WL-111	L-WL-111	094276-2	Level	WL-111 Level	Yes	a
Tank Farm Tank VES-WM-100	L-WM-100-1	057944	Level	Level WM-100 (DCS)	Yes	a
Sump For VES-WM-100	L-WM-100S-1	057944	Level	WM-100 Vault Sump Level	Yes	a
Tank Farm Tank VES-WM-101	L-WM-101-1	057945	Level	Level WM-101 (DCS)	Yes	a
Tank Farm Tank VES-WM-102	L-WM-102-1	057945	Level	Level WM-102 (DCS)	Yes	a
Vault Sump for VES-WM-101/102	L-WM-101/102S-1	057945	Level	WM-101/-102 Vault Sump Level	Yes	a
Process Waste Liquid System VES-WL-135	L-WL-135-1	368921	Level	D5 Valve Box Collection Tank Level	Yes	a

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
Sump for VES-WL-135 (SU-WL-135)	L-WL-135-2	368921	Level	D5 Valve Box Sump Level	Yes	a
Process Waste Liquid System VES-WL-136	L-WL-136-1	368922	Level	D8 Valve Box Collection Tank Level	Yes	a
Sump for VES-WL-136 (SU-WL-136)	L-WL-136-2	368922	Level	D8 Valve Box Sump Level	Yes	a
Process Waste Liquid System VES-WL-137	L-WL-137-1	368923	Level	CPP-649 Process Filter Room Collection Tank Level	Yes	a
Sump for VES-WL-137 (SU-WL-137)	L-WL-137-2	368923	Level	CPP-649 Process Filter Room Sump Level	Yes	a
Process Waste Liquid System VES-WL-138	L-WL-138-1	368924	Level	VOG Blower Room Collection Tank Level	Yes	a
Sump for VES-WL-138 (SU-WL-138)	L-WL-138-2	368924	Level	VOG Blower Room Sump Level	Yes	a
Process Waste Liquid System VES-WL-139	L-WL-139-1	368925	Level	VOG Filter Room Collection Tank Level	Yes	a
Sump for VES-WL-139 (SU-WL-139)	L-WL-139-2	368925	Level	VOG Filter Room Sump Level	Yes	a
Process Waste Liquid System VES-WL-142	L-WL-142-1	368927	Level	CPP-604 Middle Cell Collection Tank Level	Yes	a

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
Sump for VES-WL-142 (SU-WL-142)	L-WL-142-2	368927	Level	CPP-604 Middle Cell Sump Level	Yes	a
Process Waste Liquid System VES-WL-144	L-WL-144-1	368929	Level	CPP-604 North Cell Collection Tank Level	Yes	a
Sump for VES-WL-144 (SU-WL-144)	L-WL-144-2	368929	Level	CPP-604 North Cell Sump Level	Yes	a
Process Waste Liquid System VES-WL-150	L-WL-150-1	179009	Level	WL-150 Level	Yes	a
Process Condensate Collection Tanks VES-WL-106	Q-WL-106	094276-3	Volume	WL-106 Volume	Yes	a
Process Condensate Collection Tanks VES-WL-107	Q-WL-107	094276-3	Volume	WL-107 Volume	Yes	a
Process Condensate Collection Tanks VES-WL-163	Q-WL-163	094276-3	Volume	WL-163 Volume	Yes	a
Sump for VES-WL-106/107/163 (SU-WL-145) (SU-WL-146)	L-WL-145-1	368930	Level	SU-WL-145 Level Condensate Cell	Yes	a
	L-WL-146-1	368930	Level	SU-WL-146 Level Condensate Cell	Yes	a
Sump SU-WL-148	L-WL-148-1	368931	Level	Main Stack Sump Level	Yes	a

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
Evaporator VES-NCC-150	L150-1C	13425102	Level	Evaporator Level	Yes	a
	D150-1C	13425102	Density	Evaporator Density	Yes	a
	P150-1C	13425102	Pressure	Evaporator Pressure	Yes	a
	T351-1C	134251	Temperature	Condenser HE-NCC-351 Drain Line Temperature	Yes	a
	T150-1C	13425102	Temperature	Vapor Temperature Above Mesh	2 of 10 Instruments must be in service to operate	a
	T150-2C	13425102	Temperature	Vapor Temperature Above Mesh		a
	T150-3C	13425102	Temperature	Vapor Temperature Below Mesh		a
	T150-4C	13425102	Temperature	Vapor Temperature Below Mesh		a
	T150-5C	13425102	Temperature	Evaporator Liquid Temperature		a
	T150-6C	13425102	Temperature	Evaporator Liquid Temperature		a
	T150-7C	13425102	Temperature	Evaporator Liquid Temperature		a
	T150-8C	13425102	Temperature	Evaporator Liquid Temperature		a
	T150-9C	13425102	Temperature	Evaporator Liquid Temperature		a
	T150-10C	13425102	Temperature	Evaporator Liquid Temperature		a
Blend Tank VES-NCC-101	L101-1C	133410	Level	Blend Tank Level	Yes	a
Hold Tank VES-NCC-102	L102-1C	133411	Level	Blend and Hold Tank Level	Yes	a
Hold Tank VES-NCC-103	L103-1C	133412	Level	Blend and Hold Tank Level	Yes	a
Constant Head Feed Tank VES-NCC-152	L152-1C	13425103	Level	Feed Tank Level	Yes	a
Fluoride Hot Sump Tank VES-NCC-119	L119-1C	133409	Level	Bottoms Collection Tank Level	Yes	a
	D119-1C	133409	Density	Bottoms Collection Tank Density	Yes	a
Non-Fluoride Hot Sump Tank VES-NCC-122	L122-1C	133408	Level	Overheads Collection Tank Level	Yes	a
	D122-1C	133408	Density	Overheads Collection Tank Density	Yes	a
Scrub Hold Tank VES-NCC-108	L108-1C	133424	Level	Scrub Hold Tank Level	Yes	a

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)
POG Vent Condenser Knock Out Drum VES-NCC-136	L136-1C	133428	Level	Knock Out Drum Level	Yes	a
Mist Collector VES-NCC-116	L116-1C	133428	Level	Mist Collector Level	Yes	a
	P116-1C	133428	Pressure	Mist Collector differential pressure	Yes	a
Waste Feed Tank VES-SRC-131	L-C-131-2 D-C-131-1	632760	Level	Monitors liquid waste feed level.	Yes	12
Sump Tank VES-SRC-133	L-C-133-1	632823	Level	Monitors liquid level	Yes	12
Clarifier Tank VES-SRC-134	L-C-134-1	632823	Level	Monitors liquid level	Yes	12
Seal Water Tank VES-SRC-132	L-C-231-3	632760	Level	Monitors liquid level of the seal water.	Yes	12
Liquid Waste Feed System	FC-C-540-11 FC-C-540-12 FC-C-540-13 FC-C-540-14 FC-C-540-15 FC-C-540-16	632760	Flow	Monitors the liquid waste feed injector atomizing gas.	Yes, although one, two, or three feeders can be used. If a feeder is used its corresponding gas flow meter must be in service – the other flow meters can be on-line or off-line	12
Liquid Waste Feed System	FC-C-140-1 FC-C-140-2 FC-C-140-3	632760	Flow	Monitors liquid waste feed flow.	Yes, although one, two, or three feeders can be used. If a feeder is used its corresponding waste feed flow meter must be in service – the other flow meters can be on-line or off-line	12

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)
Waste Feed Tank System	P-C-131-1A P-C-131-1B	632760	Pressure	Monitors feed pump discharge pressure	One of two, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process	12
Safety Significant Instrumented System	YS-C-401-11 YS-C-402-21 YS-H-403-31	N/A	Tripped Tripped Tripped	Monitors hydrogen for deflagration protection Monitors temperature for system protection Monitors carbon monoxide	Yes	8
DMR	T-C-140-2A T-C-140-2B T-C-140-2C T-C-140-3A T-C-140-3B T-C-140-3C T-C-140-5A T-C-140-5B T-C-140-5C T-C-140-12A T-C-140-12B T-C-140-12C	632762	Temperature	Monitors fluidized bed temperature.	7 of 12 instruments must be in service to operate	12
DMR	D-C-140-4	632762	Specific Gravity	Monitors DMR specific gravity	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process	12

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)
DMR	P-C-140-1 P-C-140-7	632762	Pressure	Monitors above-bed pressure.	One of two, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process.	12
DMR (SSV)	FC-B-365-5 (steam) FC-B-365-2 (nitrogen)	632801	Flow	Monitors fluidizing gas flow.	Yes	12
DMR Fluidizing Gas	T-B-365-17	632801	Temperature	Monitors fluidizing gas temperature	Yes	12
Process Gas Filter	A-C-153-1A A-C-153-1B A-C-153-1C	632763	Concentration	Monitors hydrogen	Yes, one of three must be in operation	12
DMR	P-C-153-3	632763	Pressure	Monitors differential pressure in the process gas filter in combination with P-C-140-7	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process	12
DMR	LY-C-140-1	632762	Level	Monitors bed level	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process	12

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)
PGF	P-C-153-11	632763	Pressure	Monitors PGF ruptures disk	Yes, although it can be temporarily taken out of service to calibrate without shutting down the process	12
DMR	P-B-365-11A	632801	Pressure	Monitors pressure of steam/nitrogen fluidizing gas to superheater	Yes, although it can be temporarily taken out of service to calibrate without shutting down the process.	12
CRR	T-C-160-16 T-C-160-25 T-C-160-26 T-C-160-4 T-C-160-12	632764	Temperature	Monitors fluidized bed temperature.	3 of 5 instruments must be in service to operate	12
CRR	D-C-160-1	632764	Specific Gravity	Monitors CRR specific gravity	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process	12

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
CRR	A-C-760-1A A-C-760-1B A-C-760-1C	632764	Concentration	Monitors oxygen.	Yes, one of three must be in operation.	12
CRR	P-C-760-10 P-C-760-16	632764	Pressure	Monitors outlet pressure.	Yes, one of two must be in operations, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process.	12
CRR and COD	T-C-160-2 T-C-160-3 T-C-160-7 T-C-160-11 T-C-760-9 T-C-760-13	632764	Temperature	Monitors wall temperatures	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process	12
Off-gas Cooler	T-C-160-1A T-C-160-1B	632766	Temperature	Monitors offgas temperature after the cooler.	Yes, one of the two instruments must be in service. They can be temporarily taken out of service to calibrate or purge/clean without shutting down the process.	12

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
Off-gas Cooler	P-C-160-13	632766	Pressure	Monitors OGC rupture disk	Yes.	N/A
Off-gas Blowers	PSH-H-140-8 PSH-H-140-9	632797	Pressure	Monitors off-gas blowers rupture disk	Yes.	N/A
Off-gas Blowers	I-H-260-1A I-H-260-1B	N/A	Current	Monitors current to the off-gas blowers	Yes, although they can be temporarily taken out of service for calibration without shutting down the process	12
Offgas Filter	P-C-160-3A P-C-160-3B	632765	Pressure	Monitors the differential pressure across the offgas filter.	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process.	12
Process Cell Sump	L-C-190-1	632821	Level	Monitors liquid level in sump.	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process.	12

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
HEPA Filters /GAC Bed	T-H-140-2 T-H-140-3A T-H-140-3B	632797	Temperature	Monitors temperature.	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process.	12
Process HEPA Pre-filters and Process HEPA Filters	PD-H-140-4A PD-H-140-4B PD-H-140-4C PD-H-140-4D PD-H-140-5A PD-H-140-5B PD-H-140-5C PD-H-140-5D PD-H-140-6A PD-H-140-6B PD-H-140-6C PD-H-140-6D	632797	Pressure	Monitors the differential pressure in the individual process HEPA pre-filters and process HEPA filters	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process.	12
GAC Bed	P-H-141-7A P-H-141-7B	632798	Pressure	Monitors GAC bed rupture disk	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process.	12

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
GAC Bed	T-H-141-7A T-H-141-7B	632798	Temperature	Monitors outlet temperature for the GAC beds	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process.	12
Process Exhaust Blowers	I-H-240-10A/10B	N/A	Current	Monitors process exhaust blowers	Yes, although they can be temporarily taken out of service for calibration without shutting down the process	12
CEMS	A-H-941-3A A-H-941-3B	632799	Concentration	Monitors carbon monoxide	Yes, one required to operate, although they can be temporarily taken out of service to calibrate without shutting down the process	12
Nitrogen Tank	L-E-121-5	632805	Level	Monitors level of the nitrogen supply tank	Yes	12
Nitrogen supply	P-B-357-2A P-B-357-2B	N/A	Pressure	Monitors pressure of nitrogen supply	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process	12
Oxygen Tank	L-E-124-5	632805	Level	Monitors pressure of nitrogen supply	Yes	12

Table D-9. Instrument Table (continued)

INSTRUMENT TABLE						
	Point (DCS Tag Name)	P&ID	Control Parameter	Description	Required For Operation	O&M (Mos)-
Oxygen Supply	P-B-146-3A P-B-146-3	N/A	Pressure	Monitors pressure of the oxygen supply	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process	12
Compressed Air	P-B-166-2A P-B-166-2B	N/A	Pressure	Monitors pressure of compressed air supply	Yes, although they can be temporarily taken out of service to calibrate or purge/clean without shutting down the process	12
Seismic	XSH023-1C XSH023-2C	N/A	Seismic	Monitors the facility for a seismic event	Yes, although they can be temporarily taken out of service for calibration without shutting down the process	12
DMR Fluidizing Gas	T-B-365-17	632801	Temperature	Monitors DMR fluidizing gas temperature.	Yes	12
Fire Water Collection Tank	L-E-196-1	632826	Level	Monitors Level	No	12
TK-SRH-141	L-H-141-1	632799	Level	Monitors Level	Yes	12

Note: Some DCS instrumentation shown on P&IDs may terminate at the transmitter. For example, an instrument named L-WL-XYZ-1 will show LT-XYZ-1.

a. Maintenance/calibration is performed in accordance with the manufacturers' recommendation and instrumentation operating history.

APPENDIX D-1

P-SCR-231 Feed Pump Specifications

Rev 6. 3/3/2009

PROCESS CONDITIONS OF SERVICE - CENTRIFUGAL PUMPS

REV

1 APPLICABLE TO: ○ STUDY ○ INQUIRY ● PURCHASE ○ AS-BUILT TAG NO. P-SRC-231
2 CLIENT CH2M WG Idaho LLC LOCATION Idaho National Laboratory
3 FACILITY ICP Integrated Waste Treatment Unit SERVICE WASTE FEED PUMP
4 NO. REQ 1 + spare PUMP SIZE ■ 2 x 4 - 11 A TYPE ■ Horiz. Centrifugal NO. STAGES ONE
5 MANUFACTURER ■ Goulds MODEL ■ 3700 SERIAL NO. ■
6 INFORMATION BELOW TO BE COMPLETED: ○ BY PURCHASER ■ BY MANUFACTURER ○ BY MFR OR PURCHASER

7 **GENERAL**

8	PUMPS TO OPERATE IN (PARALLEL)		NO. MOTOR DRIVEN	2 (1 Warehouse spare)	NO. TURBINE DRIVEN N/A
9	(SERIES) WITH	N/A	PUMP ITEM NO.	P-SRC-231	PUMP ITEM NO. ---
10	GEAR ITEM NO.	N/A	MOTOR ITEM NO.	---	TURBINE ITEM NO. ---
11	GEAR PROVIDED BY	---	MOTOR PROVIDED BY	PUMP SUPPLIER	TURBINE PROVIDED BY ---
12	GEAR MOUNTED BY	---	MOTOR MOUNTED BY	PUMP SUPPLIER	TURBINE MOUNTED BY ---
13	GEAR DATA SHT. NO.	---	MOTOR DATA SHT. NO.	See pg 8 & 9	TURBINE DATA SHT. NO. ---

14 **OPERATING CONDITIONS**

15 CONDITIONS:	MINIMUM	NORMAL	RATED MAX.
16 ● CAPACITY	30 GPM	30 GPM	80 GPM
17 ■ IMPELLER SPEED	RPM	1645 RPM	1880 RPM
18 ● SUCTION PRESSURE	-3.8 PSIG	-3.8 PSIG	-5.4 PSIG
19 ● DISCHARGE PRESSURE	50 PSIG	63 PSIG	65 PSIG
20 ● DIFFERENTIAL PRESSURE	53.8 PSI	66.8 PSI	67 PSI
21 ● DIFFERENTIAL HEAD (TDH)	93.4 FT	116 FT	148 FT
22 ● NPSHA	8.1 FT	8.1 FT	5.3 FT

23 SERVICE: ● CONT. ○ INTERMITTENT (STARTS/DAY)
24 ○ PARALLEL OPERATION REQ'D ● STARTING CONDITIONS: Loaded

25 **SITE AND UTILITY DATA**

26 LOCATION:
27 ● INDOOR ● HEATED ○ UNDER ROOF
28 ○ OUTDOOR ○ UNHEATED ○ PARTIAL SIDES
29 ○ GRADE ○ MEZZANINE ● Pipe Chase
30 ● ELECTRIC AREA CLASSIFICATION - Unclassifed
31 CL -- GR -- DIV --
32 ○ WINTERIZATION REQ'D ○ TROPICALIZATION REQ'D.
33 SITE DATA (SEE GEN. NOTE #1, DATA SHT PG. 3)
34 ● ALTITUDE 4913.5 (FT) BAROMETER 12.38 (PSIA)
35 ● RANGE OF AMBIENT TEMPS: MIN/MAX. 52 / 130 (°F)
36 ○ RELATIVE HUMIDITY: MIN / MAX / (%)
37 UNUSUAL CONDITIONS: ○ DUST ○ FUMES
38 ● OTHER AREA INACCESSIBLE FOR NORM. MAINTENANCE
39 ○ UTILITY CONDITIONS:
40 STEAM: N/A DRIVERS HEATING
41 MIN (PSIG) (°F) (PSIG) (°F)
42 MAX (PSIG) (°F) (PSIG) (°F)

43 ELECTRICITY	DRIVERS	HEATING	CONTROL	SHUTDOWN
44 VOLTAGE	460	--	--	--
45 HERTZ	60	--	--	--
46 PHASE	3	--	--	--

47 COOLING WATER:
48 TEMP. INLET (°F) MAX. RETURN (°F)
49 PRESS. NORM 55 (PSIG) DESIGN 225 (PSIG)
50 MIN RETURN (PSIG) MAX ALLOW DP (PSI)

SITE AND UTILITY DATA (CONT'D)

SEAL WATER SOURCE Filtered pressure regulated treated water
PRESSURE: MIN.: 55 PSIG MAX.: 120 PSIG DESIGN 225 PSIG
CHLORIDE CONCENTRATION (PPM) 6.72 mg/l (PPM)
INSTRUMENT AIR: MAX/MIN PRESS n/a / -- (PSIG)

LIQUID

● LIQUID TYPE OR NAME SODIUM BEARING WASTE (RADIOACTIVE SLURRY)
SEE REMARKS BELOW FOR FURTHER DESCRIPTION OF LIQUID

	MIN.	NORMAL	MAX.
PUMPING TEMP (°F)	52	79	130 Note 11 pg 3
VAPOR PRESS (PSIA)	0.13	2.20	2.20
RELATIVE DENSITY (SG)	1	1.33	1.33 @ 130°F
VISCOSITY (cP)		100	

○ SPECIFIC HEAT, Cp (BTU/LB °F)
● CORROSIVE/EROSIVE AGENT See Remark 2. page 2 below
● CHLORIDE CONCENTRATION (PPM) 800
○ H_2S CONCENTRATION (PPM) NA
LIQUID ● HAZARDOUS ○ FLAMMABLE
● OTHER Water or Decon Solution (2 Molar Nitric Acid Solution)

PERFORMANCE

PROPOSAL CURVE NO. 6552-0 ■ RPM Variable
■ IMPELLER DIA. RATED 11.12 MAX. 11.125 MIN. 11.125 (IN.)
■ 30 gpm: RATED POWER 6 (BHP) EFFICIENCY 15 (%)
■ 80 gpm: RATED POWER 12.5 (BHP) EFFICIENCY 33 (%)
■ MINIMUM CONTINUOUS FLOW:
THERMAL (GPM) STABLE 26 (GPM)
■ PREFERRED OPERATING REGION TO (GPM)
■ ALLOWABLE OPERATING REGION TO (GPM)
■ MAX HEAD @ RATED IMPELLER (FT)
■ MAX POWER @ RATED IMPELLER (BHP)
■ NPSHR AT 30/100 gpm RATED CAPACITY (FT)
● SUCTION SPECIFIC SPEED
● MAX. SOUND PRESS. LEVEL REQ'D (dBA)
■ EST MAX SOUND PRESS. LEVEL (dBA)

REMARKS: 1. Solids content ' 200 grams/liter
2. Corrosion/erosion due to up to 6 Molar nitric acid concentration for slurry.
3. Solids size range from 0.5 to 100 microns.

51 NOTES: (1) SUPPLIER SHALL PROVIDE TWO COMPLETE UNITS - ONE TO BE INSTALLED

ISSUE	DATE	SHEET	PROJECT / REQ'N
6	3/3/2009	1 OF 10	25051

EQUIPMENT DATA SHEET - CENTRIFUGAL PUMP

REV

APPLICABLE TO: ○ STUDY ○ INQUIRY ● PURCHASE ○ AS-BUILT

Client:	CH2M WG Idaho LLC	Tag No.:	P-SRC-231
Facility:	ICP Integrated Waste Treatment Unit	Service:	Waste Feed Pump
Location:	Idaho National Laboratory - Scoville, ID	No. Req'd:	1 + spare
Manufacturer:	Goulds	Model & Type:	3700 horizontal centrifugal

GENERAL NOTES:

1. N/A

2. Pump shall be a horizontal centrifugal pump in accordance with API-610. Pump arrangement shall be as shown on the Data Sheets, sheet 7.

3. Priming of the suction line and pump system shall be accomplished by the use of an eductor in the discharge piping to draw pumping fluid from the tank and through the pump.

4. Decontamination solution will be flushed through the pump into the tank, prior to performing maintenance.

5. The pump baseplate shall be installed on a stainless steel mounting plate located on a concrete floor.

6. Supplier shall provide pump allowable nozzle loads with proposal and after order with Supplier Data.

7. Pump shall operate at normal flow rate and up to rated flow rate. VFD shall be provided by Buyer to allow pump operation between both design points on the pump curves.

8. N/A

9. Supplier shall complete all information requested on the Data Sheets or the data requested from the manufacturer on the NEMA Frame Motor Data Sheet. If any of the requested information is not applicable, then the Pump Supplier shall mark the information "N/A" for not applicable.

10. The lubricants used on the motor bearing shall be Exxon Unirex or Chevron SRI-2 grease Pump shall be shipped without lubrication oil. Plant Operations will fill oil reservoir with oil that will comply with manufacturer's recommendations.

11. The slurry is pumped from a tank that can absorb heat from the surroundings up to 130 $^{\circ}$F. The pump is located in a pipe chase which is ventilated to maintain a temperature no higher than 125 $^{\circ}$F.

12. All accessories/components (seal water system, drive shafts, seals, couplings, baseplate, etc.) not of stainless steel shall, be rated for washdown duty using 2 molar nitric acid solution.

13. Pump pressure boundary shall be designed to a minimum of the piping design pressure of 180 psig. Seal water system components shall be designed to a maximum pressure of 225 psig.

14. Supplier shall complete and correct these data sheets and submit to Buyer for review.

EQUIPMENT DATA SHEET - CENTRIFUGAL PUMPS

REV

3 APPLICABLE TO: ○ STUDY ○ INQUIRY ● PURCHASE ○ AS-BUILT TAG NO. P-SRC-231

4 CLIENT CH2M WG Idaho LLC LOCATION Idaho National Laboratory

5 FACILITY ICP Integrated Waste Treatment Unit SERVICE WASTE FEED PUMP

6 NO. REQ 1 + spare PUMP SIZE ■ 2 x 4 - 11 A TYPE ■ Horiz. Centrifugal NO. STAGES ONE

CONSTRUCTION

9 **APPLICABLE STANDARD:**

10 ● API 610 10TH EDITION

11 ● OTHER HI (SEE REMARKS)

12 **PUMP TYPE:** SEE SKETCH PAGE 8

13 ● OH2 ○ BB1 ○ VS1 ○ VS6

14 ○ OH3 ○ BB2 ○ VS2 ○ VS7

15 ○ OH6 ○ BB3 ○ VS3 ○ OTHER

16 ○ BB4 ○ VS4

17 ○ BB5 ○ VS5

18 ■ **NOZZLE CONDITIONS:** See Note 2 below

	SIZE (IN)	FLANGE RATING	FAC'G	POSITION
Note 2				
SUCTION	4	300 lb	RF	top
DISCHARGE	2	300 lb	RF	end
BALANCE DRUM				

24 **PRESSURE CASING CONNECTIONS:**

	NO.	SIZE (NPS)	TYPE
☐ DRAIN	none		
☐ VENT	none		
☐ PRESSURE GAUGE	none		
☐ TEMP GAUGE	none		
☐ WARM-UP			
☐ BALANCE / LEAK-OFF			

33 ○ CYLINDRICAL THREADS REQUIRED

34 **CASING MOUNTING:**

35 ☐ CENTERLINE ☐ NEAR CENTERLINE

36 ☐ FOOT ☐ SEPARATE MOUNTING PLATE

37 ☐ IN-LINE

38 **CASING SPLIT:**

39 ☐ AXIAL ■ RADIAL

40 **CASING TYPE:** ADVISE

41 ☐ SINGLE VOLUTE ☐ MULTIPLE VOLUTE ☐ DIFFUSER

42 ○ OVERHUNG ○ BETWEEN BEARINGS ○ BARREL

43 **CASE PRESSURE RATING:** Note 13, sheet 2

44 ■ MAX ALLOWABLE WORKING PRESSURE (PSIG)

46 @ (°F)

47 ■ HYDROTEST PRESSURE (PSIG)

48 ● SUCT'N PRESS. REGIONS MUST BE DESIGNED FOR MAWP

49 **ROTATION:** (VIEWED FROM COUPLING END) ADVISE

50 ☐ CW ☐ CCW

51 ○ IMPELLERS INDIVIDUALLY SECURED

52 **REMARKS:**

53

54 ● BOLT PUMP TO BASEPLATE AND BASEPLATE TO MTG PL

55 **SHAFT:**

56 ■ SHAFT DIAMETER AT COUPLING (IN)

CONSTRUCTION (CONT)

■ SHAFT DIAMETER BETWEEN BEARINGS (IN)

■ SPAN BETWEEN BEARING CENTERS (IN)

■ SPAN BETWEEN BEARING & IMPELLER (IN)

REMARKS

COUPLINGS: (3.2.2) DRIVER - PUMP

● MAKE Metastream

■ MODEL TSCS 0013-S.F. compliant to API 610 Standard

■ RATING (HP/100 RPM)

● LUBRICATION NON-LUBRICATED

○ LIMITED END FLOAT REQUIRED

○ SPACER LENGTH (IN)

● SERVICE FACTOR 1.0

DRIVER HALF COUPLING MOUNTED BY:

● PUMP MFR. ○ DRIVER MFR. ○ PURCHASER

○ COUPLING

BASEPLATES:

☐ API BASEPLATE NUMBER (APPENDIX M)

● NON-GROUT CONSTRUCTION: MATERIAL: 304 OR 316 SS

REMARKS: PUMP SHALL BE MOUNTED ON A HEAVY DUTY RIGID BASEPLATE. INSTALLATION SHALL NOT BE GROUTED. BASEPLATE SHALL BE SUITABLE FOR REMOTE INSTALLATION

MATERIALS

○ APPENDIX H CLASS API A-8 (Goulds A-8N)

○ MIN DESIGN METAL TEMP 40 (°F)

■ BARREL/CASE 316L IMPELLER 316L GLAND 316 SS

■ CASE/IMPELLER WEAR RINGS 316L \ Nitronic 60

■ SHAFT 316 SS (Note (3)) ■ BEARING FRAME Stainless Steel

■ DIFFUSERS 316L ■ BOLTING Stainless Steel

■ COUPLING SPACER/HUBS Stainless Steel

■ COUPLING DIAPHAGMS (DISKS) Stainless Steel

REMARKS:

All wear parts shall be chrome hardened for corrosion resistance.

See Note (3) below

BEARINGS AND LUBRICATION

BEARING (TYPE/MFR-NO.): Ball /

■ RADIAL Ball double row / 7312BEGAM

■ THRUST Ball single row / 6213 Inboard

○ REVIEW AND APPROVE THRUST BEARING SIZE

LUBRICATION: See note 10, sheet 2

○ GREASE ○ FLOOD ■ RING OIL

○ FLINGER ○ PURGE OIL MIST ○ PURE OIL MIST

○ CONSTANT LEVEL OILER PREFERENCE

○ PRESSURE LUBE SYS ○ API-610 ○ API-614

○ OIL VISC. ISO GRADE

58 **REMARKS:** (1) N/A

59 (2) Suction piping to pump is 4" dia.; discharge piping connection from pump is 1 1/2" dia. with 1 1/2" to 2" reducer

60 (3) Based on materials information and slurry velocity within the pump, Supplier shall recommend materials of construction to

61 prevent corrosion and erosion of the pump wetted parts.

62 (4) Data Sheets shall be completed by Supplier

ISSUE	DATE	SHEET	PROJECT / REQ'N
6	3/3/2009	3 OF 10	25051

EQUIPMENT DATA SHEET - CENTRIFUGAL PUMPS

REV

3 APPLICABLE TO: ○ STUDY ○ INQUIRY ● PURCHASE ○ AS-BUILT TAG NO. P-SRC-231

4 CLIENT CH2M WG Idaho LLC LOCATION Idaho National Laboratory

5 FACILITY ICP Integrated Waste Treatment Unit SERVICE WASTE FEED PUMP

6 NO. REQ 1 + spare PUMP SIZE ■ 2 x 4 - 11 A TYPE ■ Horiz. Centrifugal NO. STAGES ONE

8 **BEARINGS AND LUBRICATION (CONT)**

9 ◯ OIL HEATER REQ'D ○ ELECTRIC ○ STEAM

10 ○ OIL PRESS TO BE GREATER THAN COOLANT PRESS

11 **REMARKS** Bearings shall be designed to last a minimum of 5 years.

12 Oil Level sight glass to be provided

13

15 **MECHANICAL SEAL OR PACKING**

16 SEAL DATA: Note (1) below

17 ○ API-682 SEAL

18 ○ NON-API 682 SEAL

19 ○ APPENDIX H SEAL CODE

20 ◯ SEAL MANUFACTURER John Crane

21 ◯ SIZE AND TYPE / Cartridge - Pressurized Dual

22 ◯ MANUFACTURER CODE 3648-2 X P147 1 X D81 H/ X P147 1 X D81 H

23 SEAL CHAMBER DATA: 586/548;X058X058H316/HC/XF481X058H316/HC

24 ◯ TEMPERATURE (°F)

25 ◯ PRESSURE (PSIG)

26 ◯ FLOW (GPM)

27 ☐ SEAL CHAMBER SIZE

28 ☐ TOTAL LENGTH (IN) ☐ CLEAR LENGTH (IN)

29 **SEAL CONSTRUCTION:**

30 ■ SLEEVE MATERIAL 304L or 316L or Alloy

31 ■ GLAND MATERIAL 304L or 316L or Alloy

32 ○ AUX SEAL DEVICE

33 ◯ JACKET REQUIRED

34 **GLAND TAPS:**

35 ■ FLUSH (F) ■ DRAIN (D) ◯ BARRIER/BUFF. (B)

36 ◯ QUENCH (Q) ◯ COOLING (C) ◯ LUBRICATION (G)

37 ◯ HEATING (H) ◯ LEAKAGE ◯ PUMPED FLUID (P)

38 ◯ BAL'NCE FLUID (E) ◯ EXTERNAL FLUID INJECTION (X)

39 **SEAL FLUIDS REQUIREM'T AND AVAILABLE FLUSH LIQUID:**

40 NOTE: IF FLUSH LIQUID IS PUMPAGE LIQUID (AS IN API-610 FLUSH

41 PIPING PLANS 11 TO 41), FOLLOWING FLUSH LIQUID DATA IS NOT REQ'D.

42 ● SUPPLY TEMPERATURE MAX/MIN 125 / 60 (°F)

43 ○ RELATIVE DENSITY (SPECIFIC GRAVITY) 1.0 @ 70 (°F)

45 ○ NAME OF FLUID treated water

46 ○ SPECIFIC HEAT, Cp 1 (BTU/LB °F)

47 ○ VAPOR PRESSURE (PSIA) @ (°F)

48 ○ HAZARDOUS ○ FLAMMABLE ○ OTHER

49 ☐ FLOW RATE MAX/MIN / (GPM)

50 ☐ PRESSURE REQUIRED MAX/MIN / (PSIG)

51 ☐ TEMPERATURE REQUIRED MAX/MIN / (°F)

52 **BARRIER/BUFFER FLUID:**

53 ○ SUPPLY TEMPERATURE MAX/MIN see above / (°F)

54 ○ RELATIVE DENSITY (SPECIFIC GRAVITY) @ (°F)

55 ○ NAME OF FLUID treated water

MECHANICAL SEAL OR PACKING (CONT)

○ VAPOR PRESSURE (PSIA) @ (°F)

● HAZARDOUS ○ FLAMMABLE ○ OTHER

☐ FLOW RATE MAX/MIN / (GPM)

☐ PRESSURE REQUIRED MAX/MI / (PSIG)

◯ TEMPERATURE REQUIRED MAX/MIN / (°F)

QUENCH FLUID:

○ NAME OF FLUID treated water

☐ FLOW RATE (GPM)

SEAL FLUSH PIPING: (See referenced P&ID No. 632760)

■ SEAL FLUSH PIPING PLAN API 610 Plan 53A

■ TUBING ◯ CARBON STEEL

◯ PIPE ■ STAINLESS STEEL

○ AUXILIARY FLUSH PLAN

◯ TUBING ◯ CARBON STEEL

◯ PIPE ◯ STAINLESS STEEL

○ PIPING ASSEMBLY:

◯ THREADED ◯ UNIONS ■ BUTTWELDED

◯ FLANGED ◯ TUBE TYPE FITTINGS

◯ PRESSURE SWITCH TYPE

○ PRESSURE GAUGE

◯ LEVEL SWITCH TYPE

○ LEVEL GAUGE ● RESERVOIR Mounted

○ TEMP INDICATOR ● VENT TANK Shipped Loose

○ HEAT EXCHANGER ● VENT VALVE On vent tank

REMARKS 1. Seal water tubing to be socket welded

2. Seal water components to be bedplate mounted except vent tank.

3. Connection for 1/2" Sch. 40S 304 SS socket welded pipe req'd.

PACKING DATA: (APPENDIX C) N/A

MANUFACTURER

TYPE

SIZE NO. OF RINGS

☐ PACKING INJECTION REQUIRE

☐ FLOW (GPM) @ (°F)

☐ LANTERN RING

STEAM AND COOLING WATER PIPING

◯ COOLING WATER PIPING PLAN N/A

☐ COOLING WATER REQUIREMENTS

SEAL JACKET/BRG HSG (GPM) @ (PSIG)

SEAL HEAT EXCHANGER (GPM) @ (PSIG)

QUENCH (GPM) @ (PSIG)

TOTAL COOLING WATER (GPM)

○ STEAM PIPING: ○ TUBING ○ PIPE

REMARKS

57 **ADDITIONAL REMARKS:** 1.Vendor to specify a double (tandem) seal configuration and material selection compatible with

58 process service requirements and referenced API standards.

59

60

61

ISSUE	DATE	SHEET	PROJECT / REQ'N
6	3/3/2009	4 OF 10	25051

EQUIPMENT DATA SHEET - CENTRIFUGAL PUMPS

REV

3 APPLICABLE TO: ○ STUDY ○ INQUIRY ● PURCHASE ○ AS-BUILT TAG NO. P-SRC-231

4 CLIENT CH2M WG Idaho LLC LOCATION Idaho National Laboratory

5 FACILITY ICP Integrated Waste Treatment Unit SERVICE WASTE FEED PUMP

6 NO. REQ 1 + spare PUMP SIZE 2 x 4 - 11 A TYPE Horiz. Centrifugal NO. STAGES ONE

INSTRUMENTATION

8

9 **VIBRATION:**

10 ○ NONCONTACTING (API 670) ○ TRANSDUCER

11 ● PROVISION FOR MOUNTING ONLY

13 ● FLAT SURFACE REQ'D

14 ○ SEE ATTACHED API 670 DATA SHEET

15 ○ MONITORS AND CABLES

16 REMARKS

17

18

19 **TEMPERATURE AND PRESSURE:**

20 ○ RADIAL BRG METAL TEMP ○ THRUST BRG METAL TEMP

21 ○ PROVISION FOR INSTRUMENTS ONLY

22 ○ SEE ATTACHED API-670 DATA SHEET

23 ○ TEMP GAUGES (WITH THERMOWELLS)

24 OTHER

25 ○ PRESSURE GAUGE TYPE

26 LOCATION

27 REMARKS

28

29

SPARE PARTS

31

32 ● START-UP ● NORMAL MAINTENANCE

33 ● SPECIFY Five (5) YEARS OPERATING - QUOTE SEPARATE

35 PRICING FOR SPARE PARTS

36

MOTOR DRIVE - SEE MOTOR DATA SHEET ALSO

38

39 ○ MANUFACTURER Pump Mfg's Choice - Reliance Preferred

40 ■ 15 (HP) ☐ 1750 (RPM)

41 ● HORIZONTAL ○ VERTICAL

42 ☐ FRAME 254T

43 ● SERVICE FACTOR 1.15

44 ● VOLTS/PHASE/HERTZ 460 / 3 / 60

45 ● TYPE INVERTER DUTY

46 ● ENCLOSURE TEFC - XT

47 ○ MINIMUM STARTING VOLTAGE

48 ● TEMPERATURE RISE 80 (OC)

49 ○ FULL LOAD AMPS

50 ○ LOCKED ROTOR AMPS

52 ● INSULATION Class F with Class B Temp. Rise

53 ■ STARTING METHOD Loaded

54 ● LUBE Grease per Note 10, pg 3

55 ☐ VERTICAL THRUST CAPACITY

56 UP (LBS) DOWN (LBS)

57 BEARINGS (TYPE / NUMBER):

58 ☐ RADIAL /

59 ☐ THRUST /

60

RELIABILITY

61

62 ● PUMP RELIABILITY %

63 ● MOTOR RELIABILITY %

64 ● COUPLING RELIABILITY %

65 ● OVERALL PUMP/MOTOR RELIABILITY %

MOTOR DRIVE (CONT)

REMARKS REFER TO EQUIP. DATA SHEETS, PG 8 AND 9

MOTOR. MOTOR BEARINGS ARE INACCESSIBLE FOR LIFE OF PUMP

OPERATION. MOTOR BEARINGS SHALL BE PERMANENTLY LUBED.

SURFACE PREPARATION AND PAINT

● MANUFACTURER'S STANDARD FOR THE INTENDED SERVICE

OTHER .

PUMP: N/A PUMP IS STAINLESS STEEL

○ PUMP SURFACE PREPARATION

○ PRIMER

○ FINISH COAT

BASEPLATE: N/A BASEPLATE IS STAINLESS STEEL

○ BASEPLATE SURFACE PREPARATION

○ PRIMER

○ FINISH COAT

SHIPMENT:

● DOMESTIC ○ EXPORT ○ EXPORT BOXING REQUIRED

○ OUTDOOR STORAGE MORE THAN 6 MONTHS

SPARE ROTOR ASSEMBLY PACKAGED FOR:

○ HORIZONTAL STORAGE ○ VERTICAL STORAGE

○ TYPE OF SHIPPING PREPARATION

REMARKS

WEIGHTS - ADVISE

MOTOR DRIVEN:

WEIGHT OF PUMP (LBS)

WEIGHT OF BASEPLATE (LBS)

WEIGHT OF MOTOR (LBS)

WEIGHT OF GEAR (LBS)

TOTAL WEIGHT (LBS)

TURBINE DRIVEN: (N/A)

WEIGHT OF BASEPLATE (LBS)

WEIGHT OF TURBINE (LBS)

WEIGHT OF GEAR (LBS)

TOTAL WEIGHT (LBS)

REMARKS SELLER TO FILL IN ALL APPLICABLE BLANK ITEMS.

OTHER PURCHASE REQUIREMENTS

● COORDINATION MEETING REQUIRED

● REVIEW FOUNDATION DRAWINGS

○ REVIEW PIPING DRAWINGS

○ OBSERVE PIPING CHECKS

● OBSERVE INITIAL ALIGNMENT CHECK

○ CHECK ALIGNMENT AT OPERATING TEMPERATURE

● CONNECTION DESIGN APPROVAL

66 **REMARKS:**

67

68

69

####

ISSUE	DATE	SHEET	PROJECT / REQ'N
6	3/3/2009	5 OF 10	25051

EQUIPMENT DATA SHEET - CENTRIFUGAL PUMPS

REV

3 APPLICABLE TO: ○ STUDY ○ INQUIRY ● PURCHASE ○ AS-BUILT TAG NO. P-SRC-231

4 CLIENT CH2M WG Idaho LLC LOCATION Idaho National Laboratory

5 FACILITY ICP Integrated Waste Treatment Unit SERVICE WASTE FEED PUMP

6 NO. REQ 1 + spare PUMP SIZE ■ 2 x 4 - 11 A TYPE ■ Horiz. Centrifugal NO. STAGES ONE

7 **OTHER PURCHASER REQUIREMENTS (CONT)**

8 ● RIGGING DEVICE REQ'D FOR TYPE OH2 PUMP
9 ○ HYDRODYNAMIC THRUST BRG SIZE REVIEW REQ'D
10 ○ LATERAL ANALYSIS REQUIRED
11 ● ROTOR DYNAMIC BALANCE
12 ■ MOUNT SEAL RESERVOIR & CIRCULATION PIPING ON BASEPLATE
13 ○ INSTALLATION LIST IN PROPOSAL
14 ○
15 ○ TORSIONAL ANALYSIS/REPORT
16 ● PROGRESS REPORTS REQUIRED
17 ■ MEAN TIME BETWEEN FAILURES (HRS)
18 ■ MEAN TIME TO FAILURE (HRS)
19 ■ AVAILABILITY (%) (98% MIN REQD)

21 **QA INSPECTION AND TEST**

22 ● REVIEW VENDOR'S QA PROGRAM
24 ● PERFORMANCE CURVE APPROVAL
25 ● SHOP INSPECTION
26 ○ TEST WITH SUBSTITUTE SEAL

27 TEST	NON-WIT	WIT	OBSERVE
28 HYDROSTATIC (SEE REMARK 2)	●	○	○
29 PERFORMANCE	●	○	○
30 NPSH (SEE REMARK 1)	●	○	○
31 COMPLETE UNIT TEST	●	○	○
32 SOUND LEVEL TEST	○	○	○
33 ● CLEANLINESS PRIOR TO 34 FINAL ASSEMBLY	●	○	○
35 ○ NOZZLE LOAD TEST	○	○	○
36 ○ BRG HSG RESONANCE TEST	○	○	○
37 ● 4 POINT NPSHR TEST	●	○	○
38 ○ REMOVE/INSPECT 39 HYDRODYNAMIC BEARINGS 40 AFTER TEST	○	○	○
41 ○ AUXILIARY EQUIPMENT 42 TEST	○	○	○
43 ○	○	○	○
44 ○	○	○	○

45 ● MATERIAL CERTIFICATION REQUIRED
46 ● CASING ● IMPELLER ● SHAFT
47 ● OTHER COVER, BEARING FRAME, SEAL GLAND
48 ○ CASTING REPAIR PROCEDURE APPROVAL REQ'D
49 ● INSPECTION REQUIRED FOR CONNECTION WELDS
50 ○ MAG PARTICLE ● LIQUID PENETRANT
51 ○ RADIOGRAPHIC ○ ULTRASONIC
52 ○ INSPECTION REQUIRED FOR CASTINGS
53 ○ MAG PARTICLE ○ LIQUID PENETRANT
54 ○ RADIOGRAPHIC ○ ULTRASONIC

QA INSPECTION AND TEST (CONT'D)

○ ADDITIONAL INSPECTION REQUIRED FOR:
○ MAG PARTICLE ○ LIQUID PENETRANT
○ RADIOGRAPHIC ○ ULTRASONIC
○ ALTERNATE ACCEPTANCE CRITERIA
○ HARDNESS TEST REQUIRED FOR:
○ WETTING AGENT HYDROTEST
● VENDOR SUBMIT TEST PROCEDURES
○ RECORD FINAL ASSEMBLY RUNNING CLEARANCES
○ INSPECTION CHECK-LIST TO INCLUDE API - 610 INSPECTION CHECKLIST

REMARKS

GENERAL REMARKS

REMARK 1: N/A

REMARK 2: HYDRO TEST TO BE HELD FOR A MINIMUM DURATION OF 30 MINUTES AT 1.5 TIMES MAXIMUM ALLOWABLE WORKING PRESSURE OF THE PUMP CASING.

REMARK 3: N/A

REMARK 4: N/A

REMARK 5 N/A

REMARK 6: N/A

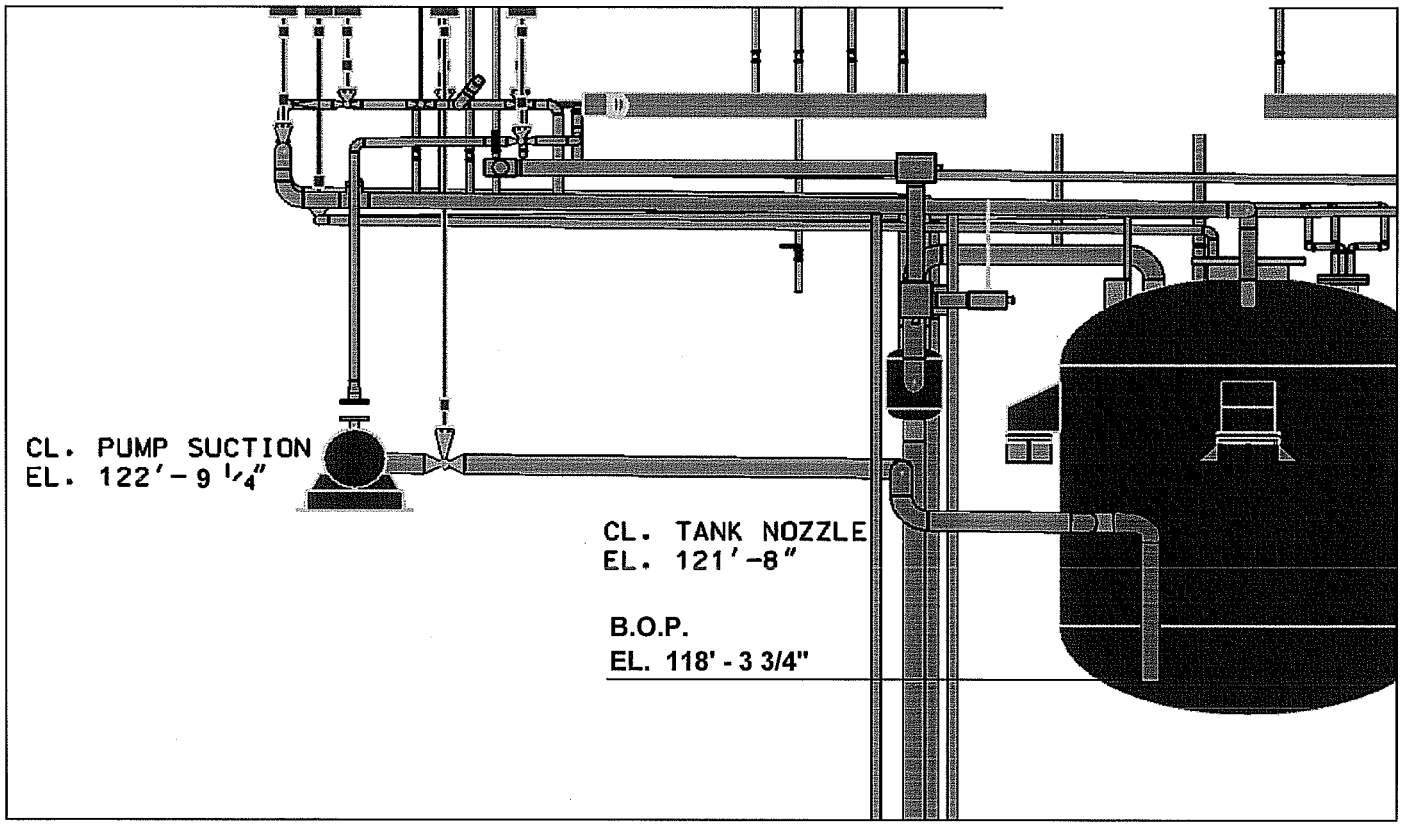
56 **ADDITIONAL REMARKS:**

ISSUE	DATE	SHEET	PROJECT / REQ'N
6	3/3/2009	6 OF 10	25051

EQUIPMENT DATA SHEET - CENTRIFUGAL PUMPS

REV

APPLICABLE TO:	○ STUDY	○ INQUIRY	● PURCHASE	○ AS-BUILT	TAG NO.	P-SRC-231
CLIENT	CH2M WG Idaho LLC		LOCATION	Idaho National Laboratory		
FACILITY	ICP Integrated Waste Treatment Unit		SERVICE	WASTE FEED PUMP		
NO. REQ	1 + spare	PUMP SIZE ■ 2 x 4 - 11 A	TYPE ■	Horiz. Centrifugal	NO. STAGES	ONE



ELEVATION OF PUMP, TANK AND PIPING

ISSUE	DATE	SHEET	PROJECT / REQ'N
6	3/3/2009	7 OF 10	25051

REV

EQUIPMENT DATA SHEET - NEMA FRAME INDUCTION MOTOR

REV

3 APPLICABLE TO: ○ STUDY ○ INQUIRY ● PURCHASE ○ AS BUILT

4 CLIENT: CH2M WG Idaho LLC — ITEM No. P-SRC-231 — NO. REQ'D: 2

5 FACILITY: ICP Integrated Waste Treatment Unit — SERVICE Waste Feed Pump Driver

6 LOCATION: Idaho National Laboratory - Scoville, ID — MFR/MODEL: ■ PUMP MFG'S CHOICE — SERIAL NO.

CONDITIONS OF SERVICE AND CONSTRUCTION FEATURES

10 NAMEPLATE HP: 15 — EFFICIENCY: ● HIGH ○ STANDARD — SYNCH SPEED: 1800 RPM

11

12 460 VOLTS 3 Ø 60 HZ — NEMA DSGN B

13 SERVICE FACTOR ○ 1.0 ● 1.15 — TEMP RISE: Class B 80°C

14 ○ ○

15 MULTISPEED — NOT APPLICABLE

16 ○ SINGLE WINDING ○ TWO WINDING

17 ○ VARIABLE TORQUE ○ CONSTANT HORSEPOWER

18 ○ CONSTANT TORQUE ● INVERTER DUTY (NOTE 3)

19 LOCATION: ALTITUDE 4913.5 FT DESIGN AMB 52 (Note 9) °C

20 SEISMIC ZONE :

21 NEC AREA CLASSIFICATION : CL GRP DIV

22 AUTO IGNITION TEMP : °C | OPERATING ATM.: Indoor

23 ENCLOSURE : ○ OPEN-DRIP PROOF

24 ○ WEATHER PROTECTED (I) (II) ● TEFC - XT ○ TENV

25 ○ FORCE VENTILATED ● SEVERE DUTY

26 ○ DUST-IGNITION PROOF ○ TEAAC

27 ○ EXPLOSION-PROOF WITH "T" CODE MARKING

28 STARTING CONDITIONS

29 ● LOADED ○ UNLOADED

30 ● FULL VOLTAGE ○ REDUCED VOLTAGE/SOFT START

31 MINIMUM STARTING VOLTAGE AS % OF RATED %

32 INSULATION : CLASS F WITH 80°C TEMP. RISE

33 TYPE : ● MFR. STD ○ ENCAPSULATED ○ VPI

34 ROTATION FACING NON-DRIVE END :

35 ○ CLOCKWISE ○ COUNTERCLOCKWISE ○

36 BEARINGS ● ANTI-FRICTION ○ SPLIT SLEEVE

37 Note 10 sht 2 ● GREASE LUBE ○ OIL LUBE

38 MOUNTING ● HORIZONTAL ○ VERTICAL SOLID SHAFT

39 ○ VERTICAL HOLLOW SHAFT

40 DRIVE SYSTEM ● DIRECT COUPLED ○ GEAR UNIT

41 ○ V-BELTS ○ CHAIN

42 ● HALF COUPLING PRESSED ON BY DRIVEN EQUIPMENT SELLER

43 ○ SHEAVE PRESSED ON BY DRIVEN EQUIPMENT SELLER

44 ACCESSORY EQUIPMENT

45 ● BASEPLATE FURNISHED BY : PUMP SUPPLIER

46 ● COUPLING FURNISHED BY : PUMP SUPPLIER

47 ○ SPACE HEATER : N/A VOLTS PHASE

48 ○ AIR FILTERS ○ GUARD SCREENS

49 ○ STATOR WINDING TEMPERATURE DETECTORS

50 ○ 100 OHM PLAT RTD, 2 PER PHASE, WIRED TO J-BOX

51 ○ THERMOSTAT, 1 PER PHASE, WIRED TO JUNCTION BOX

52 ○ DRAIN / BREATHER :

53 ○ CTs FOR DIFFERENTIAL PROTECTION

54 ○ BEARING TEMPERATURE DETECTORS

55 ○ 100 OHM PLAT RTD, 1 PER BEARING, WIRED TO J-BOX

56 ○ THERMOSTAT, 1 PER BEARING, WIRED TO JUNCTION BOX

57 ○ BEARING OIL SUMP HEATERS

58 ○ BEARING VIBRATION DETECTORS ○ ACCELERATION PAD ONLY

59 ○ SURGE CAPACITOR MTD. IN TERMINAL BOX

60 ○ VFD BY PUMP SELLER

61 TERMINAL BOX: | ● ENCLOSURE: NEMA 4X

62 ○ SIZED FOR MOTOR LEADS ONLY

63 ● OVERSIZED FOR MOTOR LEADS (LARGER THAN NEMA STD)

64 ● GROUNDING LUG MOUNTED INSIDE SIZE: #8 Cu AWG

65 ○ SEPARATE AUXILIARY TERMINAL BOX

66 ○ SEPARATE EXTERNAL GROUND PAD OR STUD (50 HP & ABOVE)

67

68

DATA SUPPLIED BY MOTOR MANUFACTURER OR BIDDER

FRAME No.: MTR TEMP RISE : °C OVER °C AMB.

LOAD	1/2	3/4	FL	SF
EFFICIENCY (%)				
CURRENT (AMPS)				
POWER FACTOR (%)				
kW LOSSES				

LOCKED ROTOR TORQUE: % OF FULL LOAD

BREAKDOWN TORQUE: % OF FULL LOAD

PULL-UP TORQUE: % OF FULL LOAD

FULL LOAD TORQUE: # - FT

LOCKED ROTOR CURRENT: AMP

LOCKED ROTOR KVA CODE LETTER:

LOCKED RTR WITHSTAND TIME: SEC (COLD) SEC (HOT)

SUCCESSIVE STARTING LIMITATIONS: PER HOUR

FULL LOAD SPEED: RPM

FAN ROTATION: ☐ UNI-DIRECTIONAL ☐ REVERSIBLE

LOAD WK^2 : $FT\text{-}LB^2$

ROTOR WK^2 : $FT\text{-}LB^2$

LOAD CAPABILITY WK^2 : $FT\text{-}LB^2$

SPACE HEATER POWER: WATTS

MOTOR NET WEIGHT: LBS

MAX ERECTION WEIGHT: LBS

MAX OVERALL L: W: H:

ADDITIONAL SPECIFICATION REQUIREMENTS OR REMARKS:

1) MOTOR SUPPLIER TO FILL IN ALL BLANK ITEMS, MARK (N/A) IF NOT APPLICABLE, AND SUBMIT COMPLETED DATA SHEET FOR REVIEW.
2) N/A
3) MOTOR WILL BE OPERATED FROM VARIABLE FREQUENCY DRIVE (VFD) AND SHALL BE RATED FOR INVERTER DUTY PER NEMA MG-1 PART 31. MOTOR SHALL BE RATED TO OPERATE CONTINUOUSLY UNDER LOAD AT ALL SPECIFIED SPEEDS.
4) N/A
5) ACCEPTABLE MOTOR MANUFACTURERS ARE AS FOLLOWS:
   TECO/WESTINGHOUSE
   TOSHIBA
   GENERAL ELECTRIC
   SIEMENS
   RELIANCE
6) QUALITY LEVEL REQUIREMENTS:
   SEE PROCUREMENT DOCUMENTS FOR REQUIREMENTS
7) MOTOR SHALL BE INSTALLED IN AN ENCLOSED AREA INACCESSIBLE FOR NORMAL MAINTENANCE. MOTOR BEARINGS SHALL BE SEALED AND LUBRICATED FOR LIFE.
8) N/A
9) TEMPERATURE IRANGE NSIDE ENCLOSURE 52º-130ºF.
10) N/A
11) ONE INSTALLED PUMP/MOTOR AND ONE UNINSTALLED SPARE PUMP/MOTOR.
12) Motor to be NRTL listed and/or labelled
13) N/A
14) N/A

ISSUE	DATE	SHEET	PROJECT # / REQ'N
6	3/3/2009	8 OF 10	25051

REV

EQUIPMENT DATA SHEET - NEMA FRAME INDUCTION MOTOR

REV

1 APPLICABLE TO: ○ STUDY ○ INQUIRY ● PURCHASE ○ AS BUILT

2 CLIENT: CH2M WG Idaho LLC — ITEM No. P-SRC-231 — NO. REQ'D: 2

3 FACILITY: ICP Integrated Waste Treatment Unit — SERVICE: Waste feed Pump Driver

4 LOCATION: Idaho National Laboratory - Scoville, ID — MFR/MODEL: [redacted] — SERIAL NO.

5

5 CRITICAL CHARACTERISTICS QUALITY LEVEL REQUIREMENTS		ACCEPTANCE METHODS SUPPLIED BY MOTOR MANUFACTURER OR BIDDER
7 MANUFACTURER'S TYPE AND FRAME DESIGNATION	●	THE CRITICAL CHARACTERISTICS DATA ARE AVAILABLE IN EXISTING DOCUMENTS SUCH AS THE DATA SHEETS.
8 HORSEPOWER OUTPUT	●	
9 TIME RATING	○	
10 MAXIMUM AMBIENT TEMPERATURE, DESIGNED	○	
11 TEMPERATURE RISE	○	
12 INSULATION SYSTEM	○	
13 RPM AT RATED LOAD	○	
14 FREQUENCY	○	ACCEPTANCE OF CRITICAL CHARACTERISTICS SHALL BE VERIFIED AND DOCUMENTED BY EQUIPMENT RECEIPT INSPECTION PERFORMED BY BUYER OR BUYER'S REPRESENTATIVE.
15 NUMBER OF PHASES	○	
16 RATED LOAD AMPERES	○	
17 VOLTAGE	○	
18 LOCKED ROTER AMPERES	○	
19 DESIGN LETER FOR MOTOR	○	
20 EFFICIENCY	○	
21 SERVICE FACTOR	○	
22 ENCLOSURE TYPE	○	
23		
24 OTHER	○	

25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 ### ###

ISSUE	DATE	SHEET	PROJECT # / REQUISITION #
6	3/3/2009	9 OF 10	25051

REV

EQUIPMENT DATA SHEET - LUBRICATION SCHEDULE

REV

APPLICABLE TO: ○ STUDY ○ INQUIRY ● PURCHASE ○ AS-BUILT

Client: CH2M WG Idaho LLC
Tag No.: P-SRC-231
Facility: Integrated Waste Treatment Unit
Service: WASTE FEED PUMP AND DRIVER
Location: Idaho National Laboratory
No. Req'd: 2

LUBRICATION REQUIREMENTS

EQUIPMENT TYPES **CENTRIFUGAL PUMP** NO. OF UNITS **2**
PARTS REQUIRING LUBRICATION **RADIAL AND THRUST BALL BEARINGS**
LUBRICANT TYPE (OIL/GREASE) **OIL SUPPLIED BY FIELD OPERATIONS THAT MEETS MFG. REQUIREMENTS**
LUBE SPECIFICATION
RECOMMENDED VISCOSITY (SUMMER) ____ SSU ____ °F (WINTER) ____ SSU ____ °F
INITIAL FILL CAPACITY ____ EST. ANNUAL FILL CAPACITY ____
PERIODIC REQUIREMENT ____ FREQUENCY ____
LUBRICANT TRADE NAMES

EQUIPMENT TYPES **ELECTRIC MOTOR** NO. OF UNITS **2**
PARTS REQUIRING LUBRICATION **ANTI-FRICTION BEARINGS - SEALED BEARINGS**
LUBRICANT TYPE (OIL/GREASE) **GREASE**
LUBE SPECIFICATION
RECOMMENDED VISCOSITY (SUMMER) ____ SSU ____ °F (WINTER) ____ SSU ____ °F
INITIAL FILL CAPACITY ____ EST. ANNUAL FILL CAPACITY ____
PERIODIC REQUIREMENT ____ FREQUENCY ____
LUBRICANT TRADE NAMES **EXXON UNIREX OR CHEVRON SRI-2**

EQUIPMENT TYPES ____ NO. OF UNITS ____
PARTS REQUIRING LUBRICATION
LUBRICANT TYPE (OIL/GREASE)
LUBE SPECIFICATION
RECOMMENDED VISCOSITY (SUMMER) ____ SSU ____ °F (WINTER) ____ SSU ____ °F
INITIAL FILL CAPACITY ____ EST. ANNUAL FILL CAPACITY ____
PERIODIC REQUIREMENT ____ FREQUENCY ____
LUBRICANT TRADE NAMES

EQUIPMENT TYPES ____ NO. OF UNITS ____
PARTS REQUIRING LUBRICATION
LUBRICANT TYPE (OIL/GREASE)
LUBE SPECIFICATION
RECOMMENDED VISCOSITY (SUMMER) ____ SSU ____ °F (WINTER) ____ SSU ____ °F
INITIAL FILL CAPACITY ____ EST. ANNUAL FILL CAPACITY ____
PERIODIC REQUIREMENT ____ FREQUENCY ____
LUBRICANT TRADE NAMES

NOTES:

ISSUE	DATE	PAGE	PROJECT # / REQ'N #
6	3/3/2009	10 OF 10	25051

APPENDIX D-2

Sintered Metal Filter Specifications

[Note: Data Sheets for F-SRC-153FE and F-SRC-160FE are considered OUO/CBI, this information is located in the OUO/CBI section of this Permit (Appendix VII)]

THOR Treatment Technologies

CLIENT:	CH2M WG Idaho LLC	**PROJECT NO.:**	28276
FACILITY:	Integrated Waste Treatment Unit	**ITEM NO.:**	F-SRC-190 FE
LOCATION:	Idaho National Laboratory	**ITEM DESCR.:**	Product Handling Vacuum Filter Elements

MECHANICAL EQUIPMENT DATA SHEET PACKAGE

Safety Significant

Yes ☐ No ■

Quality Level

QL1 ☐ QL2 ☐ QL3 ■ QL4 ☐

This title page is a record of all revisions of the data sheet package. Each time the data sheets are revised, the entire document will be reissued. For convenience, the nature of each revision is briefly noted below.

REV. NO.	DATE	BY	CHECKED	APPROVAL	SHEETS	NATURE OF REVISIONS
0	11/1/2006	/s/ C. Connell	/s/ M. Holden	/s/ A. Zindel	3	Revised per CWI Comments EFR 734 and incorporating COS-F-SRC-190 Rev. 0.
1	4/20/2007	/s/ C. Connell	/s/ J. Marquez	/s/ B. Levitt	4	Issued for CD-3 90% Design Review
2	6/20/2007	Cory Connell	J Marquez	B Levitt	4	Issued for CD-3

Rev. No.	LEAD PROC	LEAD MECH	LEAD PIPE	LEAD CIVIL	LEAD STRC	LEAD ARCH	LEAD ELEC	LEAD I & C	LEAD SYST	LEAD REMOTE HNDLG	QA	PEM	CDE	TTT CE	OPS MGR
0	/s/ RLH	/s/ AZ	---	---	---	---	---	---	/s/ MP	/s/ KL	/s/ HK	/s/ MP	---	/s/ AZ for BM	---
1	/s/ RLH	/s/ BJL	---	---	---	---	---	---	/s/ PM	/s/ KL	/s/ HK	/s/ NDA	---	---	---
2	RLH	BJL	---	---	---	---	---	---	M	KL	HK	NDA	---	---	---

LIMITED RIGHTS NOTICE

© 2006 CH2M?WG Idaho, LLC and THOR Treatment Technologies, LLC. All rights reserved.

THOR Treatment Technologies, LLC Confidential and Proprietary. This Document was prepared by and addresses technologies first conceived and developed by and at the expense of, THOR Treatment Technologies, LLC (TTT). TTT owns all right, title and interest in and to this Document and its contents. ------ TTT hereby grants CH2M?WG Idaho, LLC ("Prime") and the U.S. Department of Energy Idaho Operations Office ("DOE-Idaho") (together, the "Recipients"), and no others, the limited right to use the document for the limited purposes of Prime's performance of, and DOE-Idaho's administration of, Contract DE-AC07-05ID14516 (the "Purpose") and for no other purpose. Recipients may make limited copies of the Document for provision to those Recipient personnel, agents, consultants and contractors possessing an official need to know the information to carry out the Purpose and to no other persons or entities and provided the such further recipients are made subject to the terms of this Limited Rights Notice. Absent TTT's prior written permission, this Document may not be copied (including, without limit, storage on a retrieval system), further disseminated, or used for any other purpose. ------ This Document and its contents (i) are protected by the Trade Secrets Act, 18 USC 1905 and, therefore, use, copying or disclosure inconsistent with this disclaimer may be subject to civil and/or criminal penalties and equitable relief; and (ii) constitute trade secrets and/or sensitive commercial or financial data, the disclosure of which is likely to result in competitive harm to TTT and, therefore, is Not Releasable Under FOIA (5 USC 552(b)(4)). All copies of this Document and its contents, including references to, and quotations from, the same placed in other documents, shall contain this same legend.

PROFESSIONAL ENGINEER REGISTERED 9130 6/22/07 STATE OF IDAHO BRIAN J. LEVITT

Distribution:

Per Project Distribution Matrix

THOR Treatment Technologies / Washington Group International	EQUIPMENT DATA SHEET ■ Inquiry ☐ Proposal ☐ Study ☐ Project	ITEM NO. F-SRC-190 FE (Filter Elements)	PAGE: 2 OF 4 REV. 2

CLIENT: CWI	PROJECT: IWTU	JOB NUMBER: 28276	BY: JCC	DATE: 6/20/07

SERVICE:	MANUFACTURER	NO. REQ'D	SOURCE OF QUOTE
Product Handling Vacuum Filter		57/SET	

OPERATING CONDITIONS

FLUID FILTERED:	Vent and Vacuum Flow From The Canister Fill Station	MAX. ALLOW. ΔP: CLEAN:	0.2 PSID
		DIRTY:	2.2 (1) PSID
FLOW RATE: NORMAL:	99 SCFM	CONTAMINANTS:	
MAXIMUM:	124 SCFM		
INLET TEMPERATURE:	16-200 (70 Nom.) °C	FILTRATION REQUIRED:	99.97% of >0.3 micron Nom. 5 Micron absolute
INLET PRESSURE:	-5.0 to –0.2 (-3.6 nom.) PSIG		
DENSITY@ 150°C & –3.5 psig:	0.03033 lb/ft^3	PARTICLE SIZE REMOVAL:	0.3 MICRON PARTICLES, MICRON AEROSOLS
VISCOSITY @ INLET TEMP:			

DESIGN

TYPE: ☐ COALESCING ☐ ADSORBENT ☒ PARTICULATE ☐ POLISHING ☐ _____.

MODEL:		CONNECTIONS	
NUMBER OF CARTRIDGES:	57/SET (2)	INLET:	
CARTRIDGE SIZE:	3.14" OD X 59"L (80 mm X 1.5M)	OUTLET:	
FILTERING MEDIA:	Cylindrical Pleated Sintered Metal Fiber	DRAINS:	
FILTERING AREA:	570 ft^2	PRESSURE GAUGES:	
DESIGN PRESSURE:	175 (250°C) PSIG	RELIEF VALVE:	
DESIGN TEMPERATURE:	482 °C	RELIEF VALVE SETTING:	

CODES & STANDARDS: See Specification 15865 Sintered Metal Filter Elements

TYPE COVER: ☐ SINGLE BOLT ☐ MULTIPLE BOLT ☐ SWING BOLT ☐ LIFTING SCREW ☐ HANDWHEEL

MATERIALS

TRIM: ☐ INCONEL 600, 601 OR 625 ☐ STEEL ☐ 304 SS ☒ 316L SS ☐ BRASS ☐ BRONZE

GASKETS: ☐ TEFLON ☐ ASBESTOS ☐ LEAD ☐ NEOPRENE ☐ VELEMOID ☒ BY SUPPLIER

FILTRATION MEDIA: ☐ COTTON ☐ CELLULOSE ☐ ACETATE ☐ GLASS FIBER ☐ NYLON
☐ JUTE ☐ PAPER ☐ ACTIVATED CARBON ☐ BOROSILICATE GLASS FIBERS
☐ CERAMIC ☐ SINTERED BRONZE ☐ ACTIVATED ALUMINA ☒ SINTERED 316L

CENTER CORE: ☐ PHEONOLIC ☐ HARD RUBBER ☐ 304 SS ☒ 316L SS ☐ INCONEL 600, 601, 625

NOTES

1) Differential pressure rating across elements to be 50 psid for design of crush pressure (external) at maximum temperature and 10 psid for design burst pressure (internal).

2) Filter bundles will be configured as 3 bundles of 19 elements. Each bundle of filter elements is connected with a tube sheet. See figure page 3 .

3) Tubesheet attachment method: 2" nps sch. 40 welded end connection (or equivalent).

4) Cleaning method: reverse jet pulse, dry nitrogen with up to 150 psig supply pressure.

5) Filters may be decontaminated using 2M nitric acid.

LIMITED RIGHTS NOTICE. This document is subject to the terms of the Limited Rights Notice contained on its cover page.

THOR Treatment Technologies

CLIENT:	CH2M WG Idaho LLC	**PROJECT NO.:**	28276
FACILITY:	Integrated Waste Treatment Unit	**ITEM NO.:**	F-SRC-191 FE
LOCATION:	Idaho National Laboratory	**ITEM DESCR.:**	Product Receiver Filter Elements

MECHANICAL EQUIPMENT DATA SHEET PACKAGE

Safety Significant

Yes ☐ No ■

Quality Level

QL1 ☐ QL2 ☐ QL3 ■ QL4 ☐

This title page is a record of all revisions of the data sheet package. Each time the data sheets are revised, the entire document will be reissued. For convenience, the nature of each revision is briefly noted below.

REV. NO.	DATE	BY	CHECKED	APPROVAL	SHEETS	NATURE OF REVISIONS
0	11/1/2006	/s/ C. Connell	/s/ M. Holden	/s/ A. Zindel	3	Revised per CWI Comments EFR 734 and incorporating COS-F-SRC-191 Rev. 0.
1	4/20/2007	/s/ C. Connell	/s/ J. Marquez	/s/ B. Levitt	4	Issued for CD-3 90% Design Review
2	6/20/2007	Cody Connell	J Marquez	B Levitt	4	Issued for CD-3

Rev. No.	LEAD PROC	LEAD MECH	LEAD PIPE	LEAD CIVIL	LEAD STRC	LEAD ARCH	LEAD ELEC	LEAD I & C	LEAD SYST	LEAD REMOTE HNDLG	QA	PEM	CDE	TTT CE	OPS MGR
0	/s/ RLH	/s/ AZ	---	---	---	---	---	---	/s/ MP	/s/ KL	/s/ HK	/s/ MP	---	/s/ AZ for BM	---
1	/s/ RLH	/s/ BJL	---	---	---	---	---	/s/ MR	/s/ PM	/s/ KL	/s/ HK	/s/ NDA	---	---	---
2	RLH	BJL	---	---	---	---	---	—	M	KL	HK	NDA	---	---	---

LIMITED RIGHTS NOTICE

© 2006 CH2M?WG Idaho, LLC and THOR Treatment Technologies, LLC. All rights reserved.

THOR Treatment Technologies, LLC Confidential and Proprietary. This Document was prepared by and addresses technologies first conceived and developed by and at the expense of, THOR Treatment Technologies, LLC (TTT). TTT owns all right, title and interest in and to this Document and its contents. ----- TTT hereby grants CH2M?WG Idaho, LLC ("Prime") and the U.S. Department of Energy Idaho Operations Office ("DOE-Idaho") (together, the "Recipients"), and no others, the limited right to use the document for the limited purposes of Prime's performance of, and DOE-Idaho's administration of, Contract DE-AC07-05ID14516 (the "Purpose") and for no other purpose. Recipients may make limited copies of the Document for provision to those Recipient personnel, agents, consultants and contractors possessing an official need to know the information to carry out the Purpose and to no other persons or entities and provided the such further recipients are made subject to the terms of this Limited Rights Notice. Absent TTT's prior written permission, this Document may not be copied (including, without limit, storage on a retrieval system), further disseminated, or used for any other purpose. ----- This Document and its contents (i) are protected by the Trade Secrets Act, 18 USC 1905 and, therefore, use, copying or disclosure inconsistent with this disclaimer may be subject to civil and/or criminal penalties and equitable relief; and (ii) constitute trade secrets and/or sensitive commercial or financial data, the disclosure of which is likely to result in competitive harm to TTT and, therefore, is Not Releasable Under FOIA (5 USC 552(b)(4)). All copies of this Document and its contents, including references to, and quotations from, the same placed in other documents, shall contain this same legend.

Distribution:

Per Project Distribution Matrix

PROFESSIONAL ENGINEER REGISTERED 9130 STATE OF IDAHO BRIAN J. LEVITT

THOR Treatment Technologies / Washington Group International	EQUIPMENT DATA SHEET ☒ Inquiry ☐ Proposal ☐ Study ☐ Project	ITEM NO. F-SRC-191 FE (Filter Elements)	PAGE: 2 OF 4 REV. 2

CLIENT: CWI	PROJECT: IWTU	JOB NUMBER: 28276	BY: JCC	DATE: 6/20/07

SERVICE: PRODUCT RECEIVER FILTER	MANUFACTURER	NO. REQ'D 57/SET	SOURCE OF QUOTE

OPERATING CONDITIONS

FLUID FILTERED:	VENT FLOW FROM THE PRODUCT RECEIVER COOLERS	MAX. ALLOW. ΔP: CLEAN:	0.4 PSID
		DIRTY:	2.2 PSID
FLOW RATE: NORMAL:	806 SCFM	CONTAMINANTS:	
MAXIMUM:	1008 SCFM		
INLET TEMPERATURE:	16 TO 250 (200 NOM) °C	FILTRATION REQUIRED:	99.9% OF >2.0 MICRON 5 MICRON ABSOLUTE
INLET PRESSURE:	-8 TO 5 (-5.0 NOM.) PSIG		
DENSITY @ 141°C AND 15.1 PSIA:	0.053 lb/ft^3	PARTICLE SIZE REMOVAL:	2.0 MICRON PARTICLES, MICRON AEROSOLS
VISCOSITY @ INLET TEMP:			

DESIGN

TYPE: ☐ COALESCING ☐ ADSORBENT ☒ PARTICULATE ☐ POLISHING ☐ _____.

MODEL:		CONNECTIONS	
NUMBER OF CARTRIDGES:	57/SET	INLET:	
CARTRIDGE SIZE:	3.14" OD by 59"L (80 mm X 1.5 M)	OUTLET:	
FILTERING MEDIA:	CYLINDRICAL PLEATED SINTERED METAL FIBER	DRAINS:	
FILTERING AREA:	570 FT^2	PRESSURE GAUGES:	
DESIGN PRESSURE:	175 PSIG	RELIEF VALVE:	
DESIGN TEMPERATURE:	450 °C	RELIEF VALVE SETTING:	

CODES & STANDARDS: See Specification 15865 Sintered Metal Filter Elements

TYPE COVER: ☐ SINGLE BOLT ☐ MULTIPLE BOLT ☐ SWING BOLT ☐ LIFTING SCREW ☐ HANDWHEEL

MATERIALS

TRIM: ☐ CAST IRON ☐ STEEL ☐ 304 SS ☒ 316L SS ☐ BRASS ☐ BRONZE

GASKETS: ☐ TEFLON ☐ ASBESTOS ☐ LEAD ☐ NEOPRENE ☐ VELEMOID ☒ BY SUPPLIER

FILTRATION MEDIA: ☐ COTTON ☐ CELLULOSE ☐ ACETATE ☐ GLASS FIBER ☐ NYLON
☐ JUTE ☐ PAPER ☐ ACTIVATED CARBON ☐ BOROSILICATE GLASS FIBERS
☐ CERAMIC ☐ SINTERED BRONZE ☐ ACTIVATED ALUMINA ☒ _SINTERED _INCONEL 601___

CENTER CORE: ☐ PHEONOLIC ☐ HARD RUBBER ☐ 304 SS ☒ 316L SS ☐ _____

NOTES

1) DIFFERENTIAL PRESSURE RATING ACROSS ELEMENTS TO BE 50 PSID FOR DESIGN OF CRUSH PRESSURE (EXTERNAL) AT MAXIMUM TEMPERATURE AND 10 PSID FOR DESIGN BURST PRESSURE (INTERNAL).

2) FILTER BUNDLES WILL BE CONFIGURED AS 3 BUNDLES OF 19 ELEMENTS. EACH BUNDLE OF FILTER ELEMENTS IS CONNECTED WITH A TUBE SHEET. SEE FIGURE PAGE 3.

3) TUBESHEET ATTACHMENT METHOD: 2" NPS SCH. 40 WELDED END CONNECTION

4) CLEANING METHOD: REVERSE JET PULSE, DRY NITROGEN WITH UP TO 150 PSIG SUPPLY PRESSURE.

5) FILTERS MAY BE DECONTAMINATED USING 2M NITRIC ACID.

LIMITED RIGHTS NOTICE. This document is subject to the terms of the Limited Rights Notice contained on its cover page.

APPENDIX D-3

IWTU GAC Bed Adsorbers Breakthrough Calculations

THOR Treatment Technologies / Washington Group International	Mercury Adsorbers GAC Bed Breakthrough Calc. 28276-21-089	**Project No.:** 28276

DESIGN DOCUMENT COVER SHEET

Project Name: IWTU **Document #:** 28276-21-089

Client: CWI

Latest Revision: 1

Revision Signatures

Mary Pong	5·1·08	John Tressell	5·2·08
Prepared by	Date	Approved by QA	Issue Date
Sarah Morrow	5/1/08	N. D. Amaria	5-2-08
Reviewed/Checked by	Date	Approved by Engineering Manager	Date

Safety Significant

Yes ☒ No ☐

Quality Level QL1 ☐ QL2 ☒ QL3 ☐ QL4 ☐

Status	Rev. No.	Date	Prepared By	Pages	Description of Changes
Final	0	1/17/07	N. Kendl	7	Issue for design freeze
Final	1	5/1/08	M. Pong mp	7	Increased bed height and gas flowrate per cost reduction. Reduced mercury flowrate per latest mass balance.

THOR Treatment Technologies	Calculation Set No. 28276-21-089		Rev No. 1
Calculation Summary & Control Sheet	Prelim	Final X	Void

Project:	ICP – Integrated Waste Treatment Unit	Sheet 1 of 3	
Discipline:	Process	Project No:	28276
Structure or System	Process Off-gas	Quality Classification:	2
Subject:	Mercury Adsorbers GAC Bed Breakthrough		

Completed by:	Max Pong Max Pong	Date	5/1/08
Checked by:	Sarah Morroni Sarah Morroni	Date	5/1/08
Approved by (LDE or Department Manager)	Rich Henkel	Date	5/2/08

Distribution: Lead Process Engineer

Affected Documents:

Reason for Revision:
Increased bed height and gas flowrate per cost reduction. Reduced mercury flowrate per latest mass balance.

Total number of sheets in this issue: 7

Sheets revised, added or deleted: Sheets 1-3, Att. 1

Problem Statement:
Determine when the mercury adsorber primary GAC bed will be depleted.

Summary Conclusions:
Based on the HF-1250 Case Material and Energy Balance Rev. 4, with an average SBW feedrate of 2.5 gpm, the mercury adsorber primary bed will breakthrough in 168 days of continuous operation. The mercury adsorber will be loaded at a slower rate if the process is operating at less than the average flowrate.

Thor Treatment Technologies	Calculation Set No. 28276-21-089		Rev No. 1
Calculation Summary & Control Sheet	Prelim	Final X	Void

Project:	ICP – Integrated Waste Treatment Unit	Sheet 2 of 3	
Discipline:	Process	Project No:	28276
Structure or System	Process Off-gas	Quality Classification:	2
Subject:	Mercury Adsorbers GAC Bed Breakthrough		

Design Basis:

1. Mercury concentration in the SBW feed is the average concentration from the SBW tank farm feed tanks (WM-187, WM-188, and WM-189), 4.261 x 10^{-3} gmole/liter (Ref. 1, sheet SBW Feed).
2. Quantity of SBW to be treated in the IWTU (944,097 gallons) includes estimates for rinse water. (Ref. 1, sheet SBW Feed)
3. Mercury in off-gas (485.3 g/hr = 1.070 lb/hr) based on the on the HF-1250 stream summary for stream 98 (Ref. 1).
4. Mercury adsorber bed size (12 ft dia x 7.5 ft high) based on Rev. 3 of the Mercury Adsorbers conditions of service data sheet. (Ref. 2).
5. An average throughput of 2.5 gpm of SBW feed is used in the calculation (Ref. 1).
6. Mersorb (3 mm) or typical to be used for granular activated carbon (GAC) bed. Density information from the Mersorb product data sheet is used in the calculation (Ref. 4).
7. Adsorption capacity of the GAC is >20 g Hg / 100 g Mersorb based on vendor information (Ref. 3). Mercury capacity before breakthrough is conservatively estimated at 15 g Hg per 100 g of Mersorb (GAC) based on Hazen testing per B. Mason.
8. Depletion of the GAC bed due to high temperature is assumed negligible.

Unverified assumptions/Open items:

None

References: (Specifications, Drawings, codes, calculations, texts, reports, computer data design input documents, etc.)

1. CWI calculation 28276-21-001 Rev. 4, Mass and Energy Balance.
2. Mercury Adsorbers Conditions of Service, COS-F-SRH-141-A/B, Rev. 3.
3. Nucon International, Inc. vendor information, NUCON Bulletin 11B28, August 2004.
4. Mersorb product data information (Attachment 2, 2 pages).
5. Calculation 28276-21-005 Rev. 2, Process Exhaust Blowers

Computer Program Disclosure Information: N/A

Program Used: (name)	Rev. No.	Rev. Date	Program Type	TTT Verified Yes No
None				

Analysis description:	Run No.	Result:

The attached computer output has been reviewed, the input data checked, and the results approved for release.

Input criteria by:	Date:	Checked by:	Date:
Run by:	Date:	Approved by:	Date:

THOR Treatment Technologies	Calculation Set No. 28276-21-089	Rev No. 1	Comp. by MP 5.1.08	Chk'd by Smm 5/1/08
General Computation Sheet	Prelim / Final x		Date	Date
Project: **Integrated Waste Treatment Unit**	Sheet 3 of 3			
Subject: Mercury Adsorbers GAC Bed Breakthrough	Project No. 28276			

Mercury Present in the SBW (Ref. 1, sheet SBW Feed)
See Attachment 1 for composition of SBW
Total SBW = 944,097 gal
Mercury concentration = .004261 gmoles/liter
Mercury molecular wt = 200.6 grams/liter

944,097 gal x 3.785 liter/gal x .004261 gmoles/liter x 200.6 g/gmole x lb/453.6 g = 6734 lb Hg

From the MEB (Ref. 1) stream 98
Average mercury flowrate = 485.3 g/hr x lb/453.6 g = 1.070 lb/hr Hg

Process Off-gas Conditions (Ref. 5)
Pressure = 11.37 psia
Temperature = 145°C, 170°C max.
Off-Gas Flow = 5596 acfm for HF-1250 case
Design Off-Gas Flow = (5596 * 1.25) = 7108 acfm

Granular Activated Carbon (GAC) Specifications
Mercury Adsorber Vessel Diameter = 12 ft (Ref. 2)
Mercury Adsorber Vessel Height (approx.) = 15.5 ft (Ref. 2)
GAC Bed depth = 7.5 ft (Ref. 2)
GAC cross sectional area = (pi * (12 ft /2)^2) = 113 ft^2
GAC bed volume = 113 ft^2 x 7.5 ft = 848.25 ft^3
Density of GAC bed = 34 lb/ ft^3 (Ref. 4, 3 mm Mersorb pellets)
GAC weight each bed = 34 lb/ft^3 * 848.25 ft^3 = 28,840 lb

Mersorb Adsorption Capacity and Bed Change Requirement
Design Condition: 15 g Hg / 100 g Mersorb

Mercury Bed Change: 28,840 lbs Mersorb * 15 wt% = 4326 lbs Hg adsorbed / GAC bed
The SBW process in the IWTU has approximately 6734 lbs Hg ÷ (4326 lb Hg / GAC bed) = 1.56 primary GAC bed replacements required. (This does not include the disposal of the secondary bed upon IWTU conclusion.)

If operating at 2.5 gpm SBW feedrate, Hg vapor average flow rate equals 1.070 lbs/hr. The first GAC bed adsorbs 99.99% of the mercury in the off-gas vapor (1.07 lb/hr *.9999) = 1.0699 lb/hr adsorbed.

At constant operation: 4326 lbs Hg will load the first GAC bed at a rate of 1.0699 lbs/hr, therefore the first bed will need to be changed out every 4043 hours or every 168 days (4326 lbs Hg ÷ 1.0699 lb/hr).

Assume IWTU plant availability 70%, at this plant rate, the primary mercury adsorber GAC breakthrough will occur after approximately 241 days of operation.

Data from sheet SBW Feed (Ref. 1)

		Tank	WM-187	WM-188	WM-189	Jet water	Total
		Gallons	276,463	282454.43	282354	102825.95	944097.38
		sg	1.28E+00	1.31E+00	1.32E+00	1.00E+00	1.27E+00
			mol/l	mol/l	mol/l	mol/l	mol/l
1.01	H+	H+	1.58E+00	3.09E+00	2.66E+00	0.00E+00	2.18E+00
26.98	Al	Al+3	5.43E-01	7.45E-01	6.89E-01	0.00E+00	5.88E-01
243.00	Am	Am+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
121.76	Sb	Sb+5	5.07E-06	8.62E-06	1.89E-06	0.00E+00	4.63E-06
74.92	As	As+5	3.60E-06	3.91E-06	3.92E-06	0.00E+00	3.40E-06
137.37	Ba	Ba+2	6.21E-05	1.06E-04	5.89E-05	0.00E+00	6.76E-05
9.01	Be	Be+2	8.15E-06	1.74E-05	1.68E-05	0.00E+00	1.26E-05
10.81	B	B+3	9.27E-03	2.10E-02	1.94E-02	0.00E+00	1.48E-02
79.90	Br	Br-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
112.41	Cd	Cd+2	7.45E-04	3.15E-03	3.58E-03	0.00E+00	2.23E-03
40.08	Ca	Ca+2	4.25E-02	7.29E-02	7.13E-02	0.00E+00	5.56E-02
12.01	C		3.39E-02	3.39E-02	1.22E-02	8.33E-02	3.28E-02
140.12	Ce	Ce+4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
132.91	Cs	Cs+	1.05E-05	3.90E-05	2.67E-05	0.00E+00	2.27E-05
35.45	Cl	Cl-	2.01E-02	1.69E-02	2.61E-02	0.00E+00	1.88E-02
52.00	Cr	Cr+3	3.19E-03	6.09E-03	5.64E-03	0.00E+00	4.44E-03
58.93	Co	Co+2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
63.55	Cu	Cu+2	2.38E-09	8.62E-04	9.51E-04	0.00E+00	5.42E-04
	Cm		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Dy		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
151.97	Eu	Eu+3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
19.00	F	F-	3.71E-03	7.63E-03	7.79E-03	0.00E+00	5.70E-03
157.25	Gd	Gd+3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
72.61	Ge	Ge+4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
114.82	In	In+3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
126.90	I	I-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55.85	Fe	Fe+3	1.91E-02	2.73E-02	2.67E-02	0.00E+00	2.18E-02
138.91	La	La+3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
207.20	Pb	Pb+2	1.07E-03	1.12E-03	1.15E-03	0.00E+00	9.92E-04
6.94	Li	Li+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
24.31	Mg	Mg+2	2.37E-02	2.77E-02	2.21E-02	0.00E+00	2.18E-02
54.94	Mn	Mn+4	1.35E-02	1.67E-02	1.93E-02	0.00E+00	1.47E-02
200.59	Hg	Hg+2	1.65E-03	6.31E-03	6.32E-03	0.00E+00	4.261E-03
95.94	Mo	Mo+6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
144.24	Nd	Nd+3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
237.00	Np	Np+4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
58.69	Ni	Ni+2	2.03E-03	2.88E-03	2.37E-03	0.00E+00	2.16E-03
92.91	Nb	Nb+5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
62.01	NO3	NO3	5.16E+00	7.55E+00	7.09E+00	0.00E+00	5.89E+00
106.42	Pd	Pd+4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
94.97	PO4	PO4	7.66E-03	7.47E-04	2.34E-03	0.00E+00	3.17E-03
239.00	Pu	Pu+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
39.10	K	K+	1.86E-01	2.08E-01	2.40E-01	0.00E+00	1.88E-01
140.91	Pr	Pr+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
145.00	Pm	Pm+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
102.91	Rh	Rh+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Data from sheet SBW Feed (Ref. 1)

		Tank	WM-187	WM-188	WM-189	Jet water	Total
		Gallons	276,463	282454.43	282354	102825.95	944097.38
		sg	1.28E+00	1.31E+00	1.32E+00	1.00E+00	1.27E+00
			mol/l	mol/l	mol/l	mol/l	mol/l
85.47	Rb	Rb+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
101.07	Ru	Ru+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
150.36	Sm	Sm+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
78.96	Se	Se+	0.00E+00	4.73E-06	9.76E-07	0.00E+00	1.71E-06
28.09	Si	Si+	3.27E-04	4.12E-04	4.03E-04	0.00E+00	3.40E-04
107.87	Ag	Ag+	1.68E-06	4.39E-06	2.89E-06	0.00E+00	2.67E-06
22.99	Na	Na+	1.76E+00	1.74E+00	1.94E+00	0.00E+00	1.62E+00
87.62	Sr	Sr+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
96.06	SO4	SO4	6.44E-02	5.93E-02	5.95E-02	0.00E+00	5.44E-02
98.91	Tc	Tc+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
127.60	Te	Te+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
158.93	Tb	Tb+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
204.38	Tl	Tl+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
232.04	Th	Th+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Tm		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
118.71	Sn	Sn+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
47.87	Ti	Ti+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
238.03	U	U+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50.94	V	V+	1.47E-05	2.74E-05	2.54E-05	0.00E+00	2.01E-05
88.91	Y	Y+	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
65.39	Zn	Zn+	9.53E-04	1.07E-03	1.14E-03	0.00E+00	9.42E-04
91.22	Zr	Zr+	2.54E-05	2.57E-03	3.58E-04	0.00E+00	8.85E-04
18.02		H2O	4.53E+01	4.20E+01	4.38E+01	5.55E+01	4.50E+01
32.00		O-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Totals						
	SG	sg	1.27565009	1.31496996	1.32167477	1.001	
			g/liter	g/liter	g/liter	g/liter	
12.01	TOC	TOC	0.41	0.41	0.15	0	
	SBW Solid	UDS	62.9681686	2.93488861	2.934019	0	

28276-21-089 Rev 1
Att. 2 SWA 1 of 2

Selective Adsorption Associates, Inc.
534 Gables Court Langhorne, PA 19047 USA
YOUR ONE-STOP ADSORBENT SHOP

PRODUCT DATA

MERSORB®

MERCURY ADSORBENT

MERCURY VAPOR REMOVAL FROM: AIR, HYDROGEN, & OTHER GASES

BENEFITS

- Longer Service Life
- High Hg Removal Efficiency
- Less Blower Horsepower Required
- Clean Operation
- Proven Performance
- Dependable Technical Support

PERFORMANCE FEATURES

- Pellets Minimize Flow Channelling, thus Maximizing Adsorbent Performance
- 50 % Lower Pressure Drop than 4x10 granular
- Hard, Low Dust Pellets
- Many Commercial Installations, Worldwide
- Backed by Extensive Lab & Field Test Data

PRODUCT FEATURES

- FORM: Extruded Pellets of Uniform Diameter, Available in Pellet Diameters of 1.5 mm, 3 mm, or 4 mm.
- IMPREGNATION: Elemental Sulfur Dispersed on High Surface Area Activated Carbon.
- SURFACE AREA of CARBON SUBSTRATE: 1,000 sq. meters per gram (by N_2 BET test method)
- HARDNESS: 97 % Hardness, Minimum (ASTM D 3802)
- PACKED BULK DENSITY: 34 Lbs per Cu. Ft. (550 Kg/Cu. Meter)(ASTM D 2854)
- SULFUR CONTENT: 13 Wt. %, Typical
- MERCURY CAPACITY: ≥ 20 Wt. % Hg Adsorption Capacity is Typical in Dynamic, Gas-Treatment Applications
- MOISTURE CONTENT: 3 Wt. %, Maximum (ASTM D 2867)
- pH: 6-8 (ASTM D 3838)
- RECYCLING: Spent, Hg-loaded Adsorbent Can Be Processed by Mercury Recycling Companies.

APPLICATIONS

MERSORB® mercury adsorbent has proven performance in many commercial applications requiring removal of mercury vapor to extremely low concentrations in air, hydrogen, and other gases. Typically, a gas contact time of 10 seconds is used in designing process systems with MERSORB® adsorbent. MERSORB® mercury adsorbent installations have

28276-21-089 Rev 1
Att. 2 Sht 2 of 2

demonstrated performance for reducing mercury concentrations to < 1 microgram Hg/Nm^3 in both dry and water saturated gases, with appropriate gas contact times. Extensive technical data, adsorption design and field technical services are available.

CAUTION: Wet activated carbon removes oxygen from air. Thus, an asphyxiation hazard exists inside enclosed spaces containing activated carbon. Use appropriate safety precautions when entering vessels or other enclosed spaces containing activated carbon.

MERSORB® is a registered trademark of NUCON International, Inc. (NUCON®) for impregnated activated carbons used to remove mercury from gases and liquids. Information presented herein is believed to be accurate and reliable but does not provide any guarantee or warrantee by NUCON International, Inc. or by Selective Adsorption Associates, Inc. Nothing herein shall be construed as an invitation to use processes covered by patents without proper arrangements with individuals or companies owning those patents.

Selective Adsorption Associates, Inc. 534 Gables Court Langhorne, PA 19047 USA
Telephone: (215) 702-0323 FAX: (215) 702-0577 Email: saai@selectiveadsorption.com

---

Copyright 1998-2001 © Selective Adsorption Associates, Inc.
Site design by Competitive Design Services
http://www.selectiveadsorption.com

APPENDIX D-4

Protocol for IWTU Systems Warm-Up and Initiation of Waste Feed

IWTU Heat-Up Sequence

Purpose

This document provides an overview of the start-up sequence of the Integrated Waste Treatment Unit (IWTU). The start-up sequence begins with the plant at cold shutdown with all systems de-energized or isolated. The sequence assumes that the plant has been constructed, has passed all required commissioning and Operational Readiness Review requirements, and has no procedural hold points that prevent start-up.

Heat-Up Sequence

1. Verify that the following utility services are aligned and prepared to support system start-up:
    a. Electrical power to Power Distribution Centers and to each individual motor and panel,
    b. Compressed air to plant is available at required pressure,
    c. Nitrogen storage tanks have sufficient volume and/or additional tankers are on order as needed to maintain liquid nitrogen levels above minimum inventory requirements,
    d. Oxygen storage tanks have sufficient volume and/or additional oxygen tankers are on order as needed to maintain liquid oxygen levels above minimum inventory requirements,
    e. Treated water is available at the required pressure and quality,
    f. Ensure steam is available.
2. Verify that the following consumables are available in the amounts needed to support start-up and continued operation following start-up:
    a. Coal storage silos have sufficient volume and/or additional bulk supplies are available as needed,
    b. Coke carbon storage silo has sufficient volume and/or additional bulk supplies are available as needed,
    c. Aluminum hydroxide Carbon Reduction Reformer (CRR) additive hopper has sufficient volume and/or additional bulk supplies are available as needed,
    d. CRR alumina fluidized bed media hopper has sufficient volume and/or additional bulk supplies are available as needed,
    e. Denitration and Mineralization Reformer (DMR) alumina start-up bed media hopper has sufficient volume and/or bulk supplies are available as needed,
3. Start up or verify operation of the IWTU building ventilation system including inlet air supply conditioning units, ventilation blowers, building high efficiency particulate air (HEPA) filters, and radiation and other stack monitor systems.
4. Perform process system checkout valve alignment.
5. Align nitrogen, treated water, and air to all process instrument and purge racks,
6. Verify nitrogen purges are on to the following:

   a. Pressure transmitters,
   b. Solids transfer and packaging system line purges,
   c. Additive feeders and airlocks,
   d. Process equipment including hoppers, feeders, and filters,
   e. Waste feed injectors on the DMR
   f. Oxygen/air injectors on the CRR.

7. Start up the process offgas system, including offgas and process exhaust blowers, and process HEPA filters.
8. Start-up and ensure calibration checks on the process and offgas monitor systems:
   a. Continuous Emissions Monitoring System (CEMS),
   b. Hydrogen monitors on the outlet of the Process Gas Filter/DMR,
   c. Stack monitors.
9. Start nitrogen fluidizing gas flow through the superheater to the DMR and on through the stack.
10. Start heat-up of the process system by energizing the superheater and slowly increasing the nitrogen fluidizing gas temperature. (The Process Gas Filter, CRR, Offgas Cooler, Offgas Filter, HEPAs, and offgas system will gradually heat-up in series using heat from the hot nitrogen introduced into the DMR).
11. When DMR average bed temperature is > 150°C, then adjust DMR bed level by adding start-up alumina media to the DMR bed..
12. During heat-up verify that the Process Gas Filter and Offgas Filter nitrogen pulse back systems are functional and operating.
13. During heat-up verify that the Offgas Cooler water spray cooling is working and all functions of the Offgas Cooler water and nitrogen atomizing gas supply are functional and at required levels and pressures.
14. Continue DMR heat-up until the DMR reaches ≥ 350°C, then introduce coal into the DMR bed and add oxygen to the DMR to provide additional energy input. (Oxygen to the DMR is provided by a combination of air to the atomizing gas input to the waste feed injectors and oxygen input with the nitrogen to the fluidizing gas injectors).
15. Continue DMR heat-up until the DMR reaches operating temperature. Adjust oxygen and coal inputs to the DMR to maintain steady operating temperature.
16. When CRR average bed temperature is > 150°C, then adjust the CRR bed level as necessary by adding start-up alumina media to the CRR.
17. Ensure CRR oxygen/air injection is aligned to the CRR inlet distributor.
18. Ensure the CRR outlet oxygen heated probe sensor is operational and calibrated.

APPENDIX D-5

Risk Assessment for Air Emissions from the Integrated Waste Treatment Unit and INTEC Liquid Waste Management System

RPT-354
Revision 1

Risk Assessment for Air Emissions from the Integrated Waste Treatment Unit and INTEC Liquid Waste Management System

April 2007

Idaho Cleanup Project

CH2M • WG Idaho, LLC is the Idaho Cleanup Project contractor for the U.S. Department of Energy

RPT-354
Revision 1
Project No. 25051

Risk Assessment for Air Emissions from the Integrated Waste Treatment Unit and INTEC Liquid Waste Management System

April 2007

Idaho Cleanup Project
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14516

ABSTRACT

This risk assessment evaluates potential human health and ecological impacts due to air emissions from the INTEC Liquid Waste Management System (ILWMS) and the proposed Integrated Waste Treatment Unit (IWTU), both located at the Idaho Nuclear Technology and Engineering Center on the Idaho National Laboratory (INL) Site. Cumulative impacts from other contributing sources (e.g., Idaho CERCLA Disposal Facility [ICDF]) calculated in previous risk assessments are included. U.S. Environmental Protection Agency (EPA) guidance in *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* was used to evaluate continuous exposure to contaminant air and soil concentrations at on- and off-INL locations where maximum modeled impacts occurred. Both inhalation and ingestion pathways were evaluated with the latter including incidental soil and food product ingestion, including produce, beef, dairy, pork, and poultry/eggs. Four human exposure scenarios were evaluated in addition to an inhalation assessment for motorists on U.S. Highway 20/26 and an acute inhalation assessment at the point of maximum air concentration. Ecological risk was evaluated at the location of maximum contaminant soil concentration using ecologically based screening levels.

The maximum lifetime cancer risk from emissions from the Process Equipment Waste Evaporator, Liquid Effluent Treatment & Disposal facility, and the IWTU is estimated to be 4.8E-08, about 0.5% of the EPA risk target criterion (1E-05). The maximum non-cancer hazard index is estimated to be 0.0089, about 4% of the EPA hazard target criterion (0.25). Cumulative impacts from the Evaporator Tank System and the ICDF, which were calculated in previous risk assessments, increase these estimates to 9E-08 risk (1% of target) and <0.02 hazard index (7% of target). Maximum short-term inhalation impacts on Highway 20/26 are less than State of Idaho toxic air pollutant criteria, and the maximum 1-hour concentrations are less than EPA acute inhalation exposure criteria. The total screening level ecological hazard quotient from all sources is 0.64, compared to a conservative target criterion of 1.0. Uncertainties in these estimates are discussed in detail. These results demonstrate that the IWTU and ILWMS emissions, combined with other potentially contributing INL sources, do not pose a risk to human health or the environment.

CONTENTS

ABSTRACT iii

ACRONYMS ix

1. PURPOSE AND SCOPE 1

2. FACILITY AND SOURCE CHARACTERIZATION 2

   2.1 Facility Location 2

   2.2 IWTU SBW Process Description 2

   2.3 IWTU Emissions 5

   2.4 LET&D and PEWE Emissions 8

   2.5 ETS Emissions 8

   2.6 Other Potentially Contributing Sources 9

3. RISK ASSESSMENT GUIDELINES 10

   3.1 EPA Protocol 10

   3.2 Target Risk Criteria 10

4. AIR MODELING METHODOLOGY 11

   4.1 Control Options Input 11

   4.2 Source Input – IWTU Stack 12

   4.3 Source Input – INTEC Main Stack 12

   4.4 Receptor Grids 13

   4.5 Meteorological Information 14

   4.6 Modeling Runs 15

5. EXPOSURE ASSESSMENT 16

   5.1 Exposure Scenarios 16

   5.2 Exposure Pathways, Media Concentrations, and Intakes 17

6. RISK AND HAZARD CHARACTERIZATION 18

7. ECOLOGICAL RISK ASSESSMENT 18

8. UNCERTAINTY EVALUATION 19

9. RESULTS 19

9.1 Air Modeling 19

9.2 Human Health Impacts 27

9.2.1 Off-INL Public Health Impacts – ILWMS and IWTU 27
9.2.2 Contributions from Other Sources 33
9.2.3 Impacts to Public Motorists 33
9.2.4 Acute Inhalation Risk to a Worker 34
9.2.5 Ecological Risk 36

9.3 Human Health Risk Assessment Uncertainty 37

9.3.1 Uncertainty Associated with COPC Emission Rate Characterization 37
9.3.2 Uncertainty Associated with Air Modeling 38
9.3.3 Uncertainty Associated with Exposure Assessment 39
9.3.4 Uncertainty Associated with COPC Toxicity 39
9.3.5 Uncertainty Associated with Risk Characterization 39

9.4 Ecological Risk Assessment Uncertainty 39

9.4.1 Uncertainty Associated with Exposure Assessment 39
9.4.2 Uncertainty Associated with Ingestion Rates 40
9.4.3 Uncertainty Associated with Uptake Factors 40
9.4.4 Uncertainty Associated with Toxicity Reference Values 40
9.4.5 Uncertainty Associated with Functional Groups 40

10. REFERENCES 40

Appendix A—LET&D and PEWE COPC Offgas Emission Rates 43

Appendix B—Equations and Parameter Values EPA Human Health Risk Assessment Protocol 57

FIGURES

1. Location of the Idaho Nuclear Technology and Engineering Center on the INL Site 3

2. IWTU facility footprint and stack location in the east-central part of INTEC 4

3. ISC3 receptor grids used in the modeling 14

4. Annual-average vapor dispersion pattern (μg/m^3 per g/s, orange contour lines) for the INTEC main stack with maximum off-INL impact location noted 22

5. Annual-average vapor dispersion pattern (μg/m^3 per g/s, orange contour lines) for the IWTU stack with maximum off-INL impact location noted 23

6. Maximum 1-hour vapor dispersion pattern for the INTEC main stack (μg/m^3 per g/s, orange contour lines) 24

7. Maximum 24-hour vapor dispersion pattern for the INTEC main stack (μg/m^3 per g/s, orange contour lines) 25

8. Maximum 1-hour vapor dispersion pattern from the IWTU stack (μg/m^3 per g/s, orange contour lines) 26

9. Maximum 24-hour vapor dispersion pattern from the IWTU stack (μg/m^3 per g/s, orange contour lines) 27

TABLES

1. IWTU air pollutant emission estimates from EDF-6495 6

2. LET&D and PEWE COPCs that accounted for >99.99% of the risk/hazard calculated in previous ILWMS risk assessments 9

3. Exposure scenarios and pathways evaluated in the risk assessment 17

4. Unit release (1 g/s) air modeling results for the INTEC main (PEWE/LET&D) and IWTU stacks 20

5. Summary of total estimated human health impacts from LET&D/PEWE and IWTU emissions 28

6. Ingestion cancer risk estimates for IWTU emissions 28

7. Non-cancer ingestion hazard quotients for IWTU emissions 29

8. Ingestion cancer risk estimates for LET&D/PEWE emissions 30

9. Non-cancer ingestion hazard quotients for LET&D/PEWE emissions 31

10. Maximum inhalation health impact estimates for IWTU emissions 31

11. Maximum inhalation health impact estimates for LET&D/PEWE emissions 32

12. Comparison of maximum IWTU 24-hour air concentrations with Idaho Acceptable Ambient Concentrations for non-carcinogens on U.S. Highway 20/26 33

13. Comparison of maximum LET&D/PEWE 24-hour air concentrations with Idaho Acceptable Ambient Concentrations for non-carcinogens on U.S. Highway 20/26 34

14. IWTU acute (1-hour) inhalation impacts for a worker anywhere on the INL Site..... 35

15. LET&D/PEWE acute (1-hour) inhalation impacts for a worker anywhere on the INL Site..... 35

16. Ecological screening level quotients for IWTU COPCs 36

17. Ecological screening level quotients for LET&D/PEWE COPCs 37

ACRONYMS

AAC	acceptable ambient concentration
ACFM	actual cubic feet per minute
AHQ	acute hazard quotient
AIEC	acute inhalation exposure criteria
BAF	(prey) bioaccumulation factor
BPIPPRM	Building Profile Input Program for PRIME
C1p	Maximum 1-hour particulate concentration (µg-second/g-m^3)
C1v	Maximum 1-hour vapor concentration (µg-second/g-m^3)
C24p	Maximum 24-hour particulate concentration (µg-second/g-m^3)
C24v	Maximum 24-hour vapor concentration (µg-second/g-m^3)
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	constituent of potential concern (EPA)
Cp	annual average particulate concentration (µg-second/g-m^3)
CRR	Carbon Reduction Reformer
CSF	cancer slope factor
Cv	annual average vapor concentration (µg-second/g-m^3)
Ddp	annual average dry deposition of particulate (second/m^2-year)
Ddv	annual average dry deposition of vapor (second/m^2-year)
DEQ	Department of Environmental Quality (Idaho)
DMR	Denitration and Mineralization Reformer
DS	stack exit diameter
Dwp	annual average wet deposition of particulate (second/m^2-year)
Dwv	annual average wet deposition of vapor (second/m^2-year)
EBSL	ecologically-based screening level
ED	exposure duration
EDF	Engineering Design File

EL	emission level (IDAPA)
EPA	U.S. Environmental Protection Agency
ETS	Evaporator Tank System
GIS	Geographical Information System
GRD3	Grid 3 meteorological tower
HEPA	high-efficiency particulate air (filter)
HHRAP	Human Health Risk Assessment Protocol (for Hazardous Waste Combustion Facilities)
HI	hazard index
HQ	hazard quotient
HS	stack height
HVAC	heating, ventilating, and air conditioning
HWMA	Hazardous Waste Management Act
ICDF	Idaho CERCLA Disposal Facility
ICP	Idaho Cleanup Project
IDAPA	Idaho Administrative Procedures Act
ILWMS	INTEC Liquid Waste Management System
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISC3	Industrial Source Complex Model - 3
ISC3P	Industrial Source Complex Model - 3 with PRIME downwash
ISC-PRIME	Industrial Source Complex Model with PRIME downwash
ISCST3	Industrial Source Complex Short-Term Model -3
IWTU	Integrated Waste Treatment Unit
LET&D	Liquid Effluent Treatment & Disposal
MASSFRAX	particle mass fraction
NED	National Elevation Data (US Geological Survey)
NOAA	National Oceanic and Atmospheric Administration
NWCF	New Waste Calcining Facility
PARTDENS	particle density

PARTDIAM	particle diameter
PEWE	Process Equipment Waste Evaporator
PM	particulate matter
PUF	plant uptake factor
QA/QC	quality assurance/quality control
RAWP	Risk Assessment Work Plan
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RH	remote handled
SBW	sodium-bearing waste
SLERAP	Screening Level Ecological Risk Assessment Protocol
SLQ	screening level quotient (for ecological receptors)
SUF	site use factor
SVOC	semi-volatile organic compound
TAP	toxic air pollutant
TRU	transuranic
TRV	toxicity reference value (ecological receptors)
TS	stack effluent temperature
TSLQ	total screening level quotient
UF	uncertainty factor
URF	unit risk factor
VOC	volatile organic compound
VS	stack exit velocity

Risk Assessment for Air Emissions for the Integrated Waste Treatment Unit and INTEC Liquid Waste Management System

1. PURPOSE AND SCOPE

This risk assessment evaluates the potential human health and ecological impacts from process operations of the Idaho Nuclear Technology Center (INTEC) Liquid Waste Management System (ILWMS) and the new Integrated Waste Treatment Unit (IWTU) facility that is proposed at INTEC on the Idaho National Laboratory (INL) Site. The IWTU utilizes a steam reforming process for treating INTEC sodium-bearing waste (SBW) and newly-generated liquid wastes. IWTU site preparation began in April 2007, and the start of operations is scheduled in December 2009.

The IWTU will be permitted under the Hazardous Waste Management Act (HWMA)/Resource Conservation and Recovery Act (RCRA) as a Class 3 (most significant) Permit Modification Request and Request for Temporary Authorization to the existing HWMA/RCRA Permit for the INTEC Liquid Waste Management System (Volume 14). This action is consistent with existing language in the Permit, which describes the current ILWMS treatment units as part of an overall treatment train for liquid wastes stored at INTEC. The IWTU is the final unit in the overall ILWMS treatment system and will be used to convert SBW and newly-generated liquid waste into a solid treatment product that is suitable for ultimate disposal. The methodology and assumptions used in this risk assessment were submitted in a Risk Assessment Work Plan (RAWP) to the Idaho Department of Environmental Quality (DEQ) as part of the Volume 14 Permit Modification Request, Appendix D-6, in December 2006.

There are currently three processes that operate within the ILWMS that have potential air pollutant emissions: (1) the Liquid Effluent Treatment & Disposal Facility (LET&D), (2) the Process Equipment Waste Evaporator (PEWE), and (3) the Evaporator Tank System (ETS). Cumulative impacts from these sources, and those from the Idaho CERCLA Disposal Facility (ICDF), a potentially contributing source adjacent to INTEC, were previously evaluated in the *Human and Ecological Risk Assessment of Air Emissions from the INTEC Liquid Waste Management System* (ICP 2004). Since then, new offgas measurements were obtained for LET&D and PEWE in 2005 and revised human health impacts were calculated in EDF-6252. This risk assessment therefore evaluates air emissions from the following sources:

1. IWTU – risks calculated from modeled (mass and energy balance) emission estimates (EDF-6495), which incorporate the findings from actual emissions measurements during pilot-scale testing

2. LET&D/PEWE – risks calculated from 2003 and 2005 offgas sampling emission estimates (ICP 2004; EDF-6252)

3. ETS – previously-calculated risk contribution taken from INEEL 2002 and the 2004 ILWMS risk assessment (ICP 2004)

4. ICDF – previously-calculated risk contribution taken from ICP 2004.

Both human health and ecological impacts are evaluated. Maximum human health impacts (cancer risk and non-cancer hazard index from both inhalation and ingestion) were evaluated at the off-INL Site locations with the highest modeled air concentrations and deposition rates. Impacts were assessed separately for each of the ILWMS sources, which are released from the INTEC main stack, and the

IWTU emissions, which will be released from a separate IWTU stack. The maximum impacts of emissions from these two separate stacks, which occur at slightly different locations, were then added to obtain a conservative estimate of maximum cumulative impacts from ILWMS and IWTU emissions. In addition, maximum inhalation impacts for an on-site worker and a public motorist on U.S. Highway 20/26 were evaluated. Impacts to ecological receptors were evaluated at the downwind locations of maximum modeled deposition rate, which occurred on-site. Only atmospheric emissions of non-radiological contaminants of potential concern (COPCs) were evaluated.

2. FACILITY AND SOURCE CHARACTERIZATION

2.1 Facility Location

The IWTU will be located in the east-central part of INTEC on the INL Site (Figures 1 and 2). The facility consists of three interconnected buildings (Figure 2): (1) product storage area, (2) mechanical equipment area, and (3) process area, which houses the SBW steam reforming processes and the heating, ventilating, and air conditioning (HVAC) equipment. The complete facility is approximately 380-ft long (north-south) by 198-ft wide (east-west). The ridge height of the process building is 69 ft. All offgas is routed to a single 120-ft high stack on the southwest corner of the building. Specific building and stack dimensions are addressed in Section 4, Air Dispersion and Deposition Modeling.

2.2 IWTU SBW Process Description

Approximately 900,000 gallons of mixed liquid waste, containing both hazardous and radioactive components, are stored in three 300,000-gallon tanks at the INTEC Tank Farm Facility. This waste is collectively known as sodium-bearing waste (SBW). The IWTU will use a steam reforming process to treat this waste. The specific steam reforming technology is a thermal, fluidized-bed process that uses superheated steam, carbon, and other additives to convert the SBW into a solid granular product that is packaged in canisters suitable for ultimate disposal.

The steam reforming process for the IWTU consists of two steam reformers that are integrated into a single process system (Drawings 632750, 632753, 632754 in Appendix III to the ILWMS Permit – Volume 14). The system converts the SBW into a dry, solid, mineral product suitable for ultimate disposal as remote-handled TRU waste. The steam reforming process includes a feed collection and transfer system through which waste from the Tank Farm is transferred into the first of two steam reformers, the Denitration and Mineralization Reformer (DMR). The DMR contains a hot (580–700°C) fluidized bed. The bed particles are fluidized by superheated steam. The superheated steam and a small amount of added oxygen react with carbon (a process additive) to produce process heat and a strong chemically reducing environment. The liquid waste is sprayed into the fluidized bed where it evaporates. As the waste evaporates in the DMR, the dissolved constituents form additional bed material that is eventually removed as solid treatment product. The DMR destroys organics, nitric acid, nitrates, and nitrites in the feed, and converts the bulk of the dissolved chemicals into a solid, mineral product. The DMR converts organics in the waste into carbon monoxide (CO), carbon dioxide (CO_2), hydrogen (H_2), and short-chained organic molecules such as methane (CH_4). The strong reducing environment inside the DMR transforms nitrates, nitrites, and nitric acid into elemental nitrogen. Nitrogen oxide (NO_X) formation is minimal. The DMR converts most of the dissolved constituents in the waste into a mineral form, comprised primarily of carbonates and oxides and transforms alkali metals such as sodium (Na) and potassium (K) into compounds that will not agglomerate at the operating temperature of the fluidized bed.

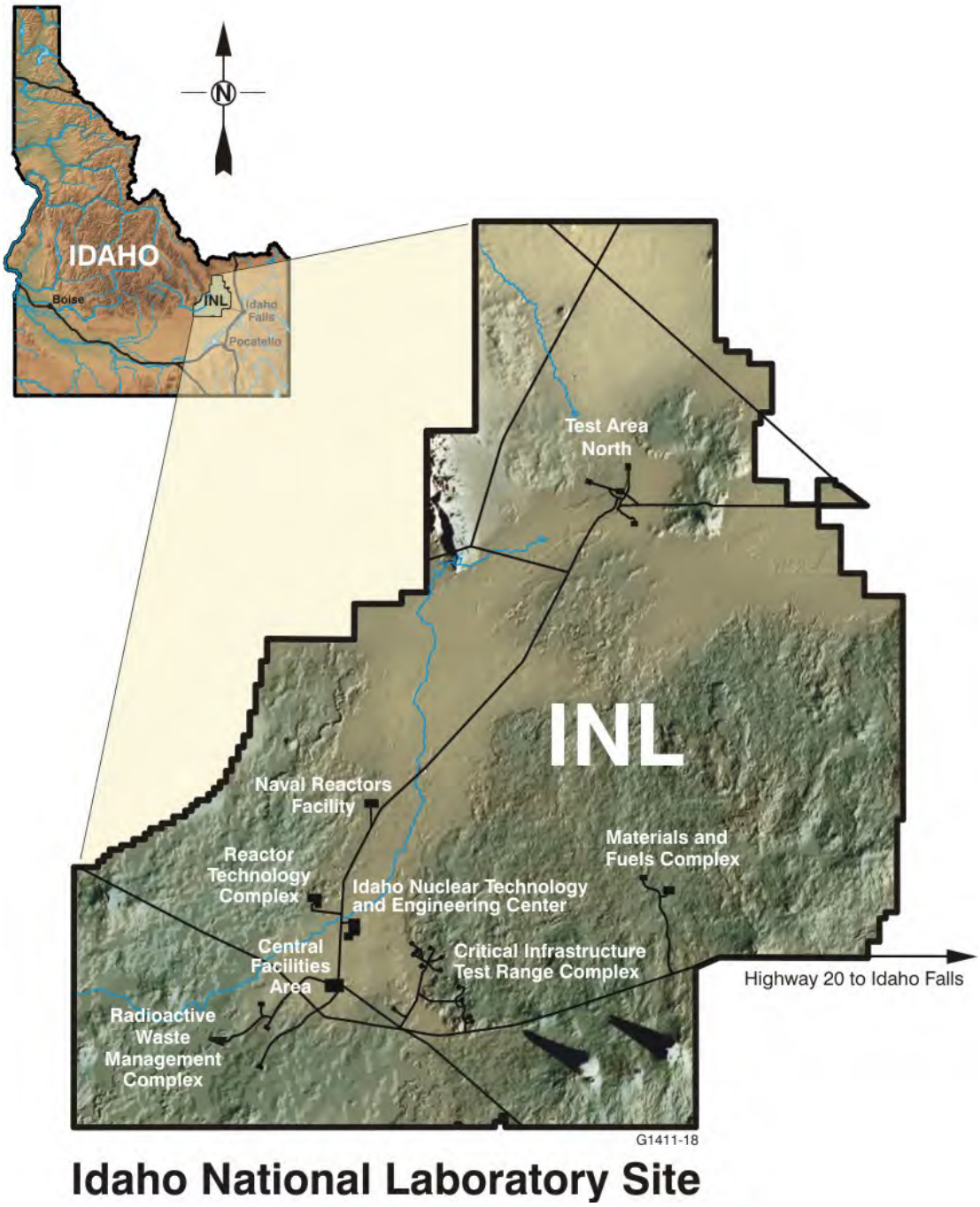


Figure 1. Location of the Idaho Nuclear Technology and Engineering Center on the INL Site.

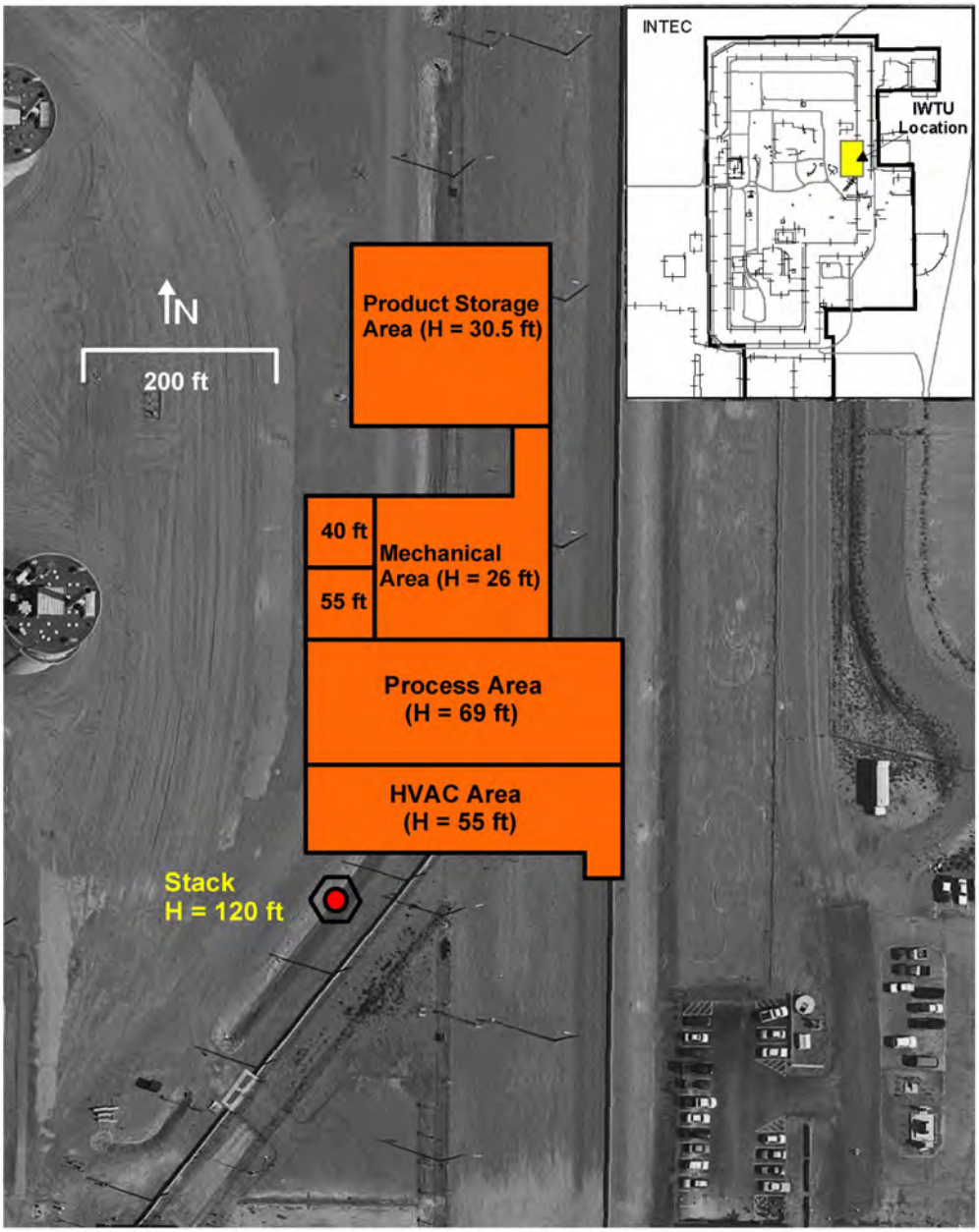


Figure 2. IWTU facility footprint and stack location in the east-central part of INTEC (building tier heights noted; stack location revised January 2007).

Process gas from the DMR goes through a sintered-metal (process) filter that removes fines. The fines are periodically removed from the filter and combined with the solid treatment product from the DMR for product packaging. The filtered process gas then flows to the Carbon Reduction Reformer (CRR) which operates at a higher temperature (775 to 1150°C) than the DMR and contains a semi-permanent fluidized bed of alumina particles. The bottom of the CRR operates in a reducing mode to convert residual NO_X from the DMR to nitrogen gas. Oxygen is added in the upper section of the bed to change from a reducing to oxidizing mode. The H_2, CO, and short-chained organics in the DMR process gas are oxidized to CO_2 and water in the CRR. Gases from the CRR (mainly oxygen, carbon dioxide, nitrogen, and water vapor) are cooled and sent through a high-efficiency sintered metal (offgas) filter and then routed to an offgas treatment system consisting of two high-efficiency particulate air (HEPA) filters (plus prefilter), a sulfur-impregnated, granular-activated-carbon mercury adsorber, and vented to the atmosphere through a dedicated stack. The treatment product from the DMR, CRR, and sintered metal filters is removed, cooled, and pneumatically transferred to a solid product packaging station. At the packaging station, the product is loaded into remote-handled disposal canisters.

2.3 IWTU Emissions

The major components in the IWTU offgas were estimated using mass and energy balance modeling to be non-hazardous nitrogen, water vapor, carbon dioxide, and oxygen. These components were verified through pilot-scale testing with SBW surrogate feed. Emission rates for potentially hazardous compounds (Table 1) were taken from EDF-6495. The criteria pollutant emission rates in Table 1 are conservative annual-average values for processing all tank waste, with an additional 40% added to account for other wastes that may be processed through the IWTU such as start-up testing surrogate and decontamination solution. For particulate matter (PM) and lead (Pb), the emissions take credit for the two process HEPA filters at a removal efficiency of 99.97%, which is the DOE standard for HEPA filters (*Specification for HEPA Filters Used by DOE Contractors*, DOE-STD-3020-2005).

Table 1 also lists potential toxic air pollutant (TAP) emissions from IWTU as defined by IDAPA 58.01.01, Sections 585 and 586, and as calculated in EDF-6495. These rates are the most conservative of seven different SBW tank processing mixture scenarios and represent upper-bound emission estimates. For comparison, the IDAPA screening emission level (EL), a conservative first-level screening criteria, is also listed in the table. Arsenic, beryllium, and hydrogen chloride exceed the IDAPA EL. This suggests that these pollutants may need to be examined more closely in the risk assessment, not necessarily that they are emitted at rates that are hazardous. No organic constituents are listed because the mass and energy balance calculations indicate that the IWTU process efficiently destroys essentially all organics in the SBW feed. Pilot plant demonstrations at the Hazen Research Facility (Golden, Colorado) support this conclusion. If future test results indicate that additional compounds may be emitted at rates which could significantly contribute to the total emissions risk, then IWTU emission rates will be revised as appropriate and re-evaluated for risk.

Table 1. IWTU air pollutant emission estimates from EDF-6495.

Criteria Pollutants	Emission Rate[a] (tons/year)	Emission Rate (lb/hr)	Emission Rate (g/s)
Carbon Monoxide (CO)	1.44	0.329	0.041
Nitrogen Oxides (NO_X)	31.77	7.25	0.914
Sulfur Dioxide (SO_2)	5.2	1.19	0.150
Particulate Matter (PM)	3.37E-09	7.69E-10	9.70E-11
Lead (Pb)	1.04E-13	2.37E-14	2.99E-15
Fluoride (F)	0.06	0.014	0.0018

Toxic Air Pollutants	IDAPA Emission Level (EL, in lb/hr)[b]	Annual-Average (lb/hr)[c]	Annual-Average (g/s)	Maximum Short-term (lb/hr)[d]	Maximum Short-term (g/s)
Aluminum (Al)	1.33E-01	5.18E-12	6.53E-13	1.52E-06	1.92E-07
Arsenic (As)	1.50E-06	3.16E-04	3.99E-05	9.42E-04	1.19E-04
Barium (Ba)	3.30E-02	1.16E-02	1.46E-03	1.95E-02	2.46E-03
Beryllium (Be)	2.80E-05	2.02E-04	2.55E-05	3.03E-04	3.82E-05
Bromine (Br_2)	4.70E-02	4.29E-05	5.41E-06	6.10E-05	7.69E-06
Cadmium (Cd)	3.70E-06	1.55E-10	1.95E-11	1.26E-08	1.59E-09
Calcium oxide (CaO)	1.33E-01	2.37E-12	2.99E-13	4.76E-07	6.00E-08
Chlorine (Cl_2)[e]	2.00E-01	1.57E-02	1.98E-03	6.14E-02	7.74E-03
Chromium (Cr)	3.30E-02	3.21E-14	4.05E-15	7.29E-09	9.19E-10
Fluorine (F_2)	1.67E-01	2.16E-02	2.72E-03	1.07E-01	1.35E-02
Hydrogen chloride (HCl)[e]	5.00E-02	1.62E-02	2.04E-03	6.32E-02	7.97E-03
Mercury (Hg)	3.00E-03	2.21E-04	2.79E-05	3.23E-04	4.07E-05
Molybdenum (Mo)	3.33E-01	3.25E-02	4.10E-03	4.81E-02	6.07E-03
Nickel (Ni)	2.70E-05	9.32E-15	1.18E-15	2.04E-09	2.57E-10
Rhodium (Rh)	1.00E-03	6.53E-04	8.24E-05	9.28E-04	1.17E-04
Selenium (Se)	1.30E-02	1.11E-04	1.40E-05	1.58E-04	1.99E-05
Silver (Ag)	1.00E-03	4.04E-04	5.09E-05	7.76E-04	9.79E-05
Tin (Sn)	1.33E-01	9.19E-03	1.16E-03	1.05E-02	1.32E-03
Zinc (Zn)	6.67E-01	7.15E-15	9.02E-16	2.01E-09	2.53E-10

a. From EDF-6495, Table 2 (abated emissions).
b. First-level TAP screening level from IDAPA 58.01.01 Sections 585 and 586 – does not imply an emission rate that is hazardous.
c. From EDF-6495 (Table 5, Scenario 1); assumes 1-year processing time, average composition of all SBW, and an additional 10,000 gallons of newly generated waste (NGLW) at the composition of Tank WM-187.
d. Highest emission rate for seven different SBW tank processing mixture scenarios, as calculated in EDF-6495.
e. Assumes all of the chlorine emissions are in this form.

The following assumptions were made in EDF-6495 to calculate the emission rates shown in Table 1:

- The waste is fed to the DMR at the maximum rate of 3.5 gallons per minute (gpm) to maximize the emissions rate.

- The particulate carry-over from the DMR was increased from 30% (expected carry-over) to 50% (worst case carry-over seen during testing at the STAR center as reported in *Phase 2 THOR Steam Reforming Tests for Sodium Bearing Waste Treatment*, [INEEL 2004a]).

- The NO_X carry-over in the DMR was increased from 3% to 7% to reflect data from pilot plant testing data (RT-ESTD-PMR-001).

- The NO_X carry-over in the Carbon Reduction Reformer (CRR) was increased from 10% to 50% to reflect data from pilot plant testing data (RT-ESTD-PMR-001).

- To more accurately reflect carbon monoxide emissions from the IWTU as seen in the pilot plant test data (RT-ESTD-PMR-001) the carbon dioxide to carbon monoxide ratio in the offgas of the DMR was increased from 92% to 97%. Additionally, the CO carry-over of carbon monoxide from the CRR was increased from 0.1% to 3%.

- The mercury concentration was increased by 25% to increase it to the high end of the analytical uncertainty as reported in *Feed Composition for the Sodium Bearing Waste Treatment Process*, (INEEL 2004b).

- The mercury removal efficiency was reduced from 99.999% to 99.99% based on the minimum required removal efficiency per the mercury adsorber equipment data sheets *Equipment Data Sheets – Mercury Adsorber*" (COS-F-SRH-0141).

- The HEPA filters efficiency was increased to 99.97% to match the DOE standard for HEPA filters (*Specification for HEPA Filters Used by DOE Contractors*, DOE-STD-3020-2005). For annual-average emissions calculations, credit was taken for both HEPAs. For maximum short-term emission rates, credit was taken for only one HEPA. No credit was taken for solids removal through the HEPA prefilter.

For facilities without site-specific monitoring data, EPA 2005 recommends that organics and metal emissions be increased by factors of 2.8 and 1.45 respectively, to account for potential increases in emissions due to process upset conditions. Although process upsets are not currently anticipated at IWTU due to the stable, uniform operating characteristics of the fluid bed systems, the potential increase in emissions, and therefore downwind impacts, is quantified and discussed in the uncertainty section.

For assessing the indirect (i.e., ingestion) risk from buildup of contaminants in the environment, the IWTU emissions are assumed to last for 15 years. This is very conservative because all of the SBW is expected to be processed by the IWTU within 15 months. Aluminum, fluoride, and manganese were only evaluated for inhalation impacts because they are not in the *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (HHRAP) (EPA 2005) data base.

2.4 LET&D and PEWE Emissions

The COPCs emission estimates for the LET&D and PEWE were developed from offgas measurements in 2003 (INEEL 2003) and 2005 (ICP 2005a; ICP 2005b) and are contained in Appendix A. These emissions were previously evaluated for risk in the 2004 ILWMS risk assessment (ICP 2004), using the 2003 offgas measurements, and revised in EDF-6252 using the 2005 offgas measurements. These assessments evaluated all analytes that met one or both of the following conditions: (1) sampling results were greater than the quantification limit in at least one of the sampling runs or (2) fate, transport, and toxicity data are published by EPA (EPA 2005). Analytes were excluded from risk evaluation if all of the sampling data were less than the quantification limit and no compound-specific modeling and toxicity data were available in EPA 1998a. All SVOC and VOC analytes that were detected at greater than the quantification limit were evaluated for risk.

The risk assessment methodology in the previous ILWMS risk assessments (ICP 2004; EDF-6252) used COPC-specific "risk coefficients" developed for New Waste Calcining Facility (NWCF) emissions from the INTEC main stack (INEEL 1999a; INEEL 1996). These NWCF risk coefficients were developed using EPA risk assessment guidance and contaminant-specific parameter values available at that time. Since then, EPA has published a final version of the HHRAP and provided revised transport and toxicity data in an on-line companion data base: (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm). For this risk assessment, PEWE, LET&D, and IWTU COPC risks were recalculated using the new 2005 EPA HHRAP methodology and parameter values. For PEWE and LET&D, only those COPCs which contributed at least 0.01% of the total risk or hazard (i.e., individual COPC risk ≥ 1/10,000 of the total risk) as calculated in the previous ILWMS risk assessments were re-evaluated. This allows available resources to be focused on refined modeling of those COPCs that have been shown to be "of potential concern" (based on previous risk calculations) while eliminating those COPCs that are either artifacts of the sampling/analytical process, non-hazardous, or emitted in extremely low, insignificant quantities. The screened LET&D and PEWE COPCs and their emission rates are listed in Table 2.

2.5 ETS Emissions

ETS offgas emission estimates are documented in the *NWCF Evaporator Tank System 2001 Offgas Emissions Inventory* (INEEL 2002) and are only summarized here. More analytes were "detected" from the ETS (15/18 metals, 45/69 SVOCs, 18/65 VOCs) than the LET&D. However, many of these "detections" were only in the back portion of the sampling train (condensate fraction) and not in the front (XAD resin) portion, indicating that they are probably analytical artifacts rather than present in the offgas. Even using these "partial hit" values, emission rates from ETS were very low. The two highest volatile organics emitted during offgas sampling were dodecane and acetone, 50 parts per billion by volume (ppbv) and 30 ppbv, respectively. The two highest semi-volatile organics emitted were benzoic acid and benzaldehyde with maximum concentrations of 310 ppbv and 80 ppbv, respectively. The sum of all volatile and semi-volatile organics was less than 1 ppmv.

Human health risk assessments of these emissions were previously completed in INEEL 2002 and ICP 2004. These risk assessments used the previously described NWCF-calculated risk and hazard coefficients (e.g., risk per g/s released) and conservative emission rates from the ETS offgas measurements. In accordance with the Risk Assessment Work Plan (RAWP), the ETS risk contribution to ILWMS and IWTU was taken directly from INEEL 2002, rather than recalculated in this risk assessment.

Table 2. LET&D and PEWE COPCs that accounted for >99.99% of the risk/hazard calculated in previous ILWMS risk assessments.[a]

Analyte	CAS#	Emission Rate (g/s)	
		Hourly	Annual
Anions			
Hydrogen chloride (HCl)	7647-01-0	1.97E+00	4.50E-01
Fluoride (F^-)[b]	16984-48-8	1.33E-03	3.04E-01
Metals			
Arsenic (As)	7440-38-2	1.82E-06	4.16E-07
Chromium (Cr)[c]	7440-47-3	5.32E-04	1.21E-04
Manganese (Mn)[b]	7439-96-5	8.01E-05	1.83E-05
Nickel (Ni)	7440-02-0	3.04E-03	6.94E-04
Mercury (Hg)	7439-97-6	6.84E-05	1.56E-05
SVOCs			
Benzo(a)pyrene (BaP)	50-32-8	2.44E-06	5.57E-07
bis(2-Ethylhexyl) phthalate	117-81-7	2.62E-05	5.98E-06
3,3'-Dichlorobenzidine	91-94-1	6.32E-06	1.44E-06
Fluoranthene	206-44-0	8.67E-07	1.98E-07
Hexachlorocyclopentadiene	77-47-4	7.41E-06	1.69E-06
N-Nitrosodi-n-propylamine	621-64-7	9.94E-07	2.27E-07
N-Nitrosodimethylamine[d]	62-75-9	2.38E-04	5.43E-05
Pyrene	129-00-0	7.50E-07	1.71E-07
VOCs			
1,4-Dichlorobenzene	106-46-7	2.53E-07	5.77E-08
1,2,3-Trichloropropane	96-18-4	5.47E-07	1.25E-07

a. ICP 2004 and EDF-6252.
b. No indirect pathway exposure parameters in HHRAP; evaluated for inhalation impacts only.
c. Evaluated as both Cr(III) and Cr(VI).
d. No indirect pathway exposure parameters in HHRAP; evaluated using N-nitrosodi-n-propylamine as a surrogate.

2.6 Other Potentially Contributing Sources

The previous ILWMS risk assessment (ICP 2004) evaluated potential contributions from other contributing INL Site facility emissions for cumulative impacts and found that only those from the ICDF were significant. Human health risks from these ICDF emissions were originally calculated in the "INEEL CERCLA Disposal Facility Short-Term Risk Assessment" (EDF-ER-327). In accordance with the RAWP, this ICDF risk contribution was taken directly from ICP 2004, rather than recalculated in this risk assessment.

3. RISK ASSESSMENT GUIDELINES

3.1 EPA Protocol

Previous NWCF and ILWMS risk assessments (INEEL 1999a; INEEL 1999b; INEEL 2002; ICP 2004) used COPC-specific "risk coefficients" (risk or hazard per g/s released) developed for emissions from the INTEC main stack. These risk coefficients were developed from modeled unit (1 g/s) release air concentrations/deposition rates and fate and transport equations given in the draft release of EPA's *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA 1998a) and earlier EPA guidance. For the current IWTU/ILWMS risk assessment, both IWTU emission estimates and new offgas data from the LET&D and PEWE sources were re-assessed using new modeling and the methods and parameter values in EPA's *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (HHRAP), which was recently released in final form (EPA 2005). Since ETS and ICDF emissions have not been revised, human health impact contributions from those sources were taken directly from the 2004 ILWMS risk assessment (ICP 2004), in accordance with the RAWP.

3.2 Target Risk Criteria

To evaluate potential carcinogenic risks, EPA generally uses a risk range of 10^{-4} to 10^{-6} and a hazard index target criteria of 1.0. However, for purposes of RCRA permitting decisions involving thermal technologies, the INL Site has traditionally used risk target levels from U.S. EPA Region 6 (EPA 1998b; INEEL 1999a; INEEL 2002; ICP 2004).

For the purposes of RCRA permitting decisions, the maximum acceptable risk is reduced from 10^{-4} to 10^{-5} primarily to account for exposure to background levels of contamination. As a result, the total individual risk associated with exposures to potential carcinogens released from a single facility should not exceed 1.0×10^{-5}. A calculated risk that exceeds these targets, however, would not necessarily indicate that the proposed action is not safe or that it presents an unacceptable risk. It may indicate that the initial assumptions and parameter values used in the modeling were overly conservative and need to be further refined.

For non-carcinogenic contaminants, U.S. EPA Region 6 recommends a modified target hazard quotient (HQ) or hazard index (HI) of 0.25 to account for background contributions. An HQ or HI equal to or exceeding 0.25 indicates only that there is a potential for non-carcinogenic effects, based on a specific set of exposure, model, and toxicity assumptions.

Ecological impacts were assessed using a screening level quotient (SLQ) and total screening level quotient (TSLQ) approach. This method divides modeled COPC soil concentrations by conservatively-calculated ecologically-based screening levels (EBSLs) to obtain a COPC-specific SLQ. The SLQs are then summed to obtain a TSLQ, similar to the human health hazard quotient/index. The EBSL methodology was first developed in Van Horn et al. (1995) and has been used at the INL Site for all CERCLA and RCRA risk assessments to date (e.g., INEEL 1999a; DOE-ID 1999). CERCLA assessments at the INL often use a TSLQ criterion of 10 for eco-risk because of the conservatisms inherent in EBSL modeling methods and assumptions. For this risk assessment, a more conservative TSLQ criterion of 1.0 was used. As with the other risk criteria used in this assessment, calculated risks that exceed this criterion do not necessarily indicate a risk but identifies a contaminant that should be investigated further using more refined (realistic) parameter values.

4. AIR MODELING METHODOLOGY

Air modeling was performed to evaluate the atmospheric dispersion, transport, and ground deposition of contaminants from the IWTU and ILWMS sources to downwind locations at which members of the public could potentially reside (off-INL Site) and to both on- and off-INL Site locations where ecological receptors may exist. In addition, maximum 24-hour air concentrations were evaluated along U.S. Highway 20/26 to assess potential motorist exposure, and maximum 1-hour air concentrations were evaluated at on-site locations to assess acute exposure for workers (or visiting public) at any facility on the INL. In accordance with the HHRAP (EPA 2005), the separate modeling runs were done for a 1 g/second release of a generic particulate contaminant and a generic vapor contaminant. Model output for maximum air concentrations ($\mu g/m^3$ per g/second released) and maximum ground depositions (g/m^2-year per g/second released) were then multiplied by contaminant-specific release rates (g/second) and vapor and particulate partitioning factors to obtain contaminant-specific results.

For evaluation of PEWE/LET&D emissions, which are released out the 250-ft high INTEC main stack, the ISCST3 model (EPA 1995, Version 02035) was used. This model has been approved by the EPA and the State of Idaho and is specified for use in EPA's HHRAP (EPA 2005). For evaluation of IWTU emissions, the Building Profile Input Program for PRIME (BPIPPRM Version 04274) and ISC-PRIME model (Version 04269) were used to assess potential building downwash of the IWTU stack (http://www.epa.gov/scram001/). Building downwash is not a concern for the INTEC main stack because it is greater than 2.5 times the height of adjacent buildings. The following sections detail model input parameter values, many of which are specified in the guidance.

4.1 Control Options Input

The following control pathway modeling options were selected:

- Regulatory default job control and dispersion options (EPA 1995):
  - Final plume rise, stack-tip downwash
  - Buoyancy-induced dispersion
  - Calms processing routine
  - No use of missing data processing routine
  - Default wind profile exponents
  - Default vertical potential temperature gradients
  - Upper bound values for super-squat buildings
  - No exponential decay for RURAL mode.
- RURAL dispersion coefficients (sigmas).
- Calculate concentration and dry, wet, and total deposition and depletion for particulate runs.
- Calculate concentration, wet deposition and depletion for vapor runs.
- Annual and 1-hour averaging times for on-site receptor runs. (Section 4.4)
- Annual averaging time for offsite receptor runs. (Section 4.4)
- 24-hour averaging times for U.S. Highway 20/26 receptor runs. (Section 4.4)

- Terrain heights evaluated (taken from the INL Geographical Information System [GIS] database). These elevations were developed from the U.S. Geological Survey National Elevation Data (NED).
- Dry deposition parameters for vapor phase modeling run: (1) replace "DEFAULT" control option with "TOXICS", (2) add control option GASDEPVD<Uservd>, where Uservd is the dry vapor deposition velocity (meters/second) - 0.5 cm/s. Since the TOXICS option is not available in the ISC-PRIME model, dry vapor deposition of IWTU emissions was calculated manually (in risk spreadsheets) by multiplying the air concentration by deposition velocity, in accordance with the draft HHRAP procedure. The results were benchmarked against the ISCST3-calculated dry deposition and found to be identical for a deposition velocity of 0.5 cm/s.

4.2 Source Input – IWTU Stack

IWTU offgas will be routed to a new stack on the southwest corner of the IWTU Process Building. ISC-PRIME source pathway input parameters for this stack are:

- Base elevation = 1498.3 m (4916 ft)
- Stack coordinates based on January 2007 design
- Height (HS) = 36.6 m (120 ft)
- Exit diameter (DS) = 1.5 m
- Effluent temperature (TS) = 335.4K (144°F)
- Effluent exit velocity (VS) = 17.8 m/s.

COPC source input parameter values include the following (EPA 2005):

- Particulate diameter (PARTDIAM): 0.35, 0.7, 1.1, 2.0, 3.6, 5.5, 8.1, 12.5, and 15.0 μm
- Mass fraction (MASSFRAX): 0.22, 0.08, 0.08 0.11, 0.10, 0.07, 0.10, 0.11, and 0.13
- Particulate density (PARTDENS): 1 g/cm^3
- Particle scavenging coefficients (PARTSLIQ [liquid] and PARTSICE [frozen]) for particle sizes listed above (liquid and ice assumed to be the same): 0.7, 0.5, 0.6, 1.3, 2.6, 3.9, 5.2, 6.7, and 6.7 ($\times 10^{-4}$ s^{-1}/mm-h^{-1})
- Vapor scavenging coefficients (GAS-SCAV): 1.7×10^{-4} (both liquid and ice)
- Wake effects from the IWTU building (building downwash) were evaluated using the Building Profile Input Program for PRIME (BPIPPRM version 04274) (http://www.epa.gov/scram001/).

4.3 Source Input – INTEC Main Stack

Existing ILWMS offgas emissions occur through the 250-ft INTEC main stack. ISCST3 source pathway input parameters for this stack are:

- Elevation = 1498.3 m (4916 ft)
- Height (HS) = 76.2 m (250 ft)
- Exit diameter (DS) = 1.98 m (6.5 ft)

- Effluent temperature (TS) = 302.6K (85°F)
- Effluent exit velocity (VS) = 18.83 m/s (at 123,000 ACFM).

Particle diameter, mass fraction, density, and scavenging coefficients are the same as those used for the IWTU stack. Building downwash was not evaluated for the INTEC main stack because its height (76.2 m) is greater than 2.5 times adjacent building heights resulting in a plume that is not affected by building wake effects (EPA 2005).

4.4 Receptor Grids

The following three receptor grids were evaluated for each particulate and vapor model run (Figure 3):

- BIG: A large 33 × 33-km coarse grid with 1-km spacing was used to determine regional dispersion and deposition trends for contour plotting, siting of refined receptor grids (see INL Site grids below) maximum on-site inhalation exposure (for field workers and other INL Site workers), and for determining maximum on-Site deposition for ecological risk assessment.

- INL Site: Two refined (100-m spacing, 1200 receptors each) grids in areas of maximum impact along the INL south site boundary and in the Big Southern Butte area were used to determine maximum annual-average air concentrations and deposition rates for long-term public exposures. Different refined grids were required for the INTEC main stack ILWMS releases and the IWTU stack releases.

- HWY: Discrete receptors placed at 100-m intervals along major impact areas of U.S. Highway 20/26, which traverses the southern portion of the INL Site. The area of maximum impact along the highway was determined from appropriate time-averaged coarse (BIG) grid modeling runs. The highway receptors were only evaluated for short-term direct inhalation impacts from non-carcinogens because the only potential receptors are transient motorists. A 24-hour averaging time was selected for modeling to be consistent with the State of Idaho Acceptable Ambient Concentrations (AACs) for non-carcinogenic toxic air pollutants.

The above receptor grids were used to determine the impacts for hypothetical "maximally-exposed" individual in each class of receptors (see Exposure Assessment section). Impacts at all other locations and real communities (e.g. Atomic City, Mud Lake) will be less due to increased plume dispersion and plume depletion with distance. Although ISCST3 may be used to assess receptors at distances of up to 50 km, model predictions become much more uncertain at distances beyond 20 km because the meteorological conditions (e.g., wind direction, speed) will likely change over the time it takes to transport pollutants to the receptor. In addition, it is known based on past modeling studies (INEEL 1999a; ICP 2004) that most of the deposition occurs within 10 km of the source. Based on these considerations, only the above receptor grids will be evaluated to determine if the target risk criteria are met.

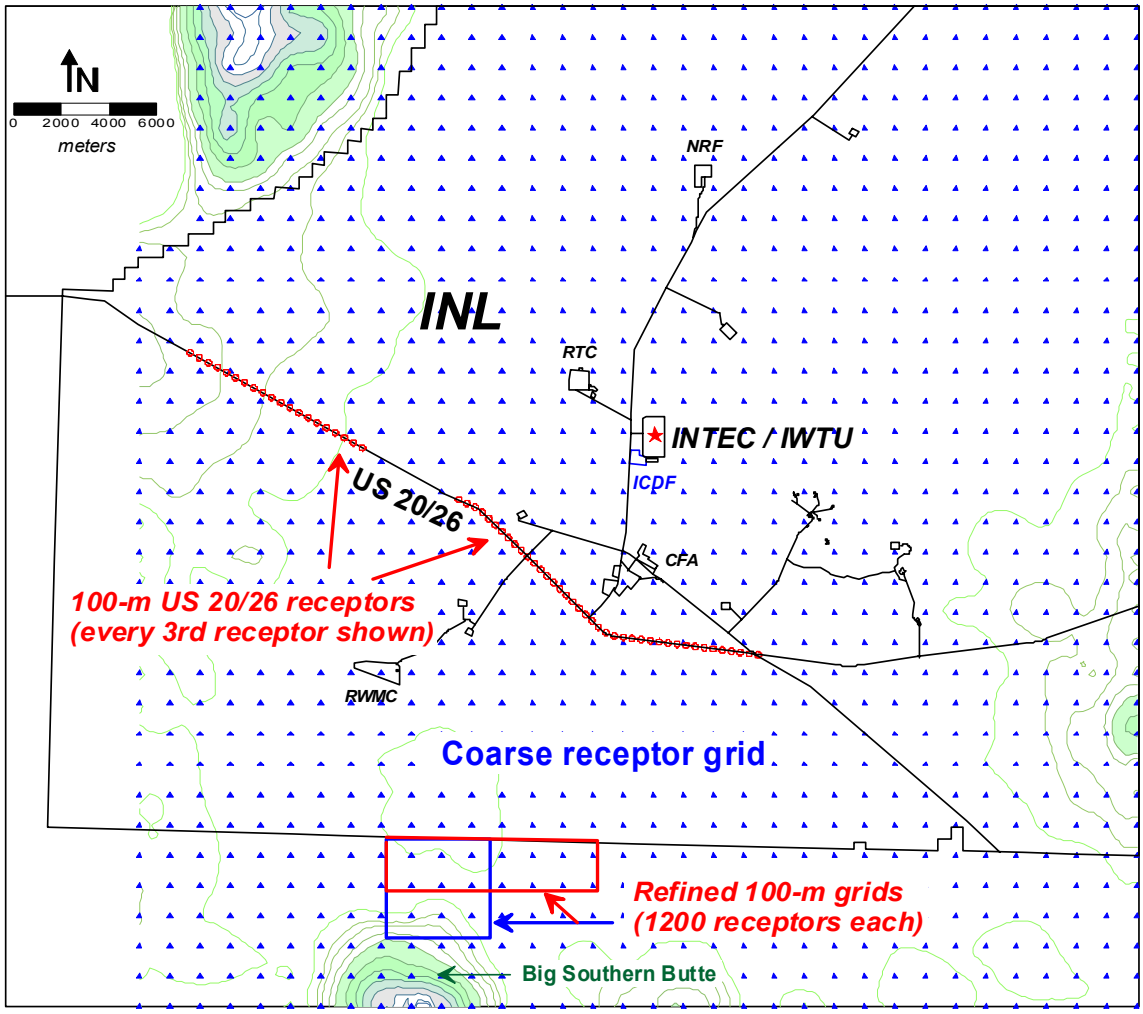


Figure 3. ISC3 receptor grids used in the modeling. Different refined grids (blue/red boxes) were required for the INTEC main stack ILWMS releases (blue box) and the IWTU stack releases (red box) because of the difference in stack parameters (250-ft vs. 120-ft heights).

4.5 Meteorological Information

Five years (1997 to 2001) of onsite meteorological data from the Grid 3 (GRD3) 200-ft (61-m) tower, located approximately 1.5 km north of the INTEC, were used for the modeling. The Grid 3 data were processed into sequential hourly ISC3 data input format by the National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory in Idaho Falls, Idaho.

The NOAA determined stability classes using the lateral turbulence (σ_A) and wind speed method as outlined in the EPA report *Onsite Meteorological Program Guidance for Regulatory Modeling Applications* (EPA 1987). The small amount of missing data in the NOAA files was filled using hourly data (for the same month, day, and hour) from other INL Site towers (e.g., the Central Facilities Area) or, for single hour gaps, linear interpolation. Wind speeds less than the anemometer's starting threshold (0.26 m/second) were set to 0.0 for calms processing in ISC3. Wind speeds between the anemometer starting threshold and 1.0 m/second were set to 1.0 m/second to ensure that the model does not calculate

unrealistic concentration estimates (EPA 1995; EPA 1996). No long-term climatology of measured mixing heights exists for the INL Site, although NOAA has done numerous short-term measurements and estimated annual-average mixing heights of 800 m and short-term mixing heights of 100 m at the INL Site (memo from J. Saggendorf, NOAA, to Mike Abbott, February 11, 1991[a]). However, at the request of the DEQ, mixing heights were set to an extremely conservative value of 150 m for annual-average model runs and 50 m for hourly runs. These low mixing heights limit the vertical dispersion of the plume, producing very conservative model predictions, especially at the INL Site boundary distances from INTEC (~15 km).

Additional processing to determine ISC3-required deposition parameters was accomplished as follows:

1. Surface roughness height (z_0) was taken from the EPA 1998a for desert shrub land type, for spring, summer, fall, and winter (0.3, 0.3, 0.3, and 0.15 m, respectively).

2. The Monin-Obukhov length (L) was set, per EPA 1998a, at 2 m for "agricultural" (open) land use classification.

3. Friction velocity (u*) was calculated using an equation for atmospheric boundary layer similarity theory described by Ramsdell et al. 1994.

4. Daytime Bowen Ratios were set per EPA 1998a for "desert shrub land", average conditions, for the seasons of spring through winter, at 3.0, 4.0, 6.0, and 6.0, for the seasons: spring, summer, fall, and winter respectively.

4.6 Modeling Runs

Unit release (1 g/s) modeling runs were made for both the INTEC main stack and the IWTU stack to obtain the following modeling output (acronyms slightly modified from those in the HHRAP):

- Cv – Annual average vapor concentration (µg-second/g-m^3)
- Cp – Annual average particulate concentration (µg-second/g-m^3)
- Ddv – Annual average dry deposition of vapor (second/m^2-year) (ISCST3 runs only)
- Dwv – Annual average wet deposition of vapor (second/m^2-year)
- Ddp – Annual average dry deposition of particulate (second/m^2-year)
- Dwp – Annual average wet deposition of particulate (second/m^2-year).
- C1v – Maximum 1-hour vapor concentration (µg-second/g-m^3)
- C1p – Maximum 1-hour particulate concentration (µg-second/g-m^3)
- C24v – Maximum 24-hour vapor concentration (µg-second/g-m^3)
- C24p – Maximum 24-hour particulate concentration (µg-second/g-m^3).

Since there is no site-specific particle size information for the IWTU or ILWMS emissions, the additional "particle-bound" phase modeling run specified in the HHRAP was not made (i.e., there is no basis for apportioning pollutants on a different size basis).

---

a. Saggendorf, J., NOAA, to Mike Abbott, INEL, February 11, 1991, "Average INEL Mixing Depths."

Separate modeling runs were made for the INTEC main stack and IWTU stack for each of the three receptor grids (BIG, INL, and HWY) depending upon the exposure scenarios evaluated (see next section). Annual-average concentration and deposition runs (Cp, Cv, Ddv, Dwv, Ddp, Dwp) were made on the BIG and INL receptor grids. Maximum 24-hour concentration runs (C24v, C24p) were made on the HWY receptor grid. Maximum 1-hour concentrations runs (C1p, C1v) were made on the BIG and HWY grids.

5. EXPOSURE ASSESSMENT

5.1 Exposure Scenarios

The risk assessment evaluated seven general exposure scenarios:

- Farmer (annual-average direct inhalation and indirect ingestion)
- Farmer child (direct and indirect)
- Resident (direct and indirect)
- Resident child (direct and indirect)
- Highway motorist (maximum 24-hour average direct inhalation only)
- Maximum INL Site worker outside of INTEC (maximum 1-hour average direct inhalation only)
- Maximum ecological receptor (annual average soil concentrations at maximum [on-site] deposition location).

The first four scenarios were evaluated at the point of maximum impact at or beyond the INL Site boundary (refined INL Site receptor grids, Figure 3). The highway motorist was evaluated at the point of maximum impact along U.S. Highway 20/26 which traverses the southern part of the INL Site (Figure 3). The maximum INL Site worker was evaluated at the point of maximum air concentration outside the INTEC fence line using the "BIG" receptor grid (Figure 3). By evaluating the worker at the point of maximum impact on this grid, the assessment conservatively bounds impacts to any real INL Site worker outside the INTEC fence line, including those from adjacent facilities (e.g., ICDF) or field workers working outside facilities on the INL Site.

The HHRAP (EPA 2005) suggests three other potential exposure scenarios: (1) adult fisher, (2) child fisher, and (3) nursing infant. The fisher scenarios were not evaluated because there are no significant fisheries in the assessment area. The nursing infant scenario was not evaluated because it is specific to exposures to dioxins (PCDDs, PCDFs) and dioxin-like PCBs, and neither the IWTU nor existing ILWMS sources emit these types of compounds in any significant quantity.

The HHRAP suggests an acute receptor scenario to assess potential acute health affects from relatively high, short-term concentrations that might occur downwind from the facility. This risk assessment evaluated acute risk from both ILWMS and IWTU for an INL Site worker (maximum 1-hour concentration on the BIG receptor grid). The acute hazard quotient (AHQ) calculated would also apply to an INL Site visitor.

Maximum 24-hour concentrations of non-carcinogenic pollutants along U.S. Highway 20/26 were also evaluated against AACs for non-carcinogenic TAPs, given in the Idaho DEQ "Rules for the Control of Air Pollution in Idaho" (IDAPA 58.01.01.585 - 586). Carcinogenic TAPs are not evaluated at highway receptors because of the lack of long-term chronic exposure there (required for carcinogenic impacts). Also, since the risk calculations for the off-INL Site receptors (farmer, resident) include assessment of inhalation risk in accordance with the HHRAP methods, no additional IDAPA TAP assessment was made for carcinogenic TAPs at or beyond the INL Site boundary.

Complete descriptions of the exposure pathways and intake rates for the other four scenarios (farmer, farmer child, resident, resident child) are contained in the HHRAP (EPA 2005). While these four scenarios are not intended to be representative of all real exposure scenarios around the INL Site, they provide a standardized and conservative evaluation of maximum potential risks and are consistent with EPA guidance (EPA 2005). The conservative methods and assumptions inherent in these scenarios and the maximum impact locations at which they are evaluated ensure protectiveness of other special subpopulations (herdsmen, hunters) and regionally specific and diverse land-uses. They also will conservatively bound both current and future land use during the maximum foreseeable time period of IWTU and ILWMS operations (15 years).

5.2 Exposure Pathways, Media Concentrations, and Intakes

Table 3 lists the exposure pathways that were evaluated for each exposure scenario. These pathways, and the methods and parameter values used to calculate them, follow HHRAP guidance (EPA 2005). Media concentrations in soil, homegrown produce, animal feeds (including forage, silage, and grain), beef, milk, chicken, eggs, and pork, as well as the scenario and pathway-specific intake rates were assessed.

Four classes of parameters were used in the risk assessment equations in accordance with the HHRAP (EPA 2005): (1) chemical/physical, (2) plant biotransfer factors, (3) animal biotransfer factors, and (4) health benchmarks. All parameter values were taken from the most recent version of EPA's on-line HHRAP Companion data base (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm). The HHRAP equations and parameter values used are contained in Appendix B of this risk assessment.

Table 3. Exposure scenarios and pathways evaluated in the risk assessment.

	Exposure Scenarios Evaluated					
Exposure Pathway	Farmer	Farmer Child	Resident	Resident Child	US 20/26 Motorist	INL Site Worker
Inhalation of vapor and particulates	●	●	●	●	●	●
Incidental ingestion of soil	●	●	●	●	—	—
Ingestion of drinking water from surface water sources	a	a	a	a	a	a
Ingestion of homegrown produce	●	●	●	●	—	—
Ingestion of homegrown beef	●	●	—	—	—	—
Ingestion of milk from homegrown cows	●	●	—	—	—	—
Ingestion of homegrown chickens	●	●	—	—	—	—

Table 3. (continued).

Exposure Pathway	Exposure Scenarios Evaluated					
	Farmer	Farmer Child	Resident	Resident Child	US 20/26 Motorist	INL Site Worker
Ingestion of eggs from homegrown chickens	●	●	—	—	—	—
Ingestion of homegrown pork	●	●	—	—	—	—
Ingestion of fish	b	b	b	b	b	b
Ingestion of breast milk	c	c	c	c	c	c

● = Pathway assessed for that exposure scenario.
— = Pathway not assessed for that exposure scenario (EPA 2005).

a. No surface drinking water supplies exist in the assessment area.
b. No significant fisheries exist in the assessment area.
c. Not evaluated because there are no significant dioxin or dioxin-like PCBs emitted.

6. RISK AND HAZARD CHARACTERIZATION

Risks for each COPC were calculated using EPA cancer slope factors (CSF) for ingestion and unit risk factors (URF) for inhalation. Hazard quotients (HQs) are calculated using EPA Reference Doses (RfD) for ingestion and Reference Concentrations (RfC) for inhalation. In addition, maximum non-cancer inhalation impacts on U.S. 20/26 were compared against the appropriate IDAPA AACs. Acute short-term (maximum 1-hour air concentration) inhalation hazard (AHQs) were assessed using acute inhalation exposure criteria (AIEC). The EPA toxicity criteria (CSFs, URFs, RfDs, RfCs, and AIECs) were taken from EPA's HHRAP Companion Data Base (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm, January 2007), which is maintained with up-to-date health benchmark values by EPA. The risk/hazard equations and parameter values used are contained in Appendix B of this risk assessment.

For each exposure pathway (Table 3), a total cancer risk was calculated by summing individual COPC risks. The cumulative cancer risk was then calculated by summing the total cancer risk from each pathway. Cumulative cancer risks were calculated for each source (IWTU, LET&D, and PEWE) and then summed. Cumulative risk from operation of other contributing sources (ETS and ICDF) were assessed by adding the maximum risk estimates from their respective risk assessments (INEEL 2002; EDF-ER-327) to the maximum exposure scenario risk estimates calculated in this risk assessment for IWTU, LET&D, and PEWE.

7. ECOLOGICAL RISK ASSESSMENT

A screening level ecological risk assessment of the IWTU and ILWMS emissions was performed using the EBSLs approach. EBSLs are back-calculated COPC-specific soil concentrations that provide a conservatively safe exposure level for ecological receptors under chronic exposure conditions. EBSLs were first developed and documented in VanHorn et al. 1995 to assess oral exposure of ecological receptors via food, water, and soil ingestion at the INL Site. Inhalation of dust and vapors and dermal contact with soils by birds and mammals are not assessed since they are considered insignificant contributors to risk (EPA 1999). In 1999, EBSLs were further developed and used in the *Work Plan for Waste Area Groups 6 and 10 Operable Unit 10-04 Comprehensive Remedial Investigation/Feasibility Study* (DOE-ID 1999). This Work Plan documents the exposure equations, receptors (functional groups), input parameters, and toxicity reference values (TRVs) used to calculate EBSLs for receptors at the INL Site. Since then, EPA published improved guidance on ecological risk assessment for organic and

inorganic COPCs in the document *Screening Level Ecological Risk Assessment Protocol (SLERAP) for Hazardous Waste Combustion Facilities* (EPA 1999). The EBSLs used in the previous ILWMS risk assessment (ICP 2004), and those used in this risk assessment, were updated using this SLERAP approach.

Conservative COPC-specific SLQs were calculated by dividing the maximum 1-year COPC soil concentration (CstD, see Appendix B) by the EBSL (see Section 9 Results for specific values). A TSLQ was then calculated by summing the COPC SLQs, similar to the HQs and HIs in the human health risk assessment. For initial screening, a conservative TSLQ value of 1.0 was used. EBSLs allow rapid screening of COPCs to identify those that are the most important for risk. Since EBSLs are calculated using very conservative exposure assumptions, a COPC with an SLQ exceeding 1 does not necessarily indicate a risk but that the EBSL should be re-assessed using more realistic parameter values.

For initial screening, the ecological risk assessment evaluated IWTU and ILWMS emissions at the INL Site location of maximum modeled deposition (BIG grid). In accordance with the RAWP, cumulative ecological impacts from other contributing sources (ETS and ICDF) were evaluated by adding their previously calculated ecological TSLQs (ICP 2004) to the TSLQs for the IWTU/ILWMS sources calculated in this risk assessment.

8. UNCERTAINTY EVALUATION

The risk assessment qualitatively addresses the uncertainty in the methods and parameter values used and their potential effects on the final calculated risk/hazard. This includes uncertainties in source emissions estimates, air dispersion and deposition modeling, exposure assessment, toxicity values and ecological risk assessment.

9. RESULTS

9.1 Air Modeling

Maximum modeled air concentrations and deposition rates for all of the modeling runs are tabulated in Table 4. Public human health impacts (both cancer risks and HQs) from ingestion and inhalation were calculated using the maximum modeled off-site (INL grid) impacts which includes particle (Ddp, Dwp) and vapor (Dydv, Dywv) annual deposition rates and particle (Cp) and vapor (Cv) annual-average air concentrations. For the IWTU runs using ISC3P, Dydv was calculated as the product of the maximum off-site vapor air concentration (Cv) and vapor dry deposition velocity (Vdv) since ISC3P does not have a vapor dry deposition algorithm. This methodology was recommended in the 1998 peer-reviewed draft HHRAP and was found to produce equivalent results to the ISCST3-calculated Dydv. Short-term public inhalation impacts (HQs) were calculated using maximum 24-hour (C24p, C24v) on U.S. Highway 20/26 (Hwy grid). On-site modeled impacts (BIG grid) were used to assess dispersion spatial variability for siting refined receptor grids (INL and Hwy), maximum short-term inhalation impacts for on-site workers (C1v-on), and ecological receptors (Ddp-on, Dwp-on, Dydv-on, Dywv-on).

Table 4. Unit release (1 g/s) air modeling results for the INTEC main (PEWE/LET&D) and IWTU stacks.

Grid	Model Output	Description	Units	UTM-E (m)	UTM-N (m)	Value
		INTEC main stack runs (ISCST3)				
BIG	Cp-on	On-site particle annual conc.	μg-s/g-m^3	344923	4824950	0.086
	Ddp-on	On-site particle annual dry dep.	s/m^2-yr	344923	4826950	0.068
	Dwp-on	On-site particle annual wet dep.	s/m^2-yr	344923	4826950	0.0076
	C1p-on	On-site particle 1-hr conc.	μg-s/g-m^3	334923	4828950	5.60
	Cv-on	On-site vapor annual conc.	μg-s/g-m^3	344923	4826950	0.092
	Dydv-on	On-site vapor annual dry dep.	s/m^2-yr	344923	4826950	0.014
	Dywv-on	On-site vapor annual wet dep.	s/m^2-yr	344923	4826950	0.0047
	C1v-on	On-site vapor 1-hr conc.	μg-s/g-m^3	343923	4828950	3.30
	C24v-on	On-site vapor 24-hr conc.	μg-s/g-m^3	Used for refined grid siting		
Hwy	C24p	US 20/26 particle 24-hr conc.	μg-s/g-m^3	341893	4819687	0.25
	C24v	US 20/26 vapor 24-hr conc.	μg-s/g-m^3	331300	4827066	0.29
INL	Cp	Off-site particle annual conc.	μg-s/g-m^3	337000	4810400	0.031
	Ddp	Off-site particle annual dry dep.	s/m^2-yr	337000	4810400	0.0049
	Dwp	Off-site particle annual wet dep.	s/m^2-yr	337000	4810400	0.00029
	Cv	Off-site vapor annual conc.	μg-s/g-m^3	337000	4810400	0.028
	Dydv	Off-site vapor annual dry dep.	s/m^2-yr	337000	4810400	0.0044
	Dywv	Off-site vapor annual wet dep.	s/m^2-yr	337000	4810400	0.00034
		IWTU runs (ICS3P with BPIPPRM)				
BIG	Cp-on	On-site particle annual conc.	μg-s/g-m^3	344923	4826950	0.32
	Ddp-on	On-site particle annual dry dep.	s/m^2-yr	344923	4826950	0.19
	Dwp-on	On-site particle annual wet dep.	s/m^2-yr	344923	4826950	0.0087
	C1p-on	On-site particle 1-hr conc.	μg-s/g-m^3	349923	4826950	13.0
	Cv-on	On-site vapor annual conc.	μg-s/g-m^3	344923	4826950	0.35
	Dydv-on	On-site vapor annual dry dep.	s/m^2-yr	Not available in ISC3-PRIME		
	Dywv-on	On-site vapor annual wet dep.	s/m^2-yr	344923	4826950	0.0056
	C1v-on	On-site vapor 1-hr conc.	μg-s/g-m^3	344923	4826950	14.4
	C24v-on	On-site vapor 24-hr conc.	μg-s/g-m^3	Used for refined grid siting		
Hwy	C24p	US 20/26 particle 24-hr conc.	μg-s/g-m^3	341538	4820039	0.89
	C24v	US 20/26 vapor 24-hr conc.	μg-s/g-m^3	340478	4821101	1.13
INL	Cp	Off-site particle annual conc.	μg-s/g-m^3	336800	4812500	0.052
	Ddp	Off-site particle annual dry dep.	s/m^2-yr	336500	4812500	0.0064
	Dwp	Off-site particle annual wet dep.	s/m^2-yr	338500	4812500	0.00040
	Cv	Off-site vapor annual conc.	μg-s/g-m^3	336500	4812500	0.062
	Dydv	Off-site vapor annual dry dep.	s/m^2-yr	Not available in ISC3-PRIME		
	Dywv	Off-site vapor annual wet dep.	s/m^2-yr	338500	4812500	0.00050

Plots of the dispersion trends for both ILWMS (INTEC main stack) and IWTU are shown in Figures 4–9. The plots were made using the PLOTFILE output from ISCST3/ISC3P and Surfer® 8 mapping software.[b,c] These figures show that the locations of the maximum off-site impact (Figures 4 and 5) are different for the INTEC main stack and the IWTU stack, with the INTEC main stack maximum occurring further out on the elevated northern slope of Big Southern Butte and the IWTU maximum occurring at the INL Site boundary. This is likely due to the fact that the 250-ft INTEC main stack is more than twice as high as the 120-ft IWTU stack, resulting in a higher INTEC main stack plume centerline which does not reach maximum at ground-level until it impacts the elevated slopes of Big Southern Butte. This difference in stack heights also influences the maximum ground-level relative (1 g/s) air concentrations off-site, with the IWTU maximum approximately twice as high as the INTEC main stack maximum. It also changes the relative dispersion patterns for the 1-hour and 24-hour model results. In both the annual-average and 24-hour modeling runs, maximum impacts were adequately resolved using refined 100-m receptor grids that extended well beyond the point of maximum impact determined in the coarse (INL) receptor grid. Maximum 1-hour concentrations on-site were deemed to be adequately assessed using the coarse (INL) receptor grid based on the very low AHQ calculated using these results.

b. Golden Software, Inc., Golden, CO (www.goldensoftware.com).

c. References herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government, any agency thereof, or any company affiliated with the Idaho Cleanup Project.

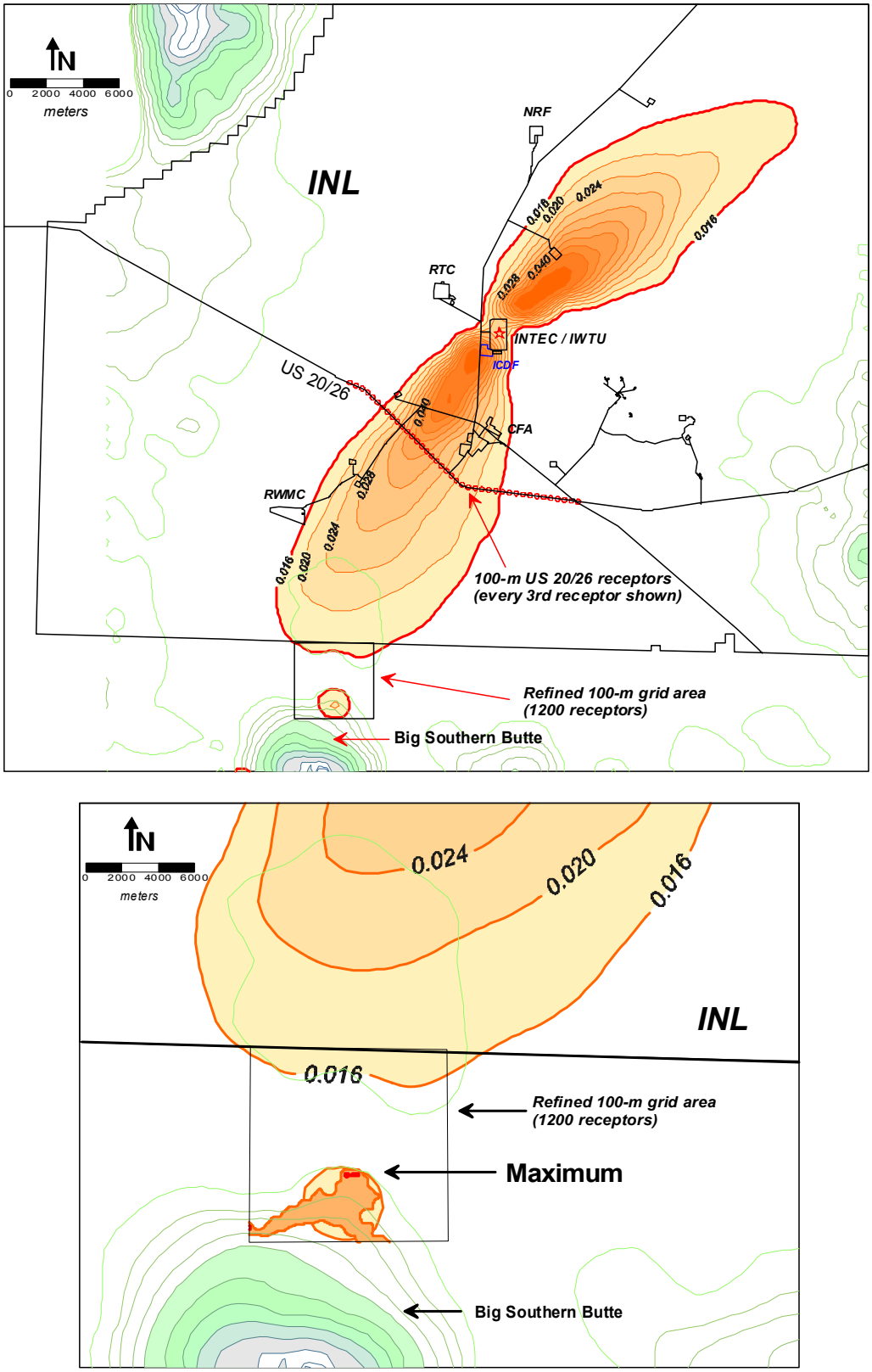


Figure 4. Annual-average vapor dispersion pattern (μg/m^3 per g/s, orange contour lines) for the INTEC main stack with maximum off-INL impact location noted.

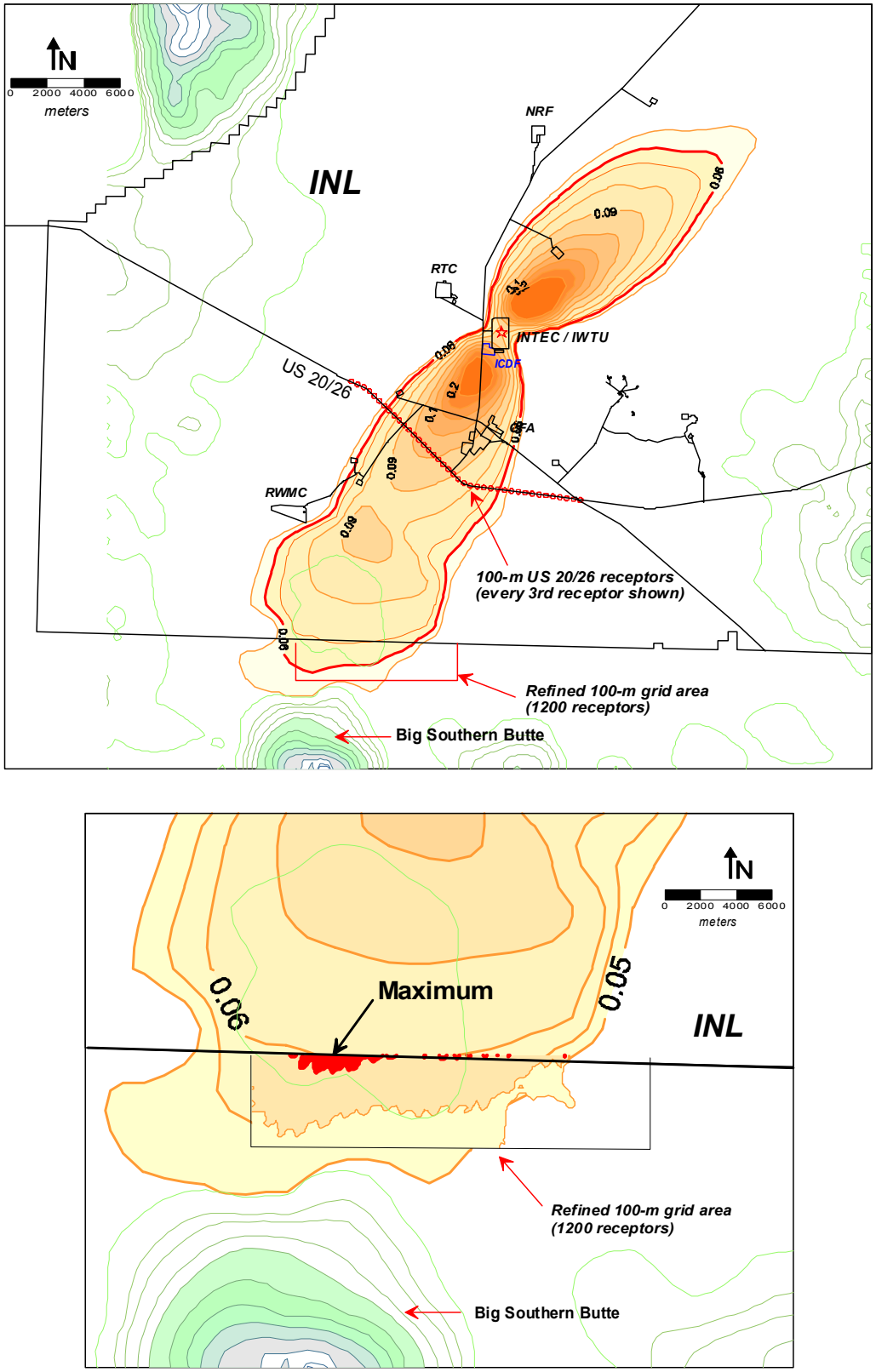


Figure 5. Annual-average vapor dispersion pattern (μg/m^3 per g/s, orange contour lines) for the IWTU stack with maximum off-INL impact location noted.

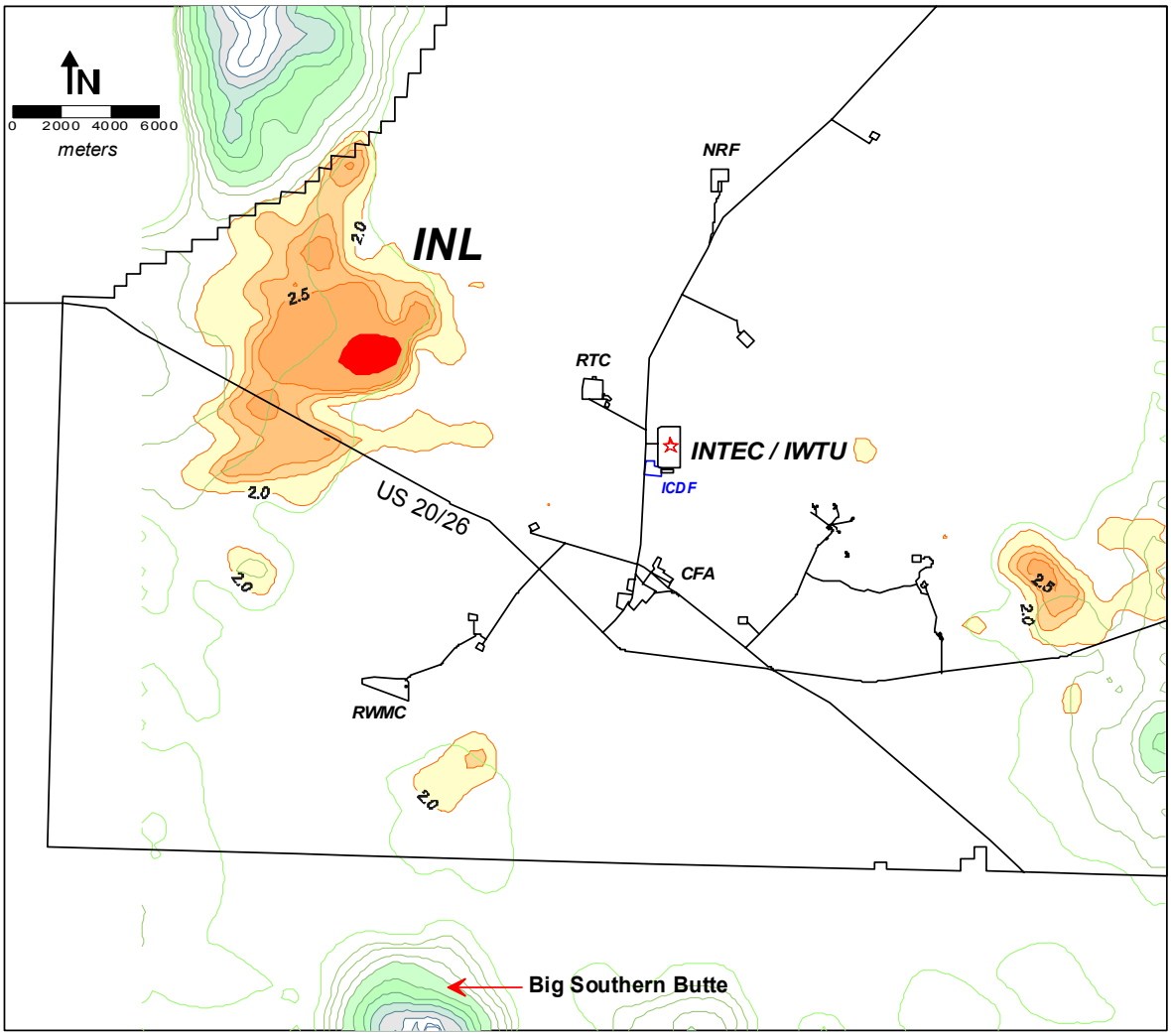


Figure 6. Maximum 1-hour vapor dispersion pattern for the INTEC main stack (μg/m^3 per g/s, orange contour lines). Used to evaluate maximum short-term acute inhalation impacts.

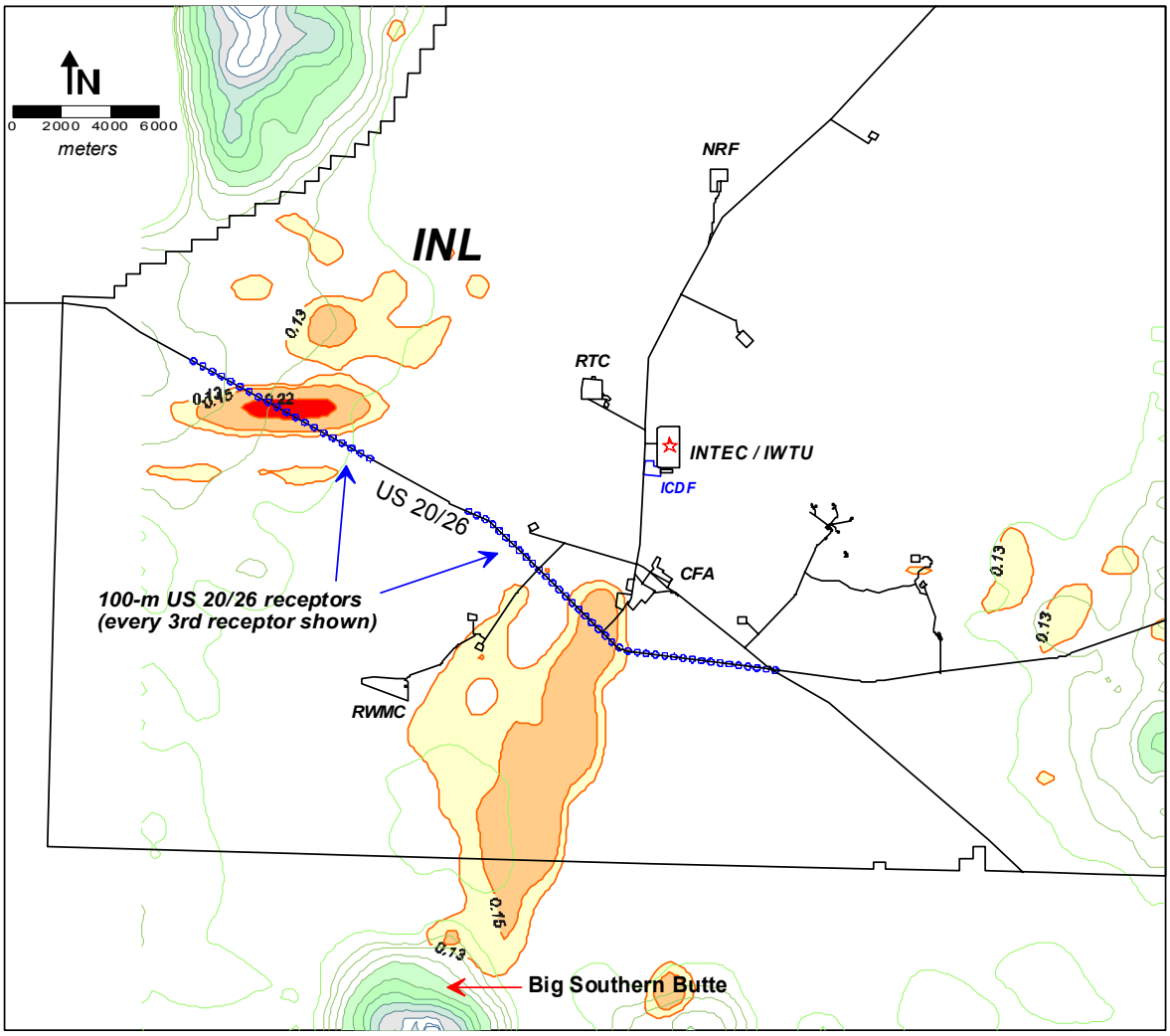


Figure 7. Maximum 24-hour vapor dispersion pattern for the INTEC main stack (µg/m^3 per g/s, orange contour lines). Used to site discrete 100-m interval receptors on U.S. Highway 20/26.

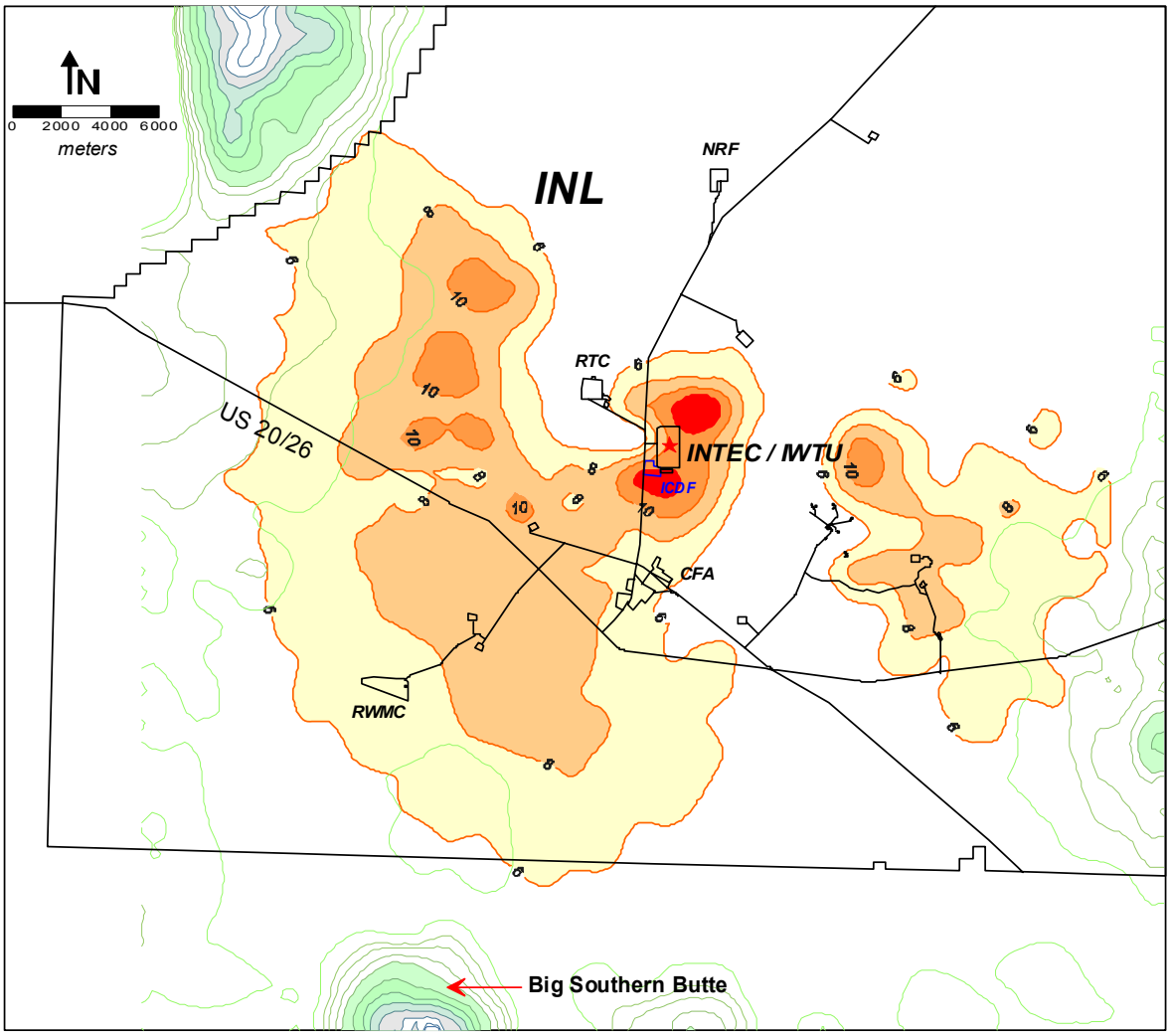


Figure 8. Maximum 1-hour vapor dispersion pattern from the IWTU stack (μg/m^3 per g/s, orange contour lines). Used to evaluate maximum short-term acute inhalation impacts.

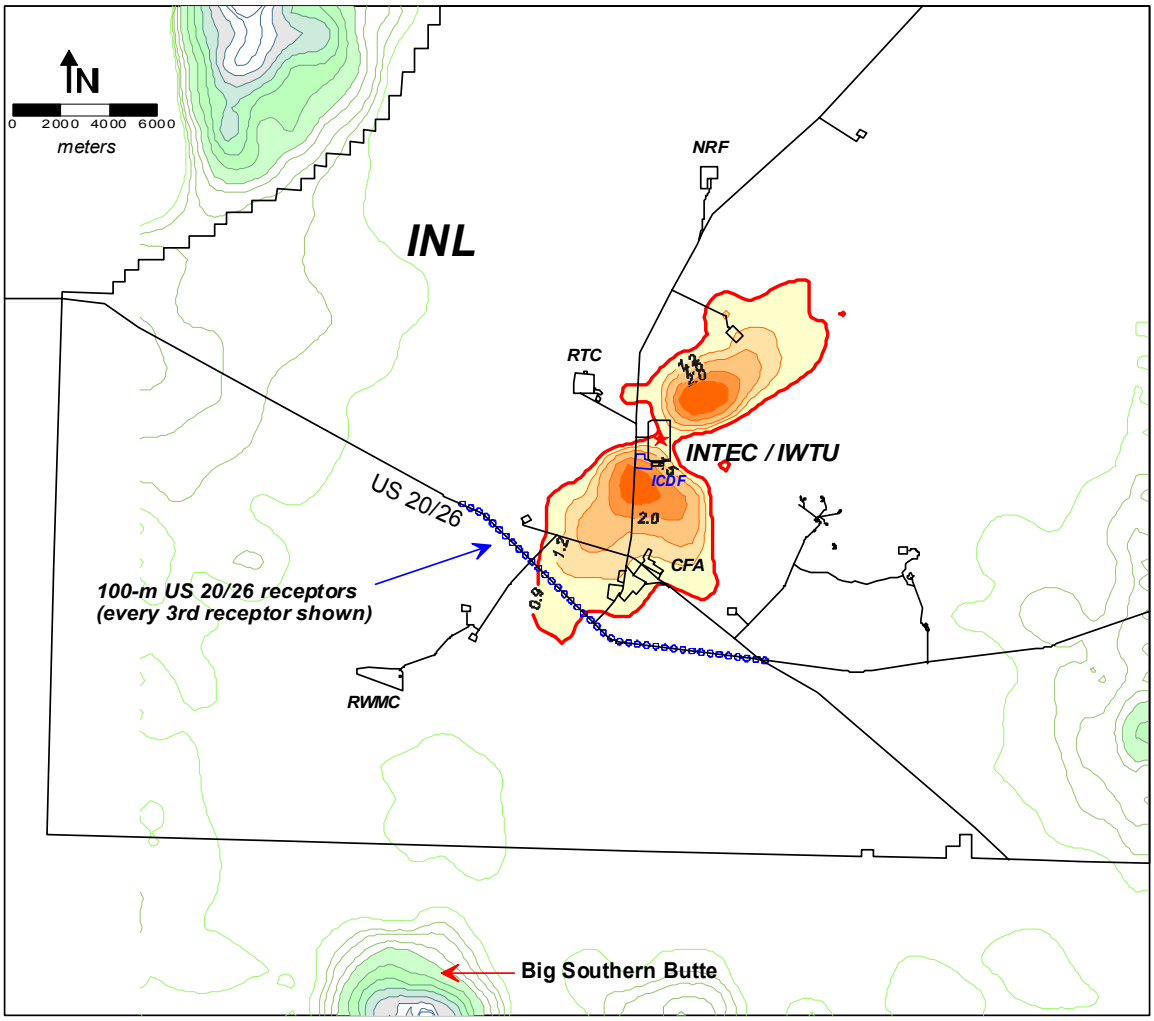


Figure 9. Maximum 24-hour vapor dispersion pattern from the IWTU stack (μg/m^3 per g/s, orange contour lines). Used to site discrete 100-m interval receptors on U.S. Highway 20/26.

9.2 Human Health Impacts

9.2.1 Off-INL Public Health Impacts – ILWMS and IWTU

This section gives the estimated human health impacts (cancer risks and hazard quotients) for the LET&D/PEWE and IWTU. These results were calculated using the HHRAP methods, equations, and parameter values listed in Section 5.2 and Appendix B. A summary of the combined estimated cancer risks and non-cancer hazards for both the LET&D/PEWE and IWTU is given in Table 5. Tables 6 through 11 provide detailed human health impact results for individual COPCs by source (IWTU, LET&D/PEWE), exposure pathway (ingestion, inhalation), and type of health impact (cancer risk, non-cancer hazard). The maximum cancer risk estimate for any of the scenarios is 4.8E-08 (farmer), which is about 0.5% of the EPA target criteria (1E-05). The maximum non-cancer hazard index estimate is 0.0089, less than 4% of the EPA target criteria (0.25). Because these scenarios were evaluated at the location of maximum off-site air concentrations and deposition rates (where no one resides), real impacts would be less for actual residents that live around the site (e.g., Atomic City). These results demonstrate that both

of these facilities can be simultaneously operated without unacceptable health impacts to the public at any off-site location.

Table 5. Summary of total estimated human health impacts from LET&D/PEWE and IWTU emissions.

Health Impact	Child	Farmer Child	Adult	Farmer
Ingestion Cancer Risk	2.2E-09	6.7E-09	8.7E-09	1.2E-08
Inhalation Cancer Risk	5.4E-09	5.4E-09	2.7E-08	3.6E-08
Total Cancer Risk	**7.6E-09**	**1.2E-08**	**3.6E-08**	**4.8E-08**
Ingestion Non-cancer Hazard	1.2E-04	1.3E-04	6.7E-05	2.7E-05
Inhalation Non-cancer Hazard	8.8E-03	8.8E-03	8.8E-03	8.8E-03
Total Non-cancer Hazard (HI)	**0.0089**	**0.0089**	**0.0088**	**0.0088**

Indirect (i.e., ingestion) cancer risks and hazard quotients for the four public exposure scenarios evaluated (child, farmer child, adult, farmer) are given in Tables 6 and 7 for the IWTU emissions and Tables 8 and 9 for the LET&D/PEWE emissions. For IWTU emissions, cancer risk (1.1E-09 maximum for the farmer scenario) is primarily due to arsenic, while hazard index (HI) (9.2E-05 maximum for the farmer child) is primarily due to mercury (mercuric chloride) and silver. For LET&D/PEWE emissions, cancer risk (1.1E-08 maximum for the farmer) is primarily due to N-nitrosodipropylene, while the HI (3.8E-05 maximum for the farmer child) is primarily due to hydrogen chloride, chromium (VI), and mercury (mercuric chloride). It should be noted that the actual valence state of the chromium emissions are unknown and that our assumption of the more hazardous chromium (VI) form is an upper-bound estimate for this metal. The sum of the maximum IWTU and ILWMS indirect impacts are 1.2E-08 cancer risk and 1.3E-04 HI.

Table 6. Ingestion cancer risk estimates for IWTU emissions.

	Ingestion Cancer Risk - IWTU Operations			
COPC	Child	Farmer Child	Adult	Farmer
Aluminum	NA	NA	NA	NA
Arsenic	1.17E-10	2.12E-10	9.33E-10	1.10E-09
Barium	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA
Cadmium	4.85E-18	1.65E-17	5.98E-17	7.77E-17
Chlorine	NA	NA	NA	NA
Chromium	NA	NA	NA	NA
Hexavalent chromium	NA	NA	NA	NA
Hydrogen chloride	NA	NA	NA	NA
Lead	1.10E-22	1.50E-22	4.28E-22	3.13E-22
Mercuric chloride	NA	NA	NA	NA
Mercury - total	NA	NA	NA	NA
Methyl mercury	NA	NA	NA	NA
Nickel	NA	NA	NA	NA
Selenium	NA	NA	NA	NA
Silver	NA	NA	NA	NA
Zinc	NA	NA	NA	NA
Total Risk	**1.2E-10**	**2.1E-10**	**9.3E-10**	**1.1E-09**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

Table 7. Non-cancer ingestion hazard quotients for IWTU emissions.

COPC	Ingestion Hazard Quotient – IWTU Operations			
	Child	Farmer Child	Adult	Farmer
Aluminum	NA	NA	NA	NA
Arsenic	3.05E-06	5.49E-06	4.84E-06	4.27E-06
Barium	2.45E-06	3.78E-06	1.77E-06	9.65E-07
Beryllium	1.20E-07	3.54E-07	3.13E-07	3.12E-07
Cadmium	1.49E-13	5.06E-13	3.67E-13	3.58E-13
Chlorine	5.55E-07	2.05E-06	7.48E-07	5.53E-07
Chromium	9.20E-19	9.81E-19	5.17E-19	1.96E-19
Hexavalent chromium	4.63E-16	4.94E-16	2.61E-16	9.86E-17
Hydrogen chloride	2.57E-08	2.57E-08	1.71E-09	1.06E-09
Lead	3.53E-16	4.80E-16	2.74E-16	1.50E-16
Mercuric chloride	2.71E-05	3.20E-05	2.15E-05	9.52E-06
Mercury - total	NA	NA	NA	NA
Methyl mercury	7.64E-07	1.37E-06	9.15E-07	9.32E-07
Nickel	1.17E-17	1.28E-17	8.17E-18	3.99E-18
Selenium	2.97E-06	3.02E-06	1.47E-06	3.00E-07
Silver	4.30E-05	4.38E-05	1.85E-05	2.37E-06
Zinc	3.63E-20	9.14E-20	6.21E-20	5.52E-20
Total Hazard Index (HI)	**8.0E-05**	**9.2E-05**	**5.0E-05**	**1.9E-05**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

Table 8. Ingestion cancer risk estimates for LET&D/PEWE emissions.

COPC	Ingestion Cancer Risk – LET&D/PEWE			
	Child	Farmer Child	Adult	Farmer
Arsenic	9.30E-13	1.68E-12	7.39E-12	8.69E-12
Benzo(a)pyrene	3.66E-10	3.73E-10	1.01E-09	5.01E-10
Chromium	NA	NA	NA	NA
Hexavalent chromium	NA	NA	NA	NA
1,4-dichlorobenzene	1.71E-18	5.93E-18	3.12E-18	9.36E-18
3,3'-dichlorobenzidine	1.01E-10	1.38E-10	3.54E-10	2.80E-10
Bis(2-ethylhexyl phthalate)	1.15E-13	2.22E-13	7.22E-13	7.63E-13
Fluoranthene	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA
Hydrogen chloride	NA	NA	NA	NA
Mercuric chloride	NA	NA	NA	NA
Mercury - total	NA	NA	NA	NA
Methyl mercury	NA	NA	NA	NA
Nickel	NA	NA	NA	NA
N-nitrosodipropylamine	1.65E-09	6.01E-09	6.41E-09	1.00E-08
Pyrene	NA	NA	NA	NA
1,2,3-trichloropropane	2.28E-15	8.04E-15	5.86E-15	1.29E-14
Total Risk	**2.1E-09**	**6.5E-09**	**7.8E-09**	**1.1E-08**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

Table 9. Non-cancer ingestion hazard quotients for LET&D/PEWE emissions.

COPC	Ingestion Hazard Quotient – LET&D/PEWE			
	Child	Farmer Child	Adult	Farmer
Arsenic	2.41E-08	4.34E-08	3.83E-08	3.38E-08
Benzo(a)pyrene	NA	NA	NA	NA
Chromium	2.09E-08	2.22E-08	1.17E-08	4.43E-09
Hexavalent chromium	1.05E-05	1.12E-05	5.91E-06	2.24E-06
1,4-dichlorobenzene	1.23E-13	4.27E-13	4.49E-14	1.01E-13
3,3'-dichlorobenzidine	NA	NA	NA	NA
Bis(2-ethylhexyl phthalate)	4.80E-09	9.25E-09	6.02E-09	4.77E-09
Fluoranthene	1.25E-09	1.35E-09	4.47E-10	1.41E-10
Hexachlorocyclopentadiene	7.25E-10	8.19E-10	2.22E-10	7.77E-11
Hydrogen chloride	1.15E-05	1.15E-05	7.62E-07	4.71E-07
Mercuric chloride	7.73E-06	9.07E-06	6.04E-06	2.64E-06
Mercury - total	6.13E-08	2.45E-07	1.75E-07	1.75E-07
Methyl mercury	2.55E-07	4.35E-07	2.85E-07	2.74E-07
Nickel	5.23E-06	5.72E-06	3.65E-06	1.78E-06
N-nitrosodipropylamine	NA	NA	NA	NA
Pyrene	3.98E-09	4.36E-09	2.08E-09	6.92E-10
1,2,3-trichloropropane	6.33E-13	2.23E-12	3.26E-13	5.36E-13
Total Hazard Index (HI)	**3.5E-05**	**3.8E-05**	**1.7E-05**	**7.6E-06**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

Maximum inhalation impacts for the child scenarios, adult, and farmer exposure scenarios are given in Tables 10 and 11. For IWTU, cancer risk (6.7E-09 maximum for the farmer) is driven by arsenic and beryllium, and non-cancer hazards (0.0056 maximum for all scenarios) are driven by nitrogen oxides, chorine, barium, and arsenic. For LET&D/PEWE emissions, cancer risks (2.9E-08 maximum for the farmer) are driven by hexavalent chromium, and non-cancer hazards (0.003 maximum for all scenarios) are driven by hydrogen chloride. The sums of the maximum IWTU and LET&D/PEWE inhalation impacts are 3.6E-08 cancer risk (farmer) and 0.0088 HI non-cancer risk (for all) (see Table 5).

Table 10. Maximum inhalation health impact estimates for IWTU emissions.

COPC	Inhalation Cancer Risk			Inhalation HQ
	Child	Adult	Farmer	
Aluminum	NA	NA	NA	1.92E-09
Arsenic	7.35E-10	3.67E-09	4.90E-09	1.98E-04
Barium	NA	NA	NA	2.46E-04
Beryllium	2.63E-10	1.31E-09	1.75E-09	9.56E-05
Bromine	NA	NA	NA	2.67E-07
Cadmium	1.51E-16	7.53E-16	1.00E-15	3.98E-10
Calcium oxide	NA	NA	NA	3.54E-11
Carbon monoxide	NA	NA	NA	2.42E-07
Chlorine	NA	NA	NA	2.29E-03
Chromium	NA	NA	NA	1.84E-12
Fluorides	NA	NA	NA	8.18E-06

Table 10. (continued).

COPC	Inhalation Cancer Risk			Inhalation HQ
	Child	Adult	Farmer	
Fluorine	NA	NA	NA	7.97E-06
Hexavalent chromium	2.08E-19	1.04E-18	1.39E-18	5.75E-09
Hydrogen chloride	NA	NA	NA	2.35E-05
Lead	1.54E-22	7.69E-22	1.03E-21	9.97E-17
Mercuric chloride	NA	NA	NA	1.02E-06
Mercury - total	NA	NA	NA	1.60E-08
Methyl mercury	NA	NA	NA	NA
Molybdenum	NA	NA	NA	6.07E-07
Nickel	1.01E-21	5.06E-21	6.75E-21	6.43E-11
Nitrogen oxides	NA	NA	NA	2.70E-03
Particulate matter	NA	NA	NA	3.23E-14
Rhodium	NA	NA	NA	1.17E-07
Selenium	NA	NA	NA	9.94E-08
Silver	NA	NA	NA	9.80E-07
Sulfur dioxide	NA	NA	NA	2.43E-05
Tin	NA	NA	NA	6.59E-07
Zinc	NA	NA	NA	1.41E-11
Total	**1.0E-09**	**5.0E-09**	**6.7E-09**	**0.0056**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

Table 11. Maximum inhalation health impact estimates for LET&D/PEWE emissions.

COPC	Inhalation Cancer Risk			Inhalation HQ
	Child	Adult	Farmer	
Arsenic	4.55E-12	2.28E-11	3.04E-11	4.12E-07
Benzo(a)pyrene	1.51E-12	7.56E-12	1.01E-11	NA
Chromium	NA	NA	NA	1.44E-07
Hexavalent chromium	3.70E-09	1.85E-08	2.47E-08	4.50E-04
1,4-dichlorobenzene	1.45E-15	7.24E-15	9.65E-15	1.92E-12
3,3'-dichlorobenzidine	1.18E-12	5.92E-12	7.90E-12	NA
Bis(2-ethylhexyl phthalate)	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	3.77E-11
Hexachlorocyclopentadiene	NA	NA	NA	2.25E-07
Hydrogen chloride	NA	NA	NA	2.62E-03
Mercuric chloride	NA	NA	NA	1.84E-07
Mercury – total	NA	NA	NA	2.77E-09
Methyl mercury	NA	NA	NA	NA
Nickel	4.24E-10	2.12E-09	2.83E-09	1.03E-04
N-nitrosodipropylamine	2.49E-10	1.24E-09	1.66E-09	NA
Pyrene	NA	NA	NA	4.14E-11
1,2,3-trichloropropane	5.70E-13	2.85E-12	3.80E-12	NA
Total	**4.4E-09**	**2.2E-08**	**2.9E-08**	**0.003**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

9.2.2 Contributions from Other Sources

Human health impacts from the other potentially contributing sources, ETS and ICDF, were previously calculated and documented in INEEL 2002, EDF-ER-327, and ICP 2004. The maximum cancer risks for ETS and ICDF were 1.3E-10 and 4.2E-08, respectively. The ETS contribution is insignificant, but the ICDF cancer risk estimate effectively doubles the maximum LET&D/PEWE/IWTU risk (4.8E-08, Table 5) to 9E-08, about 1% of the EPA target criteria target criteria (1E-05). The maximum HIs for ETS and ICDF were 6.5E-06 and <0.01, respectively. The ICDF HI estimate was calculated in EDF-ER-327 for an INL Site visitor, which conservatively bounds any off-site public receptor. The cumulative HI for all facilities (IWTU, LET&D, PEWE, ETS, and ICDF) is therefore less than 0.02, about 7% of the EPA target criteria (0.25).

9.2.3 Impacts to Public Motorists

Potential acute (non-cancer) inhalation impacts to passing motorists on U.S. Highway 20/26, which traverses the southern portion of the INL Site, were evaluated by dividing the modeled maximum 24-hour air concentrations on the highway by AACs for non-carcinogens published by the Idaho DEQ for toxic air pollutants (IDAPA 58.01.01.585). Tables 12 and 13 summarize the modeling results for this assessment. In all cases, maximum 24-hour air concentrations were well below the published AACs. The maximum impact was from IWTU fluorine emissions, which was less than 0.02% of the AAC. Inhalation cancer risk is not evaluated on Highway 20/26 because the transient nature of exposure to passing motorists does not meet the chronic exposure assumption needed to assess cancer risk.

Table 12. Comparison of maximum IWTU 24-hour air concentrations with Idaho Acceptable Ambient Concentrations for non-carcinogens on U.S. Highway 20/26.

COPC	24-hr Conc US 20/26 ($\mu g/m^3$)	AAC ($\mu g/m^3$)	Conc/AAC
Aluminum	1.71E-07	1.00E+02	1.71E-09
Arsenic	1.06E-04	NA	NA
Barium	2.19E-03	2.50E+01	8.75E-05
Beryllium	3.40E-05	NA	NA
Bromine	8.69E-06	3.50E+01	2.48E-07
Cadmium	1.41E-09	NA	NA
Calcium oxide	6.78E-08	1.00E+02	6.78E-10
Carbon monoxide	4.63E-02	NA	NA
Chlorine	8.75E-03	1.50E+02	5.83E-05
Chromium	8.17E-10	2.50E+01	3.27E-11
Fluorides	2.03E-03	1.25E+02	1.63E-05
Fluorine	1.53E-02	1.00E+02	1.53E-04
Hexavalent chromium	8.17E-10	NA	NA
Hydrogen chloride	9.01E-03	3.75E+02	2.40E-05
Lead	2.66E-15	NA	NA
Mercuric chloride	2.14E-05	2.50E+00	8.55E-06
Mercury – total	9.20E-07	2.50E+00	3.68E-07
Methyl mercury	NA	NA	NA
Molybdenum	5.38E-03	5.00E+02	1.08E-05
Nickel	2.29E-10	NA	NA
Nitrogen oxides	1.03E+00	NA	NA

Table 12. (continued).

COPC	24-hr Conc US 20/26 (μg/m^3)	AAC (μg/m^3)	Conc/AAC
Particulate matter	8.60E-11	NA	NA
Rhodium	1.04E-04	5.00E+01	2.08E-06
Selenium	1.77E-05	1.00E+01	1.77E-06
Silver	8.71E-05	5.00E+00	1.74E-05
Sulfur dioxide	1.70E-01	NA	NA
Tin	1.17E-03	1.00E+02	1.17E-05
Zinc	2.25E-10	5.00E+01	4.50E-12

Note: NA = no published AAC value. Methyl mercury is not of concern via the inhalation pathway (HHRAP).

Table 13. Comparison of maximum LET&D/PEWE 24-hour air concentrations with Idaho Acceptable Ambient Concentrations for non-carcinogens on U.S. Highway 20/26.

COPC	24-hr Conc US 20/26 (μg/m^3)	AAC (μg/m^3)	Conc/AAC
Arsenic	1.04E-07	NA	NA
Benzo(a)pyrene	1.46E-07	NA	NA
Chromium	3.03E-05	2.50E+01	1.21E-06
Hexavalent chromium	3.03E-05	NA	NA
1,4-dichlorobenzene	1.67E-08	2.25E+04	7.44E-13
3,3'-dichlorobenzidine	3.88E-07	NA	NA
Bis(2-ethylhexyl phthalate)	1.53E-06	NA	NA
Fluoranthene	5.74E-08	NA	NA
Hexachlorocyclopentadiene	4.90E-07	5.00E+00	9.80E-08
Hydrogen chloride	5.71E-01	3.75E+02	1.52E-03
Mercuric chloride	2.13E-06	2.50E+00	8.51E-07
Mercury – total	9.05E-09	2.50E+00	3.62E-09
Methyl mercury	NA	NA	NA
Nickel	1.74E-04	NA	NA
N-nitrosodipropylamine	1.58E-05	NA	NA
Pyrene	4.95E-08	NA	NA
1,2,3-trichloropropane	3.63E-08	3.00E+03	1.21E-11

Note: NA = no published AAC value. Methyl mercury is not of concern via the inhalation pathway (HHRAP).

9.2.4 Acute Inhalation Risk to a Worker

Maximum inhalation impacts to onsite workers were estimated by an acute hazard quotient (AHQ), which was calculated by dividing the maximum modeled 1-hr air concentration (C_{acute}) at any location on the INL Site by the COPC's acute inhalation exposure criteria (AIECs) taken from the EPA Companion Date Base. An AHQ of less than 1 is considered acceptable (EPA 2005). The results of this assessment (Tables 14 and 15) demonstrate that acute hazards to workers anywhere on the INL Site for both IWTU and ILWMS emissions are well within AIECs. Since AIECs are not worker-specific health criteria, this finding of no acute inhalation impact also applies to members of the public who may be visiting the site.

Table 14. IWTU acute (1-hour) inhalation impacts for a worker anywhere on the INL Site.

COPC	C_{acute} ($\mu g/m^3$)	AIEC (mg/m^3)	AHQ
Aluminum	NA	NA	NA
Arsenic	1.84E-07	1.90E-04	9.70E-07
Barium	7.88E-05	1.50E+00	5.25E-08
Beryllium	1.90E-08	5.00E-03	3.80E-09
Cadmium	3.29E-17	3.00E-02	1.10E-18
Chlorine	8.81E-04	2.10E-01	4.19E-06
Chromium	1.10E-17	1.50E+00	7.33E-21
Hexavalent chromium	1.10E-17	NA	NA
Hydrogen chloride	9.34E-04	2.10E+00	4.45E-07
Lead	1.16E-28	1.50E-01	7.76E-31
Mercuric chloride	NA	NA	NA
Mercury – total	2.44E-08	1.80E-03	1.35E-08
Methyl mercury	NA	NA	NA
Nickel	8.60E-19	6.00E-03	1.43E-19
Selenium	5.15E-09	1.47E+00	3.50E-12
Silver	1.25E-07	3.00E-01	4.16E-10
Zinc	8.33E-19	3.00E+01	2.78E-23
Total			**5.7E-06**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

Table 15. LET&D/PEWE acute (1-hour) inhalation impacts for a worker anywhere on the INL Site.

COPC	C_{acute} ($\mu g/m^3$)	AIEC (mg/m^3)	AHQ
Arsenic	1.85E-11	1.90E-04	9.74E-11
Benzo(a)pyrene	2.94E-11	6.00E-01	4.89E-14
Chromium	1.58E-06	1.50E+00	1.05E-09
Hexavalent chromium	1.58E-06	NA	NA
1,4-dichlorobenzene	2.11E-13	6.00E+02	3.52E-19
3,3'-dichlorobenzidine	1.79E-10	6.00E+00	2.99E-14
Bis(2-ethylhexyl phthalate)	3.64E-09	1.00E+01	3.64E-13
Fluoranthene	2.49E-12	1.50E-02	1.66E-13
Hexachlorocyclopentadiene	1.81E-10	2.00E-01	9.06E-13
Hydrogen chloride	1.28E+01	2.10E+00	6.10E-03
Mercuric chloride	NA	NA	NA
Mercury – total	1.54E-08	1.80E-03	8.58E-09
Methyl mercury	NA	NA	NA
Nickel	5.16E-05	6.00E-03	8.59E-06
N-nitrosodipropylamine	1.88E-07	2.00E-01	9.42E-10
Pyrene	1.86E-12	1.50E+01	1.24E-16
1,2,3-trichloropropane	9.87E-13	6.00E+01	1.65E-17
Total			**6.11E-03**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

9.2.5 Ecological Risk

Risk to ecological receptors was calculated using environmentally-based screening levels (EBSLs), which are COPC soil concentrations back-calculated from conservative ecological receptor exposure and toxicity criteria (Van Horn et al. 1995; ICP 2004). The maximum soil concentration calculated for anywhere on the INL Site was divided by the EBSL to obtain screening level quotients (SLQs). Individual COPC SLQs less than 1.0 and a TSLQ less than 10 are normally used as a target risk criteria in CERCLA risk assessments, although a more conservative TSLQ criterion of 1.0 was specified for this risk assessment in the RAWP. The TSLQ calculated for IWTU COPCs was 0.13, which was mostly due to the barium and silver (Table 16). The TSLQ calculated for the LET&D/PEWE COPC's was 0.0032 (Table 17). Combining these two TSLQs with the TSLQs previously calculated for ETS (0.25) and ICDF (0.26) (ICP 2004) gives a TSLQ for all contributing sources of 0.64, which is less than the conservative 1.0 TSLQ criterion specified in the RAWP. These results demonstrate that the IWTU and all contributing sources in the area will not adversely affect ecological receptors.

Table 16. Ecological screening level quotients for IWTU COPCs.

COPC	Max Soil (mg/kg)	EBSL	SLQ
Aluminum	1.79E-10	5.00E+00	3.59E-11
Arsenic	1.65E-09	1.00E+00	1.65E-09
Barium	1.27E-01	1.66E+00	7.65E-02
Beryllium	1.47E-06	1.00E-01	1.47E-05
Cadmium	5.17E-14	8.18E-02	6.31E-13
Chlorine	1.23E-04	NA	NA
Chromium	1.71E-13	3.31E+00	5.17E-14
Hexavalent chromium	1.72E-13	NA	NA
Hydrogen chloride	1.27E-04	NA	NA
Lead	1.18E-16	5.18E-02	2.28E-15
Mercuric chloride	1.53E-03	9.73E-01	1.58E-03
Mercury – total	0.00E+00	NA	NA
Methyl mercury	3.08E-05	9.73E-01	3.17E-05
Nickel	3.36E-18	2.50E+01	1.34E-19
Selenium	7.95E-09	5.00E-02	1.59E-07
Silver	9.49E-04	2.00E-02	4.75E-02
Zinc	2.45E-18	9.00E-01	2.72E-18
Total (TSLQ)			**1.3E-01**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

Table 17. Ecological screening level quotients for LET&D/PEWE COPCs.

COPC	Max Soil (mg/kg)	EBSL	SLQ
Arsenic	4.53E-12	1.00E+00	4.53E-12
Benzo(a)pyrene	4.56E-06	2.07E-03	2.20E-03
Chromium	1.35E-03	3.31E+00	4.07E-04
Hexavalent chromium	1.36E-03	3.31E+00	4.10E-04
1,4-dichlorobenzene	2.37E-12	NA	NA
3,3'-dichlorobenzidine	1.80E-06	NA	NA
Bis(2-ethylhexyl phthalate)	2.46E-06	2.30E-01	1.07E-05
Fluoranthene	4.53E-07	4.06E+01	NA
Hexachlorocyclopentadiene	3.55E-08	1.00E-01	3.55E-07
Hydrogen chloride	3.90E-02	NA	NA
Mercuric chloride	2.02E-04	9.73E-01	2.08E-04
Mercury – total	NA	NA	NA
Methyl mercury	4.07E-06	9.73E-01	4.18E-06
Nickel	5.21E-07	2.50E+01	2.08E-08
N-nitrosodipropylamine	2.48E-06	NA	NA
Pyrene	1.46E-06	2.43E+01	5.99E-08
1,2,3-trichloropropane	3.41E-12	NA	NA
Total SLQ (TSLQ)			**3.2E-03**

Note: NA = not applicable (no toxicity or HHRAP transport parameter values for COPC)

9.3 Human Health Risk Assessment Uncertainty

Several sources of uncertainty affect the overall estimates of human health impacts (cancer risk and non-cancer hazard index) as calculated in this risk assessment. The sources are generally associated with characterization of COPC emission rates, air modeling, exposure assessment, toxicity values, and risk characterization.

9.3.1 Uncertainty Associated with COPC Emission Rate Characterization

Offgas sampling and analysis has numerous uncertainties associated with it including inherent variability in the analysis, representativeness of the samples, sampling errors, and heterogeneity of the sample matrix. Specific QA/QC procedures used in the ILWMS offgas sampling are contained in their respective emissions inventories (INEEL 2002; INEEL 2003; ICP 2005a; ICP 2005b). In general, the procedures used to select offgas emission rates evaluated in this risk assessment are conservative, meaning the actual emission rates from these facilities are likely to be less than those evaluated here. These conservative assumptions included the use of maximum values from all sampling runs and the use of detection limit values for “nondetect” analytes. In addition, the use of upper bound facility operating times (24/7) and operational lifetimes (15 years) likely overestimate annual average emission rates and the duration over which deposition occurs. These conservative emission rate assumptions produce calculated air concentrations, soil concentrations, and risk estimates that are likely biased high.

Another uncertainty associated with emission rate characterization involves facility process upset conditions that can temporarily increase COPC emission rates over those measured during offgas sampling (EPA 2005). For facilities without site-specific data to estimate the frequency and magnitude of process upsets, EPA 2005 recommends that organics and metal emissions be increased factors of 2.8 and 1.45 respectively, to account for these conditions. Process upsets are not currently anticipated at IWTU due to the stable, uniform operating characteristics of the fluid bed systems. This combined with the conservative assumptions used to estimate maximum emission rates from that facility (EDF-6495) make the need for a process upset correction factor unnecessary for IWTU emissions. For ILWMS, applying the above EPA process upset factors would increase the total ILWMS cancer risk from 4E-08 to 6E-08 and the HI from 0.0032 to 0.0035, which are both an insignificant increase compared to the EPA target criteria (1E-05 risk and 0.25 HI).

9.3.2 Uncertainty Associated with Air Modeling

In general, models are imperfect mathematical tools that attempt to simulate highly complex environmental phenomena. Therefore, significant uncertainty usually exists in modeling output for both air concentration and ground deposition rate. These uncertainties result from imperfect model structures and inaccuracies or natural variability in the model input parameter values. Although ISCST3 is the EPA-preferred refined air dispersion model for this type of risk assessment, it is subject to the same uncertainties.

A major source of model structural uncertainty results when the “straight-line” Gaussian plume model algorithm in ISCST3 is applied for large receptor distances. The Gaussian plume model assumes that atmospheric dispersion conditions (wind direction, wind speed, and turbulence) do not change between the release point and the receptor location over the time interval of the meteorological data (1-hr). Offsite distances from the INTEC are relatively large (e.g., >13 km), and dispersion conditions may change over the time required to transport the contaminants to receptors (>1-hr average). However, published validation studies have indicated that the Gaussian plume model is reasonably reliable for estimating the longer time-averaged (e.g., annual) concentrations and relatively flat terrain conditions evaluated in this risk assessment. Errors in the highest estimated concentrations of 10 - 40% are found to be typical.

A related major source of uncertainty exists in the prediction of model output at specific receptor locations. Because of shifting winds, contaminants may follow trajectories that are not straight, which may cause model predictions at specific downwind locations, especially over the large INL Site distances, to be highly uncertain. Adding to this spatial prediction problem is the uncertainty that exists in the meteorological data file wind vectors. Measurement or processing (time-averaging) errors of 5 to 10 degrees can result in concentration errors of 20 to 70%. Such uncertainties indicate that the precise time and location are in doubt, not necessarily that an estimated concentration does not occur.

For the offsite human health impacts evaluated in this risk assessment, potential underprediction due to this spatial prediction uncertainty is avoided by evaluating exposure scenarios at the point of maximum off-INL impacts (air concentration, deposition) regardless of whether there is an actual human receptor at that location. For example, INTEC main stack annual-average air concentrations at Atomic City, the nearest continually inhabited off-site location, were calculated to be less than half those at the point of maximum off-site impact (INEEL 1999a). Therefore, the air modeling results used in this risk assessment are likely to significantly over predict the actual impacts that might occur to any real public receptor.

9.3.3 Uncertainty Associated with Exposure Assessment

The equations and parameter values specified in the HHRAP used in this assessment are based on many exposure assessment assumptions that also contribute to uncertainties in the final calculated risk values. Most of these assumptions are likely to be conservative, including the assumption of a continuous 40-year exposure time (subsistence farmer scenario), the assumption that food products are produced at the point of maximum air concentration and ground deposition rate, and the assumption that 100% of the receptor's food products are grown at the point of maximum ground deposition rate. Since the error in the final calculated risk value is the sum of the errors in each of these parameter values, these conservative exposure assumptions likely produce overestimates of the actual risks to the public. EPA uncertainty estimates for individual parameters may be found in Appendixes B and C of the HHRAP document (EPA 2005).

9.3.4 Uncertainty Associated with COPC Toxicity

The health impacts calculated in this risk assessment use toxicity criteria from the EPA HHRAP Companion Database, which is continually updated to reflect current values. However, many uncertainties and unknowns are associated with the determination of these toxicity values. They include extrapolation from high to low doses and from animals to humans; species differences in uptake, metabolism, and organ distribution; species differences in target site susceptibility; and human population variability in diet, environment, activity patterns, and for cultural factors. However, safety factors are built into the determination of the final toxicity value to compensate for these sources of uncertainty, which likely result in a bias toward overestimating risk.

9.3.5 Uncertainty Associated with Risk Characterization

In the risk characterization, the assumption was made that the total risk of developing cancer from exposure to all COPCs is the sum of the risk attributed to each individual COPC. Likewise, the potential for the development of non-cancer adverse effects is the sum of the estimated exposure to each individual COPC. This approach, in accordance with EPA guidance, does not account for the possibility that constituents act synergistically or antagonistically. This uncertainty could over or underestimate total risk.

9.4 Ecological Risk Assessment Uncertainty

9.4.1 Uncertainty Associated with Exposure Assessment

EBSLs are modeled using a site use factor (SUF) and exposure duration (ED) parameter. The SUF represents the proportion of a species home range that overlaps the area of contamination. An SUF of 1.0 indicates that the home range is less than or equal to the area of contaminant exposure. For our EBSL calculations, the SUF was assumed to be 1.0 (100% use occurs in the area of contamination) for all groups and species (VanHorn et al. 1995; ICP 2004). Home range is poorly documented for many species and may be highly variable. Exposure duration is also included to account for seasonal use of the site, for example by migratory birds that are only present for 2–3 months of the year. The assumption of 100% exposure in the development of the EBLS is highly conservative and can significantly overestimate the risk at small sites. Finally, the ecological risk assessment is evaluated at the point of maximum ground deposition (and soil concentration) on the INL Site, which is a very conservative screening-level assumption. Exposures to real populations of ecological receptors would actually occur across the INL Site, at locations where the ground deposition rate is much less than at the maximum point.

9.4.2 Uncertainty Associated with Ingestion Rates

Few intake ingestion rate estimates used for terrestrial receptors are based on data in the scientific literature. Food ingestion rates used in the EBSL calculation are calculated using allometric equations available in the literature (Nagy 1987). The use of these values may moderately over or underestimate risk.

9.4.3 Uncertainty Associated with Uptake Factors

Two parameters used in the calculation of EBSLs, prey bioaccumulation factor (BAF) and plant uptake factor (PUF), were assumed to be the greater of either the calculated value or 1.0. This is a conservative assumption that will generally overestimate risk, since less than 40% of the COPCs have PUFs greater than 1.0 and less than 1% of the COPCs have BAFs greater than 1.0. In the absence of specific BAF or PUF, a value of 1.0 was assumed. This assumption could over or underestimate the true dose from the contaminant, and the magnitude of error cannot be quantified.

9.4.4 Uncertainty Associated with Toxicity Reference Values

The EBSLs used in this assessment were developed from toxicity reference values (TRVs) that were revised based on EPA 1999 guidelines. Many uncertainties and unknowns are associated with the determination of these toxicity values. They include extrapolation from high to low doses and from individual laboratory species to multiple species living in a natural environment; species differences in uptake, metabolism, and organ distribution; and species differences in target site susceptibility. Uncertainty factors (UFs) are applied to the TRVs to ensure they are protective and provide a conservative estimate of risk.

9.4.5 Uncertainty Associated with Functional Groups

INL-specific functional groups were designed as an assessment tool that would ensure representatives from all species potentially present at the INL Site (VanHorn et al. 1995). A hypothetical species is developed using input values to the exposure assessment that represents the greatest exposure of the combined functional group members. This provides a very conservative approach and will tend to overestimate risk for actual individual species of ecological receptors.

10. REFERENCES

COS-F-SRH-0141, 2006, "Equipment Data Sheets – Mercury Adsorbers," Idaho Cleanup Project, April 2006.

DOE-ID, 1999, *Work Plan for Waste Areas Groups 6 and 10 Operable Unit 10-04 Comprehensive Remedial Investigation/Feasibility Study*, DOE/ID-10554, Rev. 0, U.S. Department of Energy Idaho Operations Office, April 1999.

DOE-STD-3020-2005, *Specification for HEPA Filters Used by DOE Contractors*, U.S. Department of Energy, December 2005.

EDF-6252, 2005, "Human Health Impacts – 2005 LET&D and PEWE Offgas Sampling," Rev. 0, Idaho National Laboratory, November 1, 2005.

EDF-6495, 2006, "Mass and Energy Balance for Sodium Bearing Waste Integrated Waste Treatment Unit – Modified to Support Emissions Permitting," Rev. 0, Idaho Cleanup Project, May 30, 2006.

EDF-ER-327, 2005, "INEEL CERCLA Disposal Facility Short-term Risk Assessment," Rev. 2, Idaho National Laboratory, January 26, 2005.

EPA, 1987, *On-Site Meteorological Program Guidance for Regulatory Modeling Applications,* EPA-450/4-87-013, U.S. Environmental Protection Agency, June 1987.

EPA, 1995, *User's Guide for the Industrial Source Complex (ISC3) Dispersion Models (Revised)*, EPA-450/B-95-003a, b, U.S. Environmental Protection Agency, 1995.

EPA, 1996, *Meteorological Processor for Regulatory Models (MPRM) User's Guide*, Revised ed., EPA-454/B-96-002, U.S. Environmental Protection Agency, 1996.

EPA, 1998a, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities – Peer Review Draft*, EPA-530-D-98-001A/B/C, U.S. EPA Office of Solid Waste and Emergency Response, July 1998.

EPA, 1998b, *Region 6 Risk Management Addendum - Draft Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA-R6-98-002, U.S. Environmental Protection Agency, July 1998.

EPA, 1999, *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities - Peer Review Draft*, EPA 530-D-99-001A, U.S. Environmental Protection Agency, 1999.

EPA, 2005, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA520-R-05-006, U.S. Environmental Protection Agency, September 2005.

ICP, 2004, *Human and Ecological Risk Assessment of Air Emissions from the INTEC Liquid Waste Management System*, ICP/EXT-04-00399, Rev. 0, Idaho Cleanup Project, May 2004.

ICP, 2005a, *FY-2005 Liquid Effluent Treatment and Disposal Facility Overhead Effluent Emissions Inventory*, ICP/EXT-05-01019, Rev. 0, Idaho Cleanup Project, October 2005.

ICP, 2005b, *FY-2005 Process Equipment Waste Evaporator Off-gas Emissions Inventory*, ICP/EXT-05-01037, Rev. 0, Idaho Cleanup Project, October 2005.

IDAPA 58.01.01, 2006, "Rules for the Control of Air Pollution in Idaho," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, 2006.

INEEL, 1999a, *Screening Level Risk Assessment for the New Waste Calcining Facility*, INEEL/EXT-97-00686, Rev. 5a, Idaho National Engineering and Environmental Laboratory, May 1999.

INEEL, 1999b, *Summary of NWCF Calciner Emissions Inventory Data*, INEEL/EXT-99-01190, Rev. 0, Idaho National Engineering and Environmental Laboratory, November 1999.

INEEL, 2002, *NWCF Evaporator Tank System 2001 Offgas Emissions Inventory*, INEEL/EXT-02-00198, Rev. 0, Idaho National Engineering and Environmental Laboratory, February 2002.

INEEL, 2003, *FY-2003 Liquid Effluent Treatment and Disposal Facility Overhead Effluent Emissions Inventory*, INEEL/INT-03-01181, Rev. 0, Idaho National Engineering and Environmental Laboratory, 2003.

INEEL, 2004a, *Phase 2 THOR Steam Reforming Tests for Sodium-Bearing Waste Treatment*, INEEL/EXT/04-01493, Rev. 0, Idaho Cleanup Project, January 2004.

INEEL, 2004b, *Feed Composition for the Sodium-Bearing Waste Treatment Process*, INEEL/EXT-2000-01378, Rev. 4, Idaho Cleanup Project, June 2004.

Nagy, K. A., 1987, Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds, Ecological Mono. 57, 111–128.

Ramsdell, J. V. Jr., C. A. Simonen, and K. W. Burk, 1994, "Regional Atmospheric Transport Code for Hanford Emission Tracking (RATCHET)," PNWD-2224 HEDR, Battelle Pacific Northwest Laboratories, Richland, Washington, February 1994.

RT-ESTD-PMR-001, 2006, *Pilot Plant Test Preliminary Completion Report for Treating Sodium-Bearing Waste Surrogates Using the THOR® Steam Reforming Process – Carbonate Flowsheet*, Rev. 0, THOR Treatment Technologies and Washington Group International, October 2006.

VanHorn, R. L, N. L. Hampton, and R. C. Morris, 1995, *Draft Guidance Manual for Conducting Screening Level Ecological Risk Assessment at the INEL*, INEL-95/0190, Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, April 1995.

Appendix A

LET&D and PEWE COPC Offgas Emission Rates (from INEEL 2003, ICP 2005a, ICP 2005b)

Appendix A

LET&D and PEWE COPC Offgas Emission Rates (from INEEL 2003, ICP 2005a, ICP 2005b)

Table A-1. LET&D "anion" emission rates from offgas measurements (INEEL 2003).

Analyte	CAS No.	Detect ? LET&D	Transport Data?	Retain as COPC?	Emission Rate (g/s)
Hydrogen chloride	7647-01-0	Yes	Yes	Yes	1.97E+00
Nitrate (as HNO_3)	7697-37-2	Yes	Yes	Yes	2.63E-01
Nitrite	14797-65-0	Yes	No	No	–
Fluoride (as HF)	7664-39-3	No	Yes	Yes	1.33E-03

Table A-2. LET&D metal emission rates from offgas measurements (INEEL 2003).

Analyte	CAS No.	Detect ? LET&D	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
Aluminum	7429-90-5	Yes	Yes	Yes	1.10E-04	2.51E-05
Antimony	7440-36-0	No	Yes	Yes	5.08E-06	1.16E-06
Arsenic	7440-38-2	No	Yes	Yes	1.82E-06	4.16E-07
Barium	7440-39-3	Yes	Yes	Yes	1.00E-05	2.29E-06
Beryllium	7440-41-7	No	No	No	–	–
Cadmium	7440-43-9	No	Yes	Yes	3.57E-07	8.16E-08
Calcium	7440-70-2	Yes	No	No[a]	–	–
Chromium	7440-47-3	Yes	Yes	Yes	5.32E-04	1.21E-04
Cobalt	7440-48-4	No	No	No	–	–
Copper	7440-50-8	Yes	Yes	Yes	1.97E-05	4.49E-06
Iron	7439-89-6	Yes	No	No[a]	–	–
Lead	7439-92-1	Yes	Yes	Yes	2.68E-06	6.11E-07
Manganese	7439-96-5	Yes	Yes	Yes	8.01E-05	1.83E-05
Mercury	7439-97-6	Yes	Yes	Yes	6.84E-05	1.56E-05
Nickel	7440-02-0	Yes	Yes	Yes	3.04E-03	6.94E-04
Phosphorus	PHQ000	Yes	No	No[a]	–	–
Potassium	7440-09-7	Yes	No	No[a]	–	–
Selenium	7782-49-2	No	Yes	Yes	2.05E-06	4.69E-07
Silver	7440-22-4	No	Yes	Yes	2.33E-06	5.32E-07
Sodium	7440-23-5	Yes	No	No[a]	–	–
Thallium	7440-28-0	No	Yes	Yes	4.81E-06	1.10E-06
Vanadium	7440-62-2	No	No	No	–	–
Zinc	7440-66-6	Yes	Yes	Yes	1.47E-04	3.35E-05

a. No toxicity data; not toxic at trace environmental levels.

Table A-3. LET&D SVOC emission rates from offgas measurements (ICP 2005a).

Analyte	CAS No.	Detect ? LET&D	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
Acenaphthene	83-32-9	No	Yes	Yes	9.03E-07	2.06E-07
Acenaphthylene	208-96-8	No	No	No	–	–
Acetophenone	98-86-2	No	Yes	Yes	2.68E-06	6.12E-07
Aniline	62-53-3	No	Yes	Yes	9.94E-06	2.27E-06
Anthracene	120-12-7	No	Yes	Yes	8.13E-07	1.86E-07
Benzaldehyde	100-52-7	No	Yes	Yes	1.76E-06	4.01E-07
Benzidine	92-87-5	No	No	No	–	–
Benzoic acid	65-85-0	Yes	Yes	Yes	7.32E-05	1.67E-05
Benzo(a)pyrene (BaP)	50-32-8	No	Yes	Yes	2.43E-06	5.54E-07
Benzo(a)anthracene	56-55-3	No	Yes	Yes	included in BaP	
Benzo(b)fluoranthene	205-99-2	No	Yes	Yes	included in BaP	
Benzo(k)fluoranthene	207-08-9	No	Yes	Yes	included in BaP	
Chrysene	218-01-9	No	Yes	Yes	included in BaP	
Dibenz(a,h)anthracene	53-70-3	No	Yes	Yes	included in BaP	
Indeno(1,2,3-cd)pyrene	193-39-5	No	Yes	Yes	included in BaP	
Benzo(ghi)perylene	191-24-2	No	No	No	–	–
Benzonitrile	100-47-0	No	No	No	–	–
Benzyl alcohol	100-51-6	No	Yes	Yes	1.81E-05	4.12E-06
bis(2-Chloroethoxy)methane	111-91-1	No	No	No	–	–
bis(2-Chloroethyl) ether	111-44-4	No	Yes	Yes	8.49E-07	1.94E-07
bis(2-Ethylhexyl) phthalate	117-81-7	Yes	Yes	Yes	2.62E-05	5.98E-06
4-Bromophenyl phenyl ether	101-55-3	No	Yes	Yes	7.32E-07	1.67E-07
Butyl benzyl phthalate	85-68-7	No	Yes	Yes	1.35E-06	3.09E-07
Carbazole	86-74-8	No	No	No	–	–
4-Chloro-3-methylphenol	59-50-7	No	Yes	Yes	2.44E-06	5.57E-07
4-Chloroaniline	106-47-8	No	Yes	Yes	5.78E-06	1.32E-06
2-Chloronaphthalene	91-58-7	No	Yes	Yes	7.23E-07	1.65E-07
2-Chlorophenol	95-57-8	No	Yes	Yes	8.22E-07	1.88E-07
4-Chlorophenyl phenyl ether	7005-72-36	No	No	No	–	–
Di-n-butyl phthalate	84-74-2	No	Yes	Yes	4.61E-06	1.05E-06
Di-n-octyl phthalate	117-84-0	No	Yes	Yes	1.08E-06	2.47E-07
Dibenzofuran	132-64-9	No	No	No	–	–
1,2-Dichlorobenzene	95-50-1	No	Yes	Yes	Included in VOCs	
1,3-Dichlorobenzene	541-73-1	No	Yes	Yes	Included in VOCs	
1,4-Dichlorobenzene	106-46-7	No	Yes	Yes	Included in VOCs	
3,3'-Dichlorobenzidine	91-94-1	No	Yes	Yes	6.32E-06	1.44E-06

Table A-3. (continued).

Analyte	CAS No.	Detect ? LET&D	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
2,4-Dichlorophenol	120-83-2	No	Yes	Yes	1.02E-06	2.32E-07
Diethyl phthalate	84-66-2	No	Yes	Yes	8.31E-07	1.90E-07
Dimethyl phthalate	105-67-9	No	Yes	Yes	6.96E-07	1.59E-07
2,4-Dimethylphenol	131-11-3	No	Yes	Yes	2.53E-06	5.77E-07
4,6-Dinitro-2-methylphenol	534-52-1	No	No	No	–	–
2,4-Dinitrophenol	51-28-5	No	Yes	Yes	1.08E-05	2.47E-06
2,4-Dinitrotoluene	121-14-2	No	Yes	Yes	1.35E-06	3.09E-07
2,6-Dinitrotoluene	606-20-2	No	Yes	Yes	9.25E-07	2.11E-07
1,2-Diphenylhydrazine	122-66-7	No	No	No	–	–
Fluoranthene	206-44-0	No	Yes	Yes	8.67E-07	1.98E-07
Fluorene	86-73-7	No	Yes	Yes	1.17E-06	2.68E-07
Hexachlorocyclopentadiene	77-47-4	No	Yes	Yes	7.41E-06	1.69E-06
Hexachlorobenzene	118-74-1	No	Yes	Yes	1.17E-06	2.68E-07
Hexachlorobutadiene	87-68-3	No	Yes	Yes	Included in VOCs	
Hexachloroethane	67-72-1	No	Yes	Yes	9.03E-07	2.06E-07
Isophorone	78-59-1	No	Yes	Yes	8.58E-07	1.96E-07
2-Methylnaphthalene	91-57-6	No	No	No	–	–
2-Methylphenol	95-48-7	No	Yes	Yes	2.26E-06	5.16E-07
3-Methylphenol & 4-Methylphenol	65794-96-9	No	No	No	–	–
N-Nitrosodi-n-propylamine	621-64-7	No	Yes	Yes	9.94E-07	2.27E-07
N-Nitrosodimethylamine	62-75-9	Yes	Yes	Yes	2.38E-04	5.43E-05
N-Nitrosodiphenylamine	86-30-6	No	Yes	Yes	8.94E-07	2.04E-07
Naphthalene	91-20-3	No	Yes	Yes	9.03E-07	2.06E-07
2-Nitroaniline	88-74-4	No	Yes	Yes	1.17E-06	2.68E-07
3-Nitroaniline	99-09-2	No	Yes	Yes	2.59E-06	5.91E-07
4-Nitroaniline	100-01-6	No	Yes	Yes	2.26E-06	5.16E-07
Nitrobenzene	98-95-1	No	Yes	Yes	1.48E-06	3.38E-07
2-Nitrophenol	88-75-5	No	No	No	–	–
4-Nitrophenol	100-02-7	No	Yes	Yes	4.34E-06	9.90E-07
2,2'-Oxybis(1-Chloropropane)	108-60-1	No	No	No	–	–
Pentachlorobenzene	608-93-5	No	Yes	Yes	9.94E-07	2.27E-07
Pentachloronitrobenzene	82-68-8	No	Yes	Yes	1.17E-06	2.68E-07
Pentachlorophenol	87-86-5	No	Yes	Yes	1.08E-05	2.47E-06
Phenanthrene	85-01-8	No	Yes	No	8.94E-07	2.04E-07
Phenol	108-95-2	No	Yes	Yes	1.20E-06	2.75E-07
Pyrene	129-00-0	No	Yes	Yes	7.50E-07	1.71E-07
Pyridine	110-86-1	No	No	No	–	–

Table A-3. (continued).

Analyte	CAS No.	Detect ? LET&D	Transport Data?	Retain as COPC?	Emission Rate (g/s) Hourly	Emission Rate (g/s) Annual
1,2,4,5-Tetrachlorobenzene	95-94-3	No	No	No	–	–
1,2,4-Trichlorobenzene	120-82-1	No	Yes	Yes	Included in VOCs	
2,4,5-Trichlorophenol	95-95-4	No	Yes	Yes	1.35E-06	3.09E-07
2,4,6-Trichlorophenol	88-06-2	No	Yes	Yes	1.17E-06	2.68E-07

Table A-4. LET&D VOC emission rates from offgas measurements (ICP 2005a).

Analyte	CAS No.	Detect ? LET&D	Risk factor avail?	Transport Data?	Emission Rate (g/s) Hourly	Emission Rate (g/s) Annual
Acetaldehyde	75-07-0	No	Yes	Yes	1.02E-05	2.33E-06
Acetone	67-64-1	Yes	Yes	Yes	7.13E-04	1.63E-04
Acrylonitrile	107-13-1	No	Yes	Yes	4.57E-06	1.04E-06
Benzene	71-43-2	No	Yes	Yes	3.70E-07	8.45E-08
Bromobenzene	108-86-1	No	Yes	Yes	2.12E-07	4.84E-08
Bromochloromethane	74-97-5	No	No	No	–	–
Bromodichloromethane	75-27-4	No	Yes	Yes	7.83E-07	1.79E-07
Bromoform	75-25-2	No	Yes	Yes	2.61E-07	5.96E-08
Bromomethane	74-83-9	No	Yes	Yes	8.09E-07	1.85E-07
2-Butanone (MEK)	78-93-3	No	Yes	Yes	3.40E-06	7.77E-07
n-Butylbenzene	104-51-8	No	No	No	–	–
sec-Butylbenzene	135-98-8	No	No	No	–	–
tert-Butylbenzene	98-06-6	No	No	No	–	–
Carbon disulfide	75-15-0	No	Yes	Yes	1.79E-07	4.10E-08
Carbon tetrachloride	56-23-5	No	Yes	Yes	2.49E-07	5.68E-08
Chlorobenzene	108-90-7	No	Yes	Yes	2.05E-07	4.67E-08
Chlorodibromomethane	124-48-1	No	Yes	Yes	3.59E-07	8.20E-08
Chloroethane	75-00-3	No	Yes	Yes	4.77E-07	1.09E-07
Chloroform	67-66-3	Yes	Yes	Yes	8.25E-06	1.88E-06
Chloromethane	74-87-3	Yes	Yes	Yes	6.72E-06	1.53E-06
2-Chlorotoluene	95-49-8	No	No	No	–	–
4-Chlorotoluene	106-43-4	No	No	No	–	–
1,2-Dibromo-3-chloropropane	96-12-8	No	Yes	Yes	7.51E-07	1.71E-07
1,2-Dibromoethane (EDB)	106-93-4	No	Yes	Yes	3.18E-07	7.26E-08
Dibromomethane	75-95-3	No	Yes	Yes	3.34E-07	7.64E-08
1,2-Dichlorobenzene	95-50-1	No	Yes	Yes	2.04E-07	4.66E-08
1,3-Dichlorobenzene	541-73-1	No	Yes	Yes	2.12E-07	4.84E-08
1,4-Dichlorobenzene	106-46-7	No	Yes	Yes	2.53E-07	5.77E-08
Dichlorodifluoromethane	75-71-8	No	Yes	Yes	2.45E-07	5.59E-08

Table A-4. (continued).

Analyte	CAS No.	Detect ? LET&D	Risk factor avail?	Transport Data?	Emission Rate (g/s) Hourly	Emission Rate (g/s) Annual
1,1-Dichloroethane	75-34-3	No	Yes	Yes	1.85E-07	4.23E-08
1,2-Dichloroethane	107-06-2	No	Yes	Yes	1.88E-07	4.28E-08
1,1-Dichloroethene	75-35-4	No	Yes	Yes	2.24E-07	5.11E-08
cis-1,2-Dichloroethene	156-59-2	No	Yes	Yes	2.12E-07	4.84E-08
trans-1,2-Dichloroethene	156-60-5	No	Yes	Yes	1.71E-07	3.91E-08
1,2-Dichloropropane	78-87-5	No	Yes	Yes	1.88E-07	4.28E-08
1,3-Dichloropropane	142-28-9	No	No	No	–	–
2,2-Dichloropropane	594-20-7	No	No	No	–	–
1,1-Dichloropropene	563-58-6	No	No	No	–	–
cis-1,3-Dichloropropene	542-75-6	No	Yes	Yes	1.66E-07	3.78E-08
trans-1,3-Dichloropropene	10061-02-6	No	No	No	–	–
Ethylbenzene	100-41-4	No	Yes	Yes	1.63E-07	3.73E-08
Hexachlorobutadiene	87-68-3	No	Yes	Yes	1.96E-07	4.47E-08
2-Hexanone	591-78-6	No	No	No	–	–
Isopropylbenzene	98-82-8	No	No	No	–	–
p-Isopropyltoluene	99-87-6	No	No	No	–	–
Methylene chloride	75-09-2	Yes	Yes	Yes	5.22E-05	1.19E-05
4-Methyl-2-pentanone (MIBK)	108-10-1	No	Yes	Yes	8.97E-07	2.05E-07
Naphthalene	91-20-3	No	Yes	Yes	2.94E-07	6.71E-08
n-Propylbenzene	103-65-1	No	No	No	–	–
Styrene	100-42-5	No	Yes	Yes	1.88E-07	4.28E-08
1,1,1,2-Tetrachloroethane	630-20-6	No	Yes	Yes	2.04E-07	4.66E-08
1,1,2,2-Tetrachloroethane	79-34-5	No	Yes	Yes	2.77E-07	6.33E-08
Tetrachloroethene	127-18-4	No	Yes	Yes	1.91E-07	4.35E-08
Toluene	108-88-3	No	Yes	Yes	1.96E-07	4.47E-08
1,2,3-Trichlorobenzene	87-61-6	No	No	No	–	–
1,2,4-Trichlorobenzene	120-82-1	No	Yes	Yes	2.69E-07	6.15E-08
1,1,1-Trichloroethane	71-55-6	No	Yes	Yes	1.96E-07	4.47E-08
1,1,2-Trichloroethane	79-00-5	No	Yes	Yes	3.59E-07	8.20E-08
Trichloroethene	79-01-6	No	Yes	Yes	2.69E-07	6.15E-08
Trichlorofluoromethane	75-69-4	No	Yes	Yes	2.77E-07	6.33E-08
1,2,3-Trichloropropane	96-18-4	No	Yes	Yes	5.47E-07	1.25E-07
1,2,4-Trimethylbenzene	95-63-6	No	No	No	–	–
1,3,5-Trimethylbenzene	108-67-8	No	No	No	–	–
Vinyl chloride	75-01-4	No	Yes	Yes	3.10E-07	7.08E-08
o-Xylene	95-47-6	No	Yes	Yes	2.37E-07	5.40E-08
m-Xylene & p-Xylene	108-38-3	No	Yes	Yes	3.34E-07	7.64E-08

Table A-5. PEWE "anion" emission rates from offgas measurements (ICP 2005b).

Analyte	CAS No.	Detect PEWE?	Transport Data?	Retain as COPC?	Emission Rate (g/s)
Hydrogen chloride	7647-01-0	Yes	Yes	Yes	2.21E-07
Chlorine	7782-50-5	Yes	Yes	Yes	2.35E-07
Nitrate (as HNO_3)	7697-37-2	Yes	Yes	Yes	3.96E-05
Fluoride (as HF)	7664-39-3	No	Yes	Yes	5.41E-07

Table A-6. PEWE metal emission rates from offgas measurements (ICP 2005b).

Analyte	CAS No.	Detect - PEWE?	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
Aluminum	7429-90-5	Yes	Yes	Yes	3.35E-08	7.66E-09
Antimony	7440-36-0	No	Yes	Yes	3.10E-10	7.08E-11
Arsenic	7440-38-2	No	Yes	Yes	3.59E-10	8.20E-11
Barium	7440-39-3	Yes	Yes	Yes	4.37E-09	9.97E-10
Beryllium	7440-41-7	No	Yes	Yes	2.32E-10	5.30E-11
Cadmium	7440-43-9	No	Yes	Yes	1.28E-10	2.92E-11
Calcium	7440-70-2	Yes	No	No[a]	–	–
Chromium	7440-47-3	Yes	Yes	Yes	2.83E-09	6.47E-10
Cobalt	7440-48-4	No	No	No	–	–
Copper	7440-50-8	Yes	Yes	Yes	1.70E-09	3.89E-10
Iron	7439-89-6	Yes	No	No[a]	–	–
Lead	7439-92-1	Yes	Yes	Yes	2.30E-10	5.25E-11
Manganese	7439-96-5	Yes	Yes	Yes	4.06E-10	9.26E-11
Mercury	7439-97-6	Yes	Yes	Yes	9.06E-09	2.07E-09
Nickel	7440-02-0	Yes	Yes	Yes	2.00E-09	4.56E-10
Phosphorus	PHQ000	Yes	No	No[a]	–	–
Potassium	7440-09-7	Yes	No	No[a]	–	–
Selenium	7782-49-2	No	Yes	Yes	3.74E-10	8.55E-11
Silver	7440-22-4	No	Yes	Yes	3.27E-10	7.47E-11
Sodium	7440-23-5	Yes	No	No[a]	–	–
Thallium	7440-28-0	No	Yes	Yes	8.80E-10	2.01E-10
Vanadium	7440-62-2	No	No	No	–	–
Zinc	7440-66-6	Yes	Yes	Yes	7.63E-09	1.74E-09

a. No toxicity data; not toxic at trace environmental levels.

Table A-7. PEWE SVOC emission rates from offgas measurements (ICP 2005b).

Analyte	CAS No.	Detect - PEWE?	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
Acenaphthene	83-32-9	No	Yes	Yes	4.04E-09	9.23E-10
Acenaphthylene	208-96-8	No	No	No	–	–
Acetophenone	98-86-2	No	Yes	Yes	1.62E-08	3.69E-09
Aniline	62-53-3	No	Yes	Yes	5.01E-08	1.14E-08
Anthracene	120-12-7	No	Yes	Yes	3.80E-09	8.68E-10
Benzaldehyde	100-52-7	No	Yes	Yes	1.48E-08	3.37E-09
Benzidine	92-87-5	No	No	No	–	–
Benzoic acid	65-85-0	No	Yes	Yes	2.62E-07	5.97E-08
Benzo(a)pyrene (BaP)	50-32-8	No	Yes	Yes	1.20E-08	2.74E-09
Benzo(a)anthracene	56-55-3	No	Yes	Yes	included in BaP	
Benzo(b)fluoranthene	205-99-2	No	Yes	Yes	included in BaP	
Benzo(k)fluoranthene	207-08-9	No	Yes	Yes	included in BaP	
Chrysene	218-01-9	No	Yes	Yes	included in BaP	
Dibenz(a,h)anthracene	53-70-3	No	Yes	Yes	included in BaP	
Indeno(1,2,3-cd)pyrene	193-39-5	No	Yes	Yes	included in BaP	
Benzo(ghi)perylene	191-24-2	No	No	No	–	–
Benzonitrile	100-47-0	No	No	No	–	–
Benzyl alcohol	100-51-6	No	Yes	Yes	2.38E-07	5.43E-08
bis(2-Chloroethoxy)methane	111-91-1	No	No	No	–	–
bis(2-Chloroethyl) ether	111-44-4	No	Yes	Yes	4.52E-09	1.03E-09
bis(2-Ethylhexyl) phthalate	117-81-7	Yes	Yes	Yes	1.40E-07	3.20E-08
4-Bromophenyl phenyl ether	101-55-3	No	Yes	Yes	3.80E-09	8.68E-10
Butyl benzyl phthalate	85-68-7	No	Yes	Yes	5.23E-09	1.19E-09
Carbazole	86-74-8	No	No	No	–	–
4-Chloro-3-methylphenol	59-50-7	No	Yes	Yes	6.18E-09	1.41E-09
4-Chloroaniline	106-47-8	No	Yes	Yes	4.04E-08	9.23E-09
2-Chloronaphthalene	91-58-7	No	Yes	Yes	3.80E-09	8.68E-10
2-Chlorophenol	95-57-8	No	Yes	Yes	4.05E-09	9.25E-10
4-Chlorophenyl phenyl ether	7005-72-36	No	No	No	–	–
Di-n-butyl phthalate	84-74-2	No	Yes	Yes	4.75E-08	1.09E-08
Di-n-octyl phthalate	117-84-0	No	Yes	Yes	5.48E-09	1.25E-09
Dibenzofuran	132-64-9	No	No	No	–	–
1,2-Dichlorobenzene	95-50-1	No	Yes	Yes	Included in VOCs	

Table A-7. (continued).

Analyte	CAS No.	Detect - PEWE?	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
1,3-Dichlorobenzene	541-73-1	No	Yes	Yes	Included in VOCs	
1,4-Dichlorobenzene	106-46-7	No	Yes	Yes	Included in VOCs	
3,3'-Dichlorobenzidine	91-94-1	No	Yes	Yes	4.99E-08	1.14E-08
2,4-Dichlorophenol	120-83-2	No	Yes	Yes	4.75E-09	1.09E-09
Diethyl phthalate	84-66-2	No	Yes	Yes	5.94E-09	1.36E-09
Dimethyl phthalate	105-67-9	No	Yes	Yes	3.80E-09	8.68E-10
2,4-Dimethylphenol	131-11-3	No	Yes	Yes	2.62E-08	5.97E-09
4,6-Dinitro-2-methylphenol	534-52-1	No	No	No	–	–
2,4-Dinitrophenol	51-28-5	No	Yes	Yes	1.24E-07	2.82E-08
2,4-Dinitrotoluene	121-14-2	No	Yes	Yes	4.77E-09	1.09E-09
2,6-Dinitrotoluene	606-20-2	No	Yes	Yes	4.52E-09	1.03E-09
1,2-Diphenylhydrazine	122-66-7	No	No	No	–	–
Fluoranthene	206-44-0	No	Yes	Yes	4.05E-09	9.25E-10
Fluorene	86-73-7	No	Yes	Yes	4.05E-09	9.25E-10
Hexachlorocyclopentadiene	77-47-4	No	Yes	Yes	7.13E-08	1.63E-08
Hexachlorobenzene	118-74-1	No	Yes	Yes	4.28E-09	9.77E-10
Hexachlorobutadiene	87-68-3	No	Yes	Yes	Included in VOCs	
Hexachloroethane	67-72-1	No	Yes	Yes	5.48E-09	1.25E-09
Isophorone	78-59-1	No	Yes	Yes	5.01E-09	1.14E-09
2-Methylnaphthalene	91-57-6	No	No	No	–	–
2-Methylphenol	95-48-7	No	Yes	Yes	2.07E-08	4.73E-09
3-Methylphenol & 4-Methylphenol	65794-96-9	No	No	No	–	–
N-Nitrosodi-n-propylamine	621-64-7	No	Yes	Yes	4.28E-09	9.77E-10
N-Nitrosodimethylamine	62-75-9	No	Yes	Yes	1.28E-08	2.93E-09
N-Nitrosodiphenylamine	86-30-6	No	Yes	Yes	3.80E-09	8.68E-10
Naphthalene	91-20-3	No	Yes	Yes	4.52E-09	1.03E-09
2-Nitroaniline	88-74-4	No	Yes	Yes	4.28E-09	9.77E-10
3-Nitroaniline	99-09-2	No	Yes	Yes	1.62E-08	3.70E-09
4-Nitroaniline	100-01-6	No	Yes	Yes	1.50E-08	3.43E-09
Nitrobenzene	98-95-1	No	Yes	Yes	4.52E-09	1.03E-09
2-Nitrophenol	88-75-5	No	No	No	–	–
4-Nitrophenol	100-02-7	No	Yes	Yes	2.38E-08	5.43E-09
2,2'-Oxybis(1-Chloropropane)	108-60-1	No	No	No	–	–
Pentachlorobenzene	608-93-5	No	Yes	Yes	4.04E-09	9.23E-10

Table A-7. (continued).

Analyte	CAS No.	Detect - PEWE?	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
Pentachloronitrobenzene	82-68-8	No	Yes	Yes	4.28E-09	9.77E-10
Pentachlorophenol	87-86-5	No	Yes	Yes	1.33E-07	3.04E-08
Phenanthrene	85-01-8	No	No	No	–	–
Phenol	108-95-2	No	Yes	Yes	6.89E-09	1.57E-09
Pyrene	129-00-0	No	Yes	Yes	4.05E-09	9.25E-10
Pyridine	110-86-1	No	No	No	–	–
1,2,4,5-Tetrachlorobenzene	95-94-3	No	No	No	–	–
1,2,4-Trichlorobenzene	120-82-1	No	Yes	Yes	Included in VOCs	
2,4,5-Trichlorophenol	95-95-4	No	Yes	Yes	1.02E-08	2.33E-09
2,4,6-Trichlorophenol	88-06-2	No	Yes	Yes	1.18E-03	5.91E-04

Table A-8. PEWE VOC emission rates from offgas measurements (ICP 2005b).

Analyte	CAS No.	Detect - PEWE?	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
Acetaldehyde	75-07-0	No	Yes	Yes	4.21E-08	9.60E-09
Acetone	67-64-1	Yes	Yes	Yes	8.66E-07	1.98E-07
Acrylonitrile	107-13-1	No	Yes	Yes	2.09E-08	4.76E-09
Benzene	71-43-2	No	Yes	Yes	8.60E-09	1.96E-09
Bromobenzene	108-86-1	No	Yes	Yes	1.13E-09	2.58E-10
Bromochloromethane	74-97-5	No	No	No	–	–
Bromodichloromethane	75-27-4	No	Yes	Yes	1.07E-09	2.45E-10
Bromoform	75-25-2	No	Yes	Yes	1.30E-09	2.98E-10
Bromomethane	74-83-9	No	Yes	Yes	1.83E-09	4.17E-10
2-Butanone (MEK)	78-93-3	No	Yes	Yes	8.52E-08	1.94E-08
n-Butylbenzene	104-51-8	No	No	No	–	–
sec-Butylbenzene	135-98-8	No	No	No	–	–
tert-Butylbenzene	98-06-6	No	No	No	–	–
Carbon disulfide	75-15-0	No	Yes	Yes	8.60E-10	1.96E-10
Carbon tetrachloride	56-23-5	No	Yes	Yes	8.69E-10	1.98E-10
Chlorobenzene	108-90-7	No	Yes	Yes	8.66E-10	1.98E-10
Chlorodibromomethane	124-48-1	No	No	Yes	8.69E-10	1.98E-10
Chloroethane	75-00-3	No	Yes	Yes	2.10E-09	4.80E-10
Chloroform	67-66-3	No	Yes	Yes	4.69E-09	1.07E-09

Table A-8. (continued).

Analyte	CAS No.	Detect - PEWE?	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
Chloromethane	74-87-3	No	Yes	Yes	1.61E-09	3.67E-10
2-Chlorotoluene	95-49-8	No	No	No	–	–
4-Chlorotoluene	106-43-4	No	No	No	–	–
1,2-Dibromo-3-chloropropane	96-12-8	No	Yes	Yes	3.39E-09	7.74E-10
1,2-Dibromoethane (EDB)	106-93-4	No	Yes	Yes	9.56E-10	2.18E-10
Dibromomethane	74-95-3	No	Yes	Yes	1.39E-09	3.17E-10
1,2-Dichlorobenzene	95-50-1	No	Yes	Yes	1.13E-09	2.58E-10
1,3-Dichlorobenzene	541-73-1	No	Yes	Yes	1.30E-09	2.98E-10
1,4-Dichlorobenzene	106-46-7	No	Yes	Yes	1.48E-09	3.37E-10
Dichlorodifluoromethane	75-71-8	No	Yes	Yes	1.13E-09	2.58E-10
1,1-Dichloroethane	75-34-3	No	Yes	Yes	7.92E-10	1.81E-10
1,2-Dichloroethane	107-06-2	No	Yes	Yes	1.04E-09	2.38E-10
1,1-Dichloroethene	75-35-4	No	Yes	Yes	1.13E-09	2.58E-10
cis-1,2-Dichloroethene	156-59-2	No	Yes	Yes	1.04E-09	2.38E-10
trans-1,2-Dichloroethene	156-60-5	No	Yes	Yes	7.91E-10	1.81E-10
1,2-Dichloropropane	78-87-5	No	Yes	Yes	9.56E-10	2.18E-10
1,3-Dichloropropane	142-28-9	No	No	No	–	–
2,2-Dichloropropane	594-20-7	No	No	No	–	–
1,1-Dichloropropene	563-58-6	No	No	No	–	–
cis-1,3-Dichloropropene	542-75-6	No	Yes	Yes	8.08E-10	1.85E-10
trans-1,3-Dichloropropene	10061-02-6	No	No	No	–	–
Ethylbenzene	100-41-4	No	Yes	Yes	6.78E-10	1.55E-10
Hexachlorobutadiene	87-68-3	No	Yes	Yes	8.60E-10	1.96E-10
2-Hexanone	591-78-6	No	No	No	–	–
Isopropylbenzene	98-82-8	No	No	No	–	–
p-Isopropyltoluene	99-87-6	No	No	No	–	–
Methylene chloride	75-09-2	Yes	Yes	Yes	9.77E-08	2.23E-08
4-Methyl-2-pentanone (MIBK)	108-10-1	No	Yes	Yes	6.18E-09	1.41E-09
Naphthalene	91-20-3	No	Yes	Yes	1.39E-09	3.17E-10
n-Propylbenzene	103-65-1	No	No	No	–	–
Styrene	100-42-5	No	Yes	Yes	9.56E-10	2.18E-10
1,1,1,2-Tetrachloroethane	630-20-6	No	Yes	Yes	9.56E-10	2.18E-10
1,1,2,2-Tetrachloroethane	79-34-5	No	Yes	Yes	1.39E-09	3.17E-10
Tetrachloroethene	127-18-4	No	Yes	Yes	8.69E-10	1.98E-10

Table A-8. (continued).

Analyte	CAS No.	Detect - PEWE?	Transport Data?	Retain as COPC?	Emission Rate (g/s)	
					Hourly	Annual
Toluene	108-88-3	No	Yes	Yes	5.19E-09	1.19E-09
1,2,3-Trichlorobenzene	87-61-6	No	No	No	–	–
1,2,4-Trichlorobenzene	120-82-1	No	Yes	Yes	1.39E-09	3.17E-10
1,1,1-Trichloroethane	71-55-6	No	Yes	Yes	1.22E-09	2.80E-10
1,1,2-Trichloroethane	79-00-5	No	Yes	Yes	1.30E-09	2.98E-10
Trichloroethene	79-01-6	No	Yes	Yes	1.83E-09	4.17E-10
Trichlorofluoromethane	75-69-4	No	Yes	Yes	1.61E-09	3.68E-10
1,2,3-Trichloropropane	96-18-4	No	Yes	Yes	2.09E-09	4.76E-10
1,2,4-Trimethylbenzene	94-63-6	No	No	No	–	–
1,3,5-Trimethylbenzene	108-67-8	No	No	No	–	–
Vinyl chloride	75-01-4	No	Yes	Yes	8.17E-10	1.87E-10
o-Xylene	95-47-6	No	Yes	Yes	1.13E-09	2.57E-10
m-Xylene & p-Xylene	108-38-3	No	Yes	Yes	1.48E-09	3.37E-10

Appendix B

Equations and Parameter Values
EPA Human Health Risk Assessment Protocol

(HHRAP – EPA520-R-05-006)
Source: http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm

Appendix B

Equations and Parameter Values
EPA Human Health Risk Assessment Protocol

(HHRAP – EPA520-R-05-006
Source: http:www.epa.gov/epaoswer/haswaste/combust/risk.htm

B-1. Media Concentration Equations – HHRAP Appendix B (See Section B-3 for parameter definitions and units.)

Cumulative soil concentration (Cs) for carcinogens:

For T_2<tD (child, farmer child scenarios):

$$Cs = \frac{Ds}{ks \cdot (tD - T_1)} \cdot \left[\left(tD + \frac{\exp(-ks \cdot tD)}{ks} \right) - \left(T_1 + \frac{\exp(-ks \cdot T_1)}{ks} \right) \right] .$$

For T_1<tD<T_2 (adult, farmer scenarios):

$$Cs = \frac{\left(\frac{Ds \cdot tD - Cs_{tD}}{ks} \right) + \left(\frac{Cs_{tD}}{ks} \right) \cdot (1 - \exp[-ks \cdot (T_2 - tD)])}{T_2 - T_1} .$$

Cumulative soil concentration (Cs) for noncarcinogens:

$$Cs_{tD} = \frac{D_s \cdot (1 - \exp[-ks \cdot tD)])}{ks} .$$

Soil loss constant as recommended by EPA OSW:

$$ks = ksg + kse + ksr + ksl + ksv .$$

Soil loss constant resulting from erosion (conservatively assumed to be 0 at INL):

$$kse = \frac{0.1 \cdot X_e \cdot SD \cdot ER}{BD \cdot Z_s} \cdot \frac{Kd_s \cdot BD}{\theta_{sw} + (Kd_s \cdot BD)} .$$

Soil loss constant due to runoff (conservatively assumed to be 0 at INL):

$$ksr = \frac{RO}{\theta_{sw} \cdot Z_s} \cdot \left(\frac{1}{1 + (Kd_S \cdot BD / \theta_{sw})} \right) .$$

Leach rate constant:

$$ksl = \frac{P + I - RO - Ev}{\theta_{sw} \cdot Z_s \cdot [1.0 + (BD \cdot Kd_s / \theta_{sw})]} \quad .$$

Volatilization loss rate constant:

$$ksv = \left(\frac{3.1536 \times 10^7 \cdot H}{Z_s \cdot Kd_s \cdot R \cdot T_a \cdot BD} \right) \cdot \left(\frac{D_a}{Z_s} \right) \cdot \left[1 - \left(\frac{BD}{\rho_{soil}} \right) - \theta_{sw} \right] \quad .$$

Deposition Term (HHRAP Draft equation – used for ISC-PRIME runs):

$$Ds = \left[\frac{100 \cdot Q}{Z_s \cdot BD} \right] \cdot \left[F_v \cdot (0.31536 \cdot Vdv \cdot Cyv + Dywv) + (Dydp + Dywp) \cdot (1 - F_v) \right] \quad .$$

Deposition Term (2005 HHRAP equation):

$$Ds = \left[\frac{100 \cdot Q}{Z_s \cdot BD} \right] \cdot \left[F_v \cdot (Dydv + Dywv) + (Dydp + Dywp) \cdot (1 - F_v) \right] \quad .$$

Mercury Deposition Term (2005 HHRAP equation):

$$Ds = \left[\frac{100 \cdot (0.48\ Q_{total})}{Z_s \cdot BD} \right] \cdot \left[F_v \cdot (Dydv + Dywv) + (Dydp + Dywp) \cdot (1 - F_v) \right] \quad .$$

Recommended values for Soil Mixing Depth (Z_s):

1cm – untilled

20cm – tilled.

Recommended values for Soil Dry Bulk Density (BD):

1.50 g/cm^3.

Recommended value for soil volumetric water content:

0.2 mL/cm^3.

Aboveground produce concentration due to direct deposition:

$$Pd = \frac{1000 \cdot Q \cdot (1 - F_v) \cdot [Dydp + (Fw \cdot Dywp)] \cdot Rp \cdot [1.0 - \exp(-kp \cdot Tp)]}{Yp \cdot kp} \quad .$$

Recommended value for interception fraction of the edible portion of plant (Rp):

0.39.

Calculating the measure of the amount of contaminant that is lost to physical processes over time:

$$kp = \left(\frac{\ln 2}{t_{1/2}}\right) \cdot 365 \quad .$$

Recommended value for plant surface loss coefficient (kp):

18.

Length of plant exposure to deposition per harvest of the edible portion of plant:

$$Tp = \frac{60 days}{365 days / yr} = 0.164 \ yr \quad .$$

Standing crop biomass (productivity):

$$Yp = \frac{Yh_i}{Ah_i} \quad .$$

Recommended values for standing crop biomass (productivity)(Yp):

Crops = 2.24 kg DW/m^2

Forage = 0.24 kg DW/m^2

Silage = 0.8 kg DW/m^2.

Aboveground produce concentration due to air-to-plant transfer:

$$Pv = Q \cdot F_v \cdot \frac{Cyv \cdot Bv_{ag} \cdot VG_{ag}}{\rho_a} \quad .$$

Correction factor for below ground produce:

$$VG_{rootveg} = \frac{M_{skin}}{M_{veg}} \quad .$$

Recommended values for Empirical Correction Factor for aboveground produce (VG_{ag}):

0.01 for COPCs with a log K_{ow} greater than 4

1.0 for COPCs with a log K_{ow} less than 4.

Produce concentration due to root uptake:

Exposed and protected aboveground produce:

$$Pr_{ag} = Cs \cdot Br \quad .$$

Belowground produce:

$$Pr_{bg} = \frac{Cs \cdot RCF \cdot VG_{rootveg}}{Kd_s \cdot 1\,kg/L} \quad .$$

Recommended values for empirical correction factor for belowground produce ($VG_{rootveg}$):

0.001 for COPCs with a log K_{ow} greater than 4

1.0 for COPCs with a log K_{ow} less than 4.

Recommended value for interception fraction of the edible portion of plant (Rp):

Forage = 0.5

Silage = 0.46.

Length of plant exposure to deposition per harvest of the edible portion of plant (Tp):

Considers the average of:

1. Average period between successive hay harvests
2. Average period between successive grazing.

$$Tp = \frac{0.5 \cdot (60\ days + 30\ days)}{365\ days/yr} = 0.12\ yr \quad .$$

Recommended value for plant exposure length to deposition per harvest of the edible portion of plant (Tp):

Forage = 0.12 yr

Silage = 0.16 yr.

Recommended values for empirical correction factor for forage and silage (VG_{ag}):

Forage = 1

Silage = 0.5.

COPC Concentration in beef:

$$A_{beef} = (\Sigma\ (F_i \cdot Qp_i \cdot P_i) + Qs \cdot Cs \cdot Bs) \cdot Ba_{beef} \cdot MF \quad .$$

Recommended value for fraction of plant type *i* grown on contaminated soil and eaten by the animal (cattle) (F_i) = 1.

Recommended values for quantity of plant type *i* eaten by the animal (cattle) each day (Qp_i):

Forage = 8.8 kg DW/day
Silage = 2.5 kg DW/day
Grain = 0.47 kg DW/day.

COPC concentration in plant type *i* eaten by the animal (cattle):

$$P_i = (Pd + Pv + Pr) \quad .$$

Recommended value for quantity of soil ingested by the animal (cattle) per day (Qs):

0.5 kg/day.

Recommended values for soil bioavailability factor (Bs):

1.0.

COPC concentration in milk:

$$A_{milk} = (\Sigma \ (F_i \cdot Qp_i \cdot P_i) + Qs \cdot Cs \cdot Bs) \cdot Ba_{milk} \cdot MF \quad .$$

Recommended values for quantity of plant type *i* eaten by the animal (dairy cattle) per day (Qp_i):

Forage = 13.2 kg DW/day
Silage = 4.1 kg DW/day
Grain = 3.0 kg DW/day.

Recommended values for quantity of soil eaten by the animal (dairy cattle) per day (Qs):

0.4 kg/day.

COPC concentration in pork:

$$A_{pork} = (\Sigma \ (F_i \cdot Qp_i \cdot P_i) + Qs \cdot Cs \cdot Bs) \cdot Ba_{pork} \cdot MF \quad .$$

Recommended values for quantity of plant type *i* eaten by the animal (swine) each day (Qp_i):

Grain = 3.3 kg DW/day
Silage = 1.4 kg DW/day.

Recommended value for quantity of soil eaten by the animal (swine) each day (Qs):

0.37 kg DW/day.

COPC concentration in chicken and eggs:

$$A_{chicken} \text{ or } A_{egg} = (\Sigma\ [F_i \cdot Qp_i \cdot Pi] + Qs \cdot Cs \cdot Bs) \cdot (Ba_{egg} \text{ or } Ba_{chicken}) \ .$$

Recommended value for quantity of plant type *i* eaten by the animal (chicken) each day (Qp_i):

Grain = 0.2 kg DW/day.

Recommended equation for calculating concentration of COPC in plant type *i* eaten by the animal (chicken):

$$Pi = \Sigma_i(Pr) \ .$$

Recommended value for quantity of soil eaten by the animal (chicken) each day (Qs):

0.022 kg DW/day.

Air Concentration (Direct Inhalation Equation):

$$C_a = Q \cdot [F_v \cdot Cyv + (1.0 - F_v) \cdot Cyp]$$

$$Hg^0: \quad C_a = 0.002 \cdot Q[Fv \cdot Cyv + (1.0 - Fv) \cdot Cyp]$$

$$Hg^{2+}: \quad C_a = 0.48 \cdot Q[Fv \cdot Cyv + (1.0 - Fv) \cdot Cyp] \ .$$

B-2. Intake and Risk Characterization Equations – HHRAP Appendix C

COPC intake from soil:

$$I_{soil} = \frac{Cs \cdot CR \cdot F_{soil}}{BW} \ .$$

COPC intake from produce:

$$I_{ag} = \left[\left((Pd + Pv + Pr) \cdot CR_{ag}\right) + \left(Pr \cdot CR_{pp}\right) + \left(Pr_{bg} \cdot Cr_{bg}\right)\right] \cdot F_{ag} \ .$$

COPC intake from beef, milk, pork, poultry, and eggs:

$$I_i = A_i \cdot CR_i \cdot F_i \quad .$$

Total daily intake:

$$I_T = I_{soil} + I_{ag} + I_{beef} + I_{milk} + I_{pork} + I_{poultry} + I_{eggs} \quad .$$

Individual cancer risk: carcinogens:

$$CancerRisk_i = \frac{I_T \cdot ED \cdot EF \cdot CSF}{AT \cdot 365} \quad .$$

Hazard Quotient: noncarcinogens:

$$HQ = \frac{I_T \cdot ED \cdot EF}{RfD \cdot AT \cdot 365} \quad .$$

Total cancer risk: carcinogens:

$$\text{Total Cancer Risk} = \sum_i \cdot \text{Cancer Risk}_i \quad .$$

Total Hazard Index: noncarcinogens:

$$\text{Total Hazard Index} = \sum_j \cdot HI_j \quad .$$

Inhalation cancer risk for individual chemicals: carcinogens:

$$\text{Cancer Risk}_{inh(i)} = EC \cdot URF_{(i)}$$

$$EC = \frac{C_a \cdot EF \cdot ED}{AT \cdot 365 \text{ days / yr}} \quad .$$

Inhalation hazard quotient for COPCs: noncarcinogens:

$$HQ_{inh(i)} = \frac{EC \cdot 0.001}{RfC} \quad .$$

Total inhalation cancer risk: carcinogens:

$$\text{Total Cancer Risk}_{inh} = \sum_i \text{Cancer Risk}_{inh(i)} \quad .$$

Total hazard index for inhalation: noncarcinogens:

$$HI_{inh} = \sum_i HQ_i \quad .$$

Acute hazard quotient:

$$AHQ_{inh(i)} = \frac{C_{acute} \cdot 0.001}{AIEC} \quad .$$

B-3. HHRAP Equation Parameter Definitions and Units

A_{beef}	=	Concentration of COPC in beef (mg COPC/kg FW tissue)
$A_{chicken}$	=	Concentration of COPC in chicken (mg COPC/kg FW tissue)
A_{egg}	=	Concentration of COPC in egg (mg COPC/kg FW tissue)
A_{milk}	=	Concentration of COPC in milk (mg COPC/kg milk)
A_{pork}	=	Concentration of COPC in pork (mg COPC/kg FW tissue)
A_j	=	Concentration of COPC in animal tissue j
AHQ	=	Acute hazard quotient (unitless)
AIEC	=	Acute inhalation exposure criteria (mg/m^3)
AT	=	Averaging time (yr)
Ba_{beef}	=	COPC biotransfer factor for beef (day/kg FW tissue)
$Ba_{chicken}$	=	COPC biotransfer factor for chicken (day/kg FW tissue)
Ba_{egg}	=	COPC biotransfer factor for egg (day/kg FW tissue)
Ba_{milk}	=	COPC biotransfer factor for milk (day/kg FW tissue)
Ba_{pork}	=	COPC biotransfer factor for pork (day/kg FW tissue)
BD	=	Soil bulk density (g soil/cm^3 soil)
Br	=	Plant-soil bioconcentration factor for produce (unitless)
Bs	=	Soil bioavailability factor (unitless)
Bv_{ag}	=	COPC air-to-plant biotransfer factor ([mg COPC/g DW plant]/[mg COPC/g air])(unitless)
BW	=	Body Weight (kg)
CR_{ag}, CR_{pp}, CR_{bg}	=	Consumption rate of aboveground, protected aboveground, and belowground produce respectively (kg/kg-day DW)
CR_{soil}	=	Consumption rate of soil (kg/day)
Cs	=	Average soil concentration over exposure duration (mg COPC/kg soil)
CS_{TD}	=	Soil concentration at time tD (mg/kg)
CSF	=	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$
Cyp	=	Unitized yearly average air concentration from particle phase (mg-s/g-m^3)
Cyv	=	Unitized yearly average air concentration from vapor phase (mg-s/g-m^3)

Ds	=	Deposition term (mg COPC/kg soil/yr)
Dydp	=	Unitized yearly dry deposition from particle phase (s/m^2-yr)
Dydv	=	Unitized yearly dry deposition from vapor phase (s/ m^2-yr)
Dywp	=	Unitized yearly average wet deposition from particle phase (s/m^2-yr)
Dywv	=	Unitized yearly wet deposition from vapor phase (s/ m^2-yr)
EC	=	Exposure concentration (μg/m^3)
ED	=	Exposure duration (yr)
EF	=	Exposure frequency (days/yr)
ER	=	Soil enrichment ration (unitless)
E_v	=	Average annual evapotranspiration (cm/yr)
F_{ag}	=	Fraction of produce that is contaminated (unitless)
F_i	=	Fraction of plant type i grown on contaminated soil and ingested by the animal (cattle)(unitless)
F_{soil}	=	Fraction of soil that is contaminated (unitless)
F_v	=	Fraction of COPC air concentration in vapor phase (unitless)
H	=	Henry's Law constant (atm-m^3/mol)
I	=	Average annual irrigation (cm/yr)
I_{ag}	=	Daily intake of COPC from produce (mg/kg-day DW)
I_{beef}, I_{milk}, I_{pork}, $I_{poultry}$, I_{eggs}	=	Daily intake of COPC from beef, milk, pork, poultry, and eggs (mg/kg-day FW)
I_i	=	Daily intake of COPC i from animal tissue j (mg/kg-day)
I_T	=	Total daily intake of COPC from all food sources (mg/kg-day)
I_{soil}	=	Daily intake of COPC from soil (mg/kg-day)
IR	=	Inhalation rate (m^3/hr)
Kds	=	Soil-water partition coefficient (mL water/g soil)
kp	=	Plant surface loss coefficient (yr^{-1})
ks	=	COPC soil loss constant due to all processes (yr^{-1})
kse	=	COPC loss constant due to soil erosion (yr^{-1})
ksg	=	COPC loss constant due to biotic and abiotic degradation (yr^{-1})
ksl	=	COPC loss constant due to leaching (yr^{-1})
ksr	=	COPC loss constant due to surface runoff (yr^{-1})
ksv	=	COPC loss constant due to volatilization (yr^{-1})

MF	=	Metabolism factor (unitless)
M_{skin}	=	Mass of thin (skin) layer of belowground vegetable (g)
M_{veg}	=	Mass of the entire vegetable (g)
P	=	Average annual precipitation (cm/yr)
P_i	=	Concentration of COPC in each plant type i eaten by the animal (cattle) (mg/kg DW)
Pd	=	Plant (aboveground produce) concentration due to direct (wet and dry) deposition (mg COPC/kg DW)
Pr_{ag}	=	Concentration in exposed or protected produce due to root uptake (mg/kg)
Pr_{bg}	=	Concentration in below-ground produce due to root uptake (mg/kg)
Pv	=	Concentration of COPC in the plant resulting from air-to-plant transfer (µg COPC/g DW)
Q	=	COPC emission rate (g/s)
Qp_i	=	Quantity of plant type i eaten by the animal (cattle) per day (kg DW plant/day)
Qs	=	Quantity of soil eaten by the animal (cattle) each day (kg/day)
R	=	Universal gas constant (atm-m^3/mol-K)
RCF	=	Root concentration factor (unitless)
RfC	=	Reference concentration (mg/kg-day)
RfD	=	Reference dose (mg/kg-day)
RO	=	Average annual surface runoff from previous areas (cm/yr)
Rp	=	Interception fraction of the edible portion of plant (unitless)
SD	=	Sediment delivery ratio (unitless) (g/m^2-yr)
tD	=	Time period over which deposition occurs (assumed 15 yr of operations)
Tp	=	Length of plant exposure to deposition per harvest of the edible portion of the ith plant group (yr)
T_a	=	Ambient air temperature (K) = 278.8 K (42 °F annual-average at INL)
$T_{1/2}$	=	Half-life (days)
T_1	=	Time period at the beginning of combustion (0 yr)
T_2	=	Length of exposure (6, 30, 40 yr for child, adult, farmer, respectively)
URF	=	Inhalation Unit Risk Factor $(\mu g/m^3)^{-1}$
Vdv	=	Dry deposition velocity (cm/s)
VG_{ag}	=	Empirical correction factor for aboveground produce (unitless)
$VG_{rootveg}$	=	Correction factor for belowground produce (g/g)

W	=	Average annual wind speed (m/s)
X_e	=	Unit soil loss (kg/m^2-yr)
Yh_i	=	Harvest yield of the ith crop (kg DW)
Yp	=	Yield or standing crop biomass of the edible portion of the plant (productivity)(kg DW/m²)
Yp_i	=	Yield or standing crop biomass of edible portion of the ith plant group (kg DW/m²)
Z_s	=	Soil mixing zone depth (cm)
ρ_a	=	Density of air (g/cm^3)
ρ_s	=	Density of surface soil (g/cm^3)
θsw	=	Soil volumetric water content (mL water/cm^3 soil)

B-4. HHRAP Equation Parameter Values (LET&D, PEWE, IWTU COPCs)

All values from U.S. EPA on-line Companion Data Base, January 2007
(ND = no value in EPA data base)

Table B-1. COPC physical/chemical parameter values used in the risk assessment.

COPC	CAS #	*Log Kow*	*Kds* (mL/g)	*ksg* (year)-1	*Fv* (unitless)
ALUMINUM	7429-90-5	ND	1.50E+03	0.00E+00	0.00E+00
ARSENIC	7440-38-2	6.80E-01	2.90E+01	0.00E+00	6.00E-03
BARIUM	7440-36-3	2.30E-01	4.10E+01	0.00E+00	9.00E-03
BENZO(A)PYRENE	50-32-8	6.00E+00	1.60E+05	4.80E-01	2.94E-01
BERYLLIUM	7440-41-7	-5.70E-01	7.90E+02	0.00E+00	9.00E-03
BIS(2-ETHYLHEXYL PHTHALATE)	117-81-7	5.10E+00	2.30E+06	1.10E+01	1.31E-01
CADMIUM	7440-43-9	-7.00E-02	7.50E+01	0.00E+00	9.00E-03
CHLORINE	7782-50-5	8.50E-01	ND	0.00E+00	1.00E+00
CHROMIUM	7440-47-3	2.30E-01	1.90E+01	0.00E+00	9.00E-03
DICHLOROBENZENE,1,4-	106-46-7	3.50E+00	1.20E+00	1.41E+00	1.00E+00
DICHLOROBENZIDINE,3,3'-	91-94-1	3.51E+00	7.21E+00	1.41E+00	4.82E-01
FLUORANTHENE	206-44-0	5.00E+00	1.10E+04	5.70E-01	9.92E-01
HEXACHLOROCYCLOPENTADIENE	77-47-4	5.04E+00	1.17E+02	9.03E+00	1.00E+00
HEXAVALENT CHROMIUM	18540-29-9	0.00E+00	1.90E+01	0.00E+00	0.00E+00
HYDROGEN CHLORIDE	7647-01-0	ND	ND	0.00E+00	1.00E+00
LEAD	7439-92-1	7.30E-01	9.00E+02	0.00E+00	7.00E-03
MERCURIC CHLORIDE	7487-94-7	-2.15E-01	5.80E+04	0.00E+00	8.50E-01
MERCURY - TOTAL	7439-97-6	6.20E-01	1.00E+03	0.00E+00	1.00E+00
METHYL MERCURY	22967-92-6	ND	7.00E+03	0.00E+00	0.00E+00
NICKEL	7440-02-0	-5.70E-01	6.50E+01	0.00E+00	9.00E-03
N-NITROSODIPROPYLAMINE	621-64-7	1.36E+00	2.20E-01	1.41E+00	1.00E+00
PYRENE	129-00-0	4.90E+00	9.50E+03	1.30E-01	9.94E-01
SELENIUM	7782-49-2	2.40E-01	5.00E+00	0.00E+00	0.00E+00
SILVER	7440-22-4	2.30E-01	8.30E+00	0.00E+00	9.00E-03
TRICHLOROPROPANE,1,2,3-	96-18-4	2.00E+00	1.40E-01	7.00E-01	1.00E+00
ZINC	7440-66-6	-4.70E-01	6.20E+01	0.00E+00	8.00E-03

Table B-1. (continued).

COPC	*MW* (g/mole)	*Vp* (atm)	*S* (mg/L)	*H* (atm m³ /mol)	*Da* (cm²/s)
ALUMINUM	2.70E+01	0.00E+00	0.00E+00	0.00E+00	2.11E-01
ARSENIC	7.80E+01	3.30E-12	3.47E+04	7.70E-01	7.72E-02
BARIUM	1.39E+02	5.58E-12	5.48E+04	0.00E+00	7.72E-02
BENZO(A)PYRENE	2.52E+02	7.24E-12	1.60E-03	1.10E-06	4.30E-02
BERYLLIUM	9.01E+00	5.58E-12	1.49E+05	1.50E-02	7.72E-02
BIS(2-ETHYLHEXYL PHTHALATE)	3.91E+02	8.95E-11	3.40E-01	1.00E-07	3.51E-02
CADMIUM	1.12E+02	5.45E-12	1.23E+05	3.10E-02	7.72E-02
CHLORINE	7.09E+01	7.70E+00	6.30E+03	1.17E-02	1.00E-03
CHROMIUM	5.20E+01	5.58E-12	8.67E+04	0.00E+00	1.27E-01
DICHLOROBENZENE,1,4-	1.47E+02	1.32E-03	7.90E+01	2.40E-03	6.90E-02
DICHLOROBENZIDINE,3,3'-	2.53E+02	4.88E-11	3.10E+00	4.00E-09	1.00E-03
FLUORANTHENE	2.02E+02	1.03E-08	2.10E-01	1.60E-05	1.00E-03
HEXACHLOROCYCLOPENTADIENE	2.73E+02	7.89E-05	1.80E+00	2.70E-02	1.00E-03
HEXAVALENT CHROMIUM	5.20E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HYDROGEN CHLORIDE	3.65E+01	4.66E+01	7.20E+05	2.36E-03	1.00E-03
LEAD	2.09E+02	3.97E-12	9.58E+03	2.50E-02	7.72E-02
MERCURIC CHLORIDE	2.72E+02	1.20E-04	6.90E+04	7.10E-10	4.53E-02
MERCURY - TOTAL	2.01E+02	2.63E-06	6.00E-02	7.10E-03	1.09E-02
METHYL MERCURY	2.16E+02	ND	0.00E+00	4.70E-07	5.28E-02
NICKEL	5.87E+01	5.58E-12	4.22E+05	2.50E-02	7.72E-02
N-NITROSODIPROPYLAMINE	1.30E+02	1.71E-04	9.89E+03	2.25E-06	1.00E-03
PYRENE	2.02E+02	6.05E-09	1.40E+00	1.10E-05	1.00E-03
SELENIUM	7.90E+01	1.87E-13	2.06E+03	9.70E-03	7.72E-02
SILVER	1.08E+02	5.58E-12	7.05E+04	0.00E+00	7.72E-02
TRICHLOROPROPANE,1,2,3-	1.47E+02	4.87E-03	1.80E+03	4.10E-04	7.10E-02
ZINC	6.54E+01	5.09E-12	3.44E+05	2.50E-02	7.72E-02

Table B-2. COPC plant bio-transfer factor parameter values used in the risk assessment.

COPC	*Fv* (unitless)	*RCF (mL/g)*	*Brroot* (unitless)	*Brag* (unitless)	*Brf/s* (unitless)	*Brgrain* (unitless)	*Bvag* (unitless)
ALUMINUM	0.00E+00	ND	ND	ND	ND	ND	ND
ARSENIC	6.00E-03	ND	8.00E-03	6.33E-03	3.60E-02	4.00E-03	ND
BARIUM	9.00E-03	ND	1.50E-02	3.22E-02	1.50E-01	1.50E-02	ND
BENZO(A)PYRENE	2.94E-01	9.68E+03	6.05E-02	1.32E-02	1.32E-02	1.32E-02	1.25E+05
BERYLLIUM	9.00E-03	ND	1.50E-03	2.58E-03	1.00E-02	1.50E-03	ND
BIS(2-ETHYLHEXYL PHTHALATE)	1.31E-01	1.96E+03	8.54E-04	4.37E-02	4.37E-02	4.37E-02	1.51E+05
CADMIUM	9.00E-03	ND	6.40E-02	1.25E-01	3.64E-01	6.20E-02	ND
CHLORINE	1.00E+00	7.36E+00	ND	8.38E+00	8.38E+00	8.38E+00	ND
CHROMIUM	9.00E-03	ND	4.50E-03	4.88E-03	7.50E-03	4.50E-03	ND
DICHLOROBENZENE,1,4-	1.00E+00	1.15E+02	9.59E+01	3.67E-01	3.67E-01	3.67E-01	1.24E-01
DICHLOROBENZIDINE,3,3'-	4.82E-01	1.17E+02	1.62E+01	3.62E-01	3.62E-01	3.62E-01	7.65E+04
FLUORANTHENE	9.92E-01	1.64E+03	1.50E-01	4.99E-02	4.99E-02	4.99E-02	7.38E+02
HEXACHLOROCYCLOPENTADIENE	1.00E+00	1.77E+03	1.50E+01	4.73E-02	4.73E-02	4.73E-02	4.83E-01
HEXAVALENT CHROMIUM	0.00E+00	ND	4.50E-03	4.88E-03	7.50E-03	4.50E-03	ND
HYDROGEN CHLORIDE	1.00E+00	ND	ND	ND	ND	ND	ND
LEAD	7.00E-03	ND	9.00E-03	1.36E-02	4.50E-02	9.00E-03	ND
MERCURIC CHLORIDE	8.50E-01	ND	3.60E-02	1.45E-02	0.00E+00	9.30E-03	1.80E+03
MERCURY - TOTAL	1.00E+00	ND	ND	ND	ND	ND	0.00E+00
METHYL MERCURY	0.00E+00	ND	9.90E-02	2.94E-02	0.00E+00	1.90E-02	0.00E+00
NICKEL	9.00E-03	ND	8.00E-03	9.31E-03	3.20E-02	6.00E-03	ND
N-NITROSODIPROPYLAMINE	1.00E+00	8.90E+00	4.09E+01	6.34E+00	6.34E+00	6.34E+00	6.98E-01
PYRENE	9.94E-01	1.38E+03	1.45E-01	5.70E-02	5.70E-02	5.70E-02	8.40E+02
SELENIUM	0.00E+00	ND	2.20E-02	1.95E-02	1.60E-02	2.00E-03	ND
SILVER	9.00E-03	ND	1.00E-01	1.38E-01	4.00E-01	1.00E-01	ND
TRICHLOROPROPANE,1,2,3-	1.00E+00	8.05E+00	5.75E+01	2.70E+00	2.70E+00	2.70E+00	1.84E-02
ZINC	8.00E-03	ND	9.00E-01	9.70E-02	2.50E-01	5.40E-02	ND

Table B-3. Animal bio-transfer factor parameter values used in the risk assessment.

COPC	CAS #	***Bamilk*** **(day/kg FW)**	***Babeef*** **(day/kg FW)**	***Bapork*** **(day/kg FW)**	***Baeggs*** **(day/kg FW)**	***Bapoult*** **(day/kg FW)**
ALUMINUM	7429-90-5	ND	ND	ND	ND	ND
ARSENIC	7440-38-2	6.00E-05	2.00E-03	ND	ND	ND
BARIUM	7440-36-3	3.50E-04	1.50E-04	ND	ND	ND
BENZO(A)PYRENE	50-32-8	7.91E-03	3.76E-02	4.55E-02	1.58E-02	2.77E-02
BERYLLIUM	7440-41-7	9.00E-07	1.00E-03	ND	ND	ND
BIS(2-ETHYLHEXYL PHTHALATE)	117-81-7	8.40E-03	3.99E-02	4.83E-02	1.68E-02	2.94E-02
CADMIUM	7440-43-9	6.50E-06	1.20E-04	1.91E-04	2.50E-03	1.06E-01
CHLORINE	7782-50-5	7.59E-05	3.60E-04	4.36E-04	1.52E-04	2.66E-04
CHROMIUM	7440-47-3	1.50E-03	5.50E-03	ND	ND	ND
DICHLOROBENZENE,1,4-	106-46-7	3.75E-03	1.78E-02	2.16E-02	7.50E-03	1.31E-02
DICHLOROBENZIDINE,3,3'-	91-94-1	3.79E-03	1.80E-02	2.18E-02	7.57E-03	1.32E-02
FLUORANTHENE	206-44-0	8.26E-03	3.92E-02	4.75E-02	1.65E-02	2.89E-02
HEXACHLOROCYCLOPENTADIENE	77-47-4	8.32E-03	3.95E-02	4.78E-02	1.66E-02	2.91E-02
HEXAVALENT CHROMIUM	18540-29-9	1.50E-03	5.50E-03	ND	ND	ND
HYDROGEN CHLORIDE	7647-01-0	1.10E-05	5.23E-05	6.33E-05	2.20E-05	3.86E-05
LEAD	7439-92-1	2.50E-04	3.00E-04	ND	ND	ND
MERCURIC CHLORIDE	7487-94-7	2.26E-03	5.22E-03	3.39E-05	2.39E-02	2.39E-02
MERCURY - TOTAL	7439-97-6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
METHYL MERCURY	22967-92-6	3.38E-04	7.80E-04	5.07E-06	3.58E-03	3.58E-03
NICKEL	7440-02-0	1.00E-03	6.00E-03	ND	ND	ND
N-NITROSODIPROPYLAMINE	621-64-7	2.06E-04	9.79E-04	1.19E-03	4.12E-04	7.21E-04
PYRENE	129-00-0	8.09E-03	3.84E-02	4.65E-02	1.62E-02	2.83E-02
SELENIUM	7782-49-2	5.86E-03	2.27E-03	1.88E-01	1.13E+00	1.13E+00
SILVER	7440-22-4	2.00E-02	3.00E-03	ND	ND	ND
TRICHLOROPROPANE,1,2,3-	96-18-4	6.11E-04	2.90E-03	3.51E-03	1.22E-03	2.14E-03
ZINC	7440-66-6	3.25E-05	9.00E-05	1.28E-04	8.75E-03	8.75E-03

Table B-4. COPC health benchmarks used in the risk assessment.

COPC	CAS #	*RfD* (mg/kg/d)	CSF (mg/kg-day)$^{-1}$	*RfC* (mg/m³)	*URF* (µg/m³)$^{-1}$	AIEC (mg/m3)
ALUMINUM	7429-90-5	ND	ND	5.00E-03	ND	ND
ARSENIC	7440-38-2	3.00E-04	1.50E+00	3.00E-05	4.30E-03	1.90E-04
BARIUM	7440-36-3	7.00E-02	ND	5.00E-04	ND	1.50E+00
BENZO(A)PYRENE	50-32-8	ND	7.30E+00	ND	1.10E-03	6.00E-01
BERYLLIUM	7440-41-7	2.00E-03	ND	2.00E-05	2.40E-03	5.00E-03
BIS(2-ETHYLHEXYL PHTHALATE)	117-81-7	2.00E-02	1.40E-02	ND	ND	1.00E+01
CADMIUM	7440-43-9	1.00E-03	3.80E-01	2.00E-04	1.80E-03	3.00E-02
CHLORINE	7782-50-5	1.00E-01	ND	2.00E-04	ND	2.10E-01
CHROMIUM	7440-47-3	1.50E+00	ND	5.30E+00	ND	1.50E+00
DICHLOROBENZENE,1,4-	106-46-7	3.00E-02	5.40E-03	8.00E-01	1.10E-05	6.00E+02
DICHLOROBENZIDINE,3,3'-	91-94-1	ND	4.50E-01	ND	3.40E-04	6.00E+00
FLUORANTHENE	206-44-0	4.00E-02	ND	1.40E-01	ND	1.50E-02
HEXACHLOROCYCLOPENTADIENE	77-47-4	6.00E-03	ND	2.00E-04	ND	2.00E-01
HEXAVALENT CHROMIUM	18540-29-9	3.00E-03	ND	8.00E-06	1.20E-02	ND
HYDROGEN CHLORIDE	7647-01-0	5.71E-03	ND	2.00E-02	ND	2.10E+00
LEAD	7439-92-1	4.29E-04	8.50E-03	1.50E-03	1.20E-05	1.50E-01
MERCURIC CHLORIDE	7487-94-7	3.00E-04	ND	1.10E-03	ND	1.25E-01
MERCURY - TOTAL	7439-97-6	8.57E-05	ND	3.00E-04	ND	1.80E-03
METHYL MERCURY	22967-92-6	1.00E-04	ND	3.50E-04	ND	3.00E-02
NICKEL	7440-02-0	2.00E-02	ND	2.00E-04	2.40E-04	6.00E-03
N-NITROSODIPROPYLAMINE	621-64-7	ND	7.00E+00	ND	2.00E-03	2.00E-01
PYRENE	129-00-0	3.00E-02	ND	1.10E-01	ND	1.50E+01
SELENIUM	7782-49-2	5.00E-03	ND	2.00E-02	ND	1.47E+00
SILVER	7440-22-4	5.00E-03	ND	1.80E-02	ND	3.00E-01
TRICHLOROPROPANE,1,2,3-	96-18-4	6.00E-03	7.00E+00	ND	2.00E-03	6.00E+01
ZINC	7440-66-6	3.00E-01	ND	ND	ND	3.00E+01

APPENDIX D-6

Modifications to Automatic Waste Feed Cut Off and Operating Parameter Limits During IWTU Shakedown, System Performance Testing, Post System Performance Testing and Normal Operations

IWTU has developed a rigorous process that will be followed during Shakedown and System Performance Testing. The process is intended to provide structure and rigor to the shakedown and testing activities to ensure testing is carried out in an orderly and efficient manner. This is accomplished by establishing a formal process that includes:

- Early planning, organization, and preparation for shakedown and testing
- Systematically performing required testing
- Documentation of the test results.

One of the key elements of the systemization approach is the establishment of a Joint Test Group (JTG). The JTG provides an independent review of the shakedown and testing information to ensure that the expected standard of testing performance and documentation are achieved and maintained. A prime responsibility of the JTG is the oversight of the shakedown and system performance testing, approval or modification of the test instructions and approval of test results.

IWTU shakedown and system performance testing will be performed as two distinct phases. Phase I (Shakedown) will direct the plant startup and required testing to validate proper operation of the facility compared to the current operating parameters specified in Table D-6. Once it is determined that the process components meet the desired specifications and system operability has been demonstrated, Phase II [System Performance Test (SPT)] will be conducted in two parts. Part 1 will be conducted on nonradioactive surrogate, and Part 2 will be conducted on actual Sodium Bearing Waste (SBW) to gauge system performance, demonstrate effective treatment, and verify/revise final operating parameters. The IWTU System Performance Test plan (PLN-3298) will document the test objectives and criteria, quality assurance requirements, sampling and analysis protocol, recordkeeping and reporting for both Parts 1 and 2 of the System Performance Test.

During Phase I (Shakedown) and Phase II, Parts 1 and 2 (System Performance Testing), the established Operating Parameters Limits (OPL) and Automatic Waste Feed Cutoff (AWFCO) Limits identified in Table D-6 will be followed. During Phase I and II, if the operating parameters cannot be maintained as identified in Table D-6 and changes to the OPLs or AWFCO are required, the following actions will be taken.

- The proposed change will be reviewed by the JTG for concurrence
- If the JTG approves the change, and the change is more conservative than the limits established in Table D-6, the change will be documented in the testing documentation and DEQ will be notified of the change

- If the JTG approves the change, and the change is less conservative than the limits established in Table D-6, the DEQ will review the proposed change. If DEQ agrees with the proposed modification, the change will be documented in the testing documentation.

It is recognized that since final OPLs and AWFCOs will be based on results from the Phase I and Phase II testing, any less conservative limits will impact IWTU operations post Phase I and Phase II testing. Following the SPT, the reduced IWTU operating parameters as identified in Table D-6 and a reduced feed rate of 2.5 gal/min, along with the OPL and AWFCO established and tested during Phases I and II will be applicable until the SPT report and Class 2 Permit Modification Request has been submitted and approved.

APPENDIX D-7

Integrated Waste Treatment Unit

Summary of Denitration Mineralization Reformer Vessel

Fluidization Design Modification

RPT-1585 (Rev. 0, July 2018)

RPT-1585
Rev. 0

Integrated Waste Treatment Unit Summary of Denitration Mineralization Reformer Vessel Fluidization Design Modification

Nathan Seaver
Tyler Crumpley

July 2018

RPT-1585
Revision 0
Project No. 25051

Integrated Waste Treatment Unit Summary of Denitration Mineralization Reformer Vessel Fluidization Design Modification

Nathan Seaver
Tyler Crumpley

July 2018

Idaho Cleanup Project Core
Idaho Falls, Idaho 83402

Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-EM0004083

This page intentionally left blank.

ABSTRACT

The effectiveness of the fluidization process within the DMR has been an area of uncertainty since early testing and modeling results. Fluor Idaho, LLC (Fluor) has engaged several experts in the field of fluidization and executed a variety of modeling and testing efforts in order to ascertain the efficacy of fluidization processes within the DMR. Multiple parallel paths were engaged to ensure identification of early options to improve physical, thermal and chemical performance, and numerous alternative designs were considered. Throughout the process of developing modifications to the DMR to enable improved process effectiveness, fluidization, regulatory, permitting, and safety considerations were of paramount importance. This report presents a summary of the engineering methodologies, practices, and processes employed to inform the decision making that led to the finalization and implementation of the IWTU DMR fluidization design modifications.

EXECUTIVE SUMMARY

Several modifications to the DMR vessel, ancillary systems, and steam reforming process have been essential in order to improve the efficacy of the critical waste treatment processes intended for the IWTU facility. Recent modifications have included the addition of a manway and A/G design improvements. These improvements have been important predecessors to the key modifications and process changes which are the focus of this document, in part because they made it possible to consider and implement design changes to the critical process areas within the DMR. This document provides an overview of the history of DMR modifications, but it is intended to provide additional detail of those modifications specifically associated with achieving significant improvements to fluidization, as well as a discussion of modifications to related systems also in support of that objective. Those systems include purge systems, heater systems, gas introduction, fluid flows management, safety systems, amongst others. The work includes permit processes, parallel concept developments, decision analysis and concept selection, CFD, FEA and thermal modeling, scaled testing, cold flow testing, engagement of outside experts, targeted mock-ups, demonstration run evaluations, samples testing, safety assessments, and many other related efforts. This document identifies those activities and their outcomes, and it acts as a repository for pointers/references to all associated design, safety, system, and process documents. This report further presents a summary of the engineering methodology, practices, and processes that support the fluidization system design modifications.

An integrated test of the IWTU facility steam reforming process was conducted from February 2, 2017 to March 31, 2017 using simulated SBW in accordance with Test Instruction TI-102, “IWTU Integrated System Test: Hot Startup—Part 3, Preops Run 1.” The purpose of the test was to operate the entire IWTU process with steam fluidizing flow and waste feed simulant to assess plant operability prior to introducing radioactive feed. A primary objective was to evaluate the performance of the new A/G design. The new design met or exceeded the design criteria during the entire demonstration run and performed all its test objectives satisfactorily. However, stable and prolonged fluidization of the DMR bed was confirmed to be a key performance area in need of improvement.

As with most prior IWTU demonstration runs, sandcastles formed in the lower part of the DMR after a relatively short period of operation. This phenomenon is indicative of a partial defluidization, or a lack of uniform fluidization. If left unchecked, it will propagate throughout the DMR bed. Sandcastles are weak agglomerations of DMR bed particles that disrupt fluidization and result in temperature differentials within the DMR. Sandcastles form in areas of insufficient fluidization where particles can settle and agglomerate. The presence of the sandcastles ultimately led to the termination of the test sooner than planned. To identify the most appropriate solutions for eliminating partial defluidization in the DMR, pilot plant tests, cold flow tests, and significant computer modeling were carried out. In addition, a number of process and equipment modifications were implemented. These modifications

include new gas heater purges, introduction of N_2 and CO_2 in the lower portion of the bed, seed particle controls, and improvements to the fluidizing gas system.

Fluor methodically evaluated a number of possibilities for improving bed fluidization within the DMR and determined that modification of the internal geometry of the lower region of the vessel would be the best approach to significantly enhance fluidization and mixing. After extensive evaluations using computer modeling and physical testing, the installation into the lower section of the DMR of a two-tiered conical membrane, equipped with an array of uniformly spaced nozzles, was shown to be the most effective solution in achieving a uniform fluidizing gas distribution within the DMR. This approach has been designated the Dual Plenum Design.

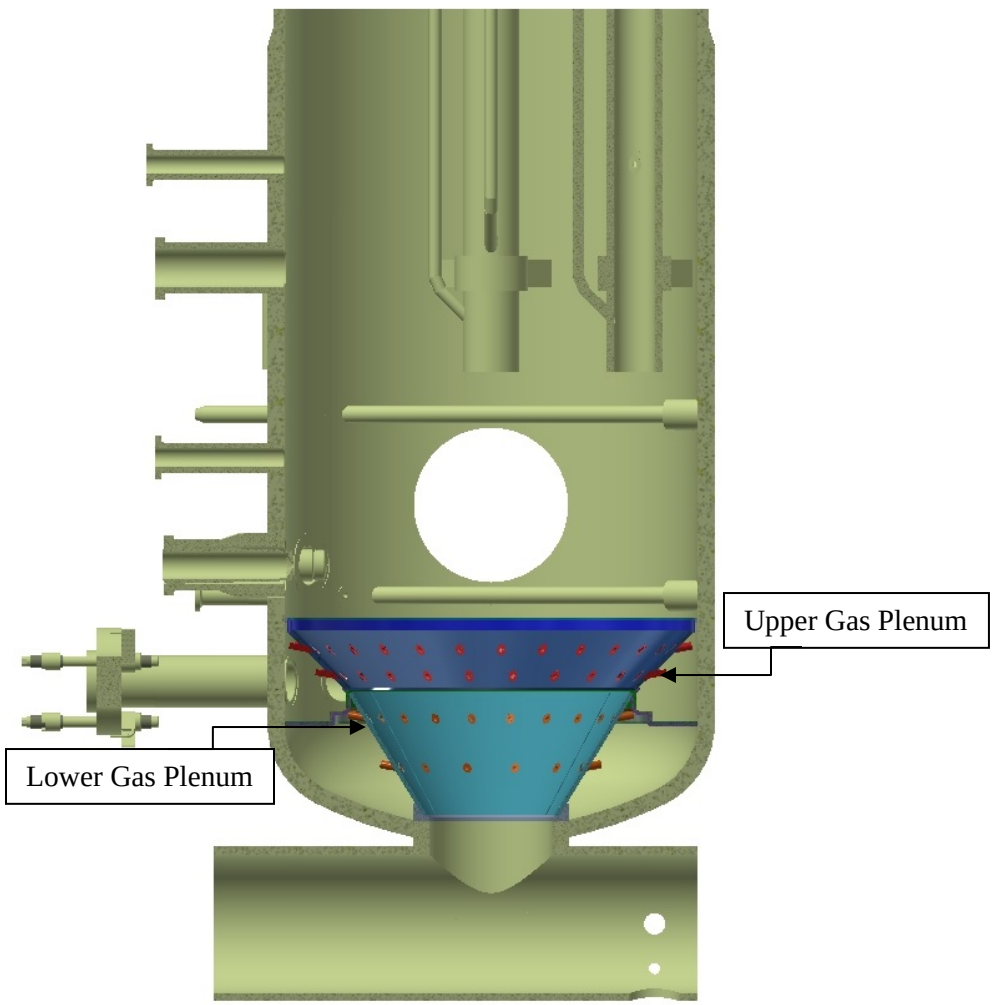


Figure ES 1. DMR dual plenum arrangement.

This report provides summaries, details, and conclusions of the following aspects of the DMR vessel lower region modification:

- Concept development and selection
- CFD analyses
- Thermal structural analysis
- Pilot plant testing
- Cold flow testing
- Physical mock-ups.

The conclusions resulting from each of these evaluations provided the engineering justification to proceed with a plan for the installation of the dual plenum design in the DMR vessel, in preparation for demonstration run 2.

CONTENTS

ABSTRACT III
EXECUTIVE SUMMARY IV
ACRONYMS XI
1 INTRODUCTION 13
2 IDENTIFICATION OF NEED FOR PERMANENT DMR DESIGN CHANGES AND BACKGROUND 15
2.1 DMR Status at Start of Fluor Contract 15
2.1.1 Auger/Grinder Status 15
2.1.2 Ring Header Status 15
2.1.3 Chemistry 15
2.1.4 Temperature Distribution 16
2.2 Initial Study, Modifications, and Demonstration Run 1 16
2.2.1 Auger/Grinder Studies 16
2.2.2 Ring Header Replacement Study (Access Options) 19
2.2.3 Chemistry and Process Study 22
2.2.4 Temperature Data 22
2.2.5 Initial CFD Study 23
2.2.6 Demonstration Run 1 Findings 23
3 EVALUATION OF FLUIDIZATION METHODS 25
3.1 Concept 1.4, Bubble Cap 28
3.2 Concept 2.2, Modified Ring Header 29
3.3 Concept 2.3, Dual Plenum 31
3.4 Independent Concept Review Support 33
4 FLUIDIZATION MODIFICATION DESIGN 34
4.1 Analyses 35
4.1.1 Thermal Structural Calculations 35
4.1.2 Computational Fluid Dynamics Analysis 39
4.1.3 Orifice Design 45
4.1.4 Fluidizing Gas Flowrates 46
4.2 Testing 48
4.2.1 Testing at HAZEN 48
4.2.2 Testing at PSRI 55
4.2.3 Mock-up Testing 59

4.3 N2 Neck Purges 61
4.4 Simulant Testing 62
5 DESIGN REVIEW 62
6 FABRICATION, DEMOLITION, AND INSTALLATION 63
6.1 Fabrication 63
6.2 Demolition 65
6.3 Installation 66
7 ANCILLARY SYSTEM DESIGN MODIFICATIONS 69
7.1 CO_2 Addition 69
7.2 Fluidizing Gas Heater 69
7.3 Over Pressure Protection 70
7.3.1 PSV Additions 70
7.3.2 Facility PSV Review and Update 70
7.4 Drain Line and Purge 71
8 ADDITIONAL SUPPORTING ACTIVITES 71
9 LIST OF DOCUMENTS 72
10 RECOMMENDED ACTIONS 72
11 CONCLUSION 72
12 REFERENCES 73
APPENDIX A-DMR FLUIDIZATION MODIFICATIONS DOCUMENT TREE 1
APPENDIX B-DMR MODIFICATIONS TIMELINE 1
APPENDIX C-DMR MODIFICATIONS FLOWCHART 1

FIGURES

Figure 1. DMR vessel, shown with the new manway. 14
Figure 2. DMR lower region internal arrangement 15
Figure 3. DMR Temperature Plot - rapid divergence of bed temperatures typical of the instabilities caused by sandcastles. 16
Figure 4. A/G Revision 1 showing cement-like deposits 17
Figure 5. A/G six-tooth blade design and associated stator (Revision 2) 18
Figure 6. A/G revision 2 after demonstration run 1, loose material vacuumed out 19
Figure 7. New manway nozzle in the lower region of the DMR. 20
Figure 8. New manway components. 21
Figure 9. New manway in use during fluidization modifications. 21

Figure 10. CFD analysis results showing voidage in six DMR locations during base-case scenario of 55/45% flow. 23
Figure 11. Photo inside DMR after Demonstration run 1 looking from the center toward the top of the ring and rails 24
Figure 12. Photo inside DMR after Demonstration run 1 looking from center at ring header nozzle 25
Figure 13. IWTU Fluidization Concept Alternatives Decision Evaluation Matrix. 27
Figure 14. Concept 1.4, Bubble Cap 29
Figure 15. Concept 2.2, Modified Ring Header 31
Figure 16. Concept 2.3, Dual Plenum 33
Figure 17. Dual plenum material Haynes 556 (green) and Inconel 625 GR1 (cream). 35
Figure 18. Startup case temperature profile, 3D. 36
Figure 19. Startup case von Mises stress profile, 3D. 36
Figure 20. Startup case temperature profile, axisymmetric. 37
Figure 21. Startup case von Mises stress profile, axisymmetric. 37
Figure 22. Normal operations case temperature profile, axisymmetric. 38
Figure 23. Normal operations case von Mises stress profile, axisymmetric. 38
Figure 24. Voidage model, Z-clip, nozzle C. 39
Figure 25. Voidage model, Z-clip, nozzle B. 40
Figure 26. Voidage model, Z-clip, nozzle A. 40
Figure 27. Voidage model, X-clip. 41
Figure 28. Original ring header design (top) compared to dual plenum design (bottom). 42
Figure 29. Vector model, Z-clip, nozzle C. 43
Figure 30. Vector model, Z-clip, nozzle B. 44
Figure 31. Vector model, Z-clip, nozzle A. 44
Figure 32. Vector model, X-clip. 45
Figure 33. Dual Plenum Design Used in EDF-11021 47
Figure 34. Hazen testing, FO- 1, modified ring with cone, pre-test 49
Figure 35. Hazen testing, FO-1, modified ring with cone, post-test. 50
Figure 36. Hazen testing, agglomerations recovered from FO-1 test. 50
Figure 37. Hazen testing, FO-2, bubble cap with flat plate, pre-test. 51
Figure 38. Hazen testing, FO-2, bubble cap with flat plate, post-test. 51
Figure 39. Hazen testing, FO-2 bubble cap detail, post-test. 52
Figure 40. Hazen testing, agglomerations recovered from FO-2 test. 52
Figure 41. Hazen testing, FO-3, dual plenum cone, pre-test. 53
Figure 42. Hazen testing, FO-3, dual plenum cone, post-test. 53

Figure 43. Hazen testing, FO-3 fluidization nozzle detail post-test. 54
Figure 44. Hazen testing, agglomerations on waste feed nozzle FO-3 post-test. 54
Figure 45. PSRI cold flow testing of existing DMR configuration 57
Figure 46. PSRI Dual Plenum Test Assembly. 58
Figure 47. Fabrication of Carbon Steel Dual Plenum Mockup. 59
Figure 48. Working on the DMR mockup. 60
Figure 49. Installation of dual plenum mockup in DMR mockup. 60
Figure 50. Dual plenum components tack welded in DMR mockup. 61
Figure 51. DMR N2 neck purge nozzle locations. 62
Figure 52. Haynes 556 dual plenum cone components being fabricated. 64
Figure 53. Installation of fluidizing gas nozzles in cone sections. 64
Figure 54. Fabrication of plenum divider. 65
Figure 55. Finished cone sections ready for installation. 65
Figure 56. Removing the 3” ring header. 66
Figure 57. Removed 3” ring header sections. 66
Figure 58. Installed lower ring and drain line hole. 67
Figure 59. Plenum segments staged for installation outside DMR manway. 67
Figure 60. Lower plenum section installed. 68
Figure 61. Upper plenum section with root welds completed. 68
Figure 62. Completed dual plenum installation. 69

TABLES

Table 1. Performer and Purpose for Final Design Analyses and Calculations 34
Table 2. EDF-11021 Fluidizing Gas Nozzle Design 46
Table 3. EDF-11021 Fluidizing Gas Nozzle Quantities 46
Table 4. EDF-11021 Fluidizing Gas Flowrates 47
Table 5. Hazen testing, weighted rating of performance indicators for fluidization options 55

ACRONYMS

A/G	Auger-Grinder
ALARA	As Low As Reasonably Achievable
ASME	American Society of Mechanical Engineers
BEA	Battelle Energy Alliance, LLC
CFD	Computational Fluid Dynamics
CWI	CH2M-WG Idaho, LLC
DMR	Denitration Mineralization Reformer
DOE	U.S. Department of Energy
EDF	Engineering Design File
FCF	Facility Change Form
FDC	Field Design Change
FEA	Finite Element Analysis
FTSR	Final Test Summary Report
INL	Idaho National Laboratory
IWTU	Integrated Waste Treatment Unit
MCP	Management Control Procedure
OCE	O'Donnell Consulting Engineers
PAUT	Phased Array Ultrasonic Testing
PLN	Plan
PMR	Permit Modification Request
PSRI	Particulate Solid Research, Inc.
PSV	Pressure Safety Relief Valve
SBW	Sodium Bearing Waste
SSV	Superficial Space Velocity
TM	Temporary Modification

Intentionally Left Blank

Integrated Waste Treatment Unit Summary of Denitration Mineralization Reformer Vessel Fluidization Design Modification

1 INTRODUCTION

The Integrated Waste Treatment Facility (IWTU) at the U.S. Department of Energy's (DOE) Idaho Cleanup Project (ICP) was designed and built to treat approximately 900,000 gallons of radioactive sodium-bearing waste (SBW) using a proprietary fluidized-bed steam reforming technology. The IWTU is managed by Fluor Idaho, LLC, as part of the Idaho Cleanup Project Core and is located at the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Laboratory (INL) Site. Non-radiological testing of the IWTU with simulated SBW over the past 4 years has resulted in identification of process and equipment problems which have been corrected to improve production reliability. The facility has continued to experience issues associated with fluidization in the denitration mineralization reformer (DMR), chemistry, and process control. The Technical Issues Resolution Project was established to resolve the remaining issues with the IWTU to enable the facility to commence radiological operations. This report discusses specifically the issues and modifications that have been made to date to the DMR to improve fluidization, chemistry, and process control of the DMR.

The DMR of the Integrated Waste Treatment Unit (IWTU) is shown below in Figure 1. The DMR is not a stamped vessel, but is designed and maintained to Section VIII, Division 1 of the 2004 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. The existing DMR lower region internal arrangement of fluidizing components is shown in Figure 2.

As part of the Technical Issues Resolution Project, a non-radiological demonstration run of the IWTU was conducted beginning in February 2017, with the primary objective of evaluating the performance of a new prototype auger-grinder (A/G). Previous versions of the A/G had failed during prior demonstration runs. This test (Demonstration Run 1) was conducted in accordance with Test Instruction TI-102, "IWTU Integrated System Test: Hot Startup—Part 3, Preops Run 1." The new design of the A/G met or exceeded the design criteria during the entire demonstration run and performed all its test objectives satisfactorily.

As with most prior IWTU demonstration runs, sandcastles formed in the lower part of the DMR, both causing and indicating partial defluidization of the DMR bed. Sandcastles are weak agglomerations of DMR bed particles that disrupt fluidization and result in temperature differentials within the DMR. Sandcastles form in areas of insufficient fluidization where particles can settle and agglomerate. The presence of the sandcastles ultimately led to the termination of this test on March 31, 2017, sooner than planned.

As a result of the early termination of demonstration run 1, it was determined that fluidization of the DMR bed with the existing design was not being achieved, and that "fine tuning" the system was not going to achieve proper and sustained fluidization needed for successful plant operation. A redesign of the DMR fluidization method and/or internal components was required for the plant to successfully complete its mission. This report documents the many other contributing elements leading to the decision to modify the geometry of the lower vessel region, a number of supporting system modifications, and the resulting dual plenum design to modify the vessel lower region geometry.

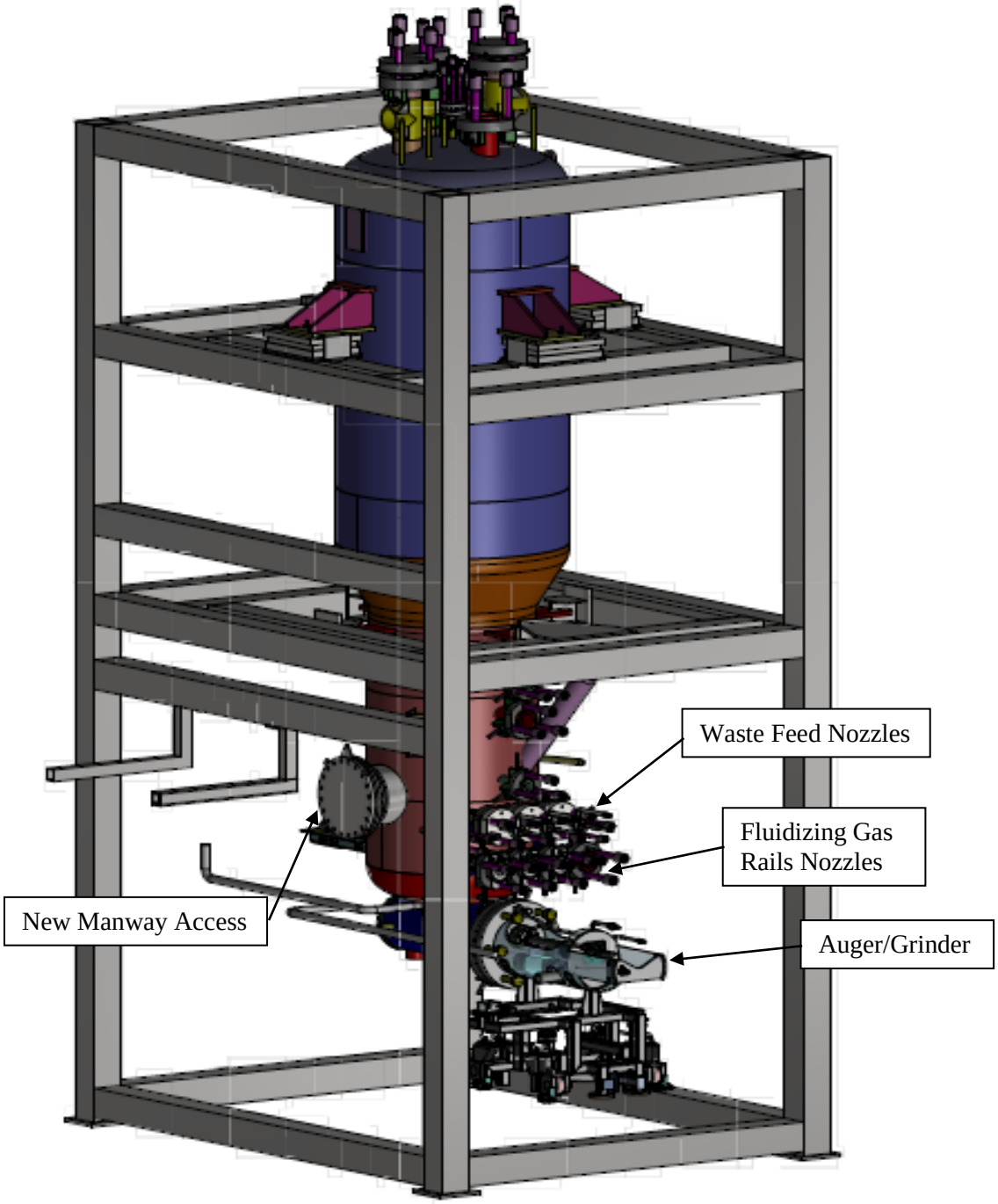


Figure 1. DMR vessel, shown with the new manway.

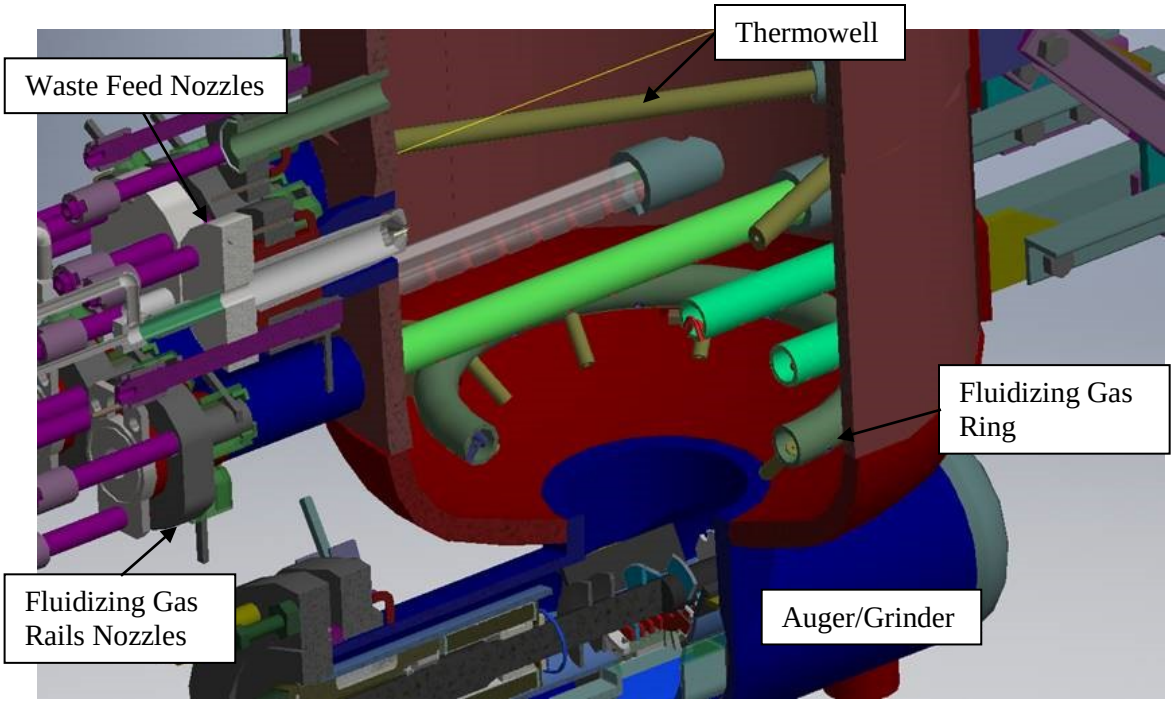


Figure 2. DMR lower region internal arrangement

2 IDENTIFICATION OF NEED FOR PERMANENT DMR DESIGN CHANGES AND BACKGROUND

2.1 DMR Status at Start of Fluor Contract

2.1.1 Auger/Grinder Status

When Fluor began the ICP Core Contract the A/G was plugged with cementitious material from the previous demonstration run by the previous contractor, see Figure 4. It was apparent that the A/G design needed to be re-evaluated to determine if an additional redesign was necessary.

2.1.2 Ring Header Status

As shown in Figure 2, above, the fluidizing gas ring header, also known as the sparge ring, is positioned in the lower head region of the DMR vessel below the fluidizing gas rails. It was discovered by the previous contractor that prior Simulant tests had caused significant erosion to occur on the ring header and that the ring header would need to be replaced prior to radiological operations. At the start of the Fluor contract the ring header had not yet been replaced. Instead, erosion plates had been installed so that another demonstration run could be performed before replacing the ring header. This would provide additional operation time to gather more data and also time to evaluate the cause of the erosion and prepare a replacement plan.

2.1.3 Chemistry

The cause of DMR bed defluidization and the plugging of the A/G seemed to all point back to the production of agglomerations of cementitious material. The agglomerations formed sandcastles in the bed and the fines produced cement-like material that bound up and plugged the A/G.

It was determined that adding carbon dioxide to the lower regions of the DMR would help mitigate the formation of cementitious material. A temporary CO2 tank was procured and piping was installed to allow the addition of carbon dioxide to the fluidizing gas.

2.1.4 Temperature Distribution

Partial defluidization of the bed causes large temperature gradients within the DMR. When the temperature gradients become large enough, the plant alarms and eventually shuts down. The temperature gradients are determined from the thermowells that span horizontally at two elevations in the lower vessel and bed region. These are the only locations in the bed region where temperature data are measured and recorded to determine these gradients.

The bed defluidization and large temperature gradients were attributed to the formation of sandcastles. The formation of sandcastles was believed to be the result of several factors, including particle size, product chemistry, and low fluidization regions. With so many potential factors, more data were needed to fully understand the cause of sandcastle formation and the resulting poor temperature distribution.

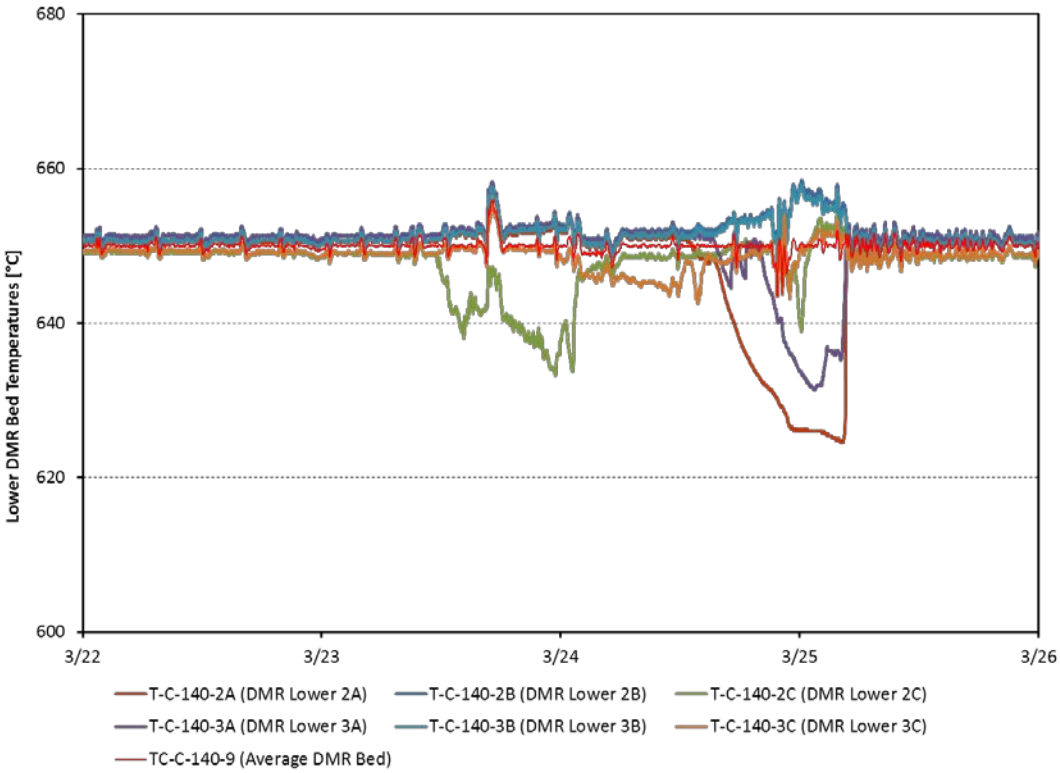


Figure 3. DMR Temperature Plot - rapid divergence of bed temperatures typical of the instabilities caused by sandcastles.

2.2 Initial Study, Modifications, and Demonstration Run 1

2.2.1 Auger/Grinder Studies

During IWTU non-radiological simulant operations on May 21, 2016, the Revision 1 design of the A/G bound up and ceased to operate. A Formal Cause Analysis (FCA) was conducted (RPT-1502), which concluded the primary root cause was that the design of the grinder blades and the auger flights was not

effective in clearing a buildup of material that constitutes some portion of the feed to the A/G. Figure 4, below, shows the Revision 1 A/G and the cement-like material after removal from the denitration mineralization reformer (DMR). Fine particulate material (fines) can be delivered to the A/G as a product of the DMR, or to some degree generated by the action of the A/G itself. The retention of these fines in the A/G, combined with excessive moisture, contributes to the formation of a cement-like material which can act to jam the A/G and restrict the flow of material through the A/G. As such, along with enhancing size reduction and self-cleaning capabilities, the design of the Revision 2 A/G was intended to both reduce the A/G's contribution to the generation of fines and reduce the locations within the A/G where fines could be retained.

Also, the Revision 1 design was a single welded unit, without any interchangeable parts. This made disassembly and removal of cement-like material buildup difficult. The Revision 2 design incorporates easily removable bolted components and tab-and-slot features that allow easy disassembly and interchangeability without cutting or welding. These features allow for easier part replacement, cleaning, and recovery from off-normal conditions. It also allowed for easy conversion between the two variants of the Revision 2 design, which made the development process more efficient.

Figure 4. A/G Revision 1 showing cement-like deposits

After development and mockup testing, both Revision 2 variants met all the design and performance requirements. The six-tooth blade design (see Figure 5) was selected as the preferred option as it showed, by testing, to clear material from the interstitial spaces between the blades and stators with somewhat more efficiency. Details of the design and detailed test results can be found in RPT-1531.

The key test objective of TI-102 – Part 3 (Fluor Demonstration Run 1) was to test the redesigned A/G to verify satisfactory A-G operation under actual DMR operating conditions. The average drain rate was 20.4 inches per hour and was consistent throughout the test. All but two of the transfers met or

exceeded the design basis rate of 15 inches per hour; for these two transfers, an abnormally long time passed between the opening of the DMR solids transfer valve and starting the A/G. More importantly, for the first time, the A/G was used to drain the DMR bed at the end of the test. It was concluded following Demonstration Run 1 that the Revision 2 design of the A/G operates consistently without failure or degradation of performance, and can meet or exceed any anticipated required transfer rate to support the envisioned IWTU operational pace. For details of the A/G Demonstration Run 1 data and results see RPT-1556. Figure 6 shows the A/G revision 2 that was removed from the DMR following demonstration run 1after vacuuming to remove lose material.

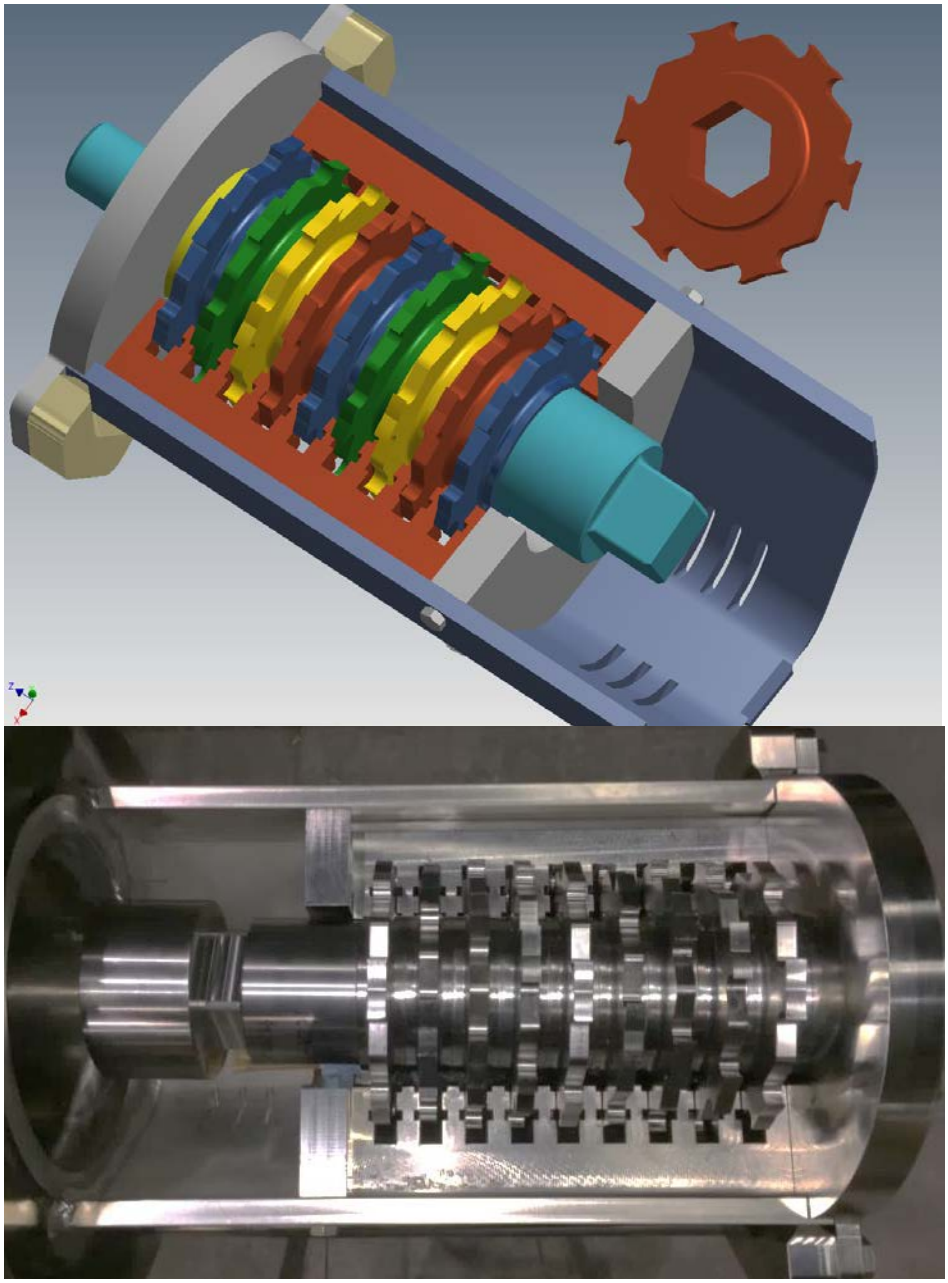


Figure 5. A/G six-tooth blade design and associated stator (Revision 2)

Figure 6. A/G revision 2 after demonstration run 1, loose material vacuumed out

2.2.2 Ring Header Replacement Study (Access Options)

Access to the interior of the denitration mineralization reformer (DMR) of the Integrated Waste Treatment Unit (IWTU) was initially extremely limited because the vessel was not designed for access. Furthermore, with limited space around the DMR available for an external ring header, a design decision, made earlier by the project, was to include an internal fixed fluidizing gas ring to the DMR. It was not anticipated that access would be required to change out or service this component. During the December 2015 demonstration run (performed by the previous contractor), erosion of the fluidizing gas ring header occurred and thus the need for access to enable replacement was recognized. CH2M-WG Idaho, LLC (CWI), had investigated a plan in which the Auger/Grinder N2 Nozzle (the housing into which the Auger/Grinder fits) could be cut to allow limited access, and subsequently re-welded. Fluor judged that this scenario was not feasible as it provided only limited, non-reusable access and presented life safety issues.

Fluor methodically evaluated a number of possibilities and determined that the installation of a new manway into the side of the DMR would allow the needed access to replace the fluidizing ring header, and would additionally allow for future modifications if necessary.

An 18-in-diameter side entry manway design was selected after the evaluation of numerous alternatives. Consistent with the Fluor management control procedure (MCP) for Conduct of Engineering, finite element analyses (FEA) were conducted by both Fluor Energy and Chemicals Division and Fluor. The DMR is not a stamped vessel, but is designed and maintained to Section VIII, Division 1 of the 2004

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. These double analyses were beyond what was required by Fluor MCPs for engineering, but provided an additional level of confidence.

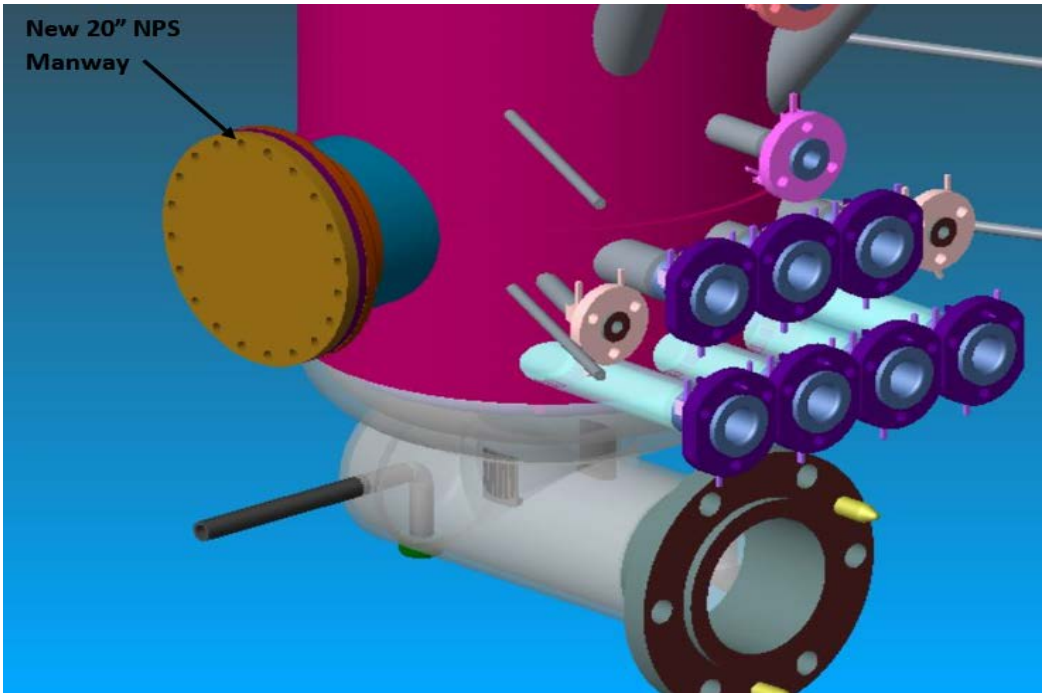


Figure 7. New manway nozzle in the lower region of the DMR.

The manway was designed to allow access to the DMR between the two levels of thermocouple rails in the lower region of the DMR. To prevent the manway from filling with bed material during DMR operations the portion of the DMR shell that was removed to create the manway opening was repurposed as a plug. When closing the manway the plug is inserted and then packing is installed around the plug. A gasket ring holds the packing in place. The plug is positioned in the manway by a flange that is bolted between the manway flange and the blind flange that closes the manway. See Figure 8 for an illustration of the manway components.

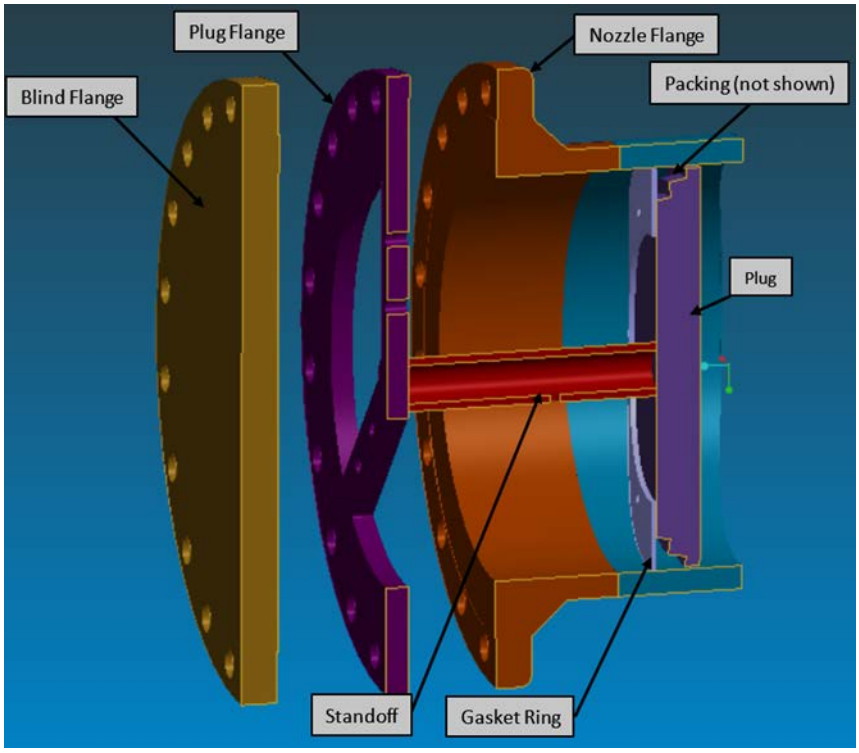


Figure 8. New manway components.

Figure 9. New manway in use during fluidization modifications.

Through progressively more demanding demonstrations and mockup testing, confidence was established to install the manway in the DMR vessel, thus, providing reliable entry into the vessel. Details of the manway design, analysis, and testing can be found in RPT-1561. Following Demonstration Run 1 the manway was installed in the DMR.

It is important to note that the decision to add a manway and the ability to repeatedly access the vessel interior made it possible to perform the necessary fluidization modifications (dual plenum) discussed in this report.

2.2.3 Chemistry and Process Study

Operation of the DMR produces a dry, granular product that accumulates in the DMR fluidized bed. Periodically the product solids are drained from the bed though an A/G that size reduces any larger solids that are produced in the bed to less than 0.5-inch in size. A/G operations during the past several SBW simulant operations have shown unacceptable accumulation of hard, cement-like deposits of fine-sized solids in the A/G that has resulted in A/G failure to rotate.

Fluor performed chemistry related testing to evaluate conditions that may produce product solids that may consolidate into hard, cement-like deposits in the A/G. Testing at the Hazen Research Inc. (Hazen) facility in Golden, Colorado was performed, see CET-AGCE-TR-1. The A/G cement evaluation test program is one part of the overall Hazen Chemistry Evaluation Test (CET) test program.

The following are the major conclusions from the A/G testing program:

- The presence of steam at temperatures less than or equal to 150°C produced significant bonding between all sizes of carbonate particles
- The presence of steam at temperatures above or equal to 175°C produced only minimal bonding between all sizes of carbonate particles
- The presence of CO_2 mixed with steam did not prevent particle bonding at 150°C
- Larger carbonate solids were not subject to particle bonding to the extent noted for small and fine-sized carbonate solids.

Recommendations provided to the team redesigning the A/G were:

> Design Considerations – Minimize fines generation, minimize fines retention (dead spots, accumulation areas), maintain internal A/G temperature above 200°C.
>
> Operational Considerations – As much as possible, conduct transfers without rotating the A/G, minimize time cold transfer gases are cooling A/G internals.
>
> Subsequent testing showed that the transfer rate decreased significantly when the A/G was not rotating. Current procedures call for rotating the A/G when making a DMR bed transfer.

2.2.4 Temperature Data

In order to gather more temperature data, additional thermocouples were temporarily installed on the exterior of the DMR (see TM-FDC-10811 and TM-FDC-11081). The additional thermocouples increase the resolution of the temperature data available for monitoring the fluidization behavior in the DMR. Because of the addition of these new thermocouples, differential temperature increases that indicate a loss of fluidization were detected by the external thermocouples before the internal thermocouples registered the change during Demonstration Run 1. This helped to confirm that fluidization problems were occurring in the DMR.

The chemistry studies determined it was desirable to maintain the A/G internal components above 200°C to reduce the potential for creating cementitious material. There are several nitrogen purges into the A/G that supply ambient temperature N2. A modification was done to install inline heaters on the purge lines to maintain the temperature above 200°C, see FDC-10722. By doing so, the temperature of the A/G internal components could be better maintained above the needed temperature while transfer activities were not being performed.

2.2.5 Initial CFD Study

A Computational Fluid Dynamic (CFD) analysis was performed using the existing DMR geometry and various combinations of rail and ring flow percentages. The analysis results were presented in an April 2017 report by the National Energy Technology Laboratory (NETL). The results show that varying the fluidizing gas flow percentage from rail to ring has very little effect on fluidization in the bottom area of the DMR where voidage is calculated to be .43 (minimal fluidization, blue). The baseline fluidizing gas flow rate of 387 kg/hr with 55% of the flow to the fluidizing rails and 45% to the ring header is shown below:

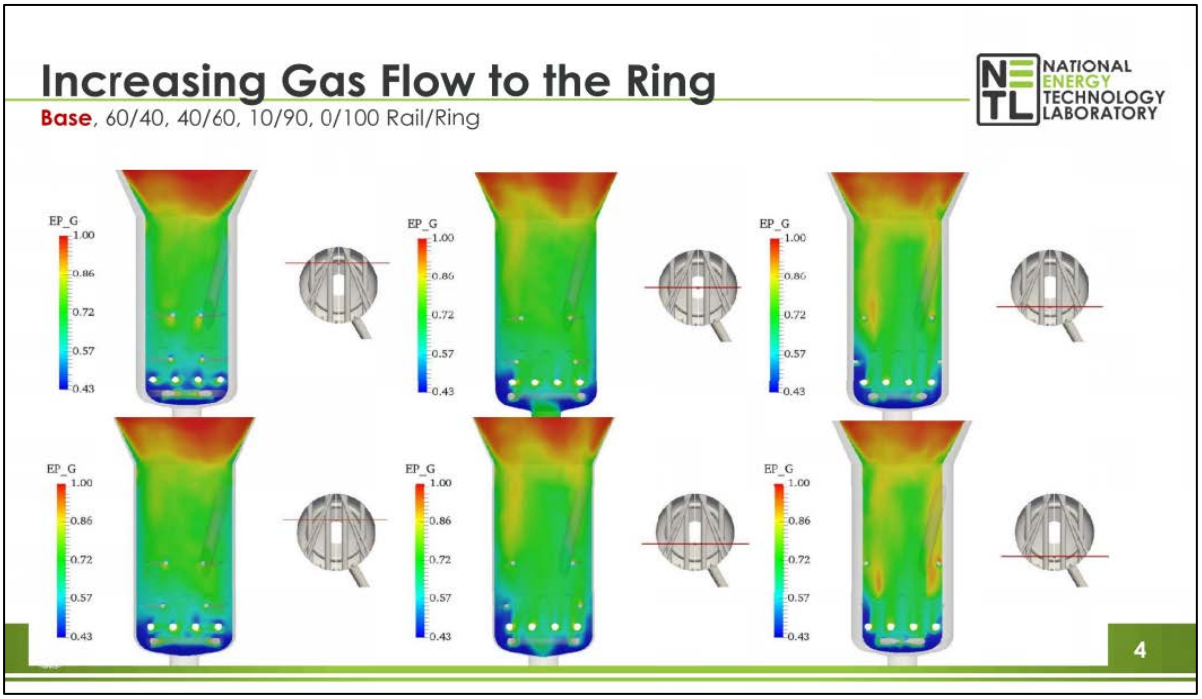


Figure 10. CFD analysis results showing voidage in six DMR locations during base-case scenario of 55/45% flow.

2.2.6 Demonstration Run 1 Findings

An integrated test of the IWTU facility steam reforming process was conducted from February 2 to March 31 using simulated SBW in accordance with Test Instruction TI-102, "IWTU Integrated System Test: Hot Startup—Part 3, Preops Run 1." (Demonstration Run 1). The purpose of the test was to operate the entire IWTU process with steam fluidizing flow and waste feed simulant to assess plant operability prior to introducing radioactive feed. Detailed performance of each plant system is provided in the Demonstration Run 1 report, RPT-1556.

IWTU performance showed improvement relative to issues such as the formation of wall scale in the DMR. Wall scale formed in this demonstration run was about half the thickness of the scale formed in

prior runs. The overall trend for wall scale is that the scale has been determined to be thinner and with simpler compositions for each subsequent Demonstration run over the last few years. In this run, the average thickness of wall scale was 1.3 mm compared to a thickness of 2.0–2.8 mm in the May 2016 run even though more SBW simulant was processed in this run compared to the May 2016 run.

The A/G successfully operated and met all test objectives, see Section 2.2.1 of this report for more information. As with most prior IWTU demonstration runs, high bed ΔTs were observed in the DMR during this test, indicating partial defluidization of the DMR bed. These high bed ΔTs formed where sandcastled bed material obstructed the flow of fluidizing gas.

On March 23, the DMR bed ΔT started to increase significantly, indicating partial defluidization of the DMR; see Figure 3. Adjustments were made to increase the DMR fluidizing gas flowrate in an attempt to mitigate the issue. This helped for a short time, but at 23:19 the 20°C DMR ΔT alarm was triggered. Additional changes were implemented, including lowering the simulant feed rate. Another ΔT alarm was received on Mar 24 at 19:37. The fluidizing gas was switched over to nitrogen, simulant feed was discontinued, and alumina was added to the DMR to increase the bed density. The high DMR ΔT alarm in the bed persisted resulting in plant shutdown and draining the DMR of bed material using the auger grinder. After cooldown an internal inspection of the DMR was performed which revealed bed material build-up on the vertical walls of the DMR extending from below the ring header to a height of about three feet or more. Due to the weak cohesive property of this material (cohesive properties similar to sand castles made of beach sand) much of it is believed to have collapsed when the bed material was drained through the auger grinder. The remnant of this bed material can be seen in the following two figures. It has been concluded that this material is not being fluidized and that it builds up over time (sand castling) causing areas of the bed to become cooler to the point where the DMR ΔT alarm was tripped.

Figure 11. Photo inside DMR after Demonstration run 1 looking from the center toward the top of the ring and rails

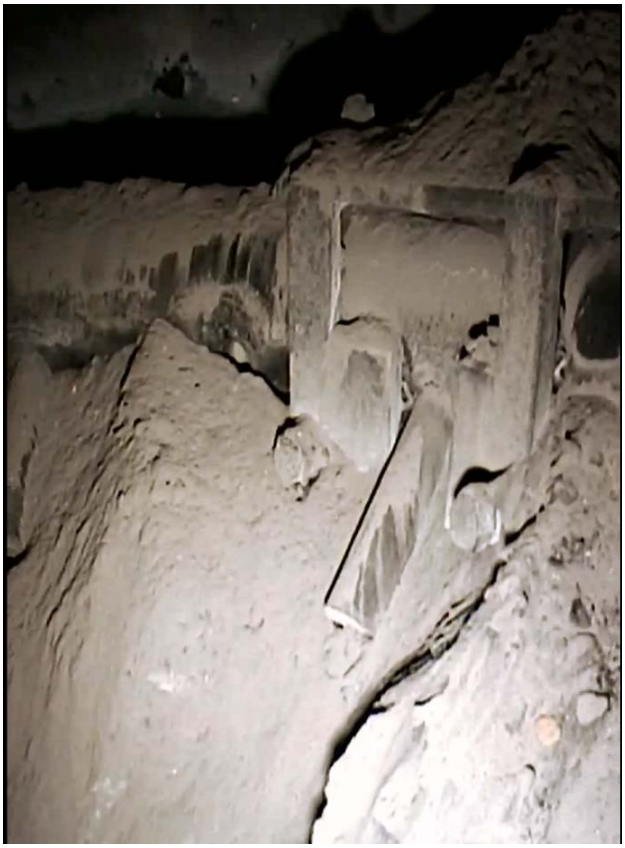


Figure 12. Photo inside DMR after Demonstration run 1 looking from center at ring header nozzle

After all the computer modeling, testing, and actual plant operation it was determined that proper fluidization of the DMR bed with the existing design was not being achieved, and that “fine tuning” the system was not going to achieve proper and sustained fluidization needed for successful plant operation. A redesign of the DMR fluidization method and/or internal components was required.

3 EVALUATION OF FLUIDIZATION METHODS

Following Demonstration Run 1 when it became apparent that the DMR bed fluidization design needed to be changed, several sessions were held to brainstorm possible solutions. From these sessions more than 20 possible concepts were proposed.

The proposed concepts were grouped into 4 basic categories: lower geometry modifications, ring header options, options addressing feed nozzle asymmetry, and options for methods of recovery in the event of a loss of fluidization. Each concept was evaluated and scored based on several criteria. For comparison purposes, the current fluidization configuration of the DMR was evaluated alongside the proposed concepts.

The evaluation methodology included four basic criteria: safety, technical solution confidence, operations and maintenance considerations, and installation and testing. The safety area scored concepts based on their operational, maintenance and industrial safety as well as their radiological and nuclear safety impacts. The technical solution confidence area measured the confidence that each concept could be designed, modeled, and analyzed. Operational and maintenance considerations looked at the durability, maintainability, and risks associated with each concept. The final criteria area, installation and testing, evaluated each concept for constructability, cost, and schedule. Each criterion was weighted based on its importance to the project. All proposed concepts were then assigned a score between 1 and 5, with a score

of 5 being the best score possible. Total scores for each concept were then calculated based on the criteria weighting and concept score.

The current DMR fluidization configuration received a total weighted score of 48.8, which placed it in the middle of the proposed concepts which had total weighted scores ranging from 28.7 to 72.9. Concepts that addressed feed nozzle asymmetry were not evaluated. Rearranging of the feed nozzles to provide a more symmetrical arrangement would be difficult given the space available around the DMR. Also, any symmetrical arrangement would be rendered asymmetrical if a feed nozzle were to plug, which is a plausible failure. As such, evaluation of these concepts was not performed.

The three concepts with the highest total weighted scores were selected for further development and evaluation. These concepts were Concept 1.4 Flat Plate Plenum with Bubble Caps (Bubble Cap) with a total weighted score of 61.6, Concept 2.2 Redesign and Relocate Ring Header (Modified Ring Header) with a total weighted score of 72.9, and Concept 2.3 Dual Plenum and Bottom Geometry Change (Dual Plenum) with a total weighted score of 60.0.For more details on the proposed concepts, evaluation criteria, criteria weighting, and concept scoring see Figure 13.

Detailed descriptions of the selected concepts are provided in sections 3.1, 3.2, and 3.3 of this report.

								1. Lower Geometry					2. Ring Header Options			3. Feed Nozzle Asymmetry (Partial)									4. Recovery	
						Concept 1.1b	Concept 1.1	Concept 1.1	Concept 1.2	Concept 1.3	Concept 1.4	Concept 1.5	Concept 2.1	Concept 2.2	Concept 2.3	Concept 3.1	Concept 3.2	Concept 3.3	Concept 3.4	Concept 3.5	Concept 3.6	Concept 3.7	Concept 3.8	Concept 3.9	Concept 4.1	Concept 4.6
CRITERIA	O/S	Group Weighting (Sum=100)	Criteria Weighting 1-100	Current Configuration	Blank or Test	Modified Rails with Ring Removed (btm geom)	Modified Rails with Ring Removed (btm geom)	Modified Rails with Ring Removed (btm geom)	Modified Ring with Rails Removed	Funnel Plenum with Nozzles/Perforations	False Plate Plenum with Bubble Caps	Modified Ring / with 2-Modified Cantilevered Rails (btm geom)	Move 2" RH & Modify Rails	Redesign & Relocate RH	Double Plenum & Btm Geom Change (like Gerald's Option)	Center Nozzle Only, with 6-12" Extension	Lengthen 3 Existing Nozzles	Center Nozzle Only, No Extension	Angle Nozzles Up/Down	Re-shape Outer Nozzles	3 Nozzles (x deg orientation)	4 + Nozzles	Top Injection Point	Optimize Feed	Pulsing the Distributor	Sweep Valves through DMR wall
NORMALIZED GLOBAL SCORE				48.8		46.4	46.4	28.7	36.9	55.0	61.6	40.1	50.6	72.9	60.0	-	-	-	-	-	-	-	-	-	42.5	57.9
SAFETY		100		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-	-	-	-	-	-	-	-	-	1.00	1.00
Go/No-Go Safety Value	1																									
Operational Safety	O		100	1		1	1	1	1	1	1	1	1	1	1										1	1
Maintenance Safety	O		100	1		1	1	1	1	1	1	1	1	1	1										1	1
Industrial Safety	O		100	1		1	1	1	1	1	1	1	1	1	1										1	1
Radiological Safety	O		100	1		1	1	1	1	1	1	1	1	1	1										1	1
Nuclear Safety Basis Impact	O		100	1		1	1	1	1	1	1	1	1	1	1										1	1
TECHNICAL SOLUTION CONFIDENCE		70		2.63	2.46	2.46	2.46	2.46	1.93	3.68	4.03	2.69	2.91	4.60	3.99	-	-	-	-	-	-	-	-	-	1.57	3.32
Confidence in Solution	S		100	1		2	2	2	1	4	4	3	2	5	4										1	3
Maturity of the Solution (413.3B as reference: see below)	O		80	3		2	2	2	1	3	3	2	3	4	3										2	3
Probability of Success (includes programmatic & all considerations)	S/O		60	1		2	2	2	1	4	4	3	2	5	5										1	4
Modeling : Confidence in Ability to Model	O		40	5		4	4	4	4	4	5	3	5	5	5										2	3
Feasibility for Pilot Plant or Other Mock-Up / Testing	O		30	3		3	3	3	3	3	5	2	3	3	2										2	4
OPS & MAINTENANCE CONSIDERATIONS		20		2.52	3.46	3.46	3.46	-	2.83	2.62	3.43	1.85	2.49	4.09	3.14	-	-	-	-	-	-	-	-	-	4.92	3.61
Maintainability (incl. ALARA/decon) (unusual maintenance, inspection requirements)	O		100	2		4			3	2	3	1	2	3	2										6	4
Consequences of Failure Mechanisms are Not Severe	S/O		80	1		4			1	2	3	2	1	5	3										3	3
Durability of Solution (Erosion, Corrosion) (incl risk of any vessel damage)	O		60	2		3			3	4	5	2	2	5	4										5	3
Simplicity (Minimal Complexity, such as not involving multiple disciplines, trades)	O		50	3		3			4	2	3	1	4	3	3										5	4
Low Risk of Operational Disruptions Caused by Soln (Unintended consequences)	O		50	1		3			1	2	2	2	1	4	3										2	3
Minimal/No "Irreversible" Change to Vessel Required to Conduct Test	O		40	6		3			3	2	2	2	5	3	2										6	3
Optimizes Unrestricted Geometry (minimal obstructions)	O		40	0		3			4	4	5	3	1	5	5										6	5
INSTALLATION & TESTING		10		5.79	3.75	3.75	3.75	-	3.00	2.00	1.94	1.58	5.00	3.37	1.78	-	-	-	-	-	-	-	-	-	4.72	4.30
Fabricability / Constructability	O		100	6		3			3	2	2	1	5	3	1										6	5
Minimal Implementation Risk	O		80	5		4			3	2	1	1	5	4	2										3	4
Minimal Cost Impact	O		50	6		4			3	2	2	2	5	3	2										3	4
Minimal Delay Cost Impact	O		40	6		4			3	2	2	2	5	4	2										5	4
Minimal Risk to Schedule	O		30	6		4			3	2	3	2	5	3	2										5	4
Lead Time (known schedule impact: none, <= 6wks, > 6wks) Is Favorable	O		30	6		4			3	2	2	2	5	3	2										5	4
Resource and Logistical Effort Required is Favorable	S/O		30	6		4			3	2	2	2	5	3	2										5	4

Figure 13. IWTU Fluidization Concept Alternatives Decision Evaluation Matrix.

3.1 Concept 1.4, Bubble Cap

Concept 1.4 was to modify the internal lower geometry of the DMR to eliminate the regions prone to “sand castling”; specifically the knuckle region of the lower head. The lower bed geometry was to be modified just above the lower head knuckle to be a flat distributor plate with 54 bubble cap assemblies throughout the plate to provide a more even distribution of fluidizing gas. All the fluidizing gas, during startup or normal operation, would be supplied through the 3” ring header supply line (3” FG-SN-160879-H) to a plenum area that would be under the flat distributor plate and between the solids drain to the DMR Auger/Grinder and the vessel wall/lower head. From the plenum, the fluidizing gas would flow up through the annulus between the plate and the post of each bubble cap and then exits horizontally under each of the caps. The 54 bubble caps would distribute the fluidizing gas evenly across the flat plate. The geometry of the cap prevents solids from entering the plenum through the annulus between the plate and the post when fluidizing gas is not being supplied to the plenum area.

The bed solids flow through the center supporting pipe and into the Auger/Grinder for removal. During decontamination activities liquid will enter the plenum area, so a liquid drain would be provided to remove the decontamination liquid from the plenum. This same drain would be used to remove any small solids that may work their way into the plenum.

Several other facility modifications would have been required to implement this design into the DMR and function properly. With all of the fluidizing gas being supplied through the existing ring header line the lines to the fluidizing gas rails would need to be disconnected from the DMR vessel and capped/flanged, and the four rail nozzles plugged. To support the desired fluidizing gas chemistry the existing O_2 line that connects to 4” FG-SN-161104-H (fluidizing gas rails supply line) would need to be re-routed and connected to 3” FG-SN-160879-H (ring header supply line). CO_2 would also need to be routed to connect to 3” FG-SN-160879-H.

The cost for executing concept 1.4 was estimated to be $1,160,000.

The design schedule for each of the three options were very similar, indicating that the engineering effort required for each of the three options was essentially the same. Differences in the fabrication and installation portion of the schedule would be reflected in the cost estimate.

The bubble cap concept was tested in the scale DMR at the Hazen facility. See section 4.2.1 of this report for details.

A preliminary CFD was performed by NETL on the bubble cap concept. Preliminary CFD results did not indicate sufficient differences between concepts to identify a preferred option.

A preliminary stress analysis was performed on the bubble cap concept. The bubble cap concept had higher stresses than other concepts.

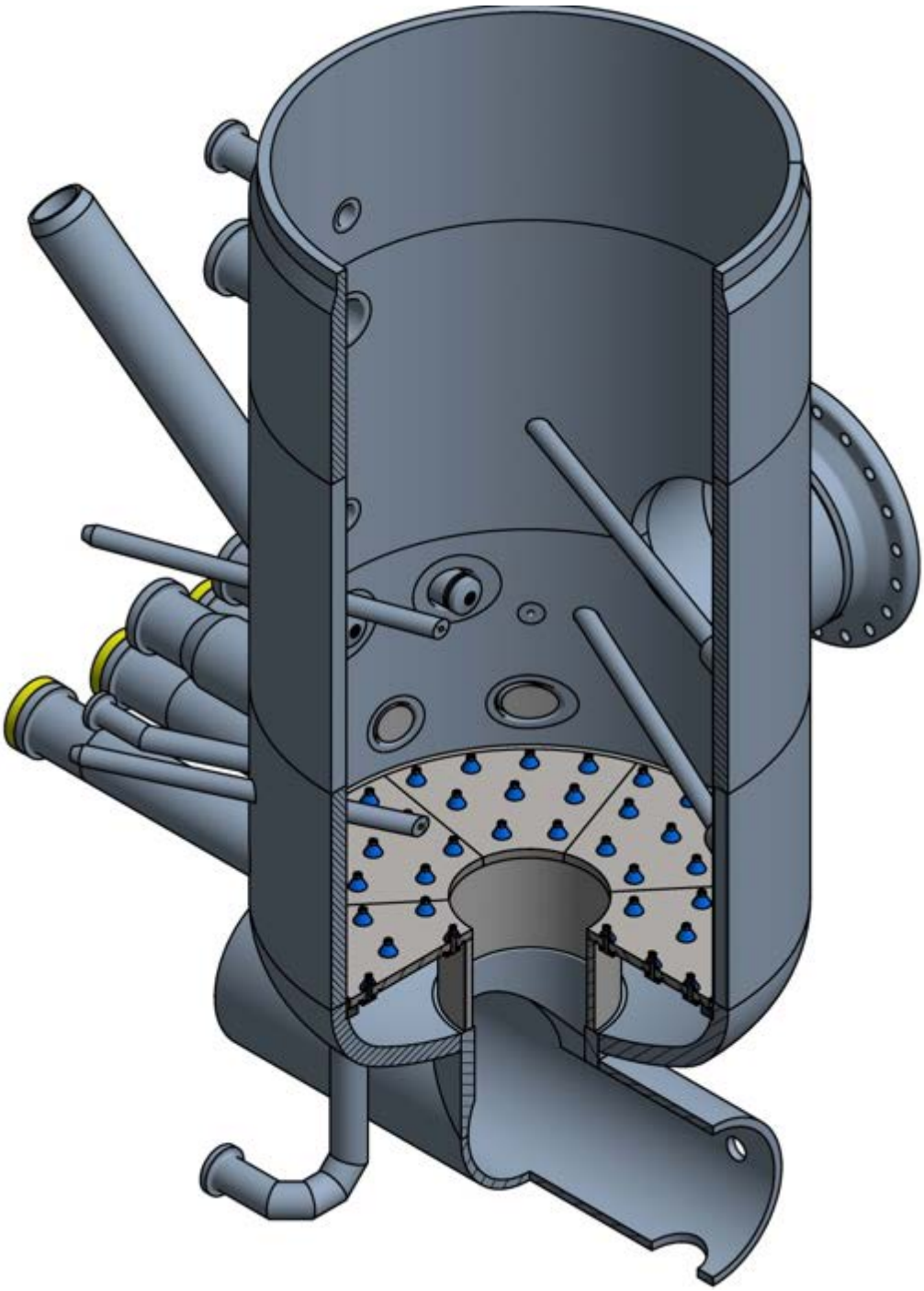


Figure 14. Concept 1.4, Bubble Cap

3.2 Concept 2.2, Modified Ring Header

Concept 2.2 consisted of a modification of the existing fluidization strategy which provided fluidizing gas via a ring header in the lower part of the DMR and fluidizing rails located slightly higher in the vessel. The purpose of the ring header was to provide gas to fluidize the bed in the DMR. Nozzles of different lengths and angles directed the fluidizing gasses to different areas of the DMR bed to enable fluidization of the entire bed. There were to be 64 nozzles in the modified fluidizing ring header. They would provide 210 – 420 scfm of gas flow to fluidize the bed. 32 short nozzles (~2” long) were to be

installed at an angle of 15° below horizontal to fluidize the outer perimeter of the bed. 32 medium length nozzles (~6” OAL) were planned to be installed at an angle that matches the low conical ring to fluidize the bed more towards the center. 32 long nozzles (~12.5” OAL) were to be installed in the same plane as the medium length nozzles. They would fluidize the center of the bed. The ring header diameter was increased to 44 inches and its elevation in the DMR is increased so that it was just below the fluidizing rails.

An upper conical ring above the ring header would be used to direct the flow of materials from the wall of the DMR more towards the center. It would help keep material from building up around and behind the fluidizing ring header. The upper conical ring was to be welded to the DMR wall and to the ring header to support the ring header.

A lower conical ring would be installed just below the ring header, and was to be used to maintain a constant slope to enable flow of the material. It would be welded to the DMR wall and end at the drain hole in the bottom of the DMR. It created a steeper angle to aid in moving material. The lower conical ring had a pipe with a slot cut out of it. This pipe was welded in the ring in the area below the ring header. It acted as a spring to take up thermal growth and reduce the stress on the DMR wall. The lower conical ring also had vents in it to equalize pressure with the interior of the DMR. Because the vents would allow liquid behind the lower conical ring, a drain was to be provided in the lower head to remove the collected liquid.

Two fluidizing rails were to be installed in the existing two center nozzles above the ring header. They would pass through the upper conical ring and extend into the DMR 10 inches past the centerline of the vessel. The remaining two existing nozzles were to be plugged with removable plugs for changes or additions in the future. The receivers for the fluidizing rails on the DMR wall opposite the nozzles would be removed to aid in fluidization. The two modified fluidizing rails would be used to provide nitrogen and oxygen to the DMR. The gas supply lines to the two plugged rail nozzles would be capped/flanged off.

The cost for executing concept 2.2 was estimated to be $1,090,000.

The design schedule for each of the three options were very similar, indicating that the engineering effort required for each of the three options was essentially the same. Differences in the fabrication and installation portion of the schedule would be reflected in the cost estimate.

The modified ring header concept was tested in the scale DMR at the Hazen facility. See section 4.2.1 of this report for details.

A preliminary CFD was performed by NETL on the modified ring header concept. Preliminary CFD results did not indicate sufficient differences between concepts to identify a preferred option.

A preliminary stress analysis was performed on the modified ring header concept. The modified ring header concept had higher stresses than other concepts.

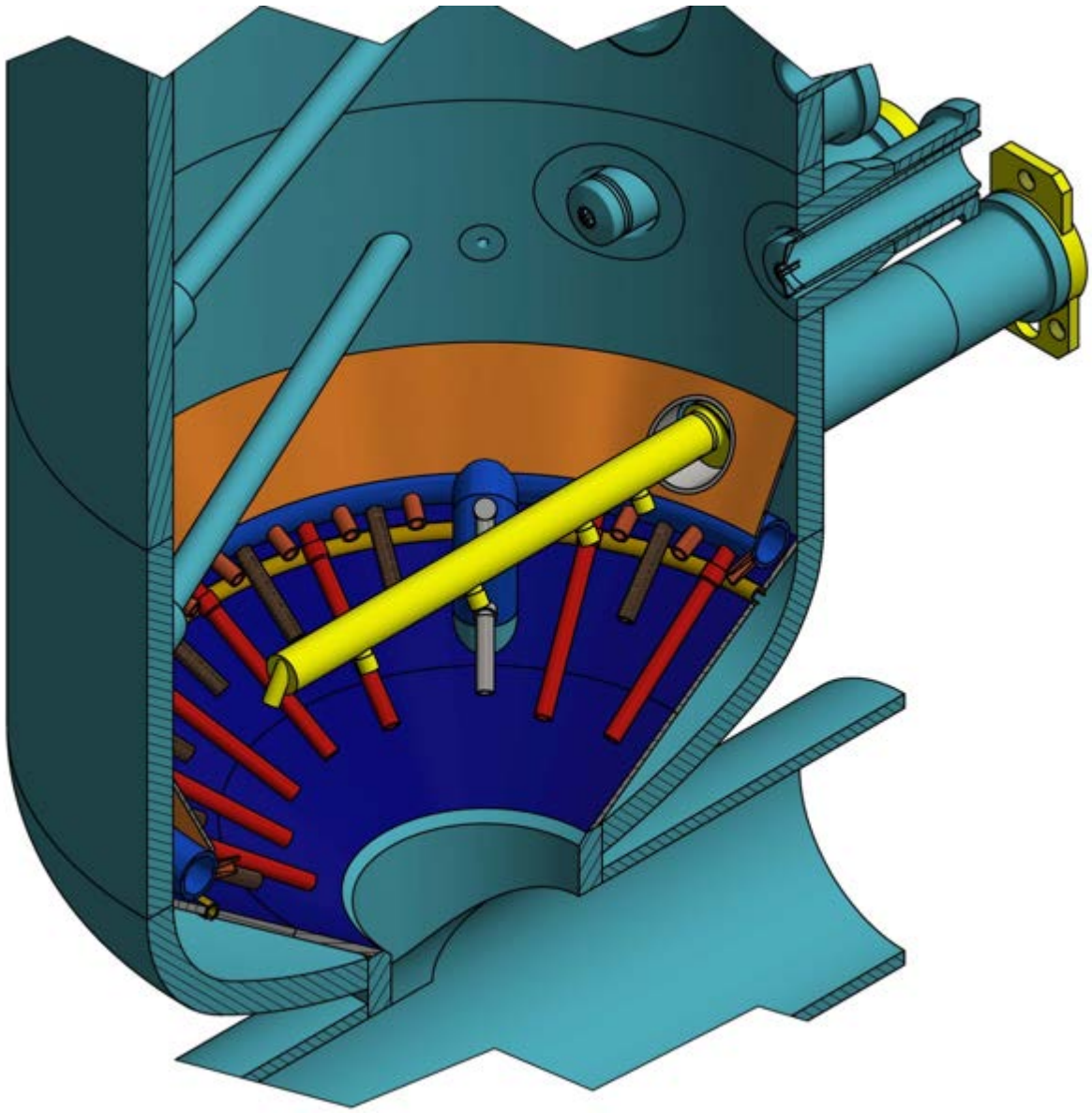


Figure 15. Concept 2.2, Modified Ring Header

3.3 Concept 2.3, Dual Plenum

Concept 2.3 would be a cone shaped insert with fluidizing nozzles installed in a uniform pattern from top to bottom at four levels in the side of the cone. The slope is maximized at 53 degrees from horizontal. The cone would be about 24 inches high and would be welded to the DMR vessel wall with a continuous circumferential weld at the top. The bottom end the cone would be welded to a sliding collar.

Fluidizing gas would enter the DMR through the same nozzles as the existing design. The gas would be maintained separate from the fluidizing ring gas as in the current design. An upper plenum having a triangular cross section between the cone and the wall of the DMR would be connected to the fluidizing gas through an inner pipe similar to the existing DMR design. The inner pipe would terminate with a bellows expansion joint welded to a flange that replaced the flange of the existing rail. The two outside nozzles, N3 and N6 were unused and would be plugged.

The lower plenum would be formed between the DMR wall and the bottom of the cone. Fluidizing gas would enter this plenum through nozzle N-22 in the same manner as the existing DMR design. This pipe is open ended inside the lower plenum. The lower plenum would be sealed at the top by the 48 inch circumferential weld between the cone and the DMR wall and at the bottom with a mechanical seal ring. The cone and plenum assembly would be completely drainable. Four small, 1/8" weep holes through the ring at the bottom and through the cone wall at the bottom of the upper plenum would ensure the two plenums can be drained. Some fluidizing gas would leak through the weep holes during normal operation but it will enter the DMR near the same location as the fluidizing gas from each plenum. Less than 4% of the fluidizing gas would be bypassed in this way.

Fluidizing gas would be supplied from the same sources as the existing DMR. Concept 2.3 provided 60% of the fluidizing gas volume through the upper plenum (nozzles N4 and N5) and 40% through the lower plenum (nozzle N22). Oxygen, carbon dioxide, and steam would be added through the upper plenum while carbon dioxide and steam would be added through the lower plenum.

The bed solids would exit the DMR through the bottom of the cone and into the Auger/Grinder for removal. During decontamination activities liquid would enter the plenum area, so a liquid drain will be provided in addition to the weep holes to remove the decontamination liquid from the plenums.

The cost for executing concept 2.3 was estimated to be $1,094,000.

The design schedule for each of the three options were very similar, indicating that the engineering effort required for each of the three options was essentially the same. Differences in the fabrication and installation portion of the schedule would be reflected in the cost estimate.

The dual plenum concept was tested in the scale DMR at the Hazen facility. See section 4.2.1 of this report for details.

A preliminary CFD was performed by NETL on the dual plenum concept. Preliminary CFD results did not indicate sufficient differences between concepts to identify a preferred option.

A preliminary stress analysis was performed on the dual plenum concept. The dual plenum concept had the lowest stresses of the three concepts analyzed.

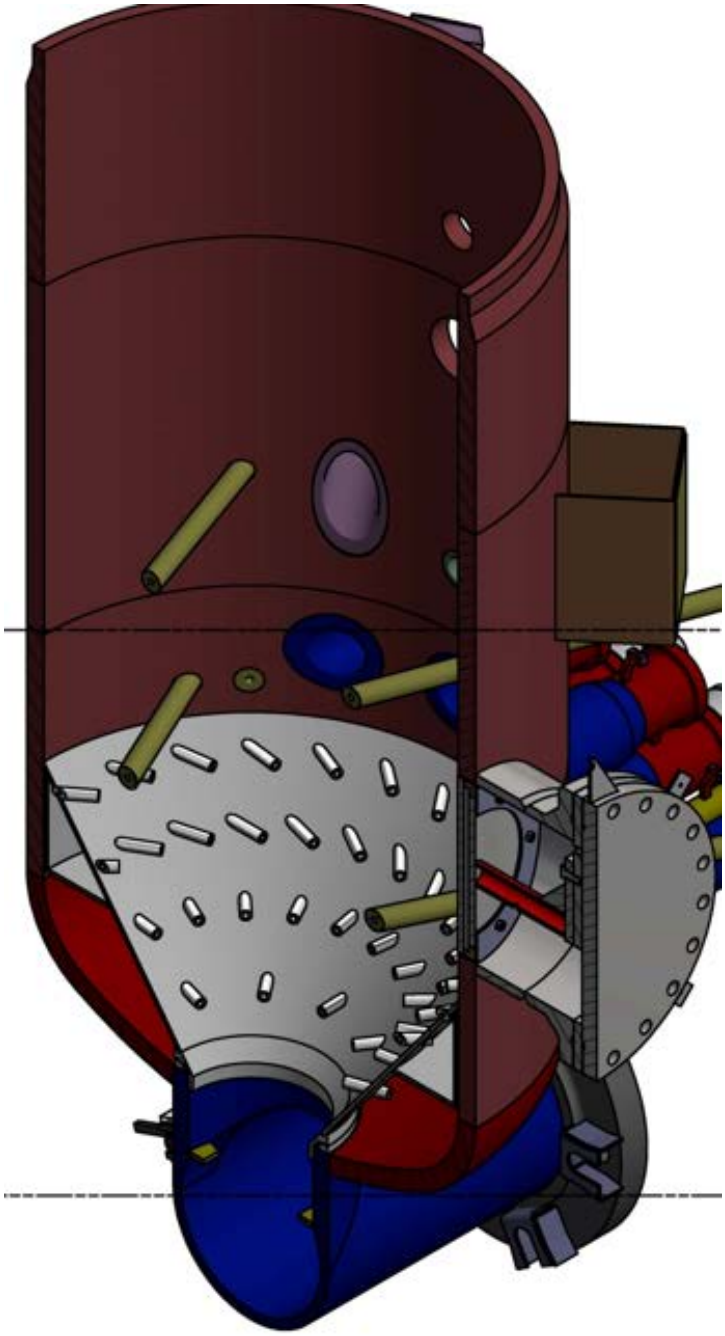


Figure 16. Concept 2.3, Dual Plenum

3.4 Independent Concept Review Support

With three basic conceptual designs expert industry consultation was acquired to support the selection and continued design of a primary concept. Particulate Solid Research, Inc. (PSRI) was contracted to provide this independent support. PSRI is an international consortium of companies focused on the advancement of technology in the multiphase flows with granular and granular-fluid systems. Since 1971, PSRI has amassed a considerable amount of design data, technology, know-how, design criteria and models on all aspects of slurries, liquid injection, fluidization, entrainment, pneumatic conveying, attrition, erosion, distributor design, standpipes, solids transfer, and circulating fluidized beds.

From the data produced, PSRI has developed design correlations, models, procedures, methods and techniques which are among the best and most useful in the field.

Based on a series of concept reviews by PSRI, it was concluded that all three concepts would result in improved fluidization of the DMR bed over the existing design, with concept 2.3, the dual plenum, being the preferred concept for successful bed fluidization.

4 FLUIDIZATION MODIFICATION DESIGN

The Concept 2.3 design was modified considerably during the detailed design process. The final dual plenum design consists of a two tiered cone where each cone tier has its own gas plenum. The upper cone is at 45 degrees from the horizontal and the lower cone is approximately 58.5 degrees from the horizontal. Each cone section has two rows of nozzles. The number, size, and distribution of the nozzles was determined in EDF-11021 with support and calculations from PSRI. The upper cone has 49 nozzles; 27 in the top row and 22 in the bottom row. The lower cone has 32 nozzles; 20 in the top row and 12 in the bottom row. Technical and functional requirements for the dual plenum design are documented in FCF-8850. Design details are shown on drawings 809252 thru 809265.

In support of the design several computer models and analyses were performed. Thermal structural FEA analysis was performed using Abaqus. Bed fluidization flows were calculated by NETL using CFD analysis. Flow distribution and orifice sizing was determined by hand calculation. Each of these analyses are summarized below in section 4.1. The performer and purpose for each analysis and calculation are shown in Table 1 below.

Table 1. Performer and Purpose for Final Design Analyses and Calculations

Analysis/Calculation	**Performer**	**Purpose**
Thermal Stress Analysis	Walsh Engineering Services	Ensure new design meets ASME Boiler and Pressure Vessel Code stress requirements
CFD Modeling	NETL	Validate that new design provides a significant improvement in fluidization
Nozzle Sizing Calculation	PSRI	Determine diameter and length of fluidizing gas nozzles.
Fluidizing Gas Flow Calculation	Fluor	Determine the flowrate of fluidizing gas needed for proper fluidization.

The use of testing, analyses, and design reviews provides confidence that the dual plenum design developed to improve fluidization in the DMR will function as expected and allow IWTU to meet its program mission.

4.1 Analyses

4.1.1 Thermal Structural Calculations

Thermal structural analysis on the dual plenum design was performed to ensure the design met the requirements of the ASME Boiler and Pressure Vessel Code. The calculations were documented in EDF-11033 IWTU DMR Dual Plenum Thermal Structural Analysis.

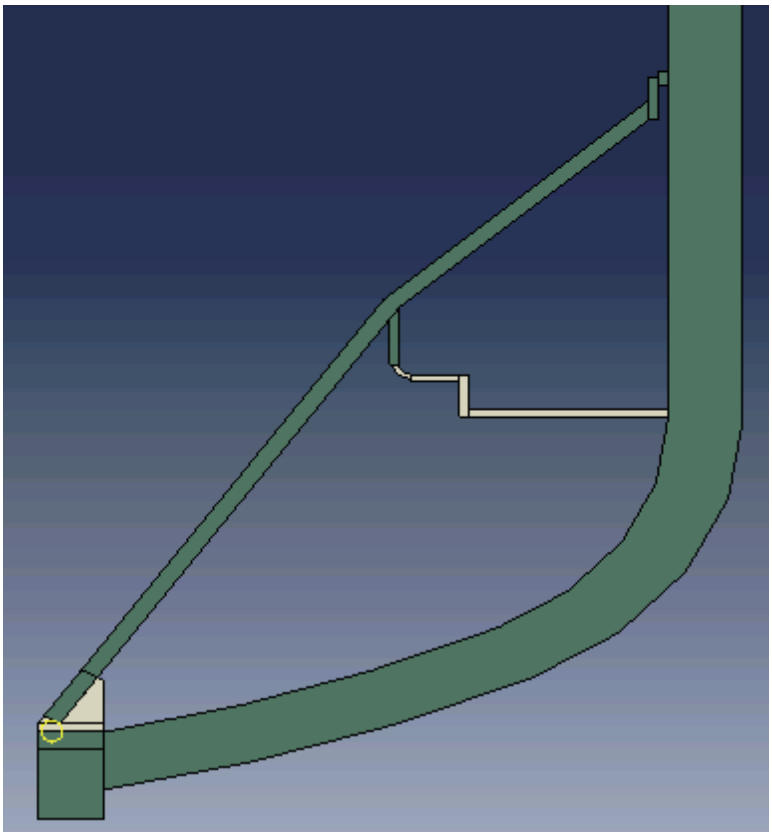


Figure 17. Dual plenum material Haynes 556 (green) and Inconel 625 GR1 (cream).

The dual plenum components were made from a combination of Haynes 556 alloy and Inconel 625 GR1 (see Figure 17). The dual plenum was analyzed in three cases:

1. All areas of the dual plenum at maximum operating temperature (700°C).

2. Startup condition (250°C temperature difference between plenum and bed, 190°C temperature difference between plenum and cone throat).

3. Normal operating condition.

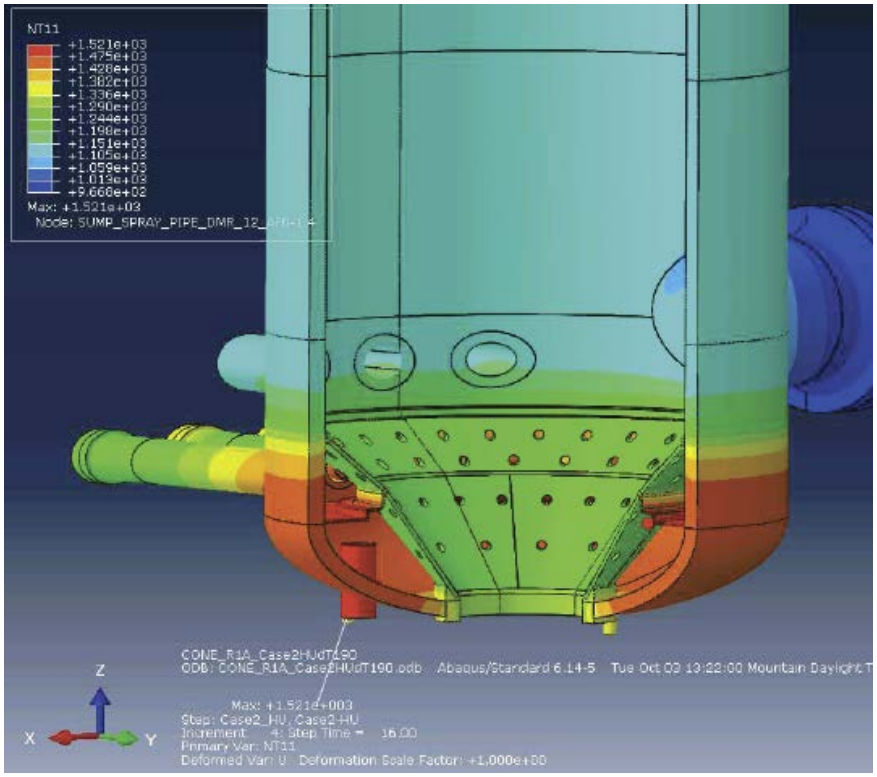


Figure 18. Startup case temperature profile, 3D.

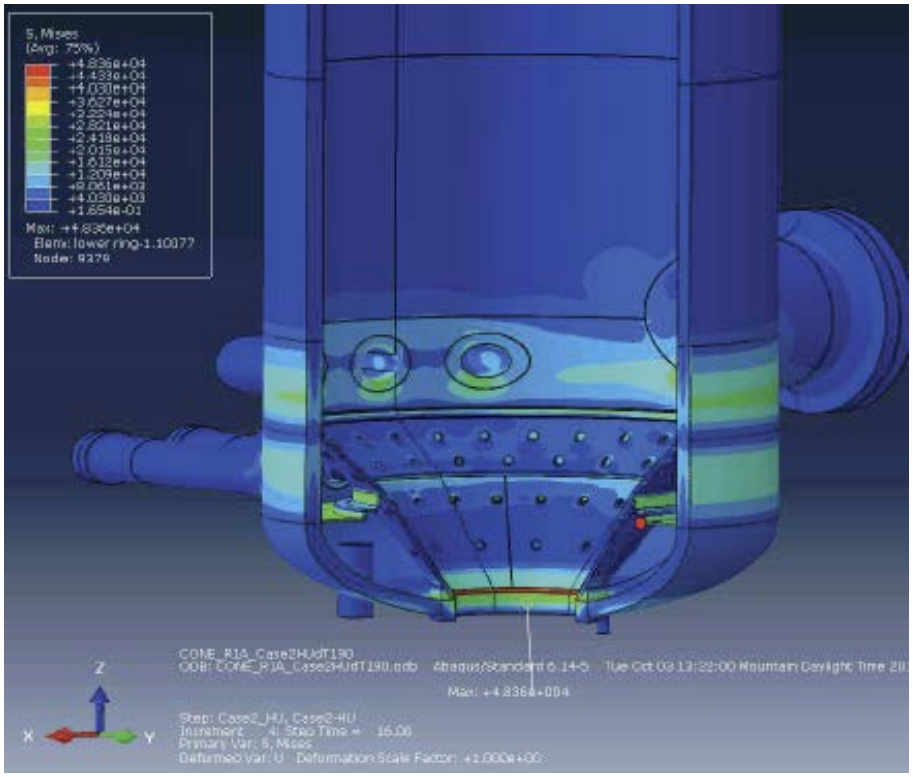


Figure 19. Startup case von Mises stress profile, 3D.

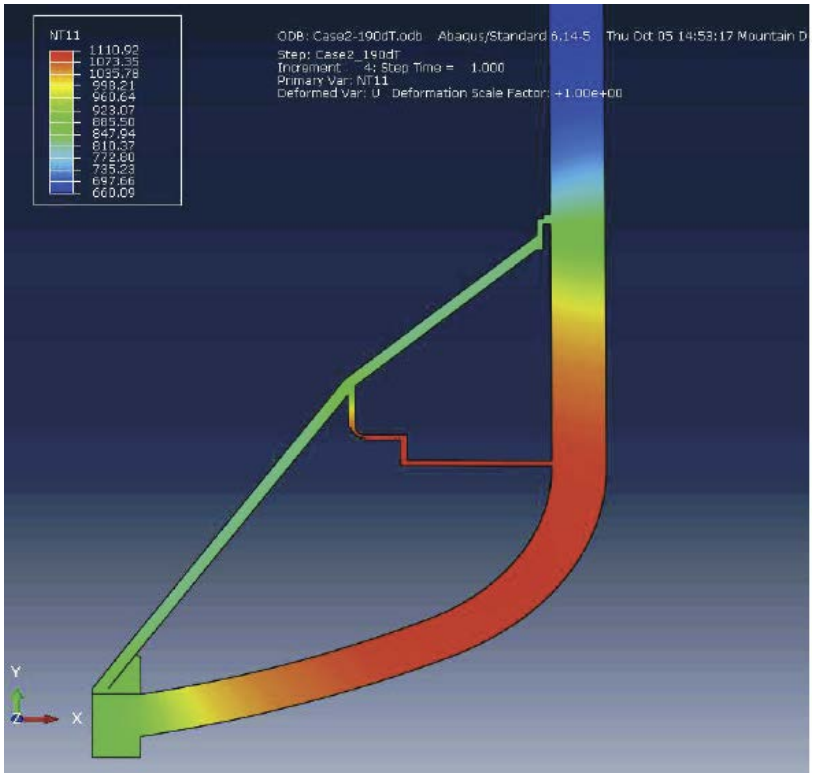


Figure 20. Startup case temperature profile, axisymmetric.

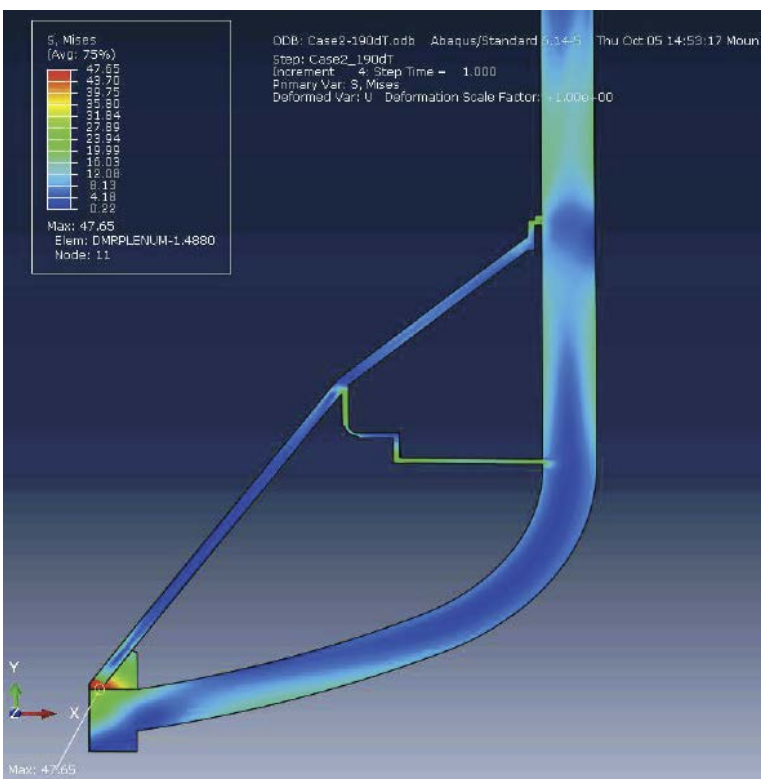


Figure 21. Startup case von Mises stress profile, axisymmetric.

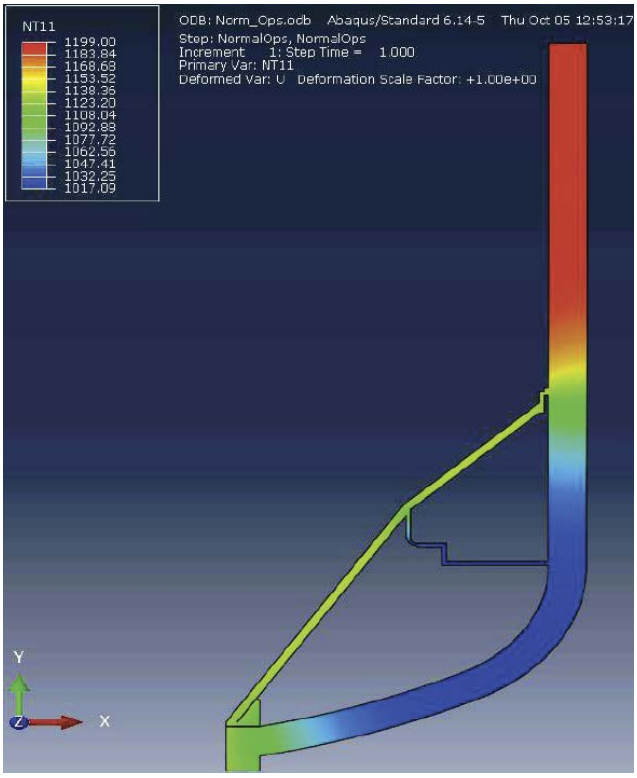


Figure 22. Normal operations case temperature profile, axisymmetric.

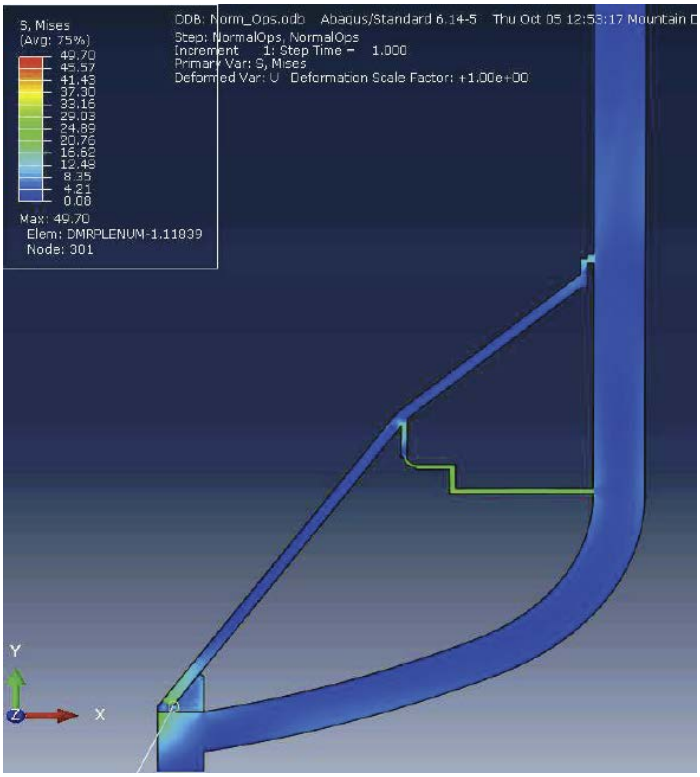


Figure 23. Normal operations case von Mises stress profile, axisymmetric.

The highest stresses were seen during the startup condition, at the square edge of the DMR throat where the base ring is welded to the vessel. As long as the temperature difference between the fluidizing gas and the throat are kept to 190°C or less the stresses are within acceptable limits.

Fatigue due to cyclic loading was also analyzed. The calculations showed that the design exceeds the requirement for 100 startup/shut down cycles by more than an order of magnitude.

Finally, the effects of creep were analyzed. The analysis found that the effects of creep are negligible compared to the overall stresses caused by differential thermal expansion.

For more explanation and details see EDF-11033.

4.1.2 Computational Fluid Dynamics Analysis

CFD analysis of the dual plenum design was performed by the National Energy Technology Laboratory (NETL). NETL modeled the voidage in the bed and the bed material velocity. The images below show the results of the NETL modeling. The plan view of the DMR on the right of each image shows the plane of the section as a red line.

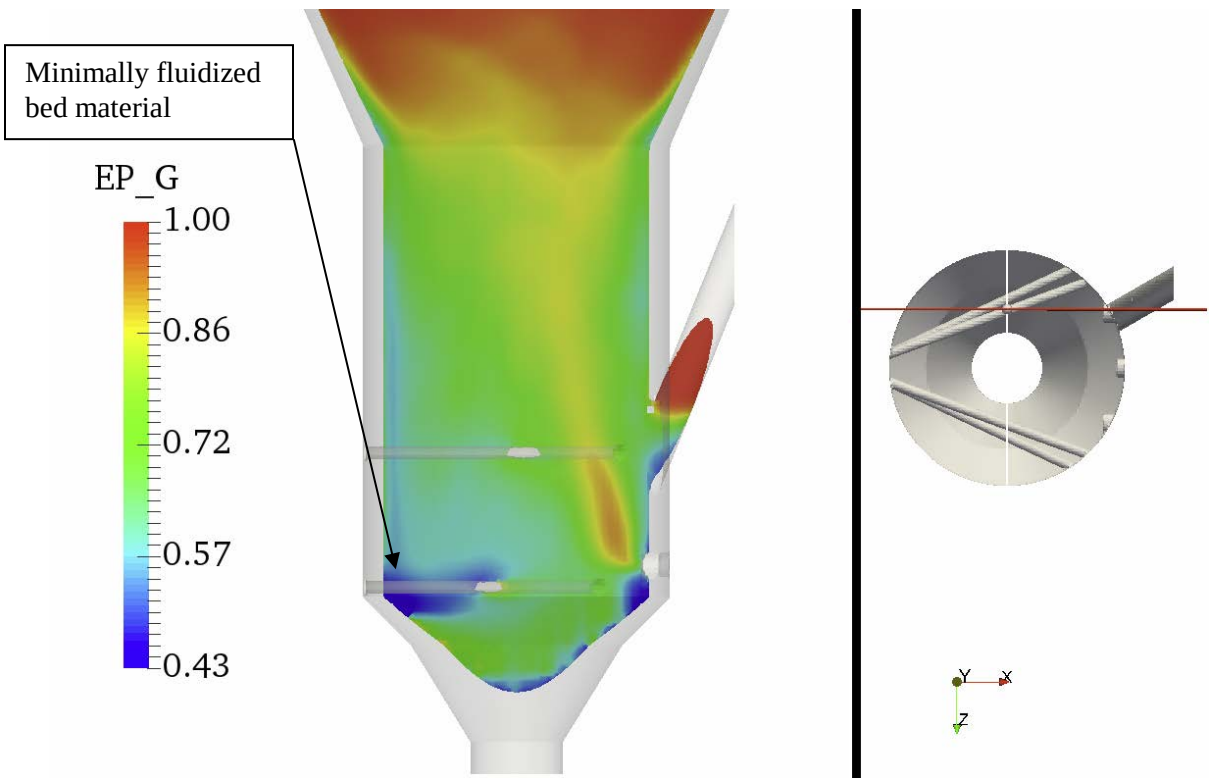


Figure 24. Voidage model, Z-clip, nozzle C.

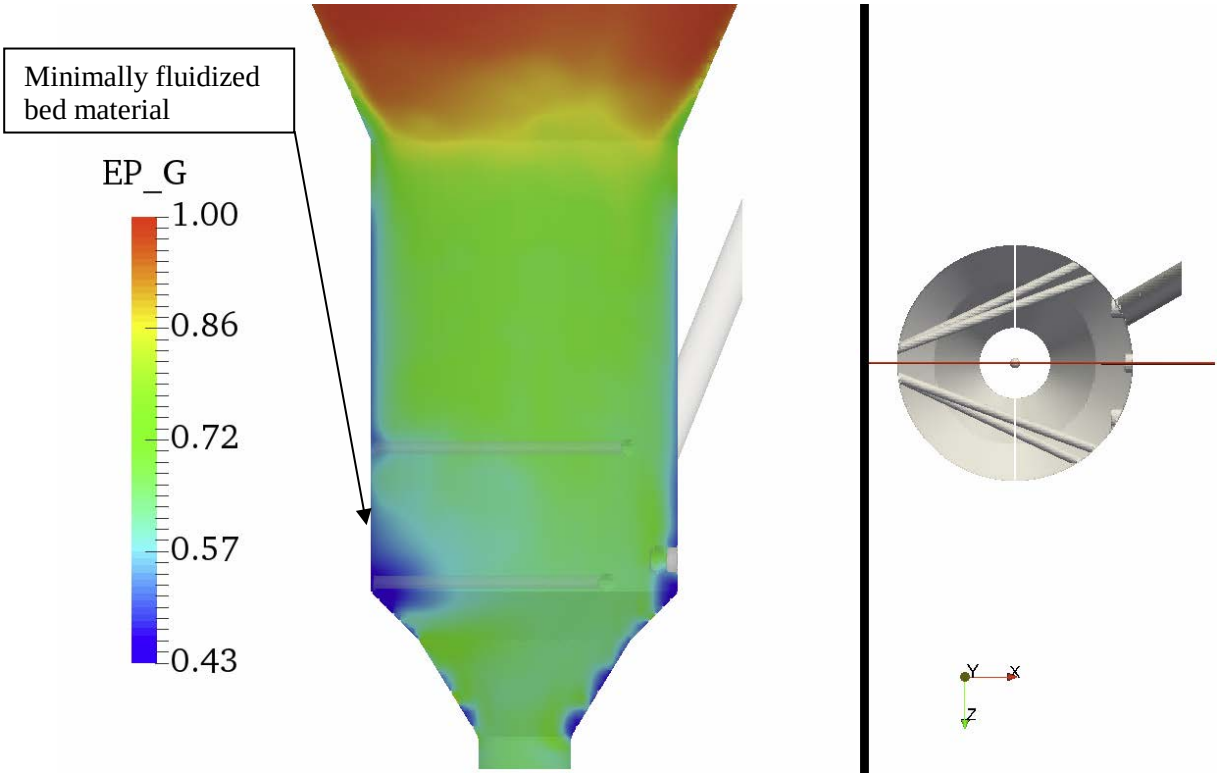


Figure 25. Voidage model, Z-clip, nozzle B.

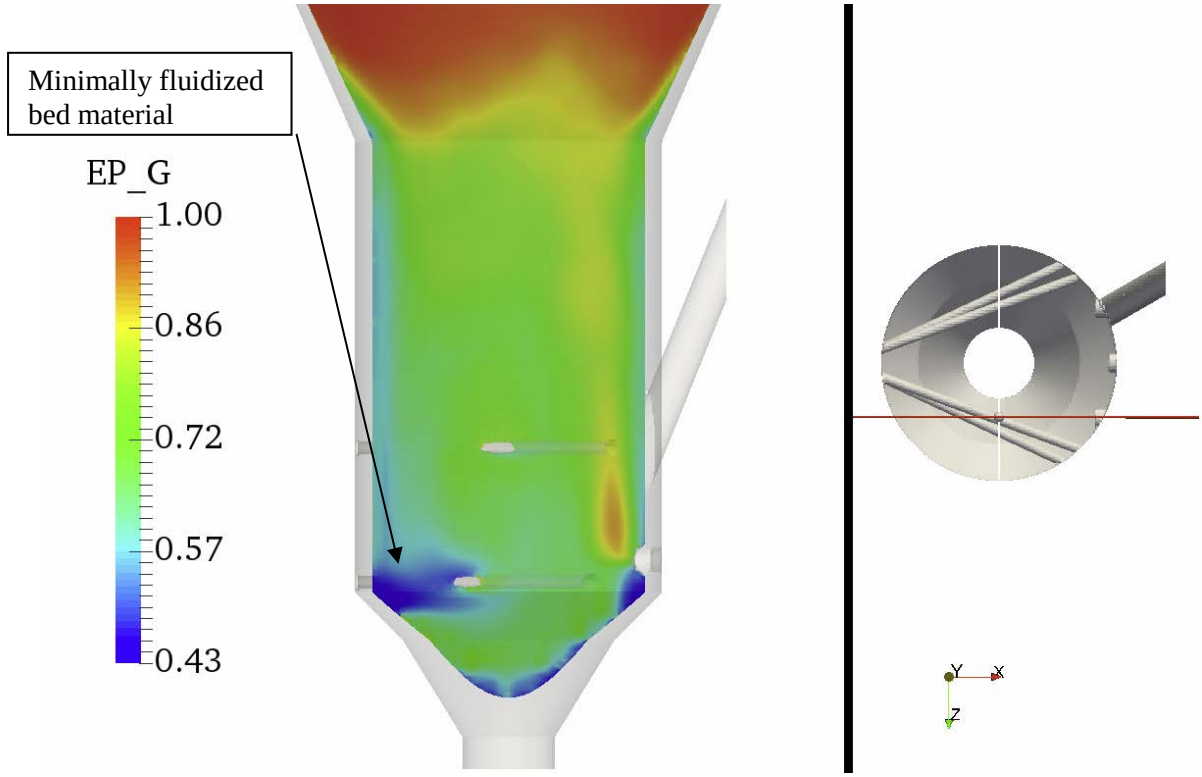


Figure 26. Voidage model, Z-clip, nozzle A.

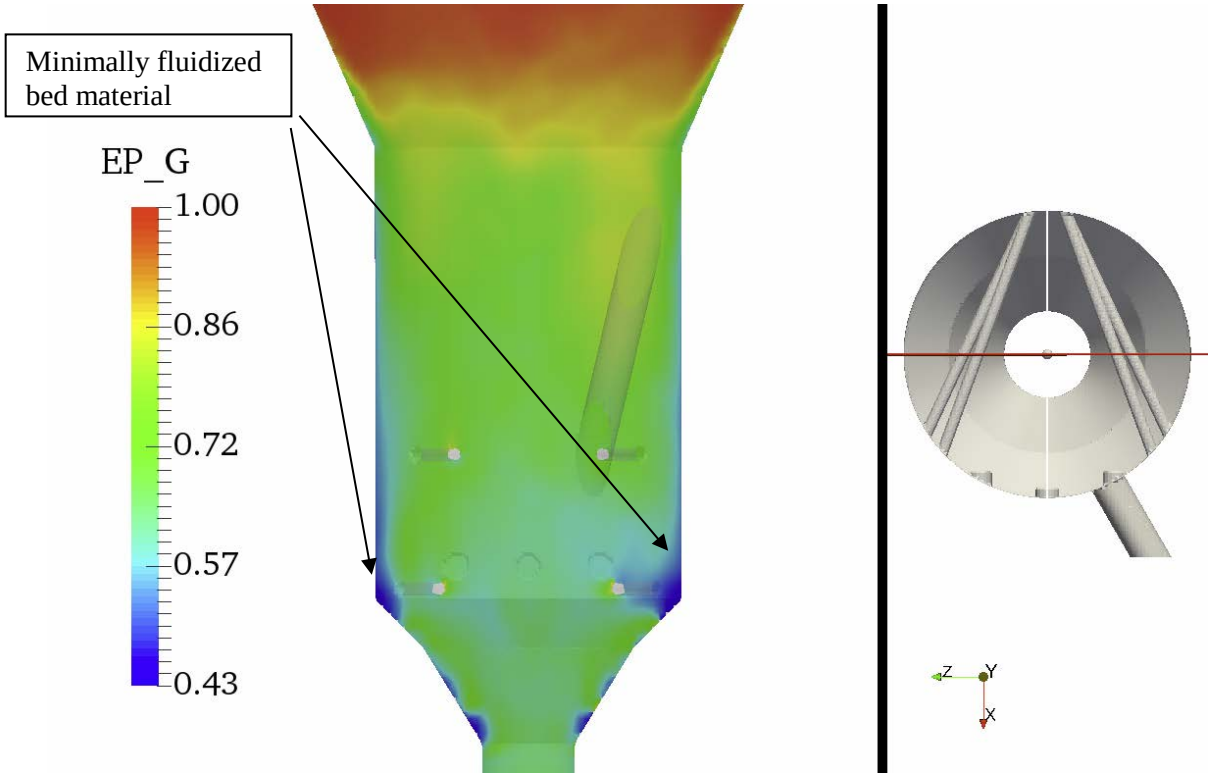


Figure 27. Voidage model, X-clip.

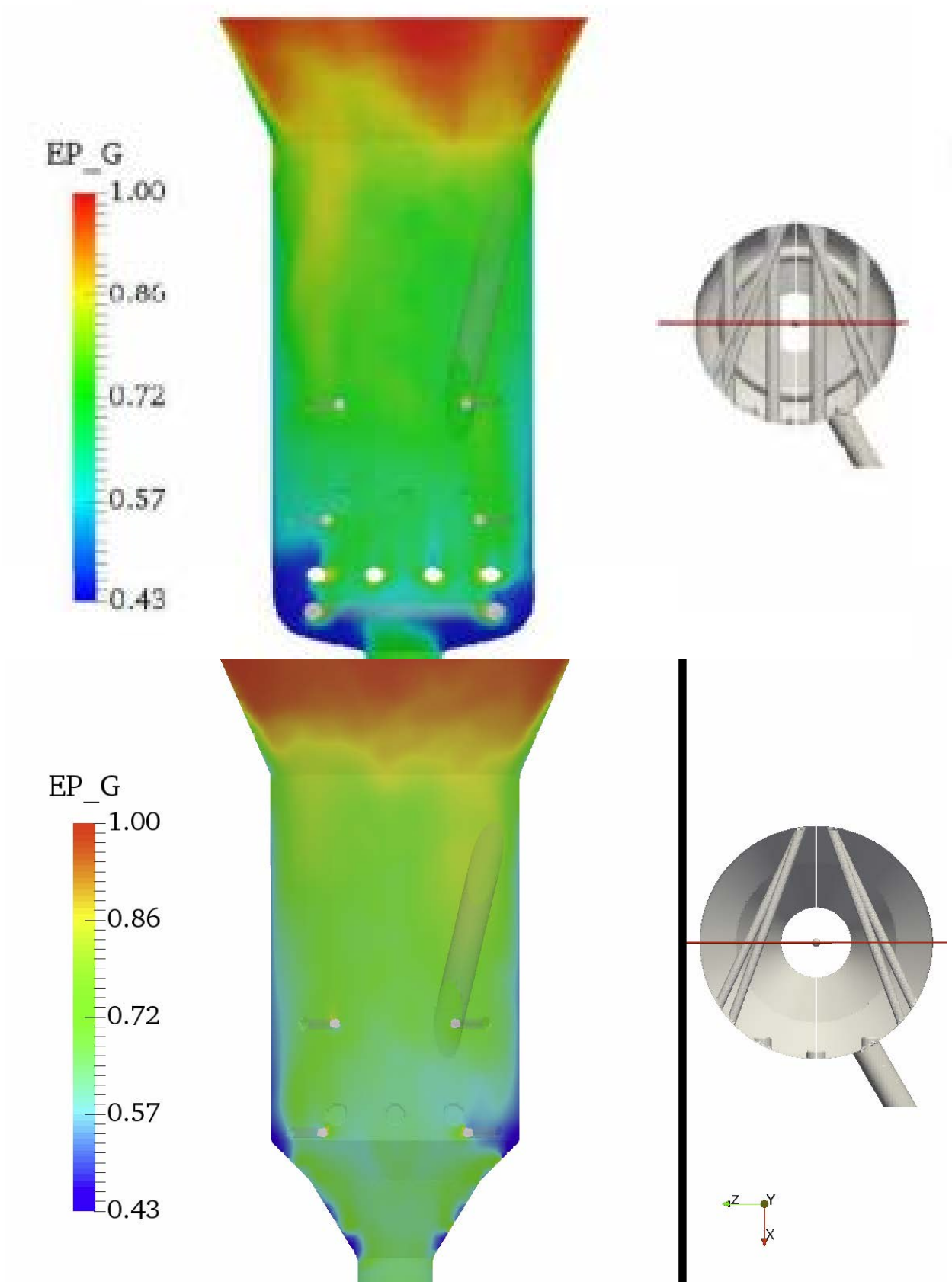


Figure 28. Original ring header design (top) compared to dual plenum design (bottom).

The lowest value of voidage (0.43) is essentially the value associated with loose bulk or minimally fluidized material. The highest value (1.00) indicates that there are essentially no solids present in that area, only gas. The results seen in the NETL model, as shown in Figure 24 through Figure 27, correlate with the fluidization behavior seen in testing at the Hazen facility (see section 4.2.1). The model indicates that there is a small area primarily around the upper interface of the cone and DMR shell where the material is minimally fluidized. This is most evident in Figure 24 and Figure 26, where the edge of the cone is close to the plane of the section rendered. The rest of the bed is acceptably fluidized in the model. Figure 28 compares a detail from Figure 10 (original ring header design) with the results shown in Figure 27 (dual plenum). There is much more minimally fluidized bed material (blue areas) in the original design than there is in the dual plenum design.

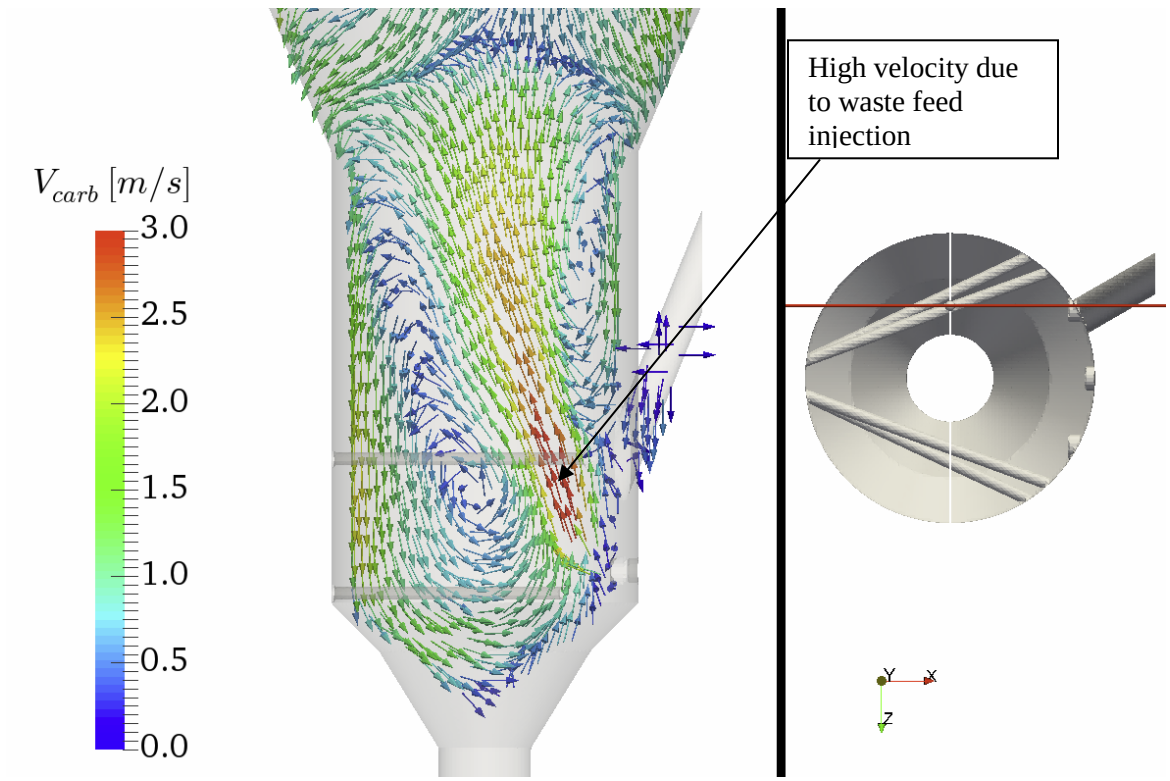


Figure 29. Vector model, Z-clip, nozzle C.

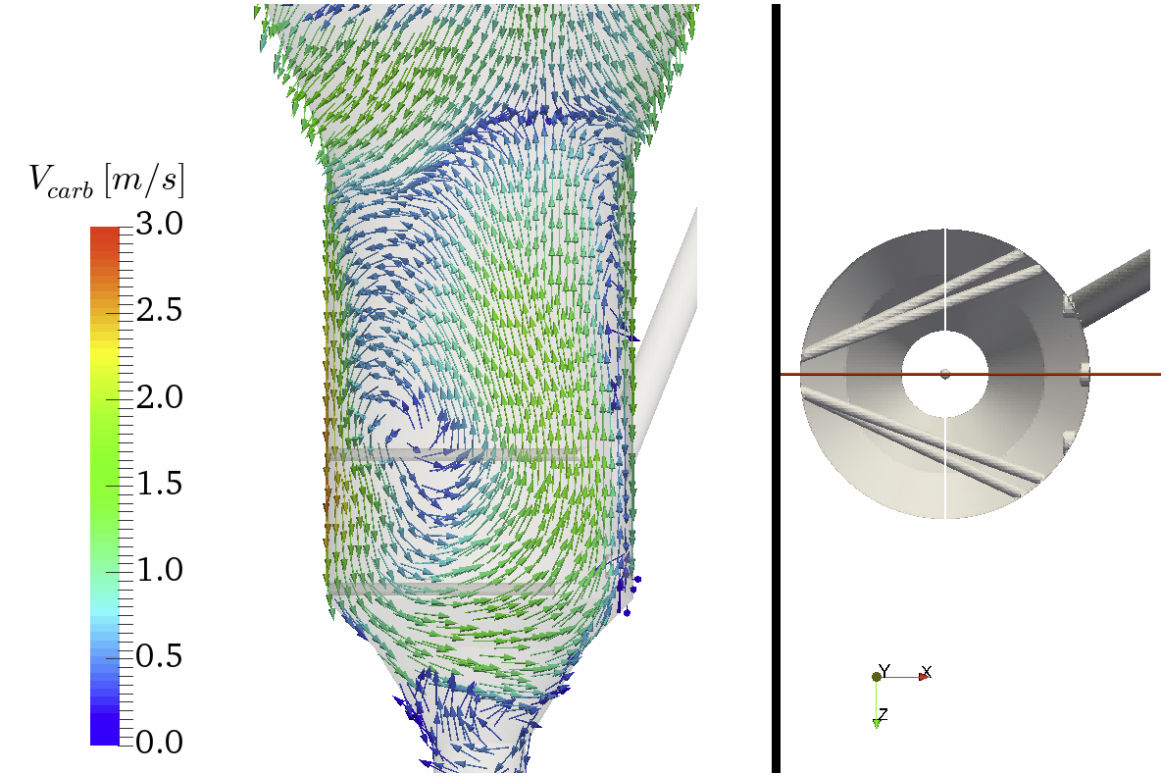


Figure 30. Vector model, Z-clip, nozzle B.

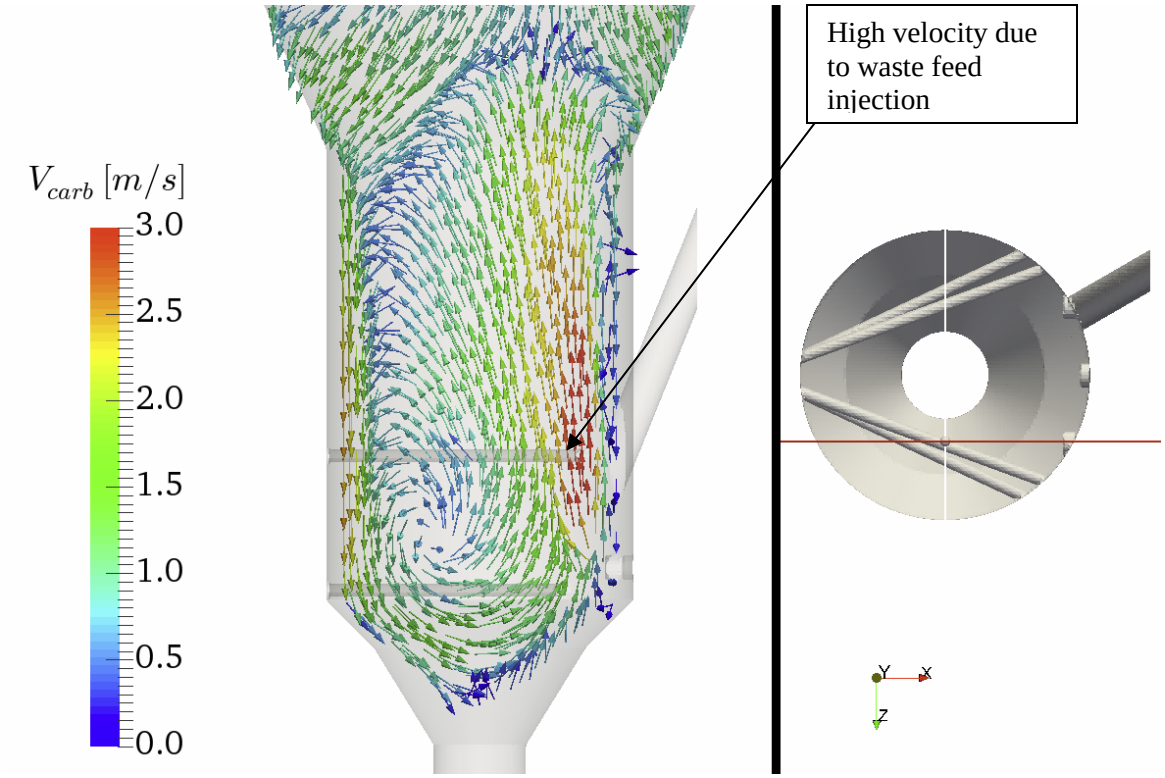


Figure 31. Vector model, Z-clip, nozzle A.

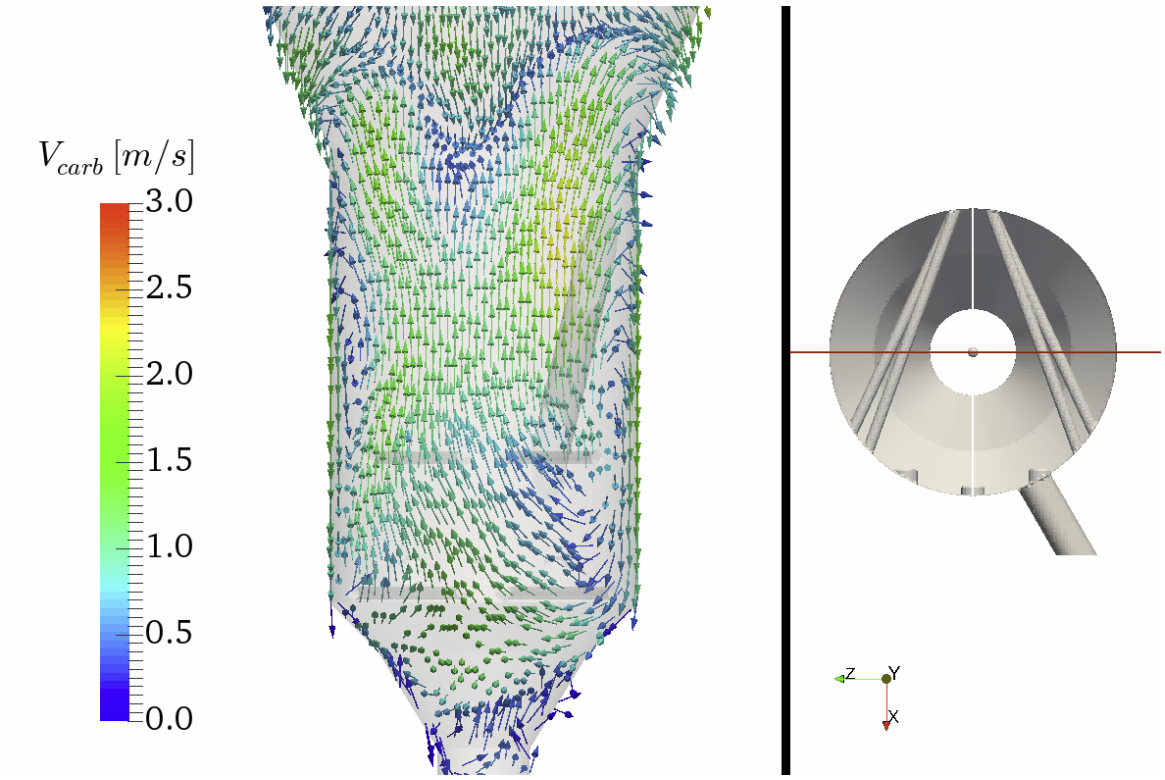


Figure 32. Vector model, X-clip.

The vector model shows behavior similar to that observed in the PSRI testing (see section 4.2.2). PSRI observed preferential gas flows on the side of the vessel where the waste feed injection occurred. In the NETL model nozzles A and C are modeled as waste feed nozzles. Higher velocity upward flows from the nozzles are visible in Figure 29and Figure 31. There is an area where the bed material is moving in a circular motion in the z plane, as shown in Figure 29, Figure 30, and Figure 31. This is most likely due to the additional gas flow as a result of the waste feed injection.

4.1.3 Orifice Design

PSRI performed design calculations to determine the number and size of fluidizing gas nozzles in the dual plenum design. As described above, the dual plenum design consists of two conical sections that form the inner wall of a fluidizing plenum in the bottom of the DMR. Fluidizing gas is supplied to the plenum space between the cone sections and the vessel wall, and is injected into the DMR bed through nozzles provided in the cone sections. A separating wall divides the plenum space into two sections.

The pressure drop through the nozzle is critical to ensuring that all nozzles provide the same flow rate of fluidizing gas. If the pressure drop is too low, the nozzles closest to the supply into the plenum will allow more fluidizing gas through than nozzles further away from the supply point. The final critical dimensions for the nozzles are defined in EDF-11021 Rev. 1 and are as follows:

Table 2. EDF-11021 Fluidizing Gas Nozzle Design

Characteristic	**Calculated Value**
Orifice Diameter	0.219 inches
Shroud Diameter	0.5 inches
Minimum shroud length	1.46 inches

Actual fabricated nozzle lengths are longer than the minimum 1.46 inches to provide a safety factor for nozzle jet expansion. See drawings 809254, 809255, 809256, 809258, 809259, and 809265 for fabricated nozzle lengths.

There are four rows of nozzles, two in each plenum section. The number of nozzles required in each row was calculated to provide an even distribution of fluidizing gas in the bed:

Table 3. EDF-11021 Fluidizing Gas Nozzle Quantities

Nozzle Row	**Number of Nozzles**
Upper Plenum, Top Row	27
Upper Plenum, Bottom Row	22
Lower Plenum, Top Row	20
Lower Plenum, Bottom Row	12

4.1.4 Fluidizing Gas Flowrates

EDF-11021also documents the calculation of fluidizing gas flowrates for the dual plenum design.

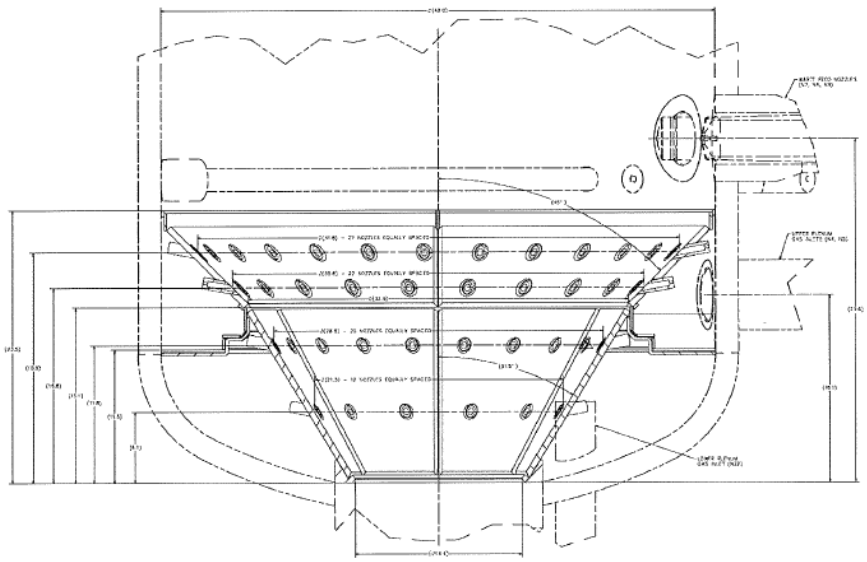


Figure 33. Dual Plenum Design Used in EDF-11021

The calculation first determined the cross sectional area of the bed that is served by each portion of the plenum and the bed drain. The area above the bed drain was calculated to be 1.13 ft2. The area above the lower plenum is 4.77 ft2, and the area above the upper plenum is 6.66 ft2. The area above the drain was not considered further, as the A/G purges will provide the fluidizing flow for this portion of the bed. Comparing just the areas above the two plenums, the lower plenum provides fluidizing gas for 41.7% of the bed above the plenums, and the upper plenum fluidizes 58.3% of the bed above the plenums.

The nominal SSV for the dual plenum distributor is 1.0 ft/s. Flow values were calculated for a range of SSVs from 0.7 to 1.5 ft/s. With a bed temperature of 650°C and bed pressure of 16.4 psia, the results were as follows:

Table 4. EDF-11021 Fluidizing Gas Flowrates

SSV (ft/s)	Lower Plenum Flowrate (scfm)	Upper Plenum Flowrate (scfm)	Total Flowrate (scfm)
0.7	69.6	97.2	166.9
0.8	79.6	111.1	190.7
0.9	89.5	125.0	214.5
1.0	99.5	138.9	238.4
1.1	109.4	152.8	262.2
1.2	119.4	166.7	286.0
1.3	129.3	180.5	309.9
1.4	139.3	194.4	333.7
1.5	149.2	208.3	357.5

EDF-11021 also calculated flowrates for varying startup conditions. See EDF-11021 for more details and calculation results.

4.2 Testing

Testing was performed at two world class facilities: Hazen and PSRI. Hazen has 55 years of experience providing chemical analyses, bench-scale experiments, continuous pilot plant demonstration, and other services. Significant focus was given to fluidization chemistry during the Hazen testing, with attention given to agglomeration formation, sandcastle formation, and wall scale buildup. The Hazen tests were performed at temperature in an 18” simulated DMR vessel. Prior experience has shown that fluidization problems do not scale well, so an additional facility with a larger vessel was looked for to improve the possibility of the testing accurately representing what would occur in the 48 inch diameter IWTU DMR.

PSRI has a facility with larger test vessels. As described in section 3.4, PSRI is an international consortium of companies with significant experience in fluidization. The PSRI tests were cold tests performed in a 33” simulated DMR vessel, and focused on fluidization characteristics. The PSRI test vessel has a transparent wall allowing actual visual observation of fluidization performance. The larger vessel available at PSRI should be more indicative of the performance in the IWTU DMR.

4.2.1 Testing at HAZEN

Testing at Hazen contributed significantly in the realm of fluidization chemistry. Three options for improving fluidization in the IWTU DMR were tested and compared at the Hazen Pilot Plant. The Hazen plant has a scale DMR, 1/8 scale based on the cross sectional area of the bed, with an outer diameter of 18” that simulates the full scale DMR.

The primary objective for the Fluidization Option (FO) test runs was demonstrating operational stability and steady-state process performance for each of the three FO fluidizing gas distributor designs and to provide data to evaluate the performance of each distributor against the following criteria. The purpose of the evaluation was to determine which of the three FO fluidizing gas distributor designs was preferred for follow-on design and implementation in the IWTU DMR.

A. Agglomeration formation.

B. Sandcastle formation.

C. In-bed thermocouple indications (temperature uniformity and stability).

D. Stagnant areas in the bed.

E. Erosion of fluidizing distributors.

F. Self-cleaning on refluidization.

G. Plugged jets/caps.

H. Wall scale.

I. Carryover of solids to the PGF.

J. Particle size control.

The three FO fluidizing gas distributor designs that were tested were the Modified Ring with Cone (FO-1); the Bubble Cap with Flat Plate (FO-2); and the Dual Plenum Cone (FO-3). Each option was run with the same bed operating temperature, target bed level, bed solids target particle size diameter, waste feed simulant and feed rates, and fluidizing gas composition. FO-1 and FO-3 had a fluidizing gas Superficial Space Velocity (SSV) of 1.1 fps at the level of the rail/upper plenum. FO-2 had an SSV of 1.0 at the bubble cap plate. FO-1 ran for 169.4 hours and processed 2,165 gal of simulant. FO-2 ran for 168.3 hours and processed 2,120 gallons of simulant. FO-3 ran for 168.6 hours and processed 2,124 gallons of simulant.

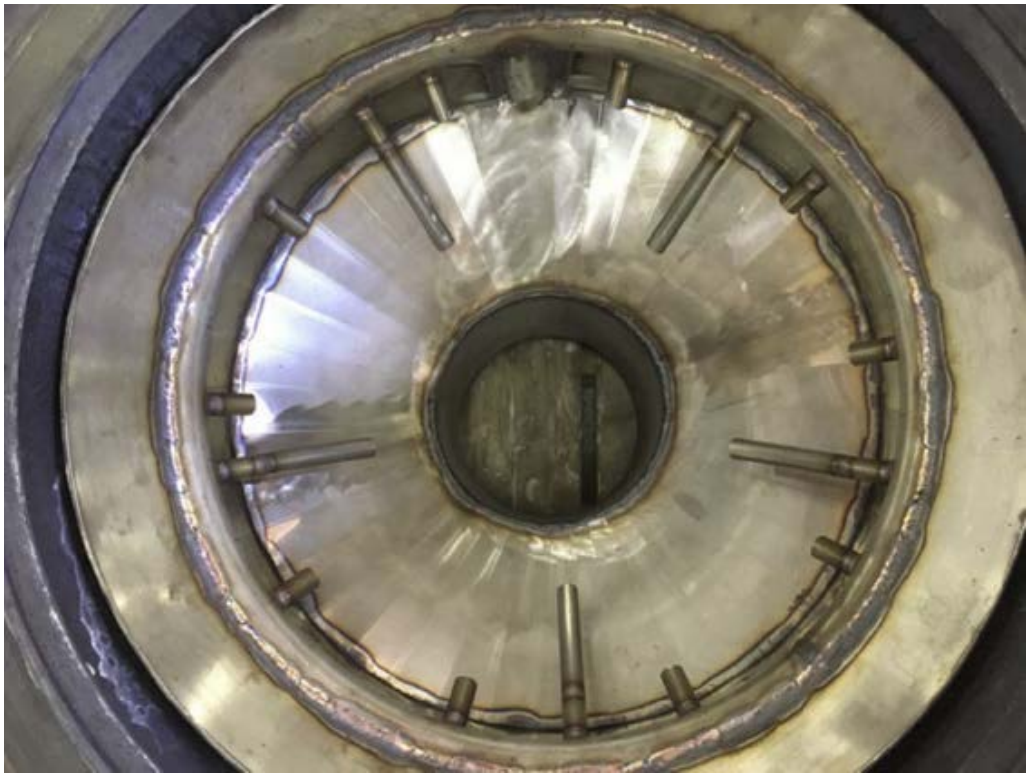


Figure 34. Hazen testing, FO- 1, modified ring with cone, pre-test.

Figure 35. Hazen testing, FO-1, modified ring with cone, post-test.

Figure 36. Hazen testing, agglomerations recovered from FO-1 test.

Figure 37. Hazen testing, FO-2, bubble cap with flat plate, pre-test.

Figure 38. Hazen testing, FO-2, bubble cap with flat plate, post-test.

Figure 39. Hazen testing, FO-2 bubble cap detail, post-test.

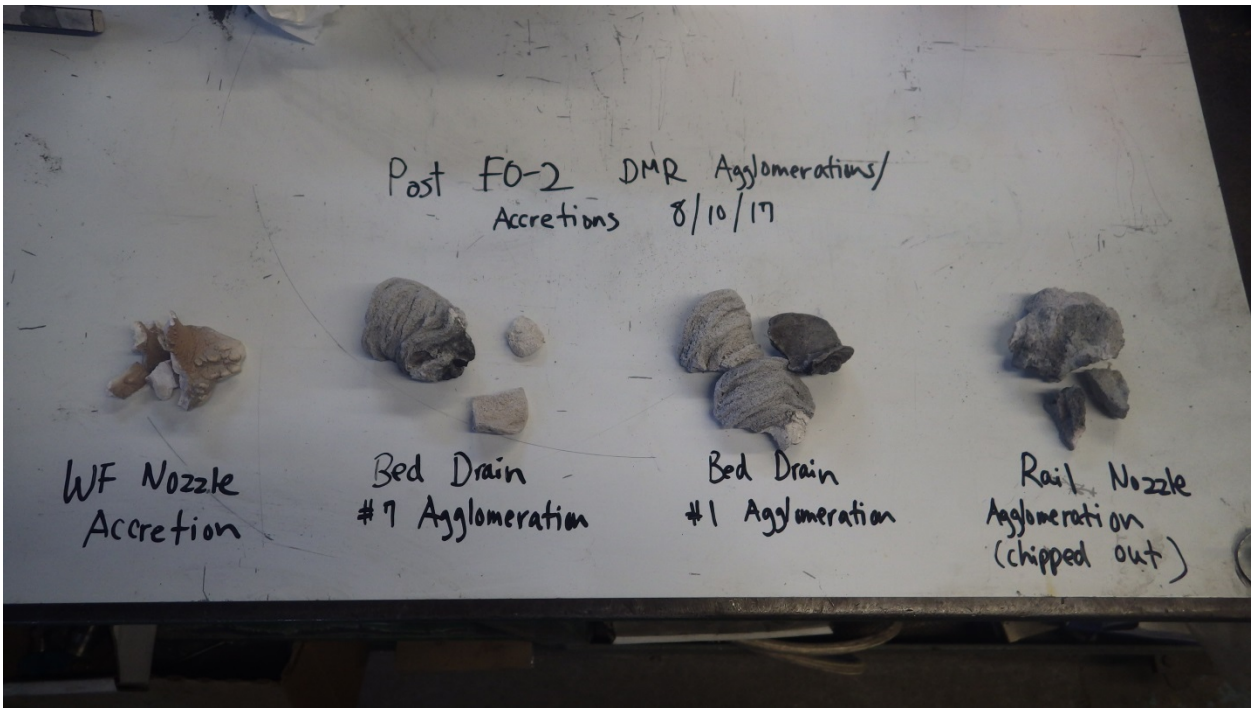


Figure 40. Hazen testing, agglomerations recovered from FO-2 test.

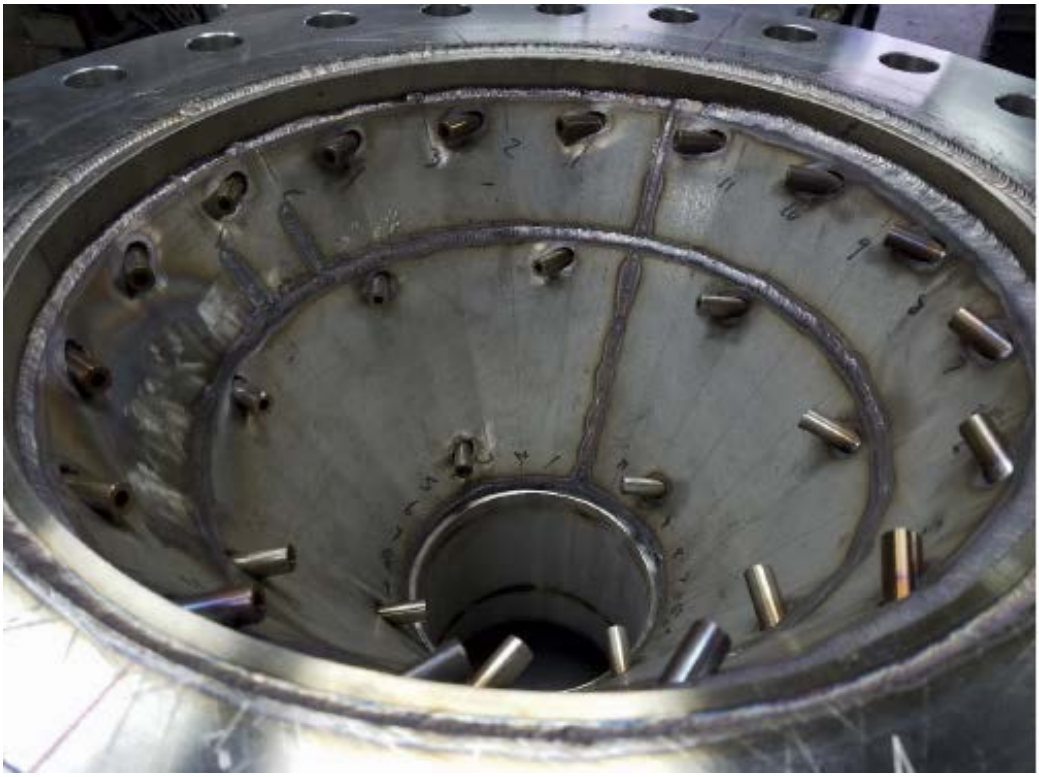


Figure 41. Hazen testing, FO-3, dual plenum cone, pre-test.

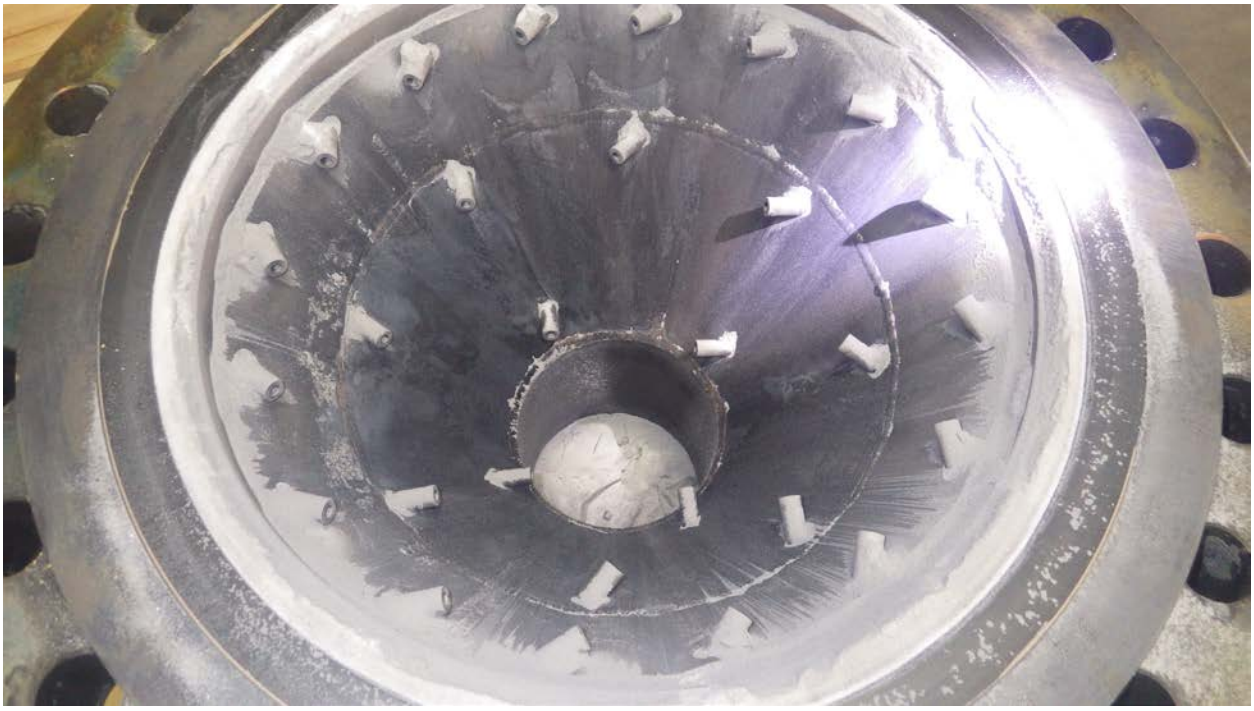


Figure 42. Hazen testing, FO-3, dual plenum cone, post-test.

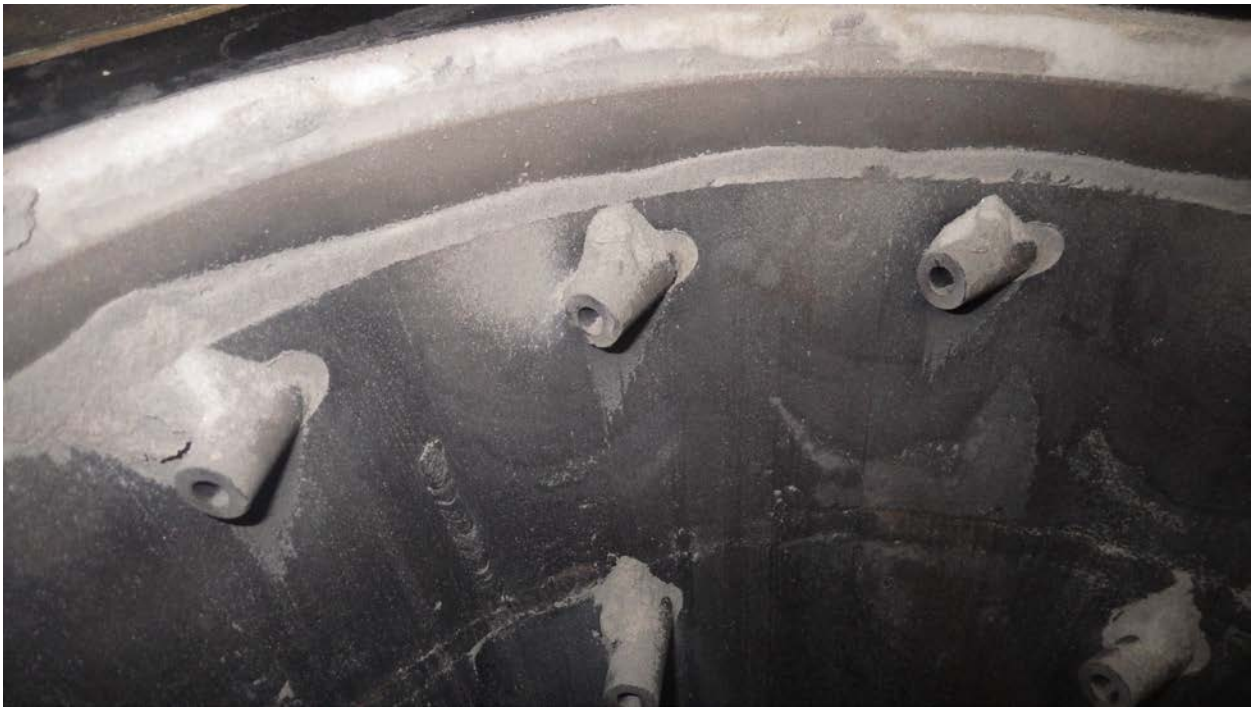


Figure 43. Hazen testing, FO-3 fluidization nozzle detail post-test.

Figure 44. Hazen testing, agglomerations on waste feed nozzle FO-3 post-test.

The following descriptions of fluidization performance were provided in the Hazen report:

> The FO-1 expanded ring and rail had a thin gap between the top edge of the upper cone and the vessel wall where solids collected. The top edge of the cone should have been welded and sloped to match the upper cone, in which case the

FO-1 design likely would not have exhibited any visible area of defluidized solids.

The FO-2 bubble cap assembly exhibited a wide area of defluidized solids between the bubble caps and the inside surface of the vessel wall on top of the flat plenum plate. The FO-2 bubble cap assembly produced significantly reduced elutriation of solids to the PGF. It is thought that this is likely due to the much slower velocity of the FG as it enters the bed under the bubble caps compared to the higher FG entry velocities from the FO-3 shrouded jets and the much higher FG entry velocities from the FO-1 rail orifices (non-shrouded). Therefore, it is recommended that the selected dual plenum design utilize reduced entry velocities by using shrouded jets with enlarged inside diameters and longer lengths.

The FO-3 dual plenum exhibited essentially no visible areas of defluidized solids in the bottom of the bed, except a thin line of solids that accumulated at the top of the cone-to-shell weld that was not sloped to match the plenum cone.

Each option was evaluated based on the evaluation criteria. Each option was rated on a scale of 1 to 5 with 1 being the worst and 5 the best. The ratings and total score for each option are given in the table below:

Table 5. Hazen testing, weighted rating of performance indicators for fluidization options

Item No.	Performance Indicator (Rating: 5 is best, 1 is worst)	Weight Factor	FO-1 Ring with Cone		FO-2 Bubble Caps		FO-3 Dual Plenum Cone	
			Rating	Factored	Rating	Factored	Rating	Factored
1	Sandcastle formation	5	5	25	5	25	5	25
2	Agglomerate formation	5	2	10	2	10	2	10
3	Stagnant areas	5	3	15	1	5	5	25
4	Erosion	4	5	20	2	8	5	20
5	In-bed temperature indications	5	4	20	1	5	5	25
6	Plugged jets	2	5	10	2	4	1	2
7	Self-cleaning on refluidization	1	5	5	3	3	3	3
8	Carryover to PGF	2	3	6	5	10	3	6
9	Wall scale	1	3	3	5	5	3	3
10	Particle size control	1	5	5	5	5	5	5
	Total (155 possible)			119		80		124

Based on the results of the testing, FO-3 the Dual Plenum Cone was the option recommended for further development.

For additional details refer to the Hazen Test Report 18HPP-FO-TR-1.

4.2.2 Testing at PSRI

Particulate Solid Research, Inc. (PSRI) was contracted to perform cold flow studies of the existing DMR fluidization configuration and the proposed dual plenum design. The intent of the cold flow studies was to optimize the DMR's gas distribution system such that it:

1. Provides optimum gas distribution.

2. Reduces stagnant areas near the wall region.

3. Minimizes bed agglomeration.

4. Minimizes material build up (sand castles) at the wall or on bed internals.

5. Provides validation data for NETL's modeling efforts.

The PSRI fluidized bed unit has a 33-in (84-cm)-diameter 118 inch tall semicircular section at the bottom, with a transparent faceplate. Bed height in the test was 62 inches. The clear faceplate allows visual observation of the fluidization behavior during testing. In addition to visual observations, each test assembly was instrumented to allow measurement of critical bed parameters during testing. DMR bed material was provided to PRSI by Fluor for use in the tests.

During testing of the existing DMR configuration it was discovered that the introduction of waste feed had a negative impact on the gas distribution in the bed material. Bubbles rising from the distributer system were drawn into the waste feed flow, which decreased the number of bubbles rising into the rest of the bed. Bubble distribution in the bed was not even, with a bubble frequency observed to range from about 5 bubbles per second on the left hand side of the bed to about 15 bubbles per second on the right hand side. Bed density was calculated by measuring the pressure drop across the bed in various locations.

Variations in pressure drop across the bed in the existing configuration indicated that there were areas where the bed density was essentially the same as the loose bulk density of the bed material, suggesting that the bed was defluidized at these points.

Figure 45. PSRI cold flow testing of existing DMR configuration

The dual plenum configuration was much less influenced by the action of the waste feed. Bubble frequency was observed to be between 10 and 15 bubbles per second. It was also noted that material drained smoothly from the dual plenum design when emptying the bed. No indications of defluidization were present in the dual plenum configuration during testing.

PRSI discovered during testing that the bed material is hydroscopic and will form solids when exposed to moisture. Material left in unsealed drums would form a layer of caked solids on the surface. There were some agglomerates (“sand castles”) removed from the bed material when draining the existing DMR configuration test assembly. In addition, agglomerates were found attached to the ring sparger at the bottom of the bed. The agglomerates were most likely formed by bed material solids coming into contact with moisture brought in by the fluidizing air. No agglomerates were identified when emptying the dual plenum configuration.

Figure 46. PSRI Dual Plenum Test Assembly.

The following conclusions were reached by PRSI as a result of the cold flow testing:

1. The dual cone-dual plenum gas distributor performs significantly better than the ring sparger and rails distributors.

2. The stagnant solid bodies provided by the ring sparger and the rails can enable solids to momentarily settle on them and that may initiate and hasten agglomerates formation.

3. The air injection on one side of the bed affects the fluidization quality, by introducing channels were gas flows up preferentially. It would be better if the gas is supplied evenly around the column.

4. For the gas flow rates of the proposed design, the unit drained and emptied itself very smoothly. No accumulation of solids was detected in the conical gas distributor.

5. Differential pressure fluctuations and bubble profiling were capable of identifying a plume-like flow of air in the fluidized bed.

6. The solids material used in this study is hygroscopic and reacts with water to form agglomerates which continue to harden over time. The sticky material can block nozzles and measurement

probes, affect solids flow, etc. Great care is needed when conducting cold flow tests with this material..

For additional details, refer to the PSRI Research Report PM720.

4.2.3 Mock-up Testing

The DMR is a small physical space with several protruding pipes, rails, nozzles, and other parts that could interfere with successful removal and installation efforts. Additionally, the limited supply of Haynes 556 alloy will not support mistakes that require re-fabrication of dual plenum components. Removal of the existing ring header and installation of the dual plenum components were performed in a mockup to ensure that all risks, limitations, and potential errors were understood prior to performing work on the actual DMR components.

First the existing ring header components were removed from the mockup DMR. This confirmed that the procedures developed for removal of these components will work in the actual vessel.

Carbon steel copies of the Dual Plenum component were fabricated for installation in the DMR mockup. The pieces were first assembled in the shop to ensure that the mockup was within design tolerances. The pieces were then disassembled and prepared for installation in the DMR mockup. The Dual Plenum mockup was installed in the DMR mockup using the procedures and tools that would be used in the actual installation.

Figure 47. Fabrication of Carbon Steel Dual Plenum Mockup.

Figure 48. Working on the DMR mockup.

Figure 49. Installation of dual plenum mockup in DMR mockup.

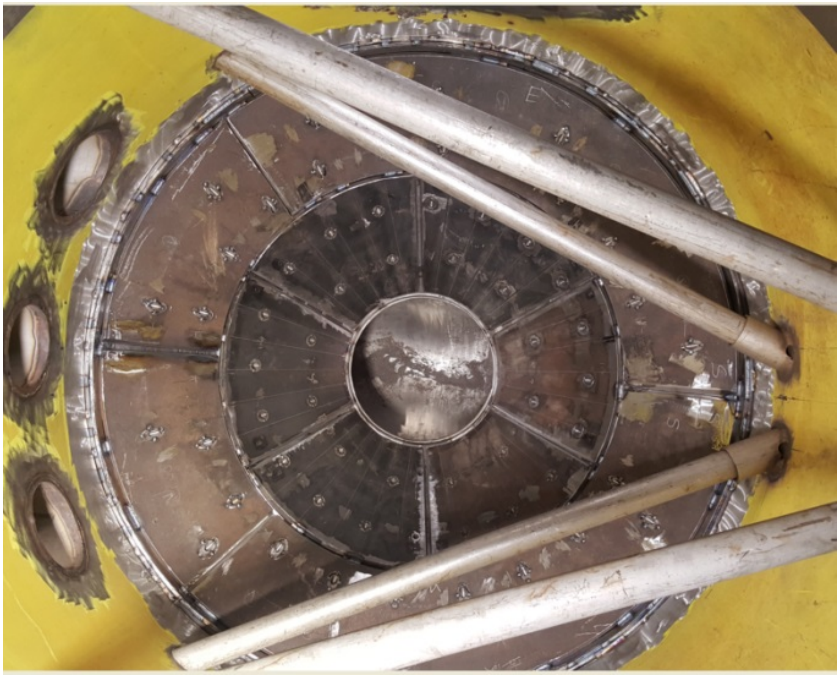


Figure 50. Dual plenum components tack welded in DMR mockup.

The crews were exposed to the same physical challenges that will be present during the actual installation working in the mockup. Improvement to tooling and procedures identified during the mockup installation were incorporated into the actual installation.

4.3 N2 Neck Purges

FDC-11487 added nitrogen purges to the DMR neck to address several issues that had been identified during earlier demonstration runs and the fluidization modification project. The DMR neck purges addressed three issues:

- Provides an air curtain to prevent DMR process gas from entering the solids transfer line
- Provides fluidizing gas for the DMR neck and during bed drains
- Provides a source of heat during startup operations to maintain differential temperature between the DMR neck and the fluidizing gas within the required limit of 190°C.

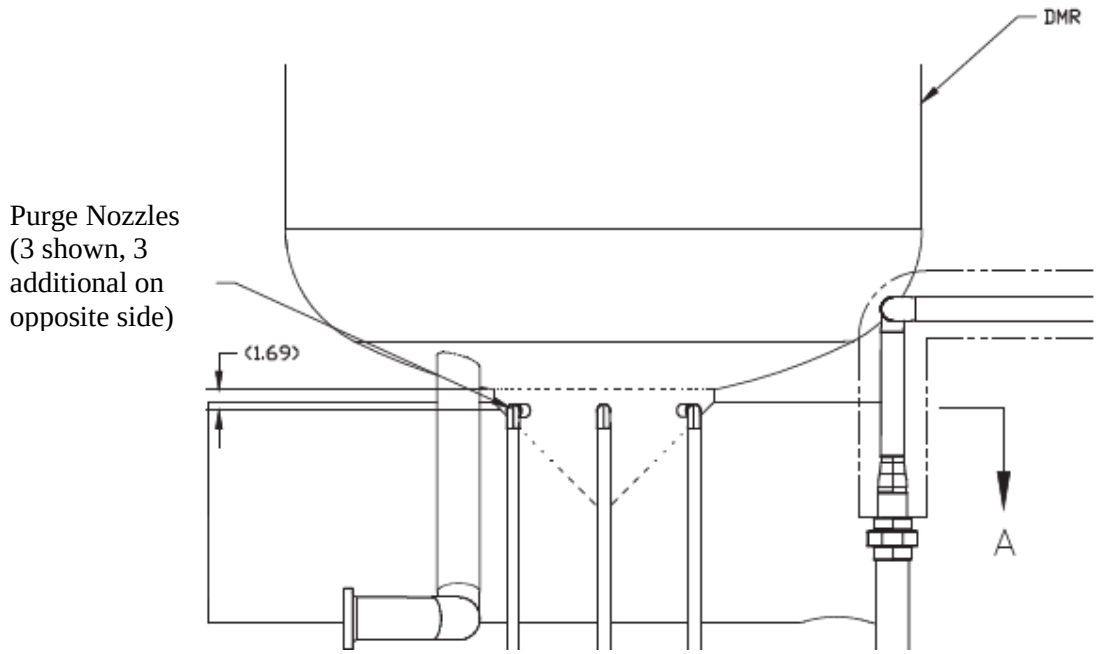


Figure 51. DMR N2 neck purge nozzle locations.

A thermal stress analysis of the new neck purge nozzles was performed and documented in EDF-11051. Four cases were analyzed:

- Case 1: Maximum operating flow (bed temperature of 680°C), gas flow (50SCFM, gas temperature of 175°C)
- Case 2: Minimum operating flow (bed temperature of 680°C), gas velocity (25ft/s, gas temperature of 175°C)
- Case 3: Failed gas heater (bed temperature of 680°C), gas flow (50SCFM, gas temperature of 26.85°C)
- Case 4: Start-up (bed temperature of 25°C), gas flow (75SCFM, gas temperature of 550°C).

Stresses in the DMR shell and the new purge nozzles were analyzed in each of the four cases. The design was found to meet the required stress limits of the ASME Boiler and Pressure Vessel Code.

4.4 Simulant Testing

Performance of the dual plenum design will be validated during demonstration run 2. See section 8 for a description of the objectives and duration of the demonstration run.

5 DESIGN REVIEW

A series of design reviews were performed during the development of the DMR fluidization design. Design review teams consisted of member of Fluor management, Quality Assurance, Nuclear Safety, Environmental Engineering, Radiological Controls, IWTU System Engineers, and the IWTU crafts foreman. Outside experts were also included in the design review team to give an independent engineering review of the designs.

The three concepts selected for development were each developed to the conceptual, or 30% design stage. A design review was held to evaluate the three concepts and determine priorities for continued design. During the 30% design review the dual plenum concept was determined to be the first priority for design efforts.

The dual plenum design was developed to the 60% stage. A second design review was conducted. Due to issues with thermal stresses, the dual plenum design was modified from a single angle cone as shown in Figure 16 to a dual angle cone as shown in Figure 33. The other two concepts were also developed to the 60% stage, at which point further development of those concepts was halted in favor of continuing the dual plenum design.

A third design review was conducted at the 90% design stage. It was identified that the nitrogen neck purge design should be analyzed to determine the thermal stresses that would be present in various scenarios of DMR startup and operation.

A final design review was performed when the design was complete. All significant design comments were resolved to the satisfaction of the design review team, and incorporated into the final design documents. For a list of final design documents associated with the DMR fluidizing gas distribution system modification, see Facility Change Form FCF-8850.

The use of testing, analysis, and reviews have produced a design that is technically correct and will provide the necessary fluidization for the DMR to successfully process SBW.

6 FABRICATION, DEMOLITION, AND INSTALLATION

6.1 Fabrication

Following the successful installation of the dual plenum components in the DMR mockup, the actual Haynes 556 components were fabricated.

The Haynes 556 dual plenum components were assembled and inspected in the shop to ensure that fit up was correct and they met the design tolerances and dimensions. Following inspections the components were disassembled and prepared for installation in the DMR.

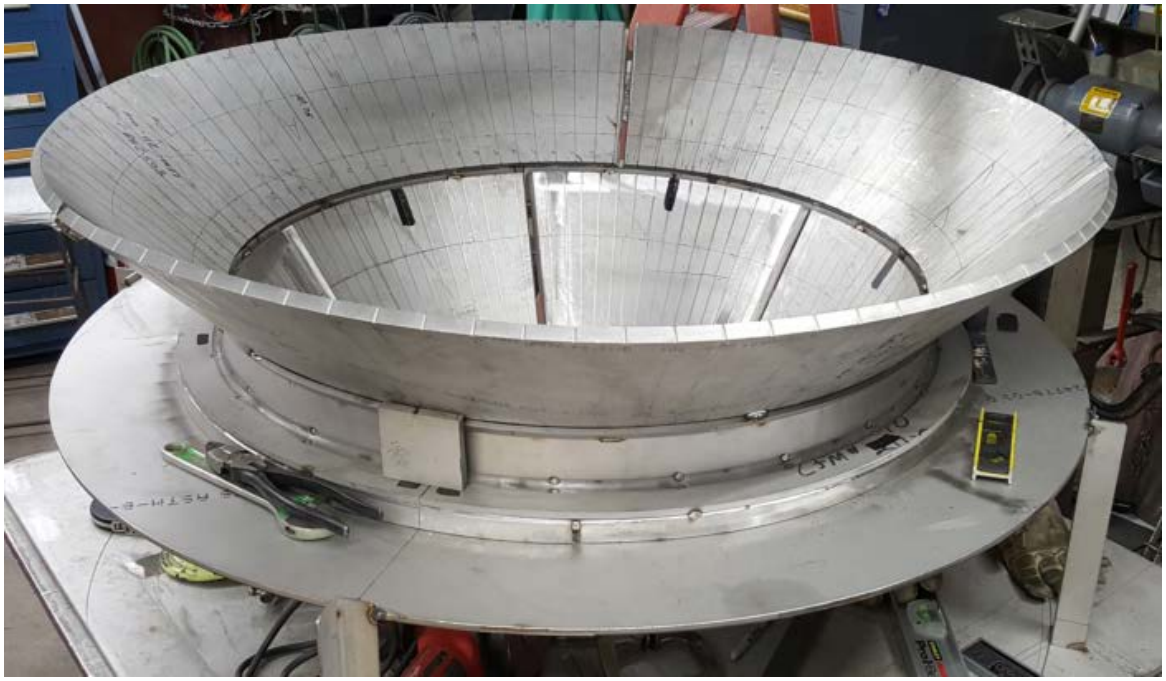


Figure 52. Haynes 556 dual plenum cone components being fabricated.

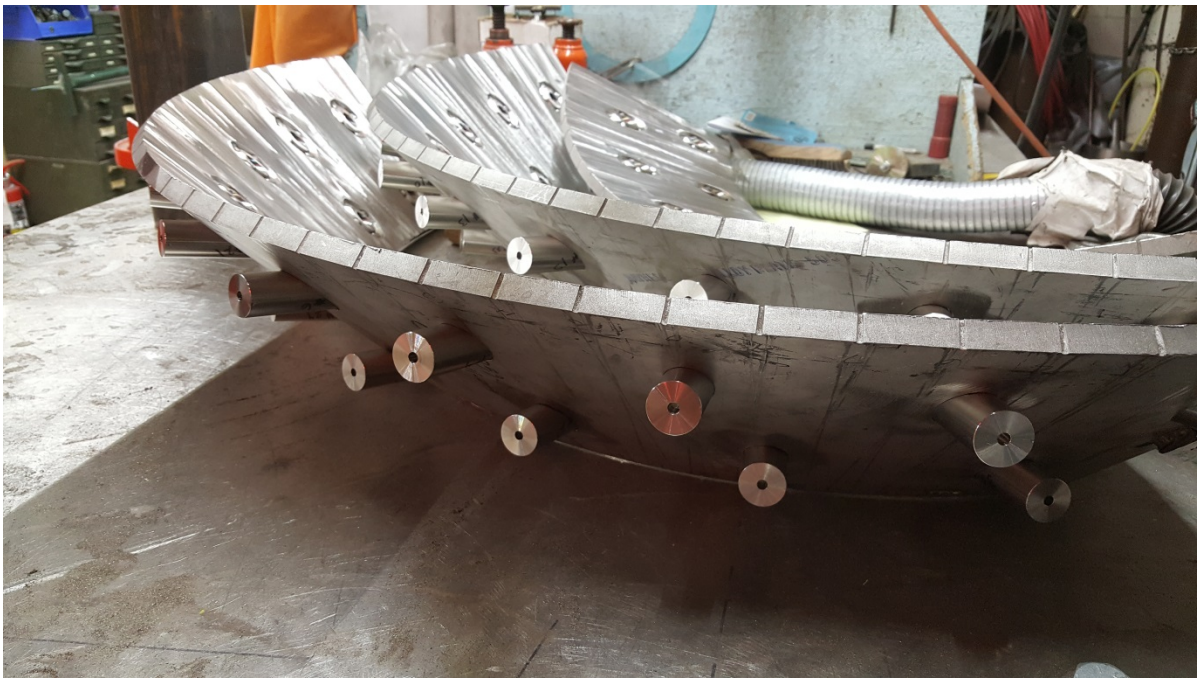


Figure 53. Installation of fluidizing gas nozzles in cone sections.

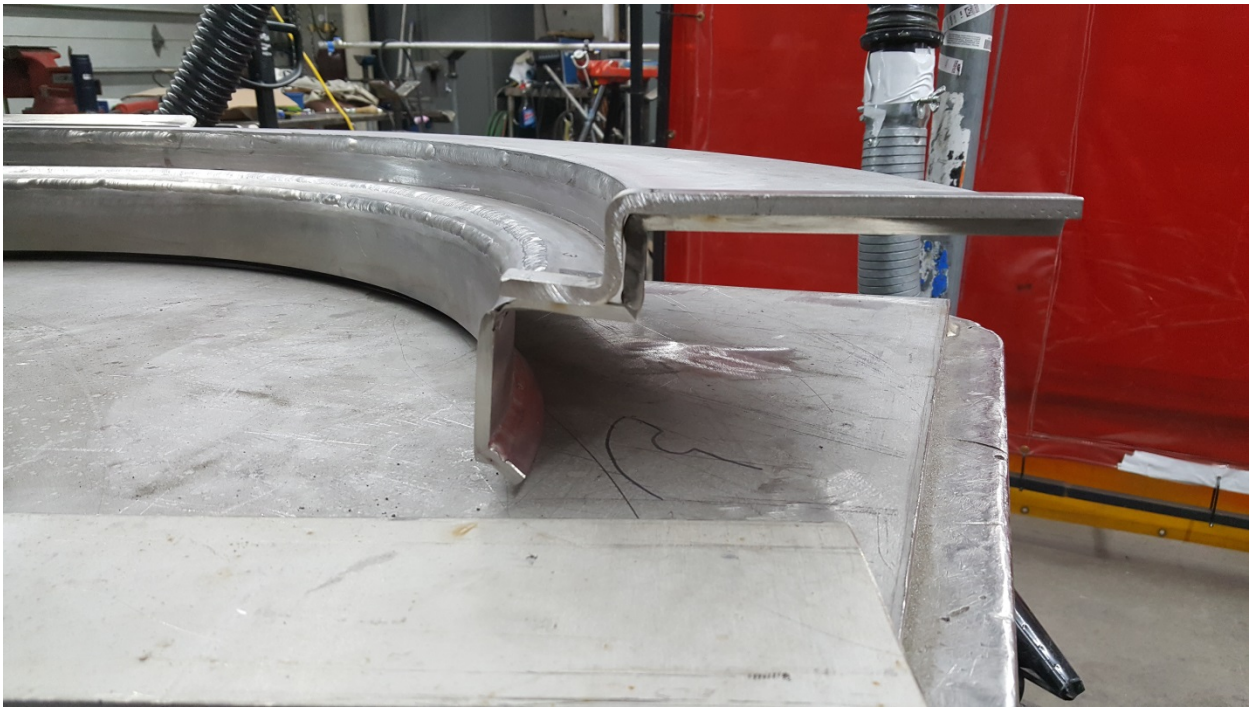


Figure 54. Fabrication of plenum divider.

Figure 55. Finished cone sections ready for installation.

6.2 Demolition

The ring header components and the fluidizing gas rails were removed from the DMR in preparation for the installation of the dual plenum.

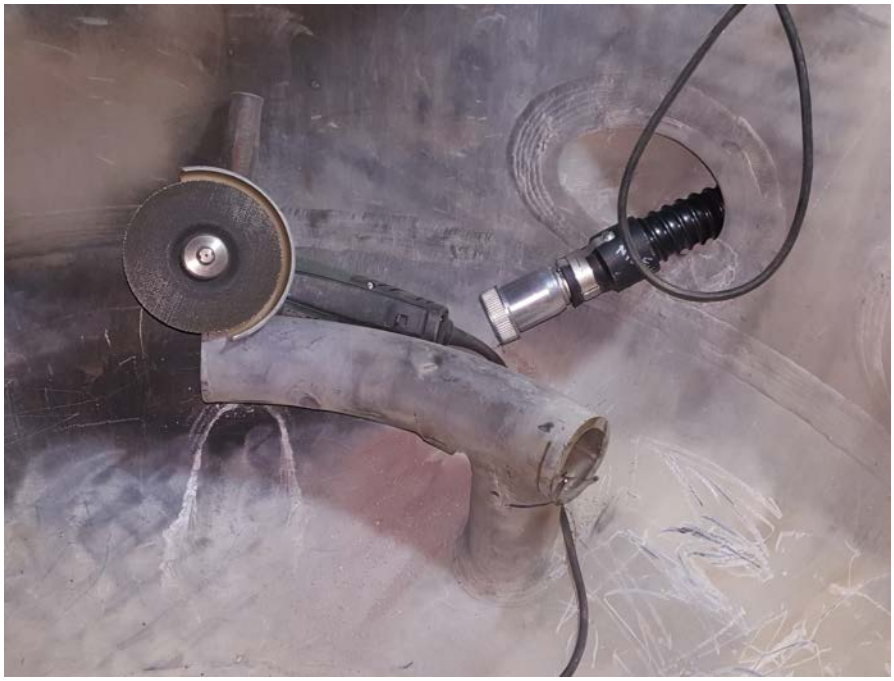


Figure 56. Removing the 3” ring header.

Figure 57. Removed 3” ring header sections.

6.3 Installation

Once the DMR was prepared, the installation of the dual plenum components began. Access for personnel and component entry was through the previously installed manway.

Figure 58. Installed lower ring and drain line hole.

Figure 59. Plenum segments staged for installation outside DMR manway.

Figure 60. Lower plenum section installed.

Figure 61. Upper plenum section with root welds completed.

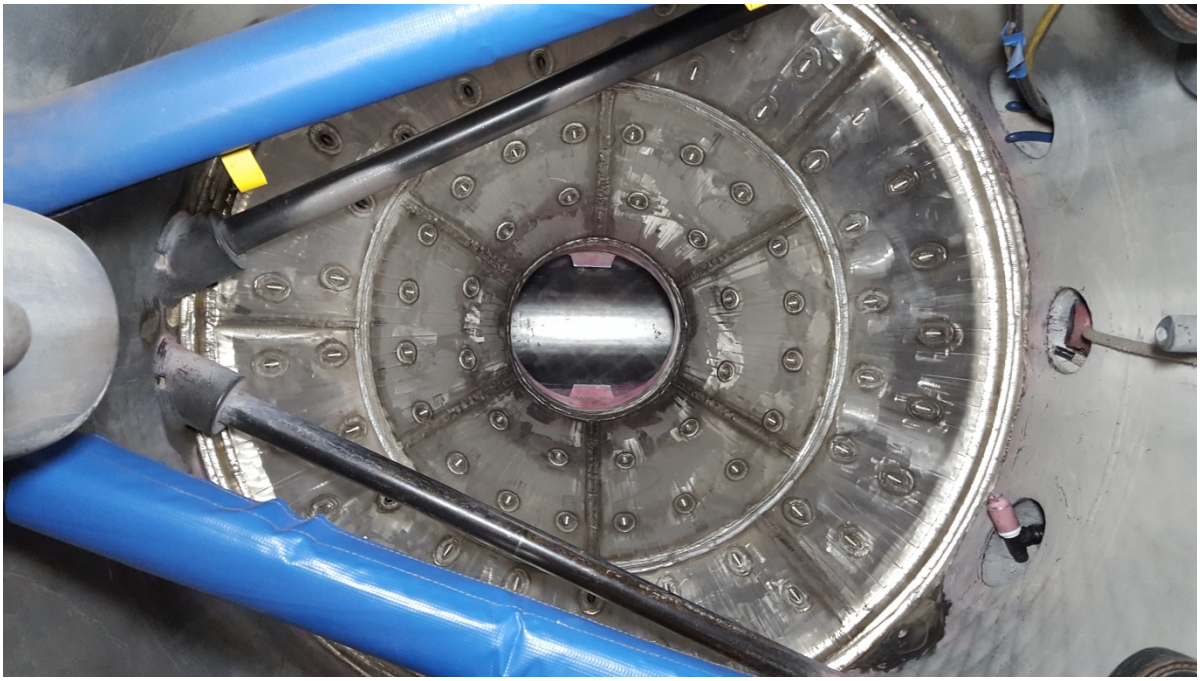


Figure 62. Completed dual plenum installation.

7 ANCILLARY SYSTEM DESIGN MODIFICATIONS

7.1 CO_2 Addition

As described in paragraph 2.1.3, carbon dioxide was added to the fluidizing gas to mitigate the formation of cementitious deposits. A temporary carbon dioxide system was procured and piping installed that supplied carbon dioxide to the fluidizing gas supply for the DMR.

Following demonstration run 1 and the successful prevention of cementitious deposits in the revised A/G, it was decided to make the carbon dioxide system permanent. A permanent design was developed and implemented by FDC-11063.

7.2 Fluidizing Gas Heater

The temporary carbon dioxide system supplied carbon dioxide to the fluidizing gas upstream of the fluidizing gas superheater. Since the A/G cementitious deposits issue was the primary reason for adding carbon dioxide, it was preferred to keep the CO2 as close to the A/G as possible. To this end, a design change was started to provide CO2 only to the ring header and not to the fluidizing gas rails higher in the vessel. The fluidizing gas lines diverge downstream of the superheater. Since temperature was also identified as a contributing factor to the formation of deposits, supplying cold CO2 to the ring header line downstream of the superheater was not advisable. A new fluidizing gas heater was specified to heat the CO2 and other gasses and supply these gases to the ring header to help prevent formation of cementitious deposits in the auger/grinder. FDC-11084 installed the new fluidizing gas heater (HTR-SRB-366).

As discussed earlier in this report, fluidization problems that continued during demonstration run 1 caused a more concentrated evaluation of DMR fluidization. During this process it was determined that using N2 and CO2 in the lower part of the DMR was not necessary. As such, piping between the new fluidizing gas heater and the DMR fluidizing gas lines was disconnected and blanked off. The new fluidizing gas heater is still installed, but will not be used at this time. The pressure safety valve protecting

the fluidizing gas heater was evaluated in EDF-9933 Pressure Safety Relief Evaluation – Fluidizing Gas System and found to be acceptable for the over-pressure scenarios identified.

The fluidizing gas heater will be left installed. If demonstration run 2 indicates that additional heating of the neck purges is needed to maintain the required temperature differential between the fluidizing gas and the DMR throat area, the fluidizing heater may be utilized for this purpose.

7.3 Over Pressure Protection

7.3.1 PSV Additions

The dual plenum design to improve fluidization in the DMR creates a scenario where fluidized gas pressure would be contained by the plenums in the DMR. The DMR is not an ASME stamped vessel, but was designed and is treated as an ASME stamped vessel with a design pressure of 14 psig. There are overpressure scenarios that could apply greater than 14 psig to the DMR plenums, thus over-pressurizing the vessel.

Two new PSVs, PSV-SRC-140-001 and PSV-SRC-540-001, were designed to protect DMR fluidizing gas lines 4”-FG-SN-161104-H and 3”-FG-SN-160879-H. Traditional PSVs would not work on the fluidizing gas lines because of the combination of low operating pressure and high temperatures. Electrically controlled pneumatically operated PSVs were chosen as the best option to protect the DMR. These PSVs are ball valves that have a pneumatic operator; the air used to operate the actuators is controlled by an electric solenoid valve. A pressure sensor in the line initiates valve opening when pressure rises above the set pressure for the valve. In the event of loss of instrument air pressure or electrical power the PSVs will fail open. The PSV vents were tied into line 4”-FG-SN-16193-H which is the vent line for the superheater PSV. Pipe stress analysis and heat loss calculations were performed to ensure that the piping designs were acceptable and would not negatively affect the fluidizing gas temperatures. The new PSV design is documented in FDC-11488.

7.3.2 Facility PSV Review and Update

The Pressure Safety Relief Valve (PSV) systems in the Integrated Waste Treatment Unit (IWTU) plant are documented in a series of Engineering Design Files (EFDs) as listed below:

- EDF-9909 IWTU Pressure Safety Relief Evaluation – SBW Steam Reforming Unit
- EDF-9924 IWTU Pressure Safety Relief Evaluation – Product Transfer and Loadout System
- EDF-9926 IWTU Pressure Safety Relief Evaluation – Process Exhaust System
- EDF-9927 IWTU Pressure Safety Relief Evaluation – Additive System
- EDF-9933 IWTU Pressure Safety Relief Evaluation – Fluidizing Gas System
- EDF-9938 IWTU Pressure Safety Relief Evaluation – Utility System
- EDF-10334 IWTU Pressure Safety Relief Evaluation for PHVF and PRF
- EDF-10341 IWTU Canister Pintle PSV Design Evaluation.

Due to the time elapsed since the last revisions to these documents, it was determined that the EDFs should be assessed for revision. To determine which of the PSV EDFs should be revised, all of the

Field Design Changes (FDCs) for IWTU issued since the earliest revision date for the PSV EDFs were evaluated for impact on the PSV systems. There were 877 FDCs entered into the FDC system between October 2nd, 2012 (the earliest PSV EDF revision date) and June 28th, 2017 (the last date the FDCs were pulled from the system).

All of the FDCs were assessed for relevance to the PSV systems. Those that were deemed not relevant were eliminated from further consideration. The remaining FDCs were assessed and affected EDFs were identified for each FDC. The final stage of FDC evaluation consisted of reviewing the technical details of each remaining FDC to determine if an impact to the PSV systems occurred as a result of the change. FDCs were assessed for potential impact to flow rates, piping modification to PSV inlet and outlet lines, changes to control valves and PSVs, and changes to methods of plant operations that might affect an existing scenario evaluated in one of the PSV EDFs or create a new scenario.

Due to the large number of FDCs identified that had the potential to affect flow rates and the mass and energy balance of the IWTU plant, it was recommended that EDF-9937 "Process Inputs for IWTU Pressure Relief Valve Evaluation" should be revised prior to performing the revisions of the PSV EDFs. This EDF documents the IWTU plant normal and maximum operating flow rates, temperatures, stream molecular weights, and composition for use in the PSV EDFs. This EDF was updated in parallel with the final stage of FDC evaluation.

The effected EDFs were revised to address the changes made in the identified FDCs. The revised inputs from EDF-9937 were also incorporated into the calculations. All existing PSVs were found to adequately protect the respective portions of the plant.

No FDCs were identified that effected EDF-10334 or EDF-10341. Additionally, these EDFs do not use inputs from EDF-9937. As a result revisions were not made to these EDFs.

Several additional plant revisions were included in the scope of the PSV EDF revisions. These include the fact that the new fluidizing gas heater will not be connected to the process at this time, and the new PSVs that will be installed on the fluidizing gas lines feeding the DMR. Due to the changes to the DMR to improve fluidization, the possibility exists that fluidizing gas pressure could be applied to the DMR pressure boundary, which is only rated for 14 psig. PSVs will be added to the fluidizing gas lines to eliminate the possibility of exceeding the pressure rating of the DMR (see section 7.3.1).

FDCs that entered into the system after June 28th were reviewed to determine if any would apply to the EDF PSV revisions. No relevant FDCs were identified, other than those additional plant modifications previously mentioned.

7.4 Drain Line and Purge

A new drain line was added to the DMR to allow removal of solids and liquids from the lower fluidizing plenum using the DMR decontamination system. To prevent buildup of solids in the drain line during operations, FDC-11488 added nitrogen purges to the drain line to prevent solids accumulation. A decontamination system for the upper plenum will be designed and installed as part of the next phase.

8 ADDITIONAL SUPPORTING ACTIVITES

The DMR is a permitted vessel with the State of Idaho Department of Environmental Quality (DEQ). Changes to the operation or configuration of the DMR require DEQ to approve revised permits describing the change. Two permit modification requests (PMR) were required for recent DMR modifications, one for the addition of the manway, and a second for the fluidization modifications. The PMR for the DMR manway has been submitted and approved. The PMR for the fluidization

modifications will be submitted for approval following demonstration run 3. A final PMR will be required to document the final operating parameters prior to processing SBW.

The Haynes 556 alloy used in most of the dual plenum components has limited availability and a long lead time. Procurement activities for this material had to be initiated as soon as possible to ensure the material had arrived and was available when fabrication was scheduled to begin.

The limited quantities of Haynes 556 alloy available also drove the need for mocking up the installation activities prior to fabricating the actual dual plenum components. This allowed for any issues with the design and installation procedures to be identified and resolved prior to fabrication so that Haynes 556 alloy would not be wasted due to errors in design or mistakes in installation.

The new PSVs for the fluidizing gas lines were also long lead time items. The valves are unique due to the high temperature environment and low operating pressure requirements. The procurement activities for these valves were also started as early as possible to ensure that the vales were available to support the installation schedule.

9 LIST OF DOCUMENTS

A list of documents reviewed during the decision process is included in Appendix A, DMR Fluidization Modifications Document Tree.

10 RECOMMENDED ACTIONS

None.

11 CONCLUSION

When Fluor assumed the ICP Core Contract, the IWTU plant was not functional and had several significant issues preventing operation of the plant. These issues included an A/G that was plugged with cementitious material and an eroded fluidizing gas ring header that needed to be replaced, but no effective way to access the inside of the DMR to carry out the replacement. The IWTU plant could not operate until these issues were resolved.

The A/G was redesigned to better size and move bed material out of the DMR. The A/G redesign also improved maintainability of the A/G by utilizing bolted connections that allow for easier disassembly and repair. The redesigned A/G was tested during demonstration run 1 and operated successfully.

A manway was designed for the DMR to allow access so that the eroded ring header could be replaced. The manway provides a larger and easier access point than those used previously and was instrumental in providing the access needed to correct issues with the internal arrangement of the DMR.

Demonstration run 1 showed, by its early termination, that there continued to be significant fluidization issues in the DMR. Complete and sustained fluidization of the DMR bed with the existing design was not being achieved. Rather than replace the ring header as originally planned, Fluor conducted a series of studies, tests, and simulations to determine the best path forward to achieve consistent fluidization in the DMR. Industry experts were brought in to assess the design and provide their input to selecting the best path forward. As a result of this multifaceted approach, a dual plenum distributor design was selected as the best option for fluidizing the DMR bed. The detailed design was completed, computer and physical simulations run to demonstrate the effectiveness of the design, mock-up testing was performed to support installation, and the new components were fabricated and installed. The dual

plenum design will allow the DMR to maintain proper fluidization, which is key to the IWTU plant meeting its mission.

The modifications to the DMR and supporting systems described above will correct the issues that have prevented the DMR from operating as intended in the past. The effectiveness of the modifications will be verified during additional demonstration runs that will demonstrate the ability of the DMR to operate effectively during long term operations.

12 REFERENCES

Drawing 809252, "DMR Vessel Fluidizing Bed Double Plenum Assembly and Installation," Rev. 0, Idaho Cleanup Project Core.

Drawing 809253, "DMR Fluidizing Bed Double Plenum Lower Ring Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809254, "DMR Fluidizing Bed Double Plenum Lower Cone Segment A Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809255, "DMR Fluidizing Bed Double Plenum Lower Cone Segment B Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809256, "DMR Fluidizing Bed Double Plenum Lower Cone Segment C Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809257, "DMR Fluidizing Bed Double Plenum Plenum Divider Segment Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809258, "DMR Fluidizing Bed Double Plenum Upper Cone Segment A Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809259, "DMR Fluidizing Bed Double Plenum Upper Cone Segment B Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809260, "DMR Vessel Fluidizing Bed Lower Plenum Drain Assembly 1½"-HW-SJ-161970-N," Rev. 0, Idaho Cleanup Project Core.

Drawing 809261, "DMR Vessel Fluidizing Bed Double Plenum N4/N5 Nozzle Connection Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809262, "DMR Vessel Fluidizing Bed Double Plenum N3 Nozzle Plug Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809263, "DMR Vessel Fluidizing Bed Double Plenum N6 Nozzle Plug Assembly," Rev. 0, Idaho Cleanup Project Core.

Drawing 809264, "DMR Vessel Fluidizing Bed Plenum Drain N2 Purge ½"-NR-SE-161971-N," Rev. 0, Idaho Cleanup Project Core.

Drawing 809265, "DMR Fluidizing Bed Double Plenum Upper Cone Segment C Assembly," Rev. 0, Idaho Cleanup Project Core.

EDF-10913, 2017, "Structural Evaluation of the Manway Nozzle (N-28) on the Denitration/Mineralization Reformer (VES-SRC-140)," Rev. 2, Idaho Cleanup Project Core, February 2, 2017.

EDF-11021, 2017, "Fluidizing Gas Flowrates for the IWTU Dual-Plenum DMR Distributor," Rev. 1, Idaho Cleanup Project Core, October 23, 2017.

EDF-11033, 2017, "DMR Double Plenum Thermal Structural Analysis," Rev. 0, Idaho Cleanup Project Core, October 24, 2017.

EDF-11051, 2018, "DMR Nozzle N2 Purge Thermal Stress Analysis," Rev. 0, Idaho Cleanup Project Core, January 16, 2018.

FDC-10812, "Replace DMR Sparge Ring FCF 8740 Redesigned Ring Header for the DMR Vessel."

MCP-9217, 2016, "Design Verification, Rev. 12," Idaho Cleanup Project Core, August 17, 2016.

MI2D-ODRH-58-RP-001, 2016, *IWTU Technical Issues Resolution Project, DMR Manway FEA Stress Analysis, Final Report*, Rev. 1, December 20, 2016.

MI2D-PHS2-55-RP-001, *DMR Internal Access – Manway Weld Test Plan and Special Requirements*.

OCE 06-449-1, 2010, *Final Design Analysis Report – Design Analyses of the Denitration/Mineralization Reformer (DMR)*, Rev. 6, December 10, 2010.

"Phase 1 Project Plan," Idaho Cleanup Project Core.

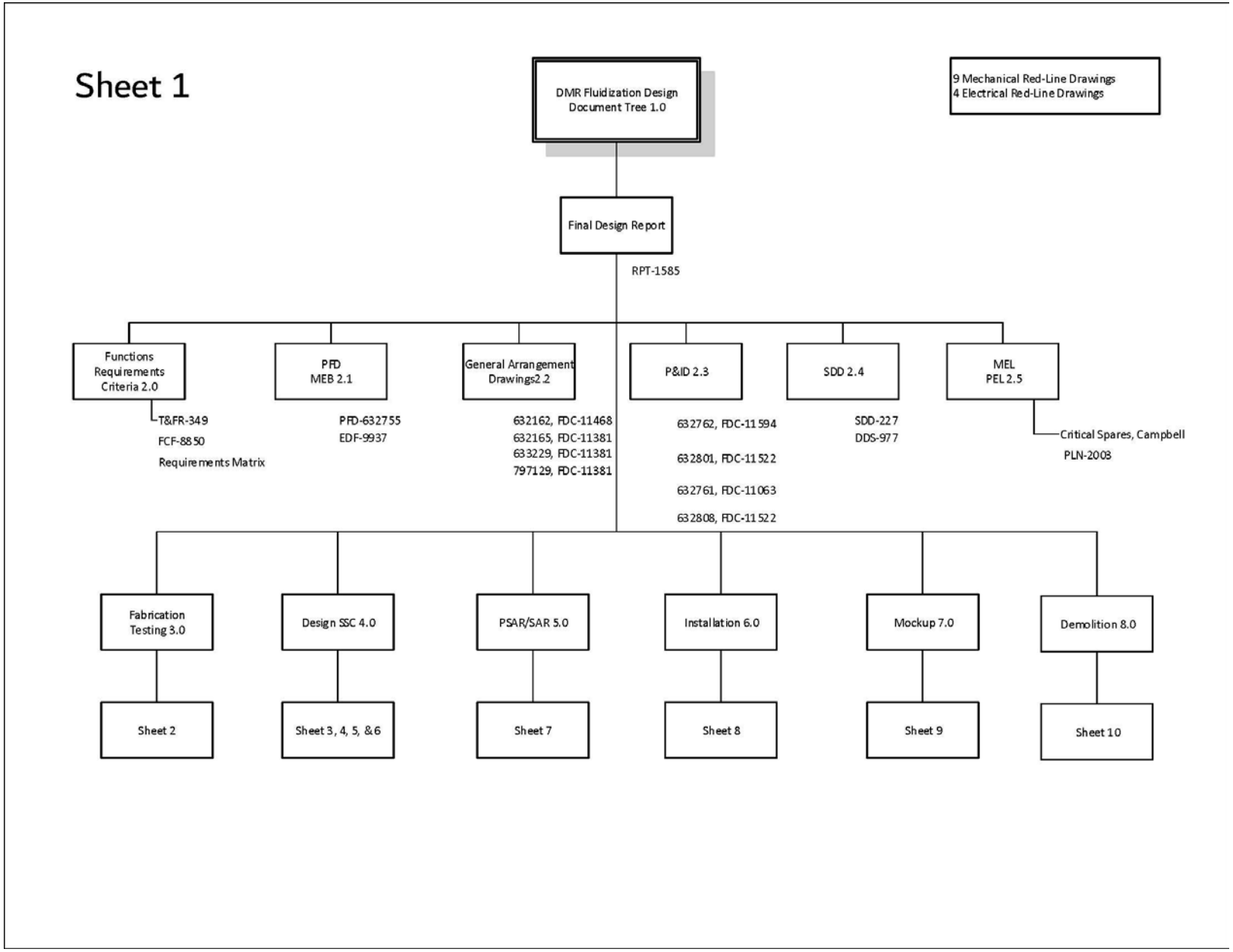
Research Report No. PM720, *Gas Distributor Evaluations for Fluidized Bed Denitration Mineralization Reformer (DMR)*, PSRI, November 12, 2017.

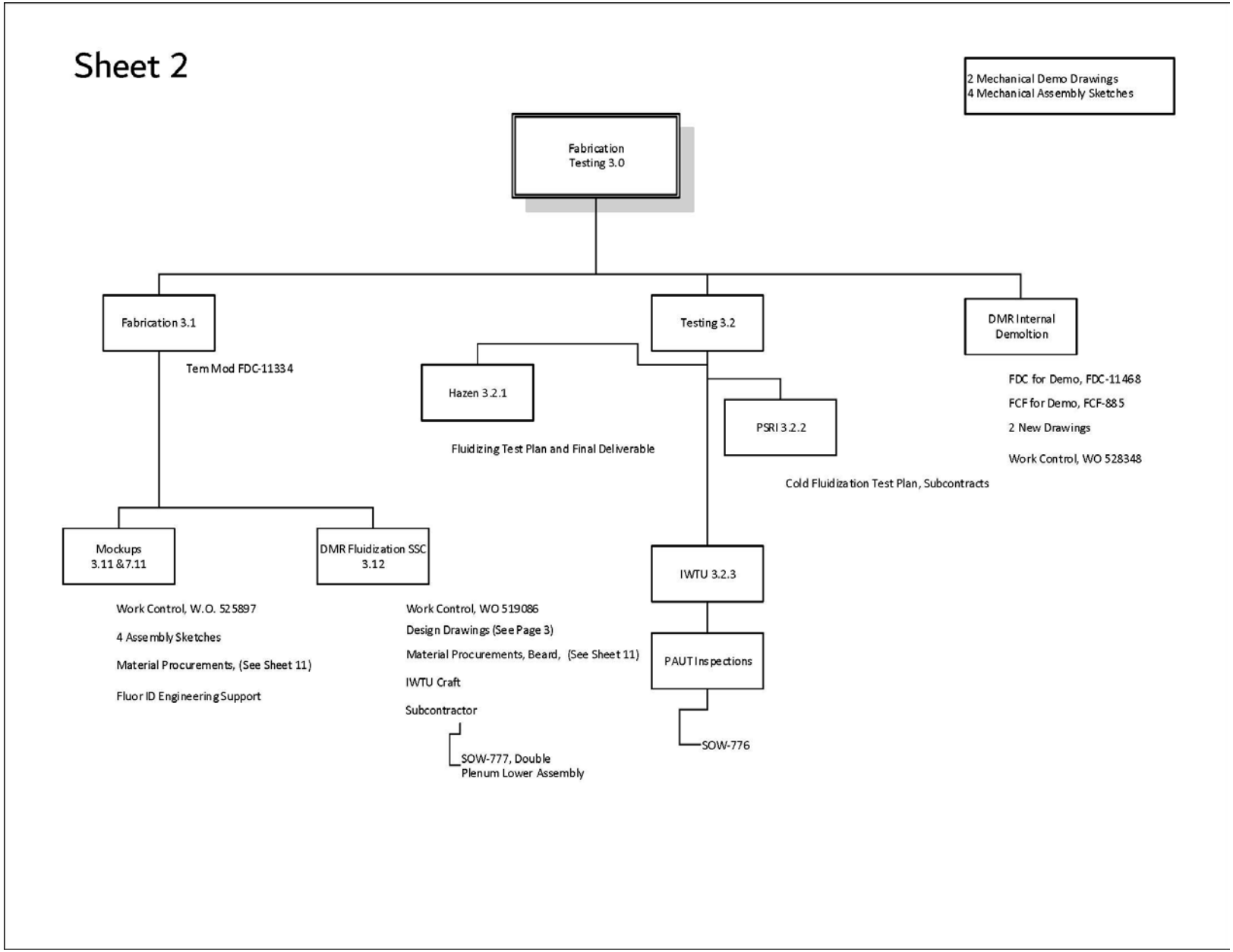
RPT-1541, 2016, *Integrated Waste Treatment Unit (IWTU), Denitration/Mineralization Reformer (DMR) Manway Final Design Review Meeting Report*, Rev. 0, Idaho Cleanup Project Core, December 22, 2016.

Test Report 18HPP-FO-TR-1 *18-Inch Hazen Pilot Plant Fluidization Options Test Program*, Rev. 0, Studsvik, Inc., December 6, 2017.

Appendix A

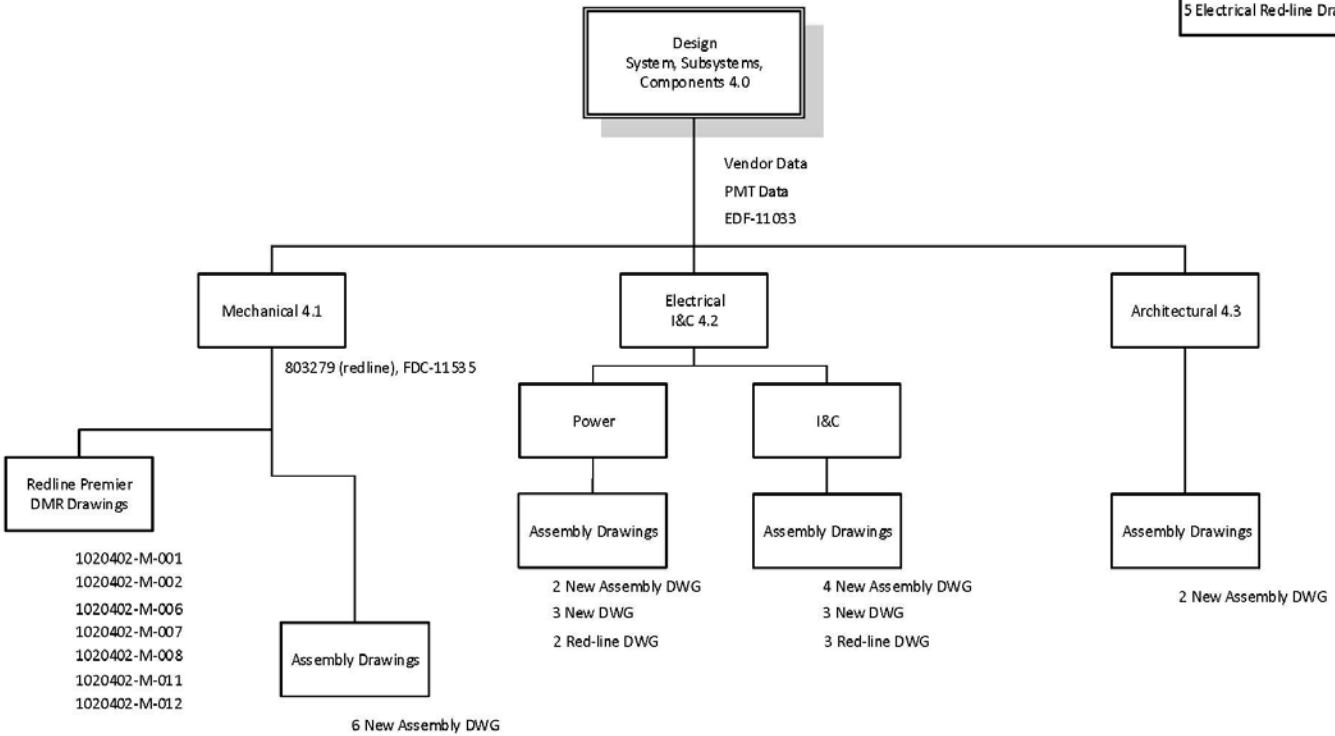
DMR Fluidization Modifications Document Tree


Sheet 1
DMR Fluidization Design Document Tree 1.0
9 Mechanical Red-Line Drawings
4 Electrical Red-Line Drawings
Final Design Report
RPT-1585
Functions Requirements Criteria 2.0
T&FR-349
FCF-8850
Requirements Matrix
PFD MEB 2.1
PFD-632755
EDF-9937
General Arrangement Drawings2.2
632162, FDC-11468
632165, FDC-11381
633229, FDC-11381
797129, FDC-11381
P&ID 2.3
632762, FDC-11594
632801, FDC-11522
632761, FDC-11063
632808, FDC-11522
SDD 2.4
SDD-227
DDS-977
MEL PEL 2.5
Critical Spares, Campbell
PLN-2008
Fabrication Testing 3.0
Design SSC 4.0
PSAR/SAR 5.0
Installation 6.0
Mockup 7.0
Demolition 8.0
Sheet 2
Sheet 3, 4, 5, & 6
Sheet 7
Sheet 8
Sheet 9
Sheet 10

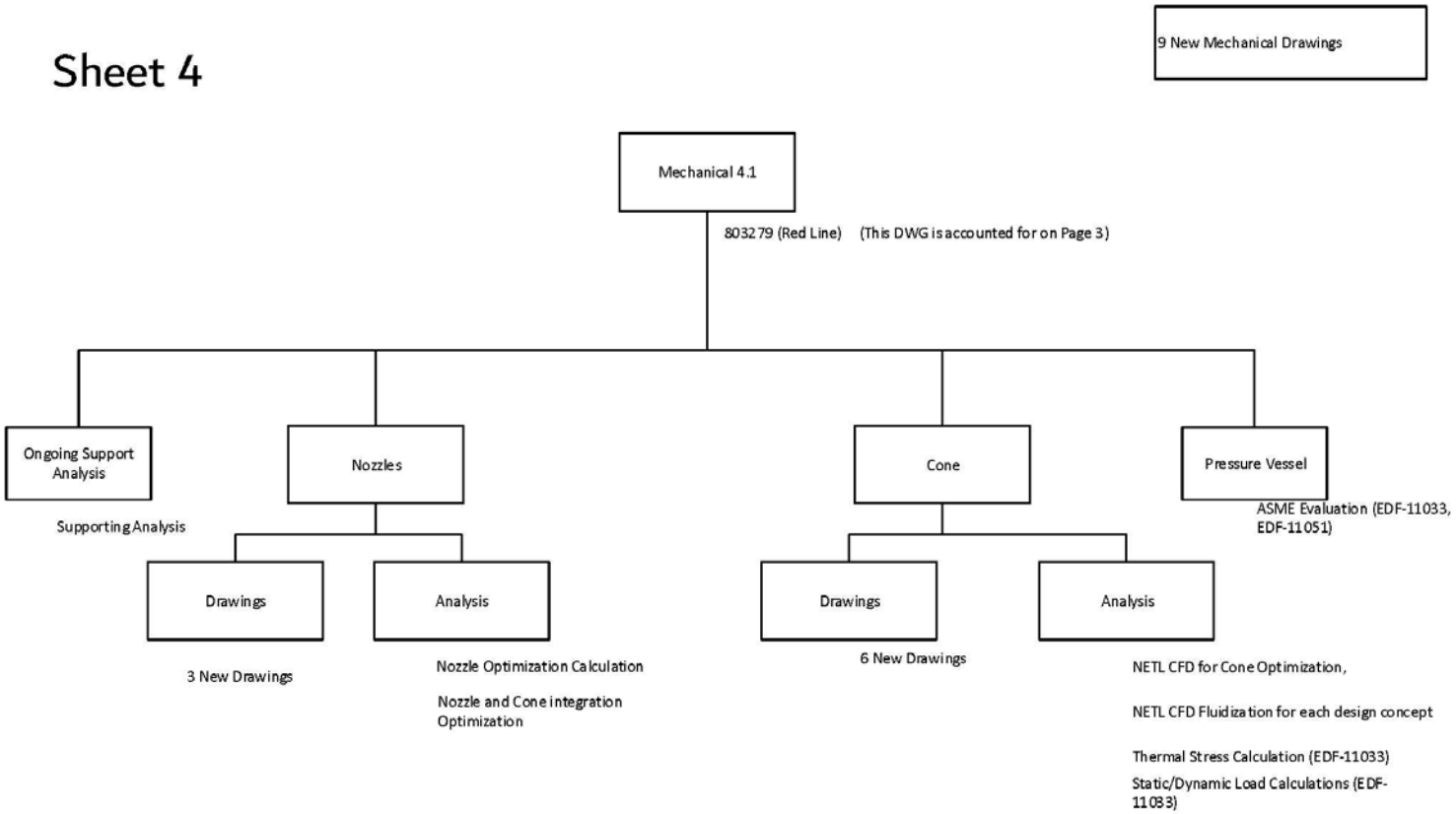

Sheet 2
2 Mechanical Demo Drawings
4 Mechanical Assembly Sketches
Fabrication Testing 3.0
Fabrication 3.1
Tem Mod FDC-11334
Testing 3.2
Hazen 3.2.1
Fluidizing Test Plan and Final Deliverable
PSRI 3.2.2
Cold Fluidization Test Plan, Subcontracts
DMR Internal Demoltion
FDC for Demo, FDC-11468
FCF for Demo, FCF-885
2 New Drawings
Work Control, WO 528348
Mockups 3.11 & 7.11
Work Control, W.O. 525897
4 Assembly Sketches
Material Procurements, (See Sheet 11)
Fluor ID Engineering Support
DMR Fluidization SSC 3.12
Work Control, WO 519086
Design Drawings (See Page 3)
Material Procurements, Beard, (See Sheet 11)
IWTU Craft
Subcontractor
SOW-777, Double Plenum Lower Assembly
IWTU 3.2.3
PAUT Inspections
SOW-776

Sheet 3

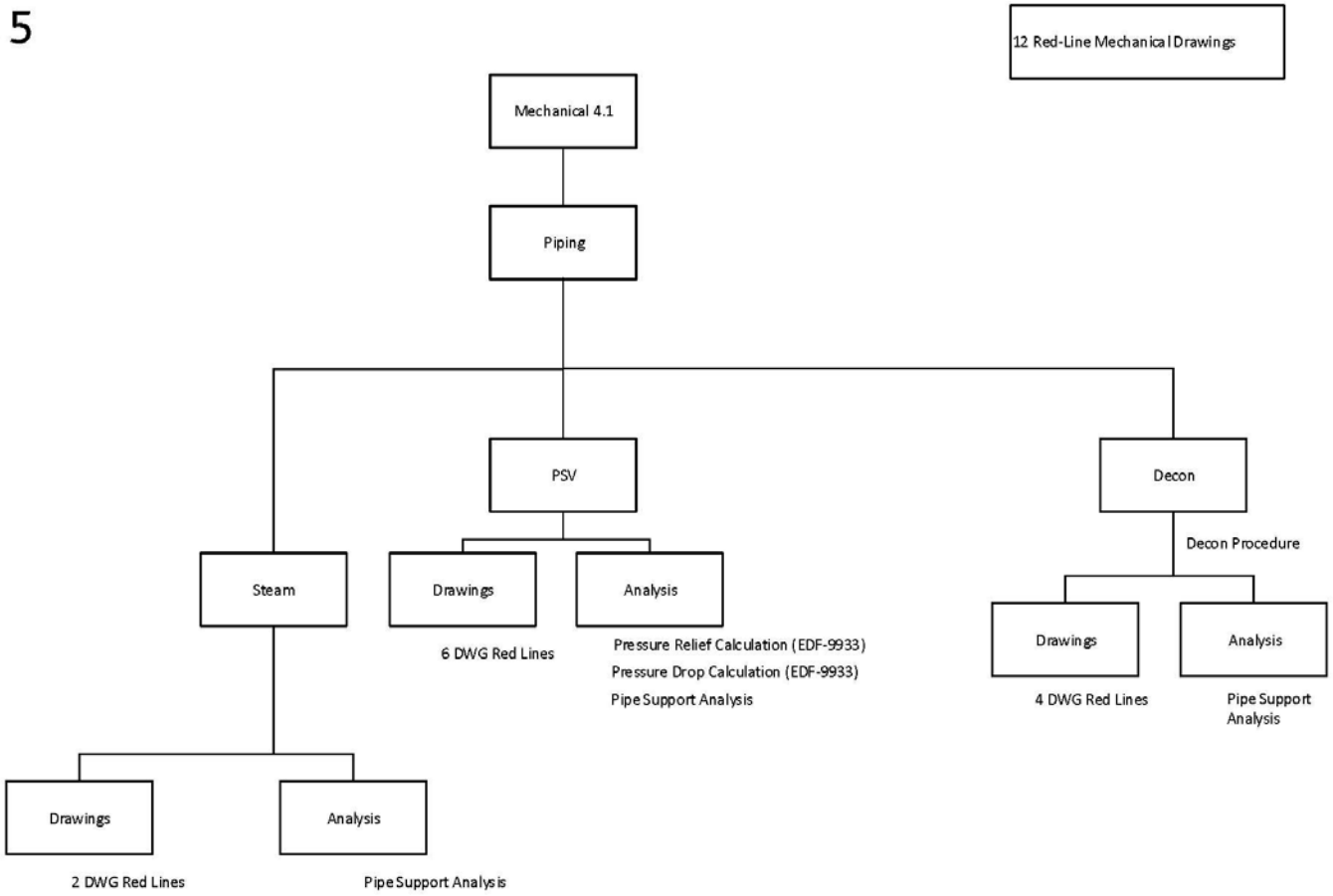
8 Mechanical Red-line Drawings
6 New Mechanical Drawings
2 New Architectural Drawings
12 New Electrical Drawings
5 Electrical Red-line Drawings



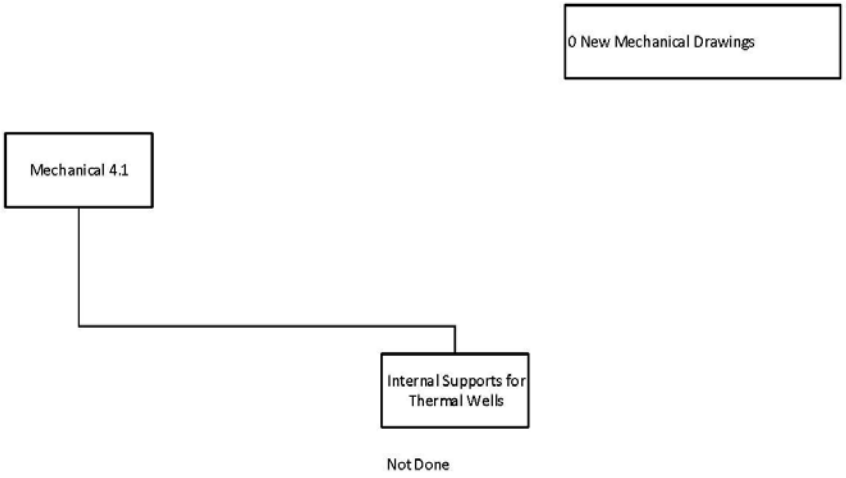
Sheet 4


9 New Mechanical Drawings
Mechanical 4.1
803279 (Red Line) (This DWG is accounted for on Page 3)
Ongoing Support Analysis
Supporting Analysis
Nozzles
Drawings
3 New Drawings
Analysis
Nozzle Optimization Calculation
Nozzle and Cone integration Optimization
Cone
Drawings
6 New Drawings
Analysis
NETL CFD for Cone Optimization,
NETL CFD Fluidization for each design concept
Thermal Stress Calculation (EDF-11033)
Static/Dynamic Load Calculations (EDF-11033)
Pressure Vessel
ASME Evaluation (EDF-11033, EDF-11051)

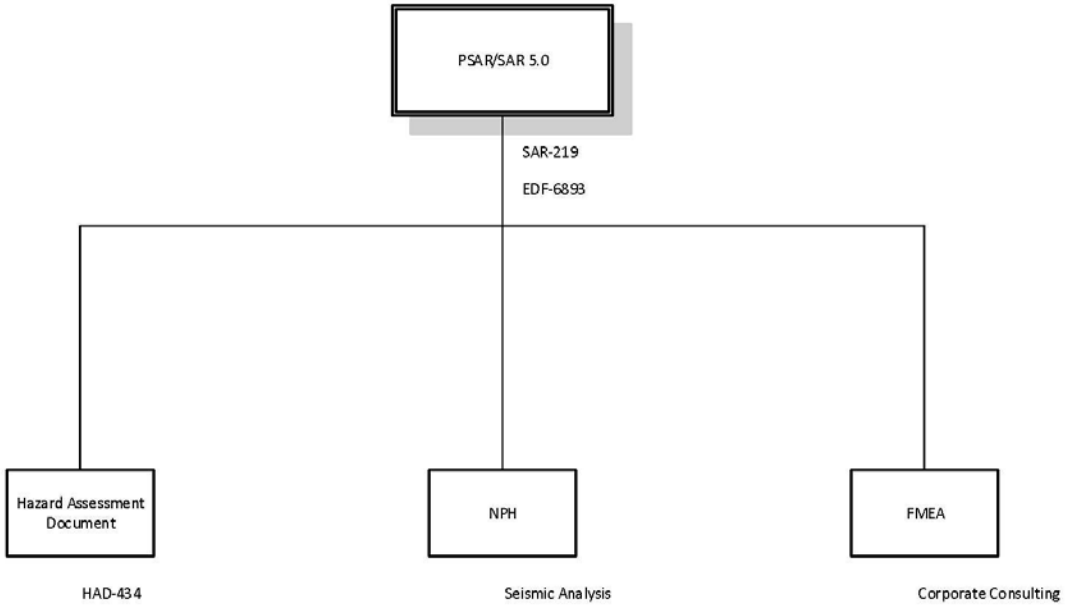
Sheet 5


12 Red-Line Mechanical Drawings
Mechanical 4.1
Piping
PSV
Decon
Steam
Drawings
Analysis
6 DWG Red Lines
Pressure Relief Calculation (EDF-9933)
Pressure Drop Calculation (EDF-9933)
Pipe Support Analysis
Decon Procedure
Drawings
Analysis
4 DWG Red Lines
Pipe Support Analysis
Drawings
Analysis
2 DWG Red Lines
Pipe Support Analysis

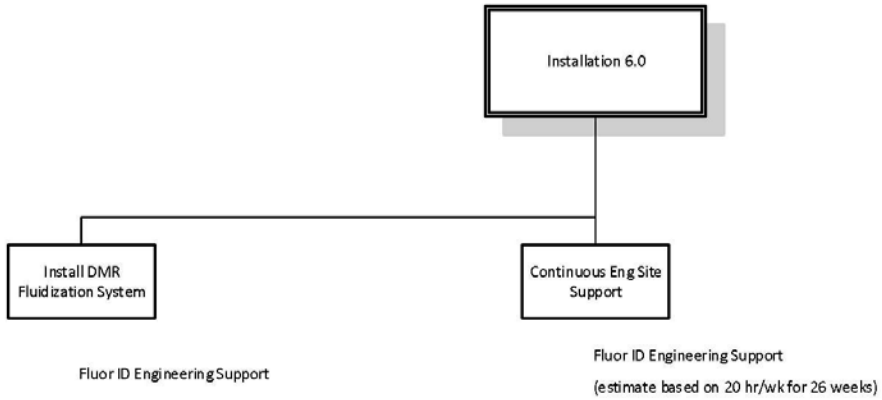
Sheet 6


0 New Mechanical Drawings
Mechanical 4.1
Internal Supports for Thermal Wells
Not Done

Sheet 7

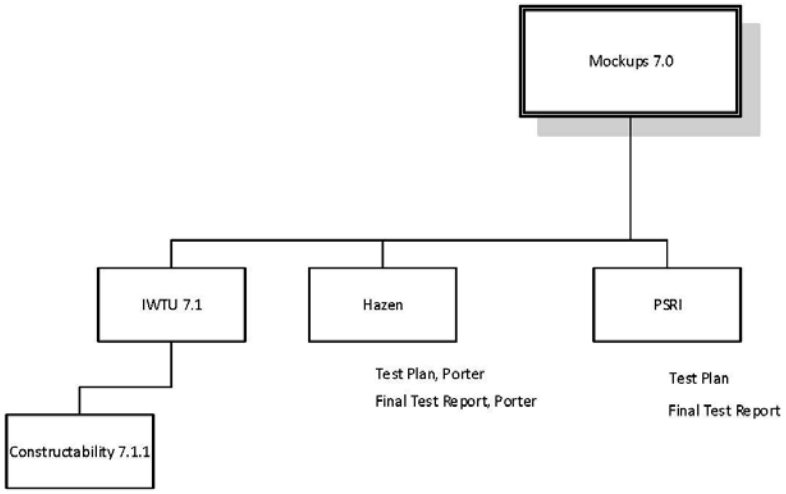

PSAR/SAR 5.0
SAR-219
EDF-6893
Hazard Assessment Document
NPH
FMEA
HAD-434
Seismic Analysis
Corporate Consulting

Sheet 8


Installation 6.0
Install DMR Fluidization System
Continuous Eng Site Support
Fluor ID Engineering Support
Fluor ID Engineering Support
(estimate based on 20 hr/wk for 26 weeks)

Sheet 9

4 New Mechanical Drawings
4 New Mechanical Sketches
1 New Electrical Drawing



Animation, Price (4 Animation Sketches)

Work Control, W.O. 525897

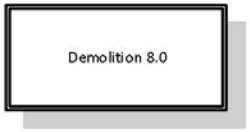
Mockup Location

Support Equipment (4 new mechanical DWG, 1 New Electrical)

Constructability Final Report

Tooling Development

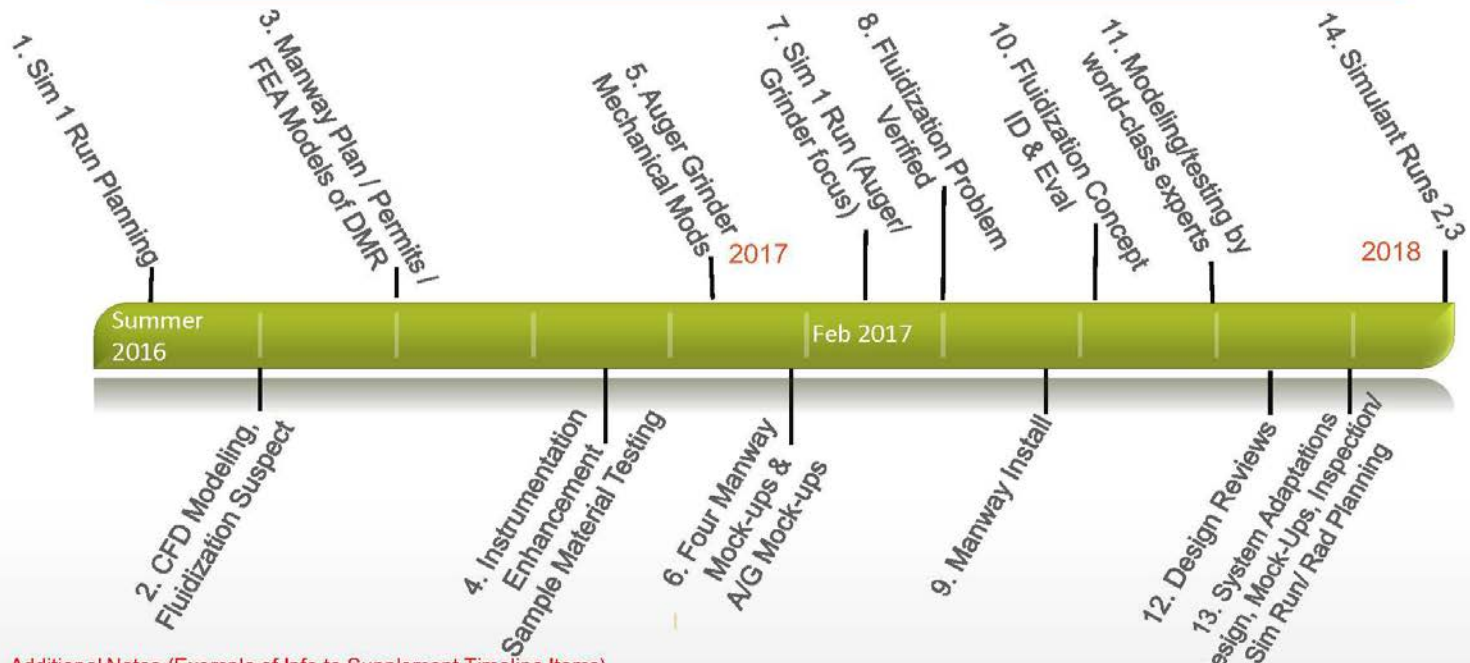
Sheet 10



Appendix B

DMR Modifications Timeline

Review of IWTU DMR Modifications Process (FLUOR)



Additional Notes (Example of Info to Supplement Timeline Items)

1.1 Ring Header Replacement Planning, Leading to Plan for Manway Addition
1.2 Fluidization Effectiveness Deemed Suspect
1.3 Heated Purges and CO2 Introduction (Auger-Grinder Report) to Address Cementitious Material Formation
1.4 Fluidization Gas Heater Design, Selection, Infrastructure Mods to Support

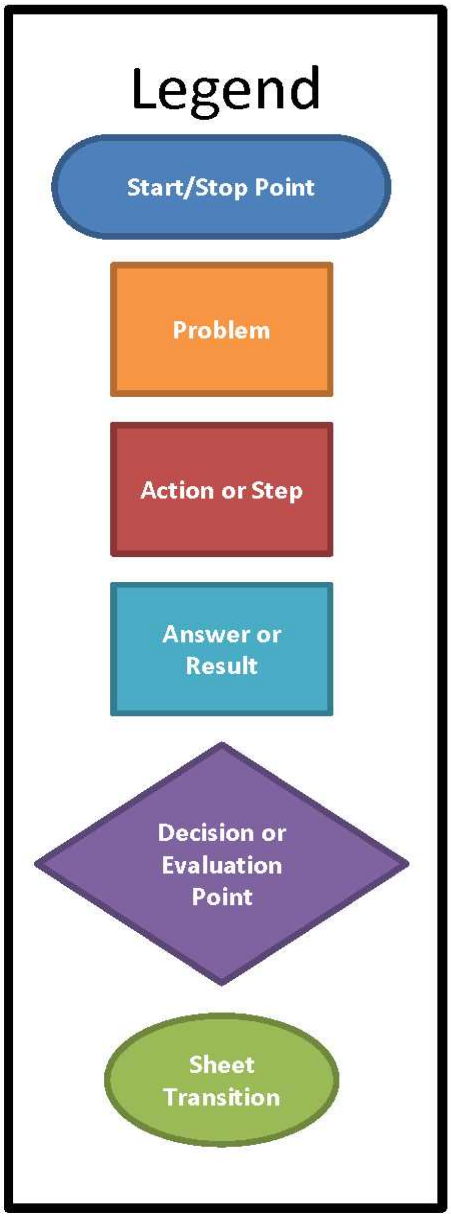
10.1 Teams worked to identify 23 potential alternative fluidization improvement approaches (concepts)
10.2 Decision methodology employed to select 3 best concepts (1.4, 2.2, 2.3)
10.3 Hazen, PSRI, NETL and WALSH engaged for cold testing, fluidization modeling, hot testing, and structural/thermal analysis.
10.4 Independent decision methodology and outside experts select the same preferred solution (2.3, Double Plenum)

January, 2018

Appendix C

DMR Modifications Flowchart

DMR Modifications Flowchart



Starting Points

Sheet 2

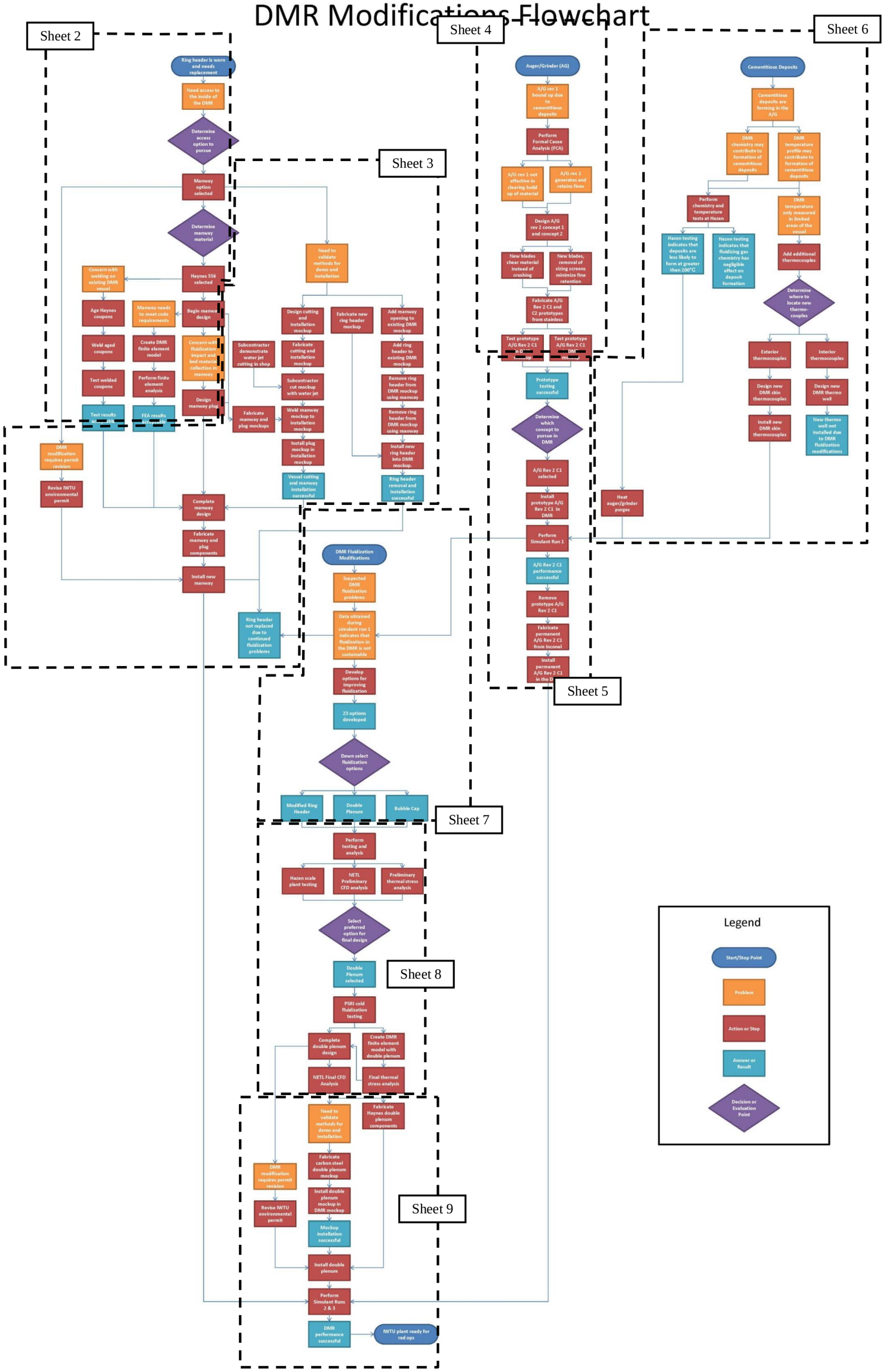
Sheet 4

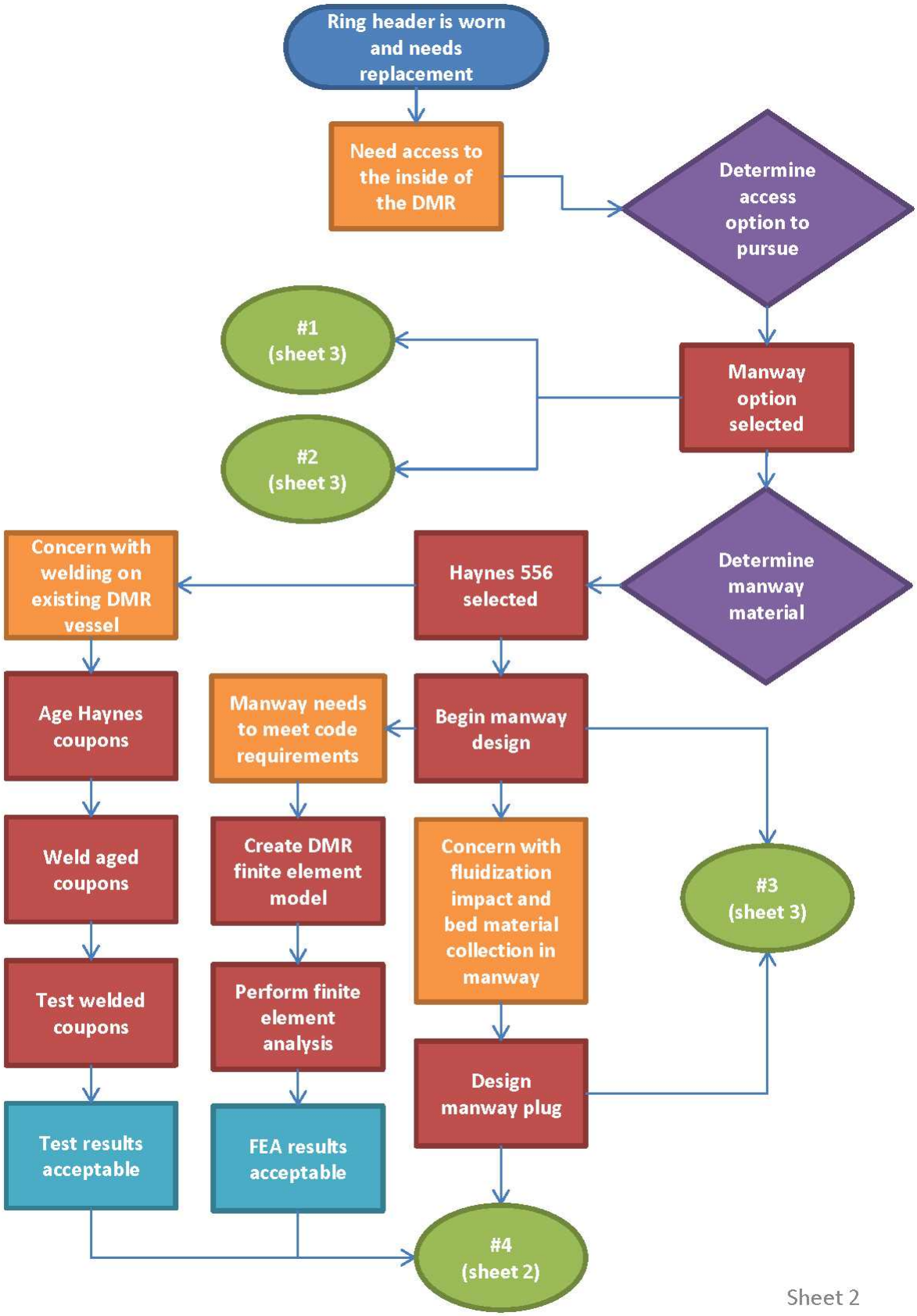
Sheet 5

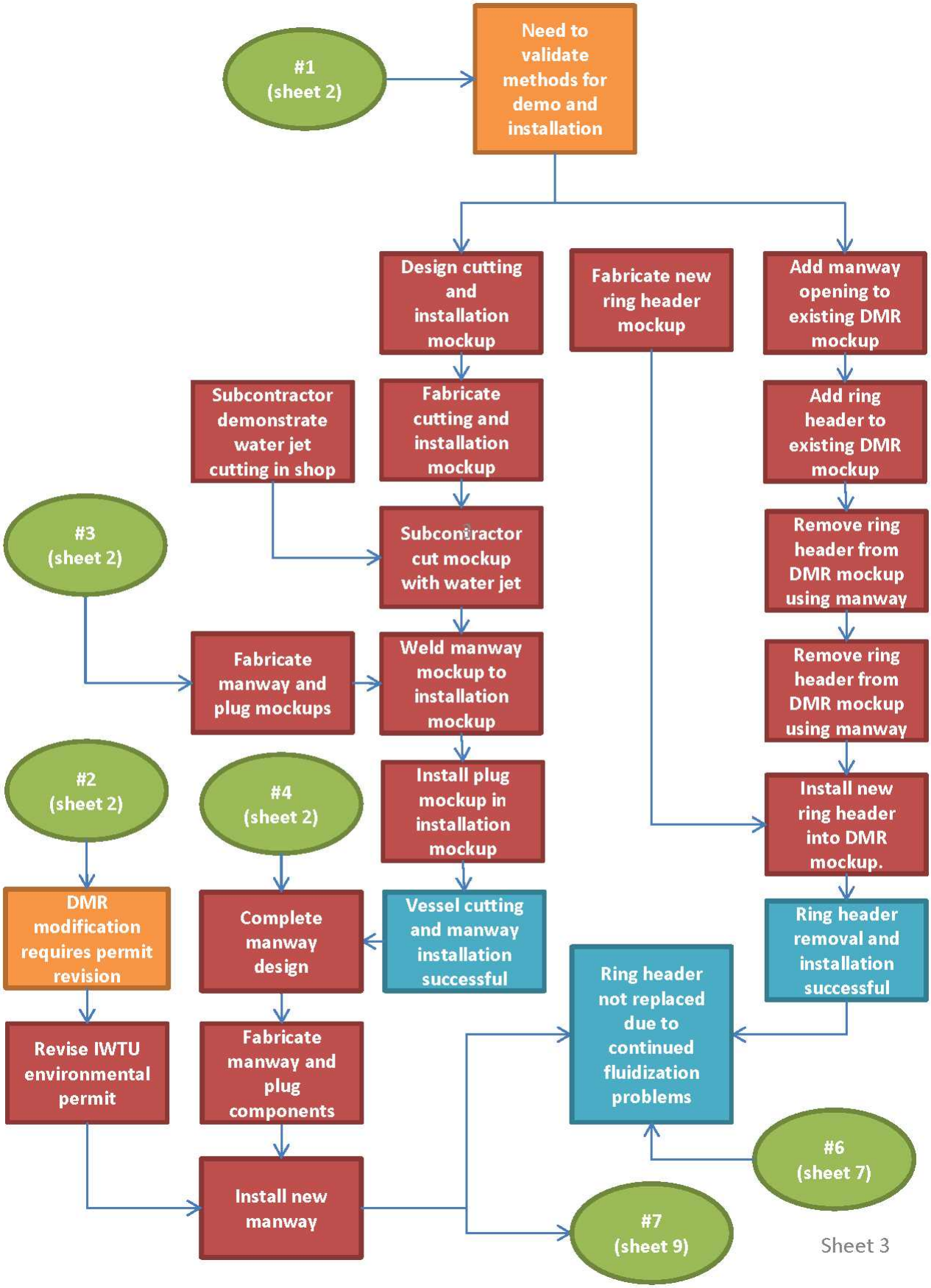
Sheet 7

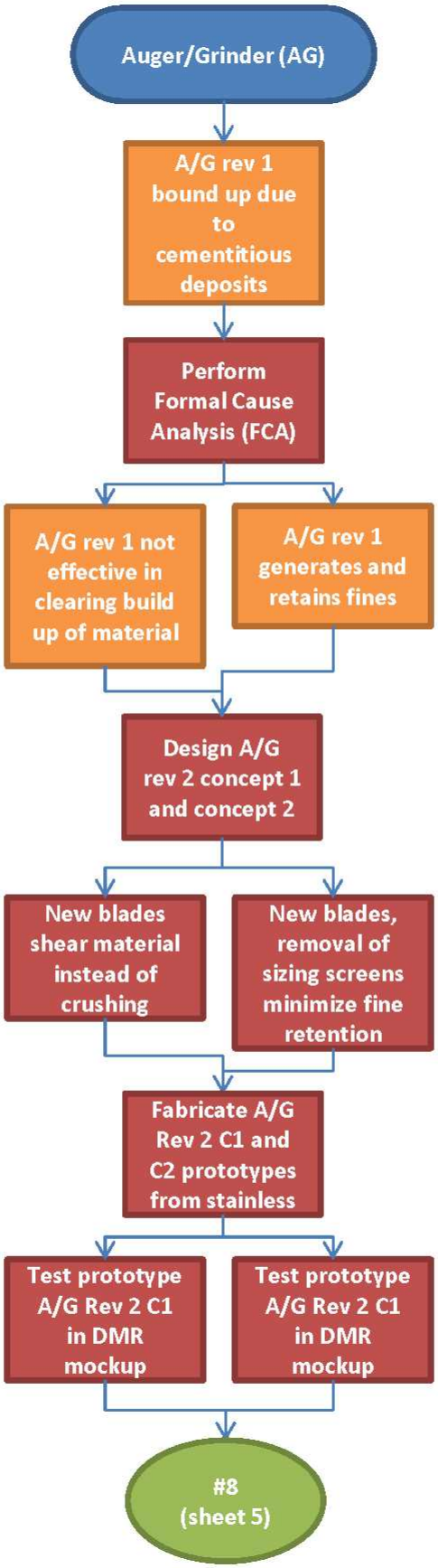
Sheet 1

DMR Modifications Flowchart

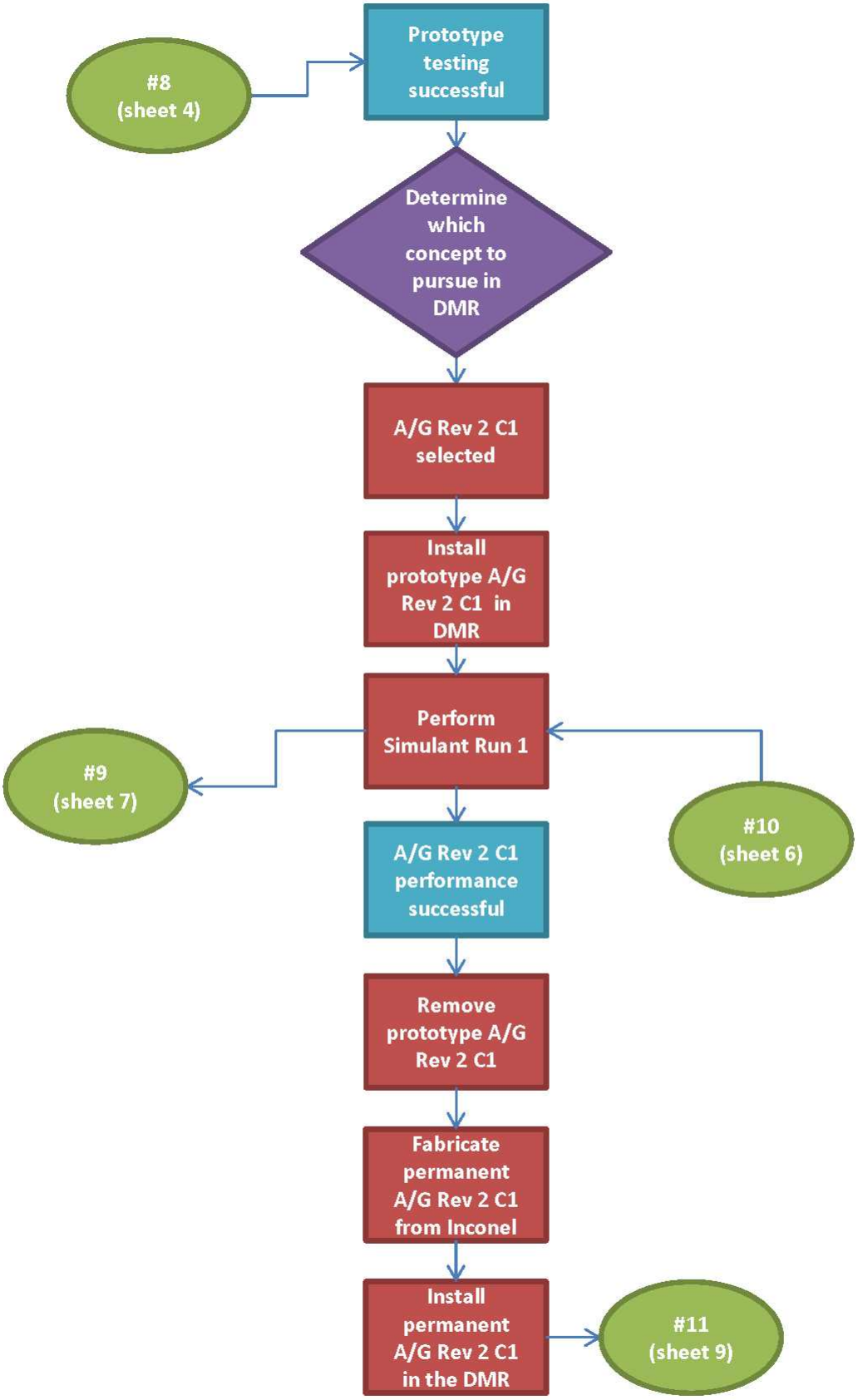



Ring header is worn and needs replacement
Need access to the inside of the DMR
Determine access option to pursue
#1 (sheet 3)
#2 (sheet 3)
Manway option selected
Determine manway material
Concern with welding on existing DMR vessel
Haynes 556 selected
Age Haynes coupons
Manway needs to meet code requirements
Begin manway design
Weld aged coupons
Create DMR finite element model
Concern with fluidization impact and bed material collection in manway
#3 (sheet 3)
Test welded coupons
Perform finite element analysis
Design manway plug
Test results acceptable
FEA results acceptable
#4 (sheet 2)
Sheet 2

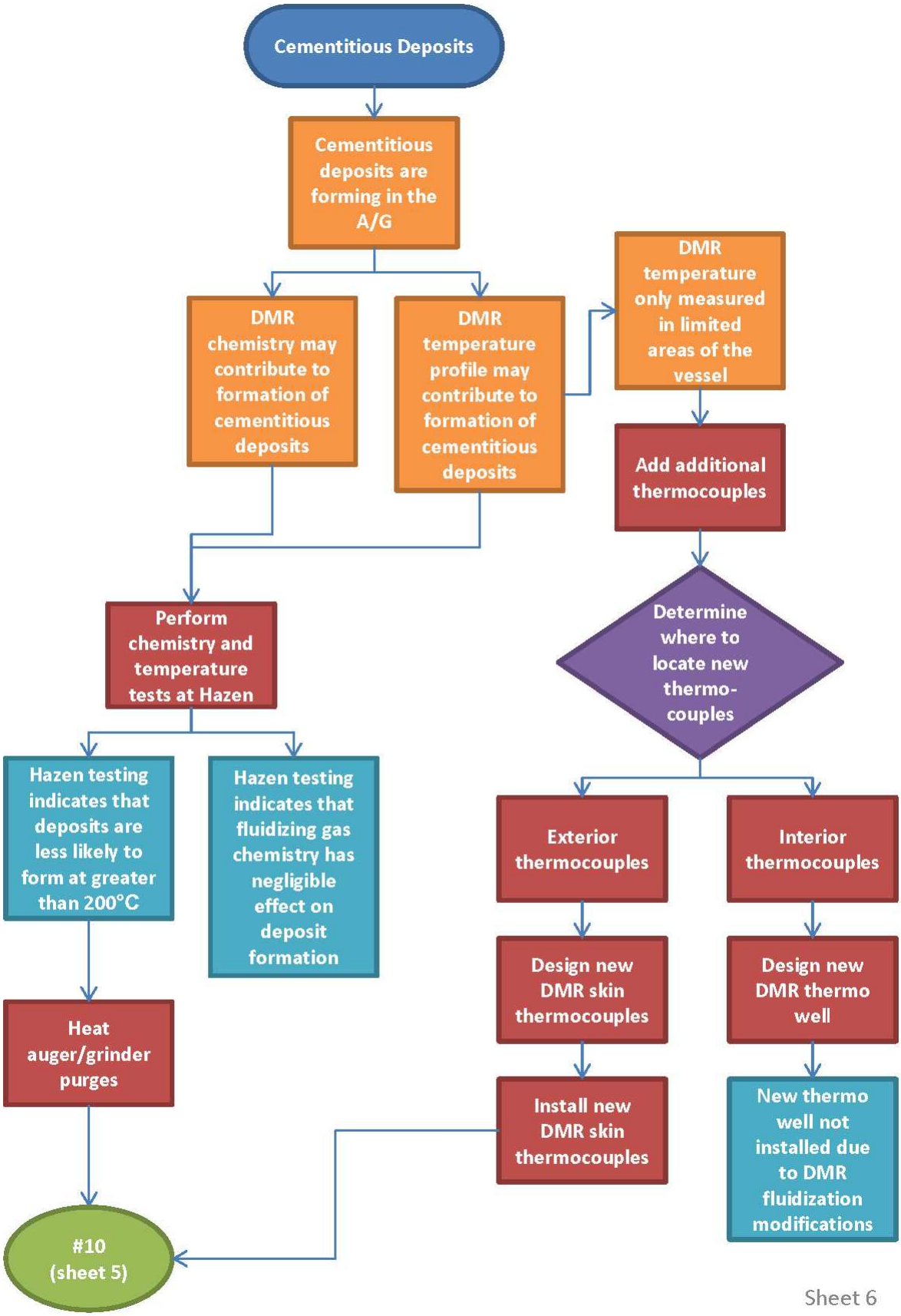

#1
(sheet 2)
Need to validate methods for demo and installation
Design cutting and installation mockup
Fabricate new ring header mockup
Add manway opening to existing DMR mockup
Subcontractor demonstrate water jet cutting in shop
Fabricate cutting and installation mockup
Add ring header to existing DMR mockup
#3
(sheet 2)
Subcontractor cut mockup with water jet
Remove ring header from DMR mockup using manway
Fabricate manway and plug mockups
Weld manway mockup to installation mockup
Remove ring header from DMR mockup using manway
#2
(sheet 2)
#4
(sheet 2)
Install plug mockup in installation mockup
Install new ring header into DMR mockup.
DMR modification requires permit revision
Complete manway design
Vessel cutting and manway installation successful
Ring header removal and installation successful
Ring header not replaced due to continued fluidization problems
Revise IWTU environmental permit
Fabricate manway and plug components
#6
(sheet 7)
Install new manway
#7
(sheet 9)
Sheet 3

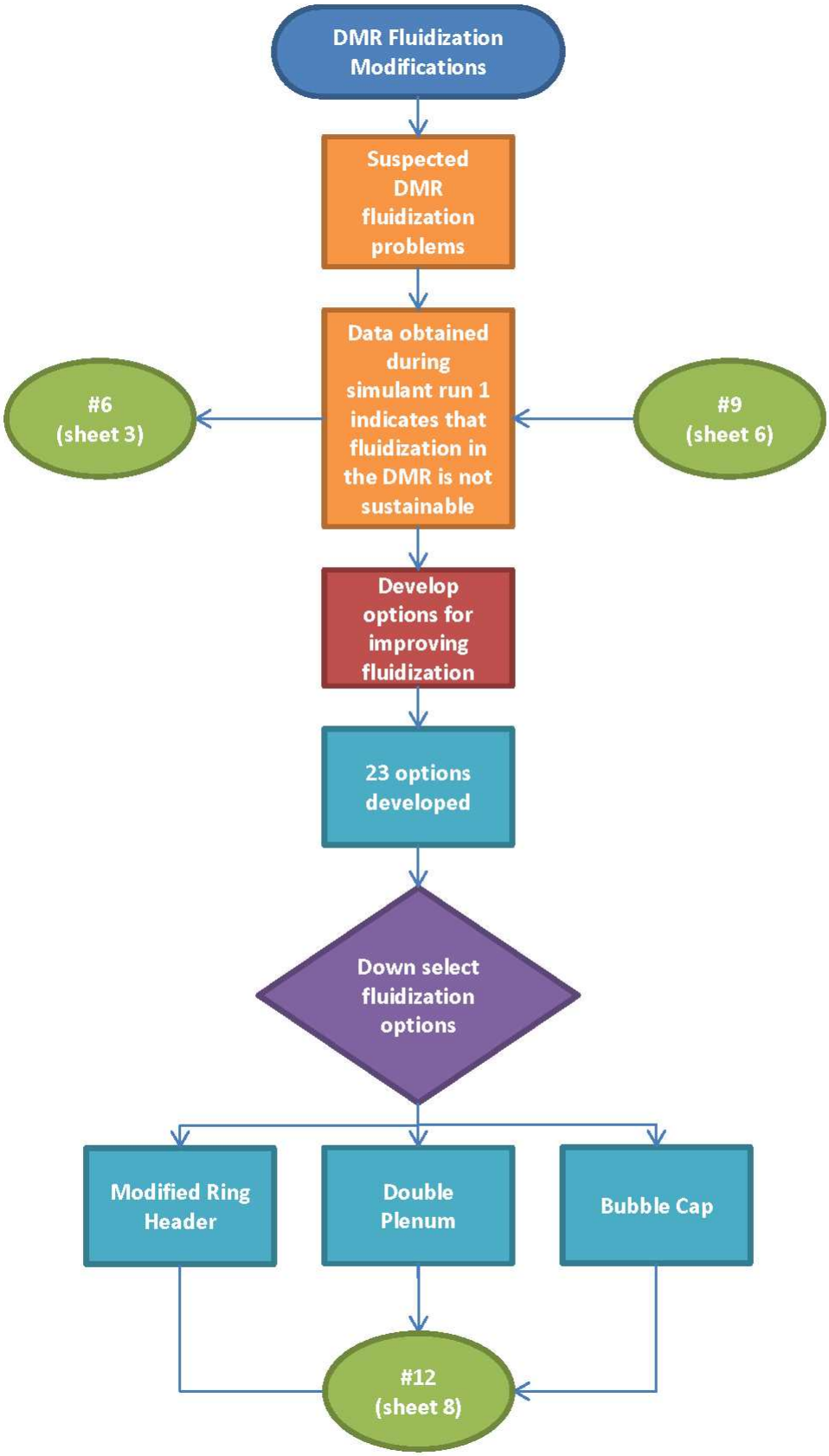

Auger/Grinder (AG)
A/G rev 1 bound up due to cementitious deposits
Perform Formal Cause Analysis (FCA)
A/G rev 1 not effective in clearing build up of material
A/G rev 1 generates and retains fines
Design A/G rev 2 concept 1 and concept 2
New blades shear material instead of crushing
New blades, removal of sizing screens minimize fine retention
Fabricate A/G Rev 2 C1 and C2 prototypes from stainless
Test prototype A/G Rev 2 C1 in DMR mockup
Test prototype A/G Rev 2 C1 in DMR mockup
#8 (sheet 5)

Sheet 4

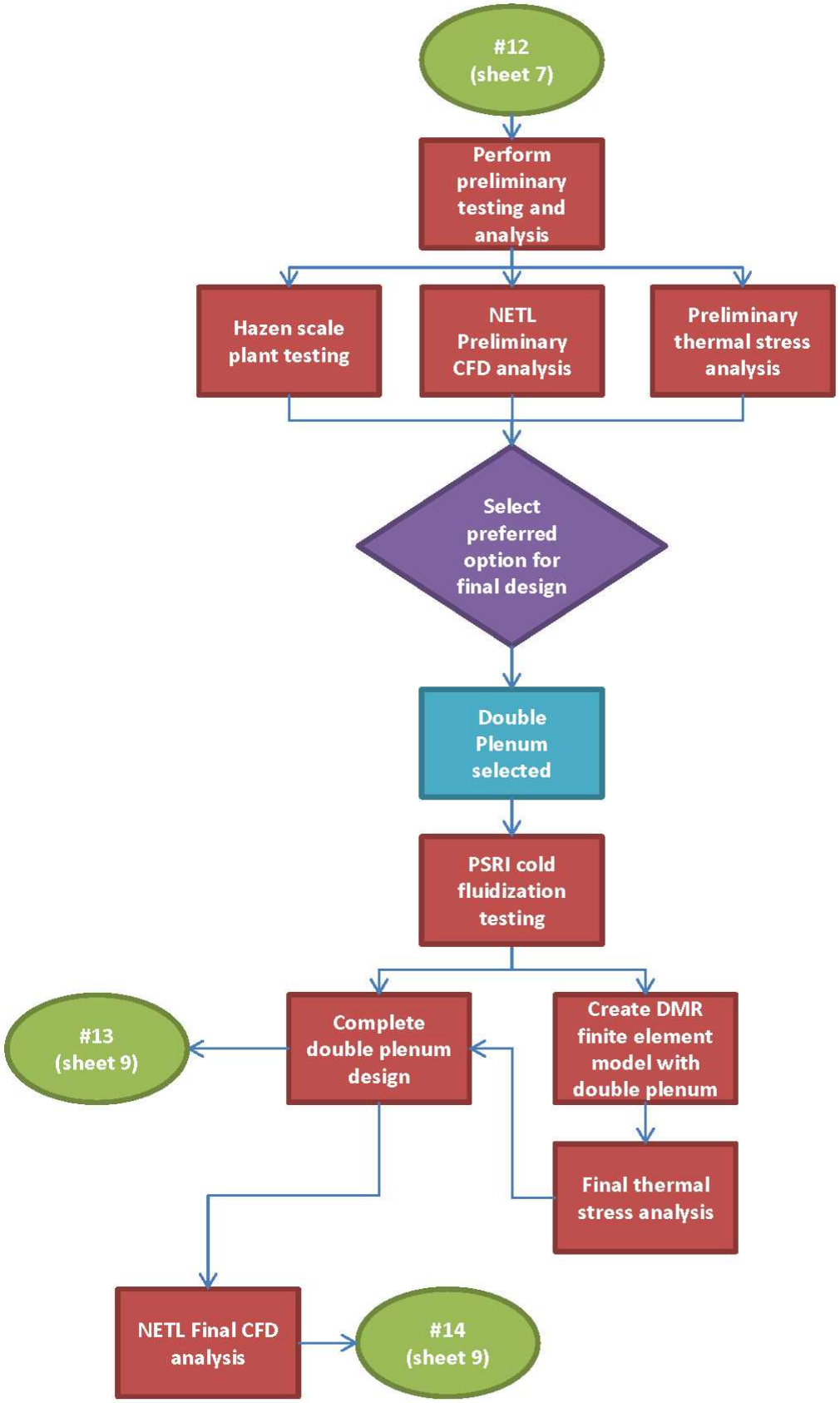

#8
(sheet 4)
Prototype testing successful
Determine which concept to pursue in DMR
A/G Rev 2 C1 selected
Install prototype A/G Rev 2 C1 in DMR
Perform Simulant Run 1
#9
(sheet 7)
#10
(sheet 6)
A/G Rev 2 C1 performance successful
Remove prototype A/G Rev 2 C1
Fabricate permanent A/G Rev 2 C1 from Inconel
Install permanent A/G Rev 2 C1 in the DMR
#11
(sheet 9)

Sheet 5

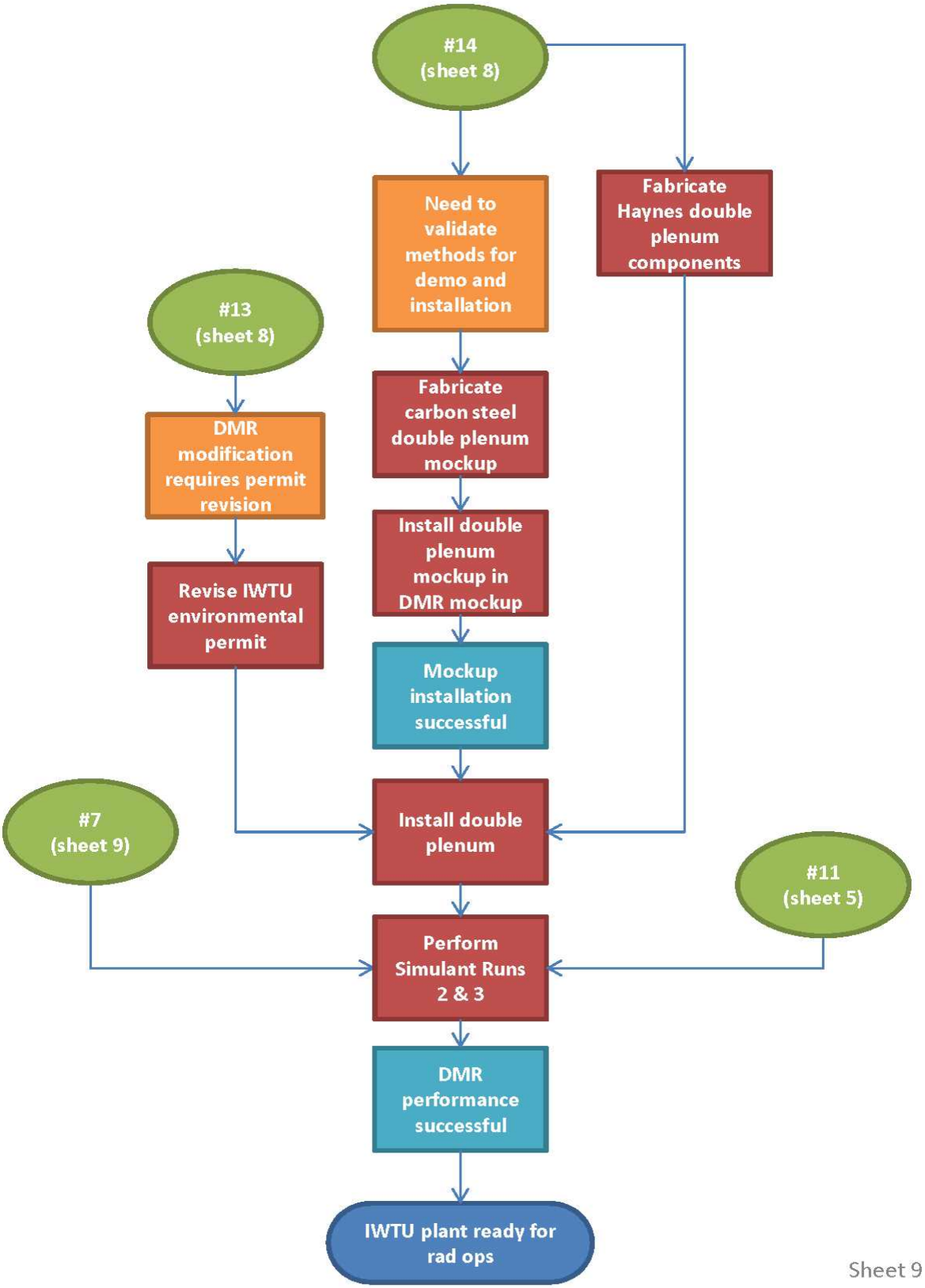

Cementitious Deposits
Cementitious deposits are forming in the A/G
DMR chemistry may contribute to formation of cementitious deposits
DMR temperature profile may contribute to formation of cementitious deposits
DMR temperature only measured in limited areas of the vessel
Add additional thermocouples
Determine where to locate new thermo-couples
Perform chemistry and temperature tests at Hazen
Hazen testing indicates that deposits are less likely to form at greater than 200°C
Hazen testing indicates that fluidizing gas chemistry has negligible effect on deposit formation
Heat auger/grinder purges
#10 (sheet 5)
Exterior thermocouples
Interior thermocouples
Design new DMR skin thermocouples
Design new DMR thermo well
Install new DMR skin thermocouples
New thermo well not installed due to DMR fluidization modifications
Sheet 6


DMR Fluidization Modifications
Suspected DMR fluidization problems
Data obtained during simulant run 1 indicates that fluidization in the DMR is not sustainable
#6 (sheet 3)
#9 (sheet 6)
Develop options for improving fluidization
23 options developed
Down select fluidization options
Modified Ring Header
Double Plenum
Bubble Cap
#12 (sheet 8)

Sheet 7


#12
(sheet 7)
Perform preliminary testing and analysis
Hazen scale plant testing
NETL Preliminary CFD analysis
Preliminary thermal stress analysis
Select preferred option for final design
Double Plenum selected
PSRI cold fluidization testing
#13
(sheet 9)
Complete double plenum design
Create DMR finite element model with double plenum
Final thermal stress analysis
NETL Final CFD analysis
#14
(sheet 9)

Sheet 8


#14
(sheet 8)
Need to validate methods for demo and installation
Fabricate Haynes double plenum components
#13
(sheet 8)
DMR modification requires permit revision
Fabricate carbon steel double plenum mockup
Install double plenum mockup in DMR mockup
Revise IWTU environmental permit
Mockup installation successful
#7
(sheet 9)
Install double plenum
#11
(sheet 5)
Perform Simulant Runs 2 & 3
DMR performance successful
IWTU plant ready for rad ops

Sheet 9