Idaho Cleanup Project

Calcine Disposition Project

Joel Case
Calcine Disposition Project Federal Project Director

November 17, 2010

EM Environmental Management
safety ❖ performance ❖ cleanup ❖ closure

CH2M•WG IDAHO, LLC
Safely delivering the Idaho Cleanup Project

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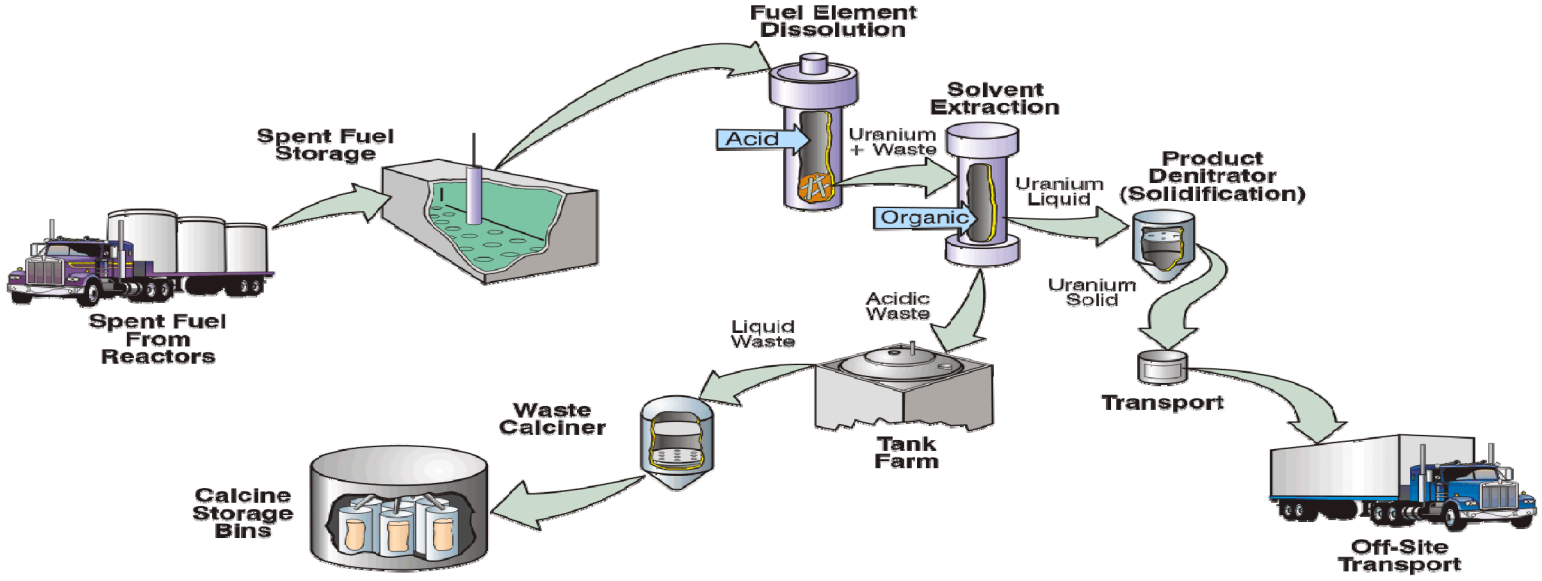
Calcine is Solidified First & Other Cycle Raffinates

- Resulted in a 7 to 1 volume reduction
- Capable of being safely stored for several hundred years in 43 large shielded bins contained in six bin sets



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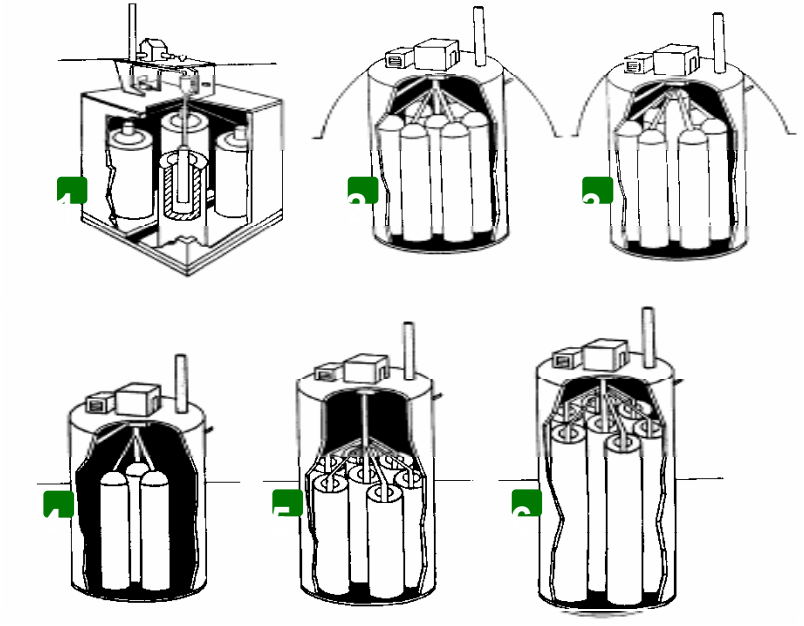
Calcine Generation History

Campaign		Parameters			
Begin	End	Volume gal	Volume ft^3	Volume m^3	Curies
Dec- 63	Mar - 81	4,081,000	77,300	2,189	
Aug - 82	May - 00	3,644,000	78,000	2,209	
Total		7,725,000	155,300	4,398	3.64E+07

Calcine Solids Storage Facility (CSSF)

Status	CSSF	Bins	Capacity (m^3)
In Use	1	12	227
	2	7	851
	3	7	1,130
	4	3	486
	5	7	1,010
	6	7	1,506
	Sub	43	5,210
Not in Use	7	7	1,784
	Total	50	6,994



Hot Isostatic Press Treatment Technology

- The Department Selected Hot Isostatic Press Process as the preferred Calcine treatment technology (December 2009 Record of Decision)
- Established in US industry for 30 years
- Produces robust glass-ceramic waste form
- Volume reduction
- Results in large life-cycle cost savings through final disposition

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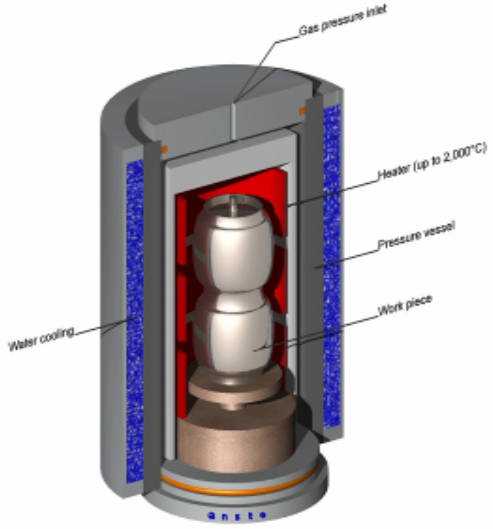
Basic Hot Isostatic Pressing Process

- HIP patented in the US by Romp in 1941.
  - Battelle patented HIP process to diffusion bond nuclear fuel in 1964.
- Technology consists of a pressure vessel containing an electrically heated furnace.
- Components are placed in a sealed can inside the furnace and isostatically pressed with argon gas to maximum density
  - Temperatures to 2,550 degrees C
    - 1,050-1,200 degrees C required for calcine treatment
  - Pressures to 30,000 psi
    - 5,100-7,200 psi required for calcine treatment
- Pressure vessels are built to stringent ASME codes, and include active and passive safety systems.
  - HIP vessels experience less than 0.1% failure rate
    - HIP can isolates pressure vessel from contamination



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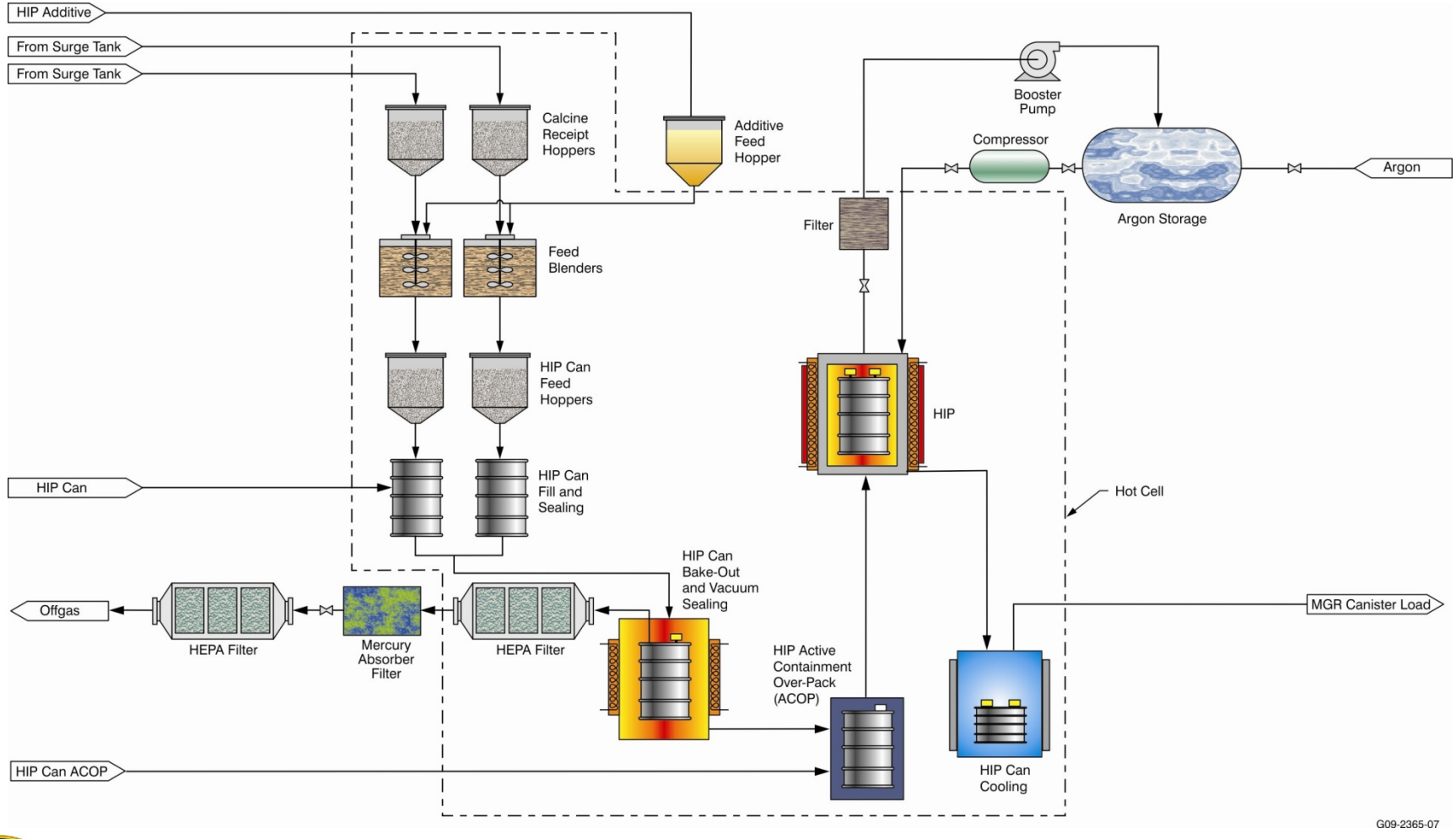
HIP Process Flow



Project Status

- Focus for FY2011-2012 on HIP Technology Maturation to support Critical Decision-1
- EM Technology Readiness Assessment (TRA) on-site visit July 2010
- **Key FY11/12 milestones**
  - Technology Maturation Plan scope is complete
    - In review process with DOE-HQ TRA Team
    - Submit to DOE-HQ (November 2010)
  - Complete calcine-related technologies to TRL-4
    - HIP Can and HIP Can Containment by December 2011
    - Ceramic additive/simulant formulation by March 2012
      - » May require maturation plan revision to address outstanding issues
  - Submit CD-1 package to DOE-HQ (June 2012)
  - Advance technology toward achieving TRL-6
  - DOE submit RCRA Permit Modification to State of Idaho (December 2012)

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DOE TRA Team TRL Determination

Critical Technology Element	Technology Readiness Level by October 4, 2010
Retrieval/pneumatic transfer	4
Batching, sampling, and mixing	4
Ceramic additive formulation	3
HIP can	3
HIP furnace/HCC	2
HIP can filling/closure	4
Bakeout system	4
Canister loading and closure	4
Remote operation and maintenance	4
Characterization (feed, admixture, and product)	4
Simulant Formulation	3
HIP hot isostatic pressing HIP furnace/HCC HIP furnace/HIP can containment	

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Calcine FY11 & FY12 Approach to Achieve TRL-4 and Advance TRL-6

Major Activity	FY 11	FY 12	Subtotal
Achieve TRL-4* • Develop HIP can (currently at TRL-3) December 2011 • Develop HIP can containment (currently at TRL-2) December 2011 • Develop ceramic additive/simulant formulation (currently at TRL-3) March 2012 • Advance Bin Set 1-5 retrieval technology • Advance 23 subsystems critical/high risk to RCRA permit submittal	**$13.3M**	**$13.9M**	**$27.2M**
Deliver CD-1 package to DOE-HQ (June 2012)* • Complete conceptual design (drawings, engineering design files, etc.) of Bin Sets 1-5 retrieval, and HIP support subsystems • Perform external/internal reviews (PDRI Review, final package preparation)	**$5M**	**$4.5M**	**$9.5**
Advance TRL-6 (September 2016)** • Design/engineer mockup layout, produce drawings, solicitation of vendors, identification of long lead items, complete package for procurement and installation of mockup facility	**$1M**	**$2M**	**$3M**
TOTALS	**$19.3M**	**$20.4M**	**$39.7M**

* Completion of TRL-4 and CD-1 results in compliant RCRA Permit submittal to meet Settlement Agreement milestone by December 2012

** Long lead procurements occur in FY13 in support of TRL-6

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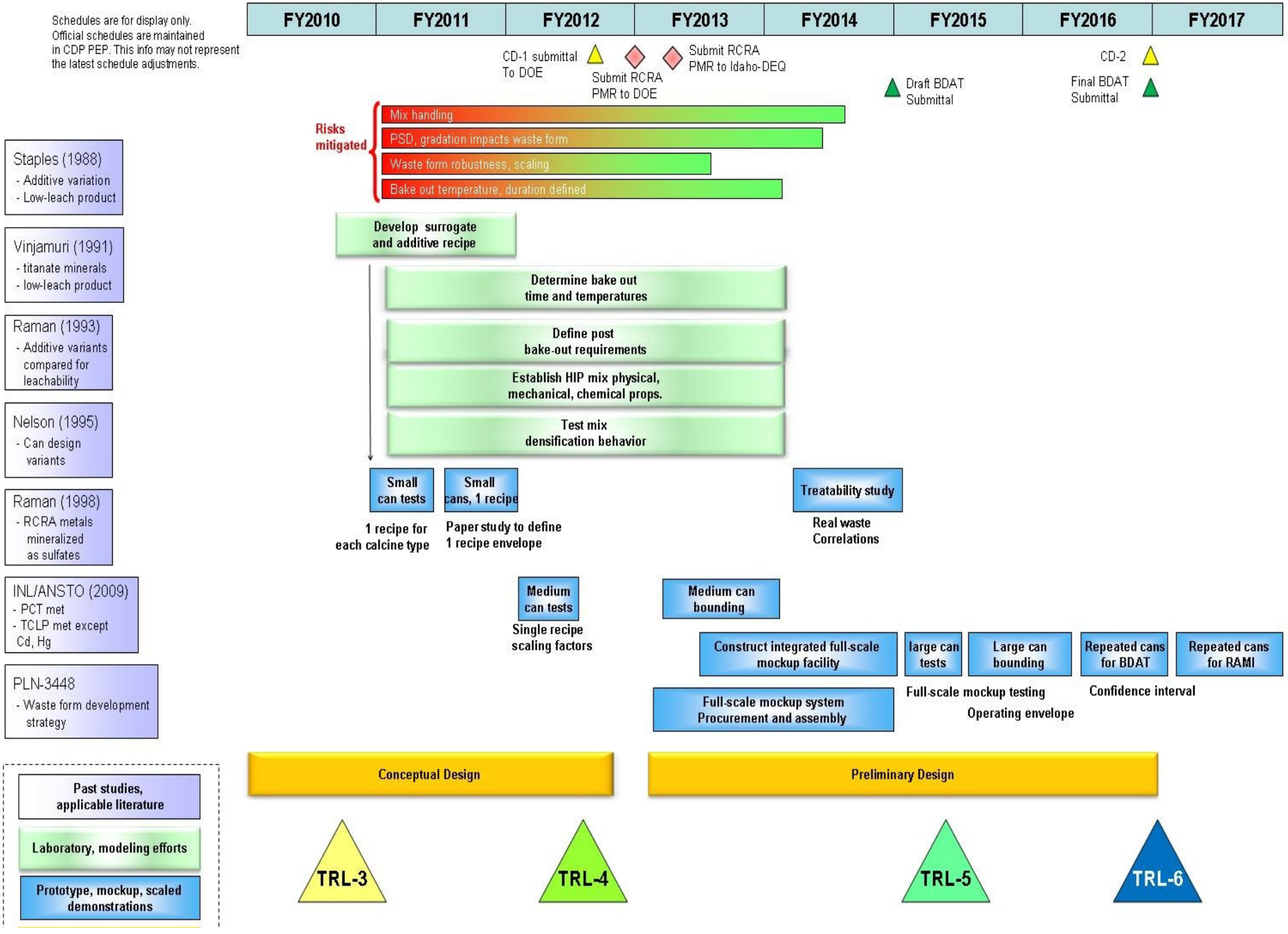
Waste Form Technology Development Roadmap

Schedules are for display only. Official schedules are maintained in CDP PEP. This info may not represent the latest schedule adjustments.



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HIP Can Technology Development Roadmap

Schedules are for display only. Official schedules are maintained In CDP PEP. This info may not represent the latest schedule adjustments.

Larker and Tegman (1981)
- HIP of rad waste at same full scale

Staples (1988)
- Process parameters

Nelson and Vinjamuri (1995)
- Can design variants

Bateman (2002)
- HIP in rad environment

INL/ANSTO (2009)
- PCT met
- TCLP met except Cd, Hg

EDF-9643, HIP Can Conc. Design
- Components compatible
- Scaling
- Risks
- Manufacturing processes

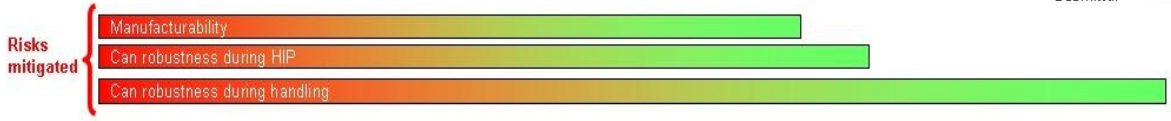
EDF-9644, Small Can Analysis (w/ large can attachment)
- Modeling and simulation, scaled equip
- Testing requirements, perform metrics
- Component compatibility

EDF-9578, HIP Can Trade Study
- Cost drivers
- Manufacturing processes, mitigation for risks

EDF-9794, HIP Process Parametric Calc
- Scaling

EDF-9716, FMEA
- Risks, operating limits

SDD-292, HIP Can
SDD-270, HIP Treatment
- Designs, drawings, process flow
- Full scale design



HIP can tests designs

Can optimization and manufacturability

Develop model, refine / conduct bounding conditions experimentation with multiphysics model of can / mix interactions, including correlations to physical data. Conduct plasticity analysis.

Small can tests

Medium can tests

Full-scale can tests

Construct integrated full-scale mockup facility

Testing of HIP Can remote handling

Procure, install full-scale HIP system

Repeated HIP treatment of full-sized cans

HIP can RAMI

Component testing
System integration
System to system remote operations, interference identification
Remote maintenance and recovery
Rapid manned maintenance and recovery (ALARA)

Conceptual Design

Preliminary Design

TRL-3

TRL-4

TRL-5

TRL-6

Past studies, applicable literature

Laboratory, modeling efforts

Prototype, mockup, scaled demonstrations

Design Phases

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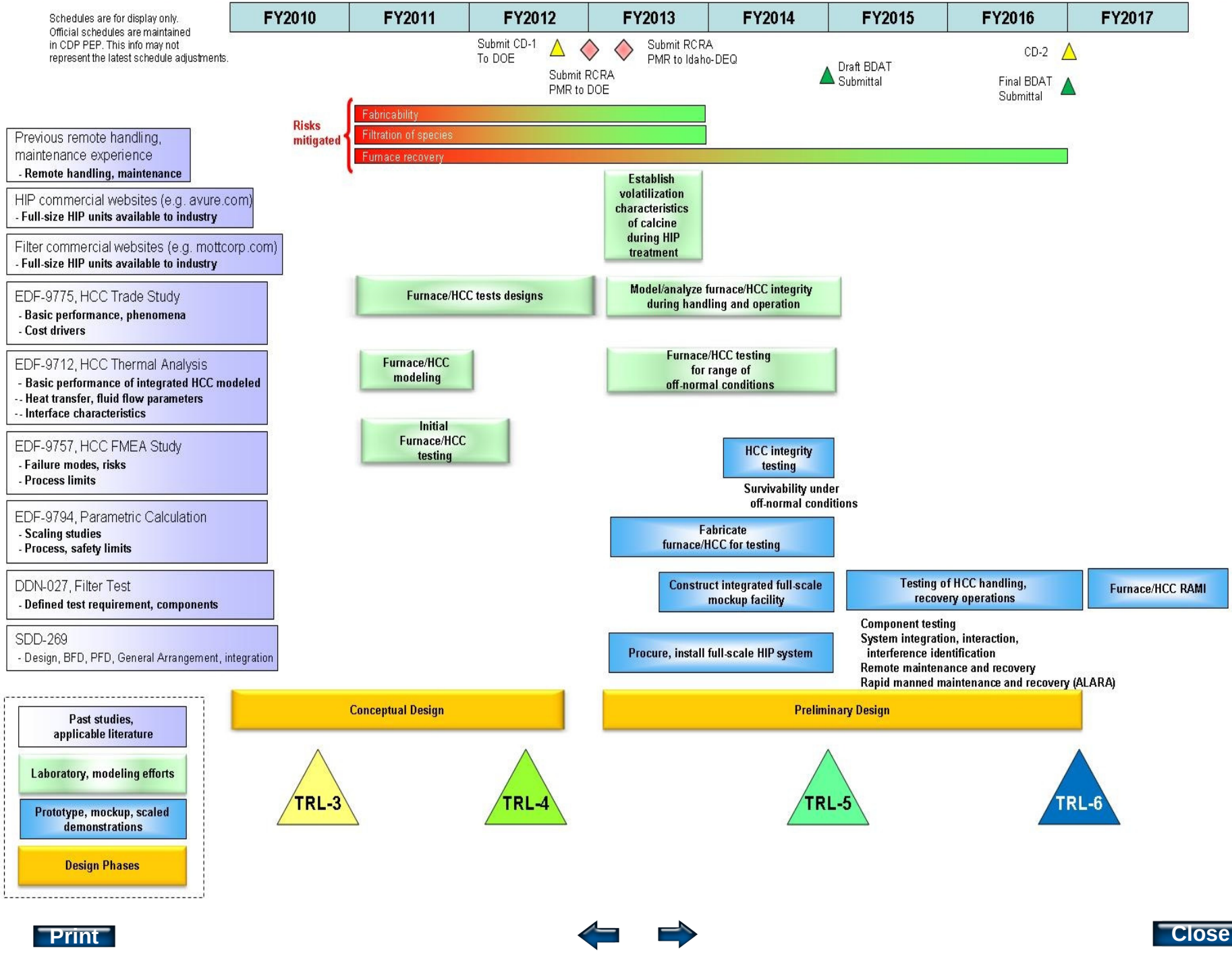
Furnace and HIP Can Confinement (HCC) Technology Development Roadmap



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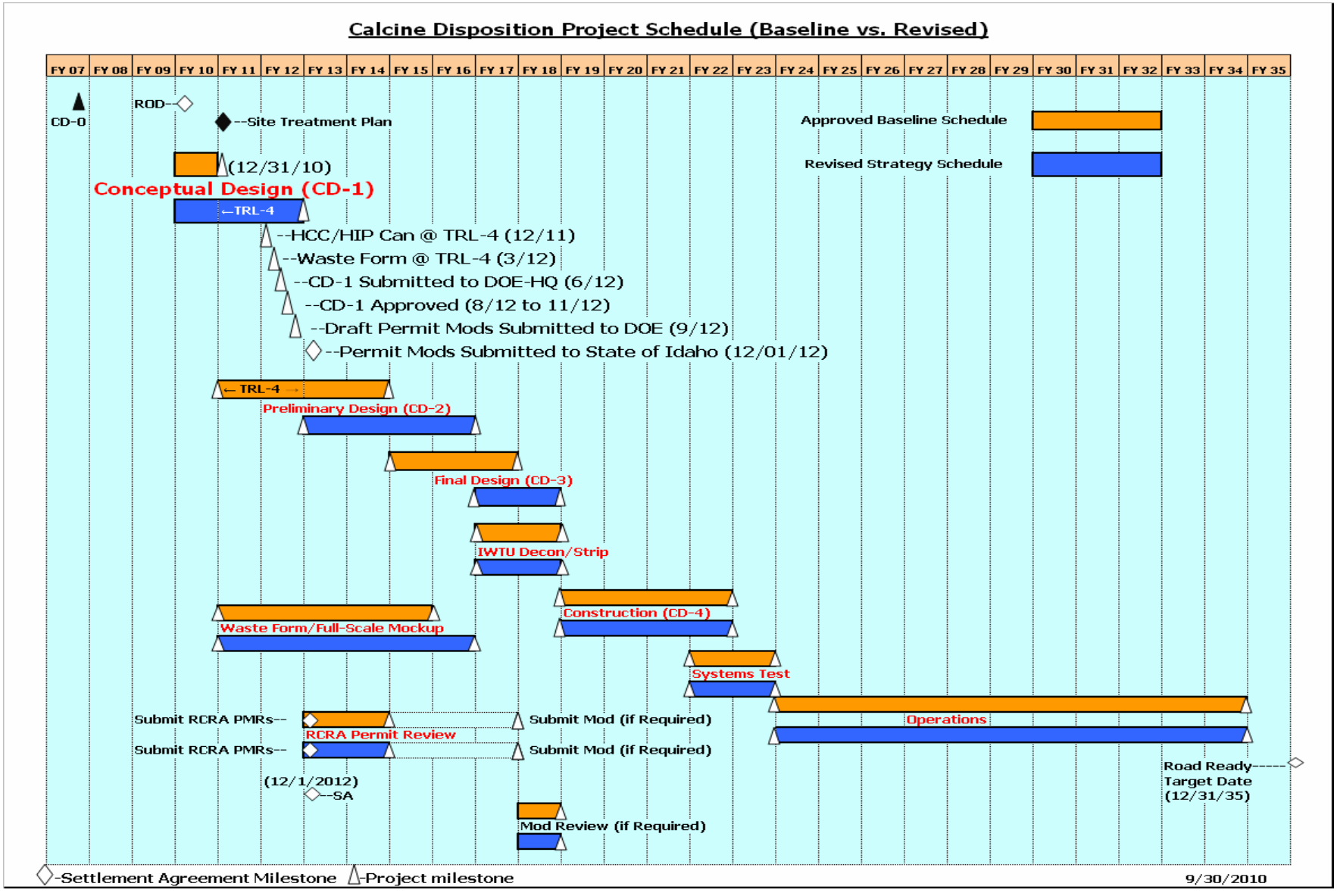
Calcine Project Schedule



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