

# **DOE-STD-1189 and IWTU**

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# Introduction

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Using an integrated approach for the early identification of appropriate and reasonably conservative safety structures, systems, and components (SSCs) has minimized the potential for significant cost and schedule impacts from changing system design requirements late in the Integrated Waste Treatment Unit (IWTU) project life cycle.

# IWTU Process Background

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- ◆ IWTU uses existing steam reforming technology to treat approximately 900,000 gal of radioactive liquid waste containing nitric acid and mercury
- ◆ The end product is highly stable radioactive granules
- ◆ Conceptual design started 2005
- ◆ Critical Decision (CD)-2 Submitted May 2006
- ◆ CD-3 Submitted June 2007
- ◆ Treatment to start Late 2009 or early 2010
- ◆ Project completed 2011 (18 month cycle)

# Significant Hazards

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- ◆ High Radiation Fields (Product Solids)
- ◆ Nitric Acid (Liquids)
- ◆ Mercury (Liquids, Off-gas, GAC)
- ◆ Hydrogen (Off-gas to CRR)
- ◆ Extreme Temperatures (DMR, CRR, Off-gases)

# IWTU Safety Analysis Background

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- ◆ Idaho Cleanup Project (ICP) contract awarded to CH2M-WG Idaho (CWI), April 2005
- ◆ Nuclear Safety involved at CD-1, April 2005
- ◆ Approval of preliminary hazard analysis, Sept 2005
- ◆ Preliminary Documented Safety Analysis (PDSA) approved prior to draft DOE-STD-1189 and DOE O 413.3A
- ◆ PDSA approved with CD-2 package, May 2006
- ◆ Revised PDSA approved with CD-3 package, June 2007
- ◆ PDSA revision planned for Nov 2007
- ◆ DSA and TSRs to be submitted June 2008

# IWTU Control Strategy

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- ◆ **Per STD-1189, consideration of defense in depth included the following:**
  - Choosing an appropriate site
  - Minimizing the quantity of material at risk
  - Applying conservative design margins and quality assurance
  - Using successive physical barriers for protection against radioactive releases
  - Using multiple means to ensure critical safety functions needed to:
    - control processes,
    - maintain processes in safe status, and
    - confine and mitigate the potential for accidents with radiological releases
- ◆ **STD-1189 hierarchy of controls philosophy used**
  - Passive over active
  - Preventive over mitigative
  - Engineered over administrative

# STD 1189/IWTU Comparison

DOE STD 1189 Deliverable Requirements	IWTU Deliverables
CD-0 Approve Mission Need (Conceptual Design)	
Perform pre-conceptual planning activities	Assessment of the SBW Treatment and Disposition Alternatives Decoupled from the Calcine Treatment – INEEL/EXT-02-00265 – February 2002
Prepare Mission Needs Statement	Mission Needs Statement - DOE/NE-ID-11193 Sept 2004
Develop ROM estimates for MAR and release consequences	Idaho HLW and Facilities Disposition FEIS – DOE/EIS-0287 – September 2002
Develop tailoring strategy Safety-in-Design	Not currently required
Develop an DOE approved Safety Basis Strategy	Not currently required

# STD 1189/IWTU Comparison

DOE STD 1189 Deliverable Requirements	IWTU Deliverables
<b>CD-1 Approve Alternative Selection and Cost Range (Preliminary Design)</b>	
Establish Integrated Project Team and SDIT	IPT Charter - 9-15-05
Develop design/process alternatives analyses	Conceptual Design Report - ICP/EXT-05-00908 – July 2005
Update Safety Basis Strategy	Not currently required
Perform Preliminary Project Execution Plan	Preliminary Project Execution Plan – PLN-1963 – June 2005
Incorporate safety controls into design	Preliminary Hazards Analysis for the IWTU – 28276-26-001 July 2005
Prepare Conceptual Safety Design Report	Hazards Assessment Document for the IWTU – HAD-359 – September 2005, Radioactive Inventories for the IWTU Process – EDF-6137 – August 2005, Fire Hazard Analysis Title 1 Design – 28276-15-0002 – September 2005
DOE prepare Conceptual Safety Validation Report	DOE-ID Concurrence with the IWTU Preliminary Hazards Characterization – CCN-301042 – September 2005
Prepare PHA (< Hazard Category 3 facilities) DOE approval	N/A

# STD 1189/IWTU Comparison

DOE STD 1189 Deliverable Requirements	IWTU Deliverables
<b>CD-2 Approve Performance Baseline (Final Design)</b>	
Prepare Hazards Analysis Report	Hazard and Operability (HAZOP) Review for the IWTU – EDF-6796 – March 2006
Update Safety Basis Strategy	Not currently required
Revise design to incorporate definitive safety controls	Preliminary Safety Classification for the IWTU Equipment – EDF-6152 – February 2006, IWTU CD-2 Formal Design Review – May 2006
Prepare Preliminary Design Report	Technical and Functional Requirements for the IWTU – March 2006, Design Basis Document – DB-22-001 – May 2006
Prepare Preliminary Safety Design Report	Preliminary Safety Analysis Report for the IWTU – SAR-219 – May 2006
DOE prepare Preliminary Safety Validation Report	Safety Evaluation Report for SAR-219 – May 2006
Establish Performance Baseline	Approve Performance Baseline (CD-2) and the Associated Baseline Change Proposal, Long Lead Procurements and Site Preparation (CD-3B), and the Project Execution Plan for the Sodium Bearing Waste Treatment Project – December 2006

# STD 1189/IWTU Comparison

DOE STD 1189 Deliverable Requirements	IWTU Deliverables
<b>CD-3 Approve Start of Construction</b>	
Prepare Final Design Report	Complete the IWTU CD-3 Formal Design Review
Revise Hazards Analysis if required	Update the Hazard and Operability (HAZOP) Review for the IWTU – EDF-6796
Update Safety Basis Strategy if required	Not currently required
Prepare Preliminary Documented Safety Analysis	Completed at CD-2 for Long Lead Procurements
DOE prepare Safety Evaluation Report	Completed at CD-2 for Long Lead Procurements
Update Hazards Analysis Report (< Hazard Category 3 facilities)	N/A

# STD 1189/IWTU Comparison

DOE STD 1189 Deliverable Requirements	IWTU Deliverables
<b>CD-4 Approve Start of Operations or Project Closeout</b>	
Issue Checkout, Testing and Commissioning Plan	Update the Test Plan for the Sodium-Bearing Waste Treatment Facility System Turnover, Acceptance Criteria and Start-up – PLN-2020
Issue Transition to Operations Plan	Update the Operations Plan that is being written for CD-3
Complete Readiness Assessment or Operational Readiness Review	Complete CD-4 per DOE O 413.3A
Finalize Hazard Analysis Report	Complete the CHAP review final
Prepare DSA and TSR	Complete the Final SAR-219
DOE prepare SER	DOE complete the final SER

# Agency Interactions

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- ◆ **Frequent interactions with DOE-HQ, DOE-ID, and DNFSB**
  - Define control strategy
  - Define appropriate seismic design criteria
  - Define applicability of DOE and ANSI standards (e.g. ISA-84.00.01)
  - Define appropriate consequence analysis methods
  - Approvals or reviews of three revisions to the PDSA

# Application of DOE Facility Safety Requirements

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- ◆ **Design compliance with DOE O 420.1A and B requirements demonstrated in the PDSA and its revisions**
- ◆ **IWTU designed in accordance with DOE seismic performance criteria (PC) rather than ANSI/ANS 2.26 seismic design categories (SDCs)**

# Summary of Results

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- ◆ Safety was integrated in to the IWTU design
- ◆ Design basis accident calculations performed early in design
- ◆ Appropriate and reasonably conservative safety structures, systems, and components were selected early in IWTU design
- ◆ Safety disciplines were involved as soon as possible in hazard analysis, control selection, and design
- ◆ The control strategy of STD-1189 was used in design and safety system identification
- ◆ Agency involvement throughout design ensured agreement on the safety strategy
- ◆ DOE facility safety requirements integrated in design
- ◆ Multiple HAZOPs and revisions to PDSA to reflect design changes and receive agency approval of controls

# **DOE-STD-1189 and the Remote Waste Disposition Project (RWDP)**

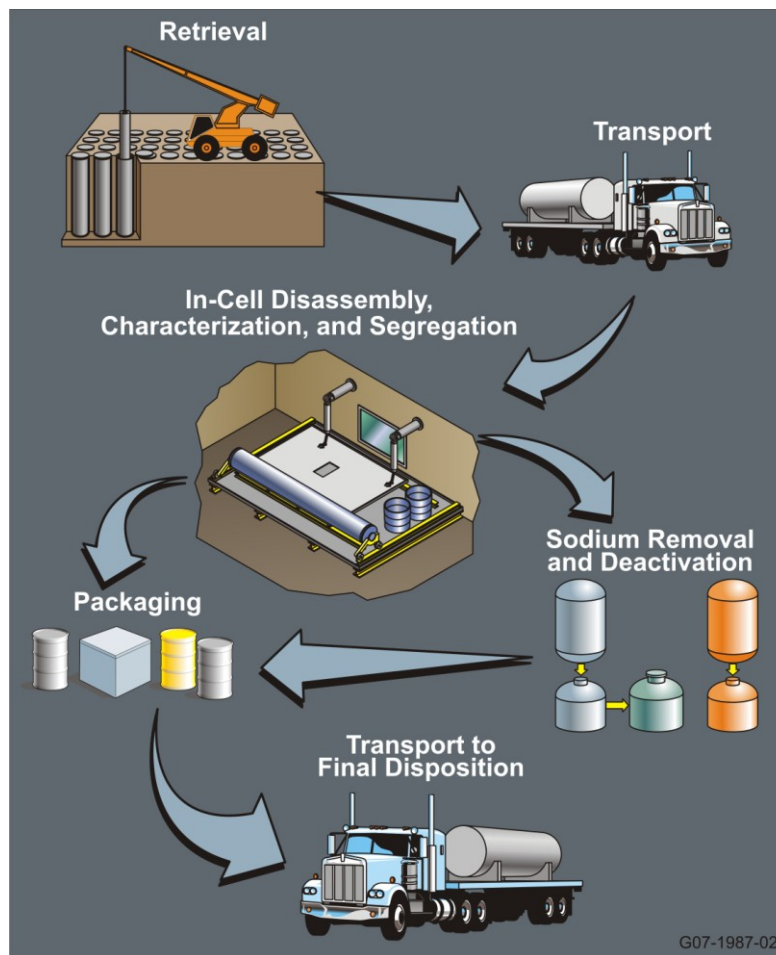


# RWDP Overview

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- Remote handled waste currently stored at **the Materials and Fuels Complex (MFC)** and **Radioactive Waste Management Complex (RWMC)** facilities must be **retrieved** and repackaged for final disposition.
- The mission of the RWDP is to transfer, **disassemble**, segregate, characterize, treat, repackage, and ship over 300 cubic meters for final disposal.

# RWDP Overview



# RWDP Safety Design Strategy

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## Three Main Attributes (DOE-STD-1189-DRAFT)

### 1. Guiding Philosophies/Assumptions to be **U**sed for Design

#### ◆ Consolidated Hazard Analysis Process (CHAPs)

- A formal analysis of process hazards for every phase of the project from design to operations (can also be applied through decommissioning)

### 2. Safety-in-Design / Safety Goals

#### ◆ Preliminary Hazard Categorization – **Haz Cat 2**

#### ◆ Commit to DOE O 420.1B – **CWI Contract Commitment**

#### ◆ High Cost Design Attributes / Project Risk

- Derive a seismic design criteria
- Identify Safety Significant/Class Structures, Systems, and Components (SSCs)

### 3. Overall Safety Basis Approach

#### ◆ RWDP Safety Basis Documents (CHAPs, PSDR, PDSA, DSA/TSR)

# RWDP 1189 Crosswalk

DOE STD-1189 Deliverable Requirements	RWDP Deliverables
<b>CD-0 Approve Mission Need (Pre-conceptual/Conceptual Design) - BEA</b>	<b>Completed December 14, 2000 (BEA)</b>
Perform Pre-conceptual Planning Activities	
Prepare Mission Need Statement	
Develop Estimates for Material at Risk (MAR) and Release Consequences	
Develop Safety Design Strategy	
<b>CD-1 Approve Alternative Selection and Cost Range (Preliminary Design) - BEA</b>	<b>Completed December 21, 2004 (BEA)</b>
Establish Integrated Project Team	
Develop Design/Process Alternatives	
Develop Project Execution Plan	
Prepare Conceptual Safety Design Report	
Prepare Conceptual Safety Validation Report	
Prepare Preliminary Hazards Analysis	

# RWDP 1189 Crosswalk - cont

DOE STD-1189 Deliverable Requirements	RWDP Deliverables
<b>CD-2 Approve Performance Baseline (Final Design)</b>	<b>Expected CD-2 Package Submittal to DOE – April 30, 2008</b>
Revise Hazards Analysis Report	<a href="#">Revised CHAP Report (to include Cask Design/Transport) – Submit to DOE February 29, 2008</a>
Update Safety Design Strategy (SDS)	Refer to PEP (Safety Basis Strategy)
Update Project Execution Plan (PEP)	<a href="#">Revised PEP</a>
Prepare Preliminary Design Report	<a href="#">CD-2 Design Review (Team Member)</a>
Prepare Preliminary Safety Design Report (PSDR)	<a href="#">Preliminary Safety Design Report (PSDR) – Submit to DOE March 31, 2008</a>
Prepare Safety Validation Report (SVR) for the PSDR	<a href="#">DOE Approval of the PSDR</a>
Establish Performance Baseline	<a href="#">DOE Approval - Performance Baseline (CD-2)</a>
<b>Commence FDP Cell Prep (D&amp;D)</b>	

# RWDP 1189 Crosswalk - cont

DOE STD-1189 Deliverable Requirements	RWDP Deliverables
<b>CD-3 Approve Start of Construction</b>	<b>Expected CD-3 Package Submittal to DOE – January 30, 2009</b>
Prepare Final Design Report	<a href="#">CD-3 Design Review (Team Member)</a>
Update Hazards Analysis Report	<a href="#">Updated CHAP Report</a>
Update Safety Design Strategy	Not required (Safety Basis Strategy)
Prepare Preliminary Documented Safety Analysis (PDSA)	<a href="#">Preliminary Documented Safety Analysis (PDSA; SAR-XXX) – November 2008</a>
	<a href="#">Preliminary Transport Plan (PLN-XXX) – November 2008</a>
Prepare Safety Evaluation Report (SER)	<a href="#">DOE Approval - SER for SAR-XXX (PDSA) – December 2008</a>
<b>Commence Construction</b>	<b>November 2009</b>

# RWDP 1189 Crosswalk - cont

DOE STD-1189 Deliverable Requirements	RWDP Deliverables
<b>CD-4 Approve Start of Operations</b>	<b>Expected CD-4 Package Submittal to DOE – September 30, 2011</b>
Issue Checkout, Testing and Commissioning Plan	Test Plan
Issue Transition to Operations Plan	Transition Plan
Complete Readiness Assessment or Operational Readiness Review	Conduct Storage/Prep RA/ORR – Start March 2011/Declare Readiness April 2011 Conduct Process (RWDP) ORR – Start August 2012/Declare Readiness September 30, 2012
Finalize Hazard Analysis Report	Not required
Prepare Final Documented Safety Analysis (DSA) Report(s) and TSRs	SAR-112 Revision (Lag Storage at CPP-749 and/or -2707) – Submit to DOE October 2010 SAR-113 Revision (Lag Storage Preparation in CPP-666 Truck Bay) – Submit to DOE October 2010 Final Transport Plan (PLN-XXX) Final DSA (SAR-XXX/TSR-XXX) – Submit to DOE March 2012
Prepare Safety Evaluation Report (SER)	DOE Approval - SERs for SAR-112 and 113 Revisions – November 2010 DOE Approval - SER for SAR-XXX (FDSA) – April 2012
Commence Transport Operations (for Lag Storage)	Spring 2011
Commence RWDP Operations	October 1, 2013