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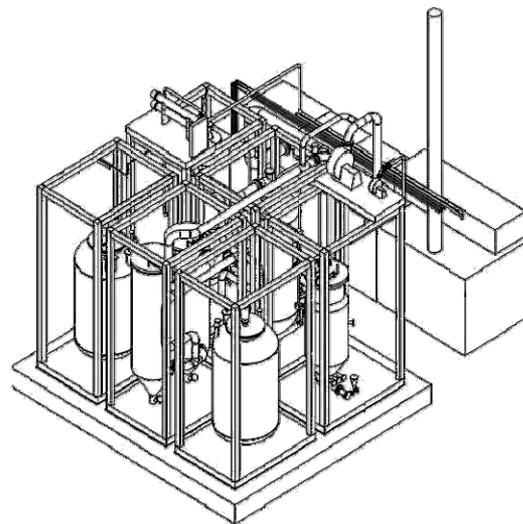
# Tank 48 Treatment Process

EM Technical Exchange

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SRR-MS-2010-00248

- Mission and Process Overview
- Project History
- Key Technical Topics
  - Testing and Technology Development
  - Engineering Scale Technology Demonstration
  - Design Optimization



- **Tank 48 is a 1,300,000 gallon new style HLW tank**
- **Contents:**
  - 240,000 gal HLW
  - 22,000 kg Tetraphenylborate (TPB) solids from the ITP process, 1.7 Ci/gal Cs-137
- **The organic presents a unique Tank Farm hazard**
  - Deflagration potential
  - Tank segregated from all others
  - Non-productive tank space
- **Project objective**
  - Destroy organic waste through Fluidized Bed Steam Reforming and disposition resulting product through DWPF
  - Generate usable HLW tank space, system planning



- Physical
  - 250,000 gallons
  - Specific Gravity – 1.165
  - Insoluble solids – 3 wt%
- Chemical
  - 21,800 kg Potassium Tetrphenylborate (KTPB)
  - 0.15 wt% Monosodium Titanate (MST)
  - > 1M OH
  - ~ 1,350 curies alpha
  - 400,000 curies Cs-137
  - 3.8M Na



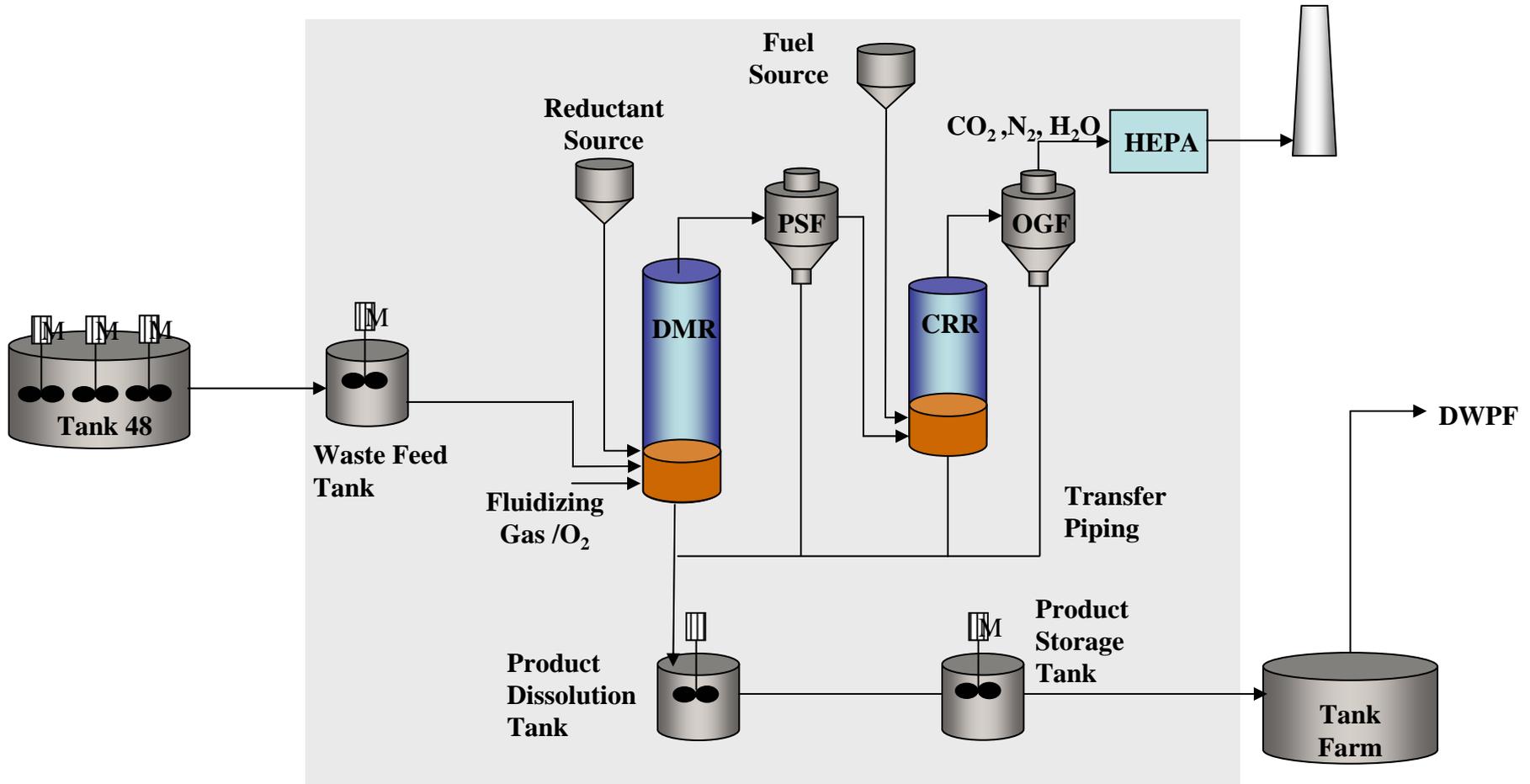
241-96H

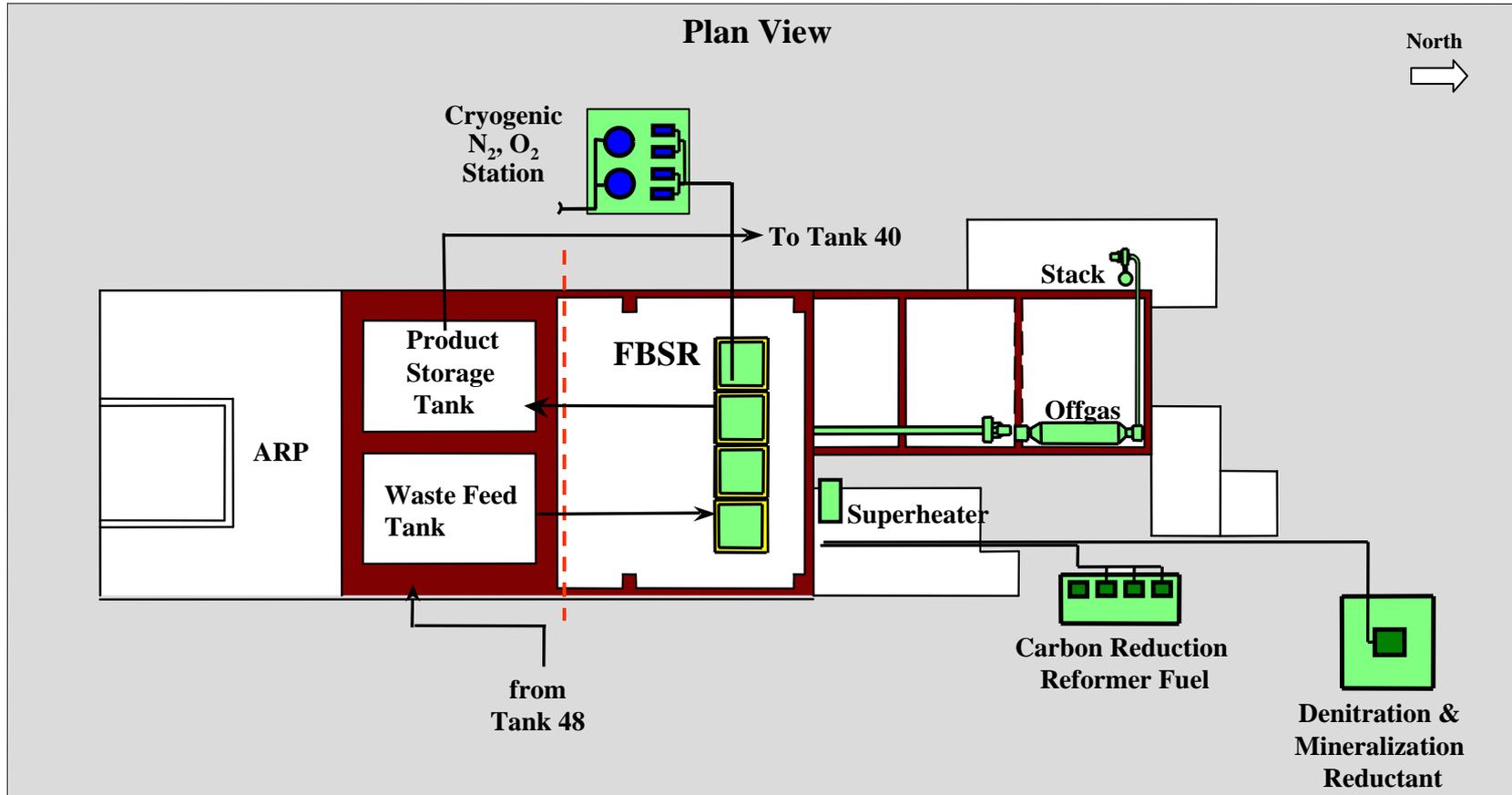
Tank 48H



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safety ❖ performance ❖ cleanup ❖ closure

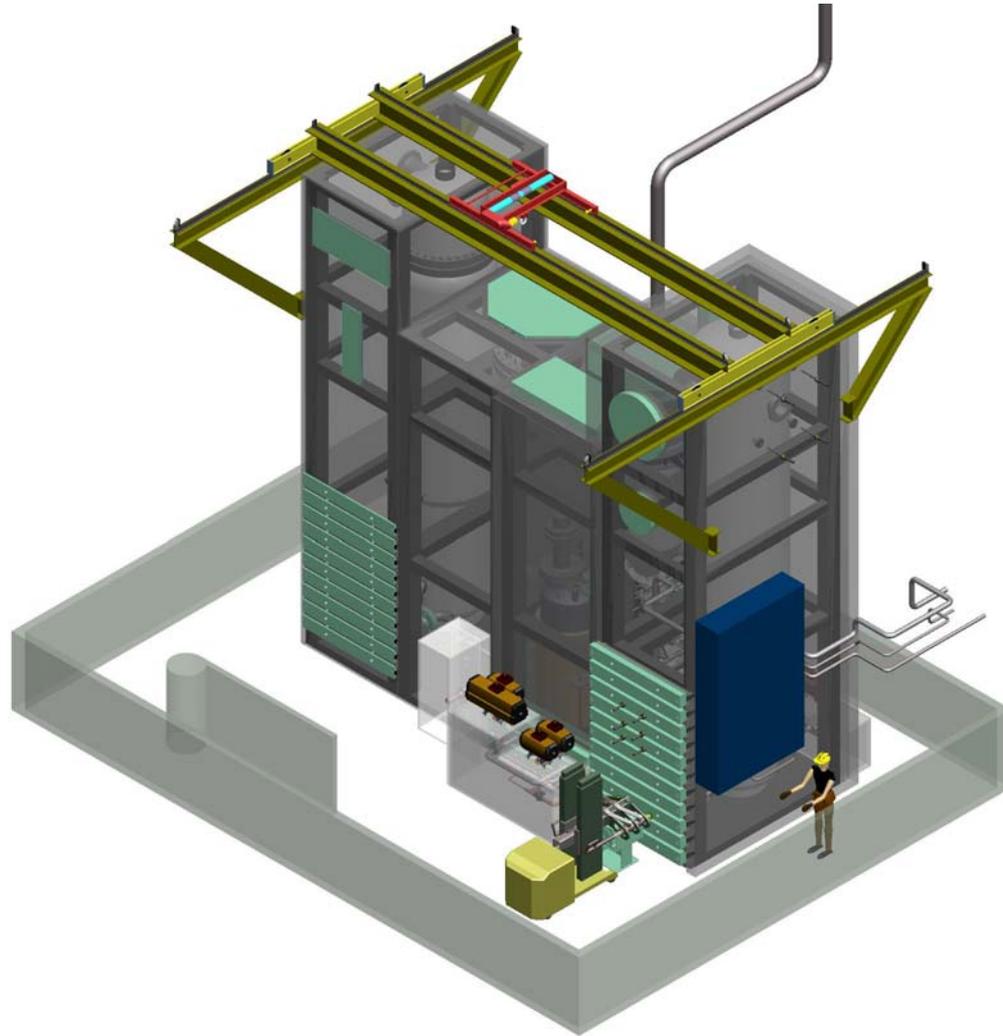




■ - Concrete walls 1 - 3 ft thick, 19 - 26 ft tall



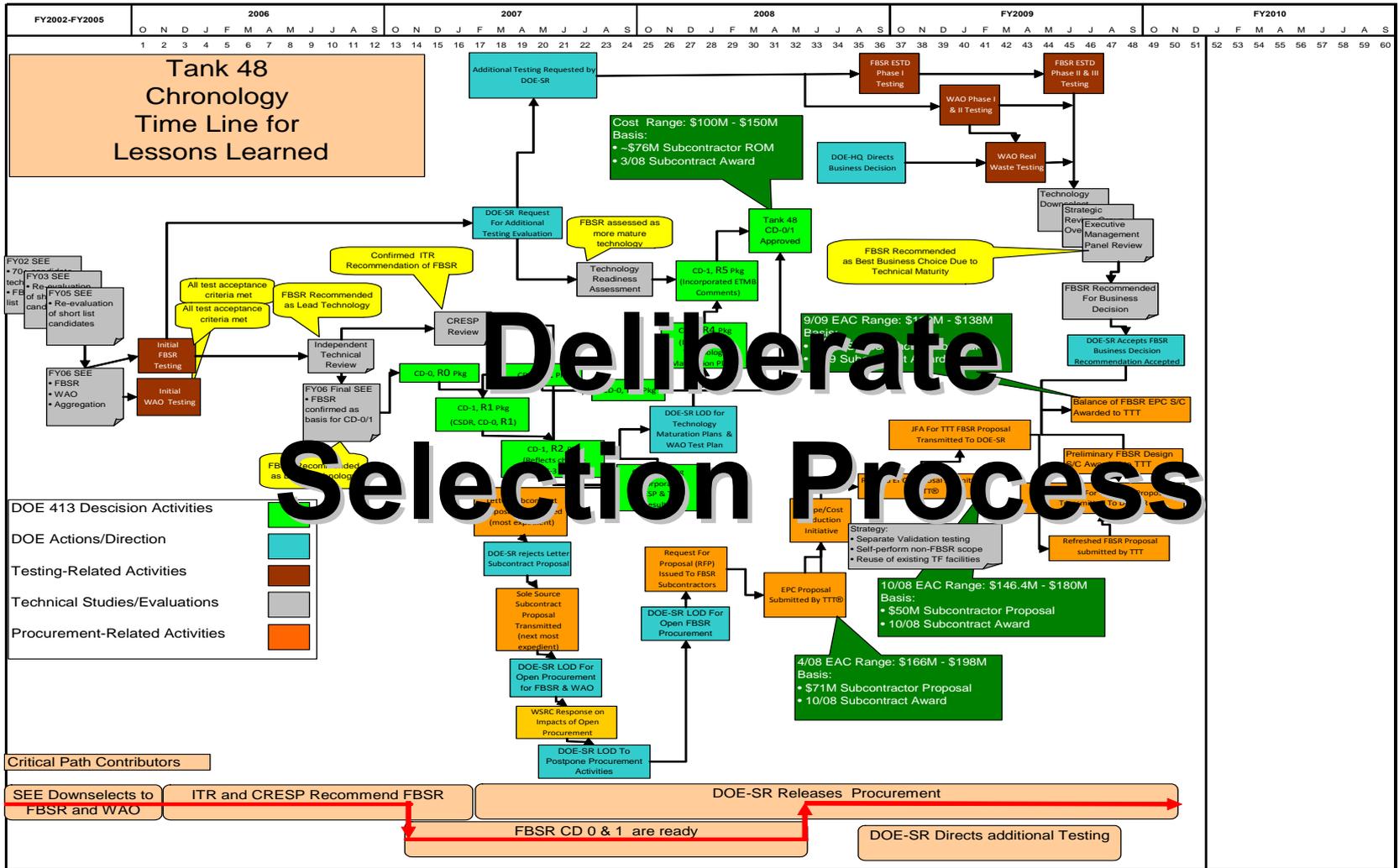
# 3-D Model of Tk48 FBSR



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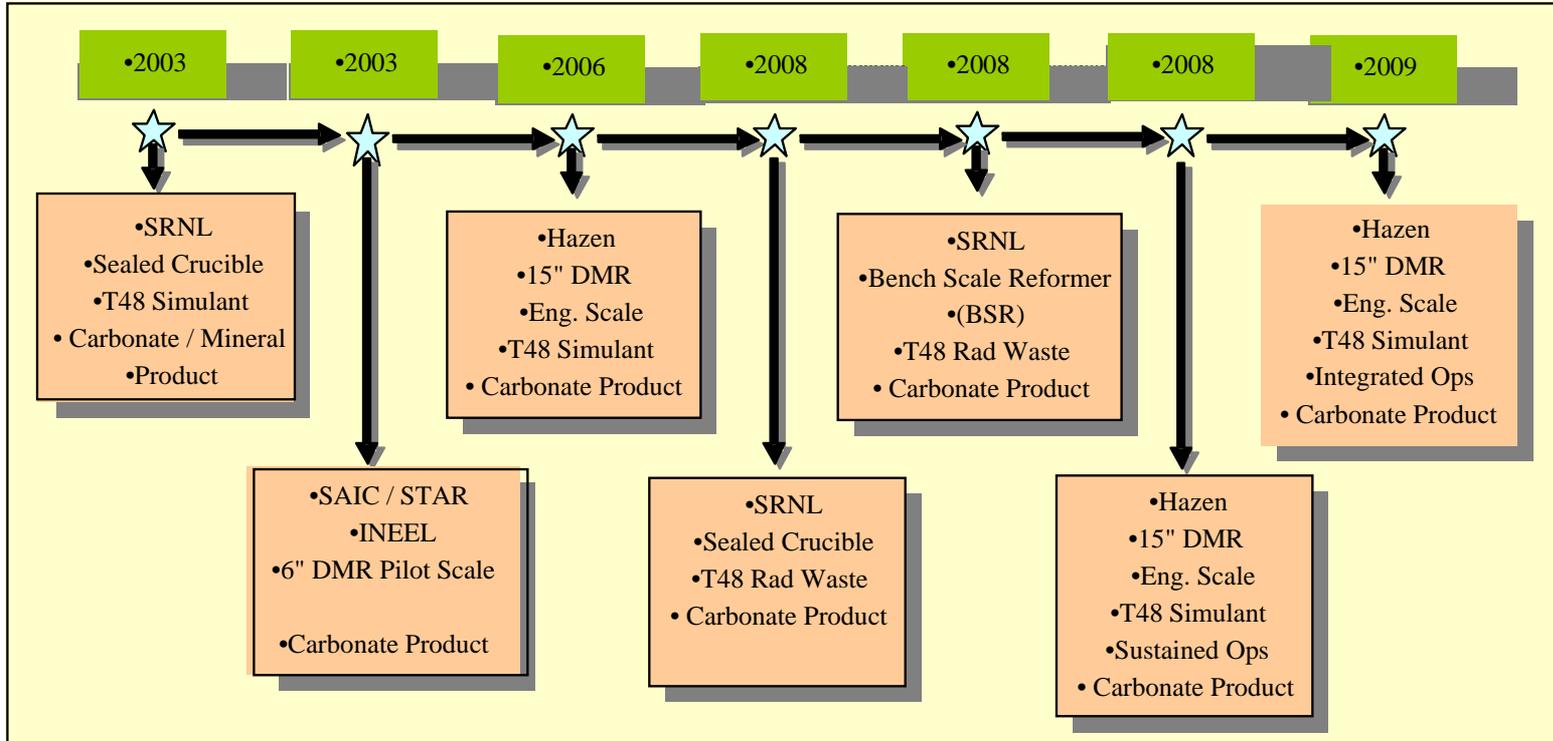


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- Testing and Technology Selection
- Engineering Scale Technology Demonstration
- Agglomeration
- Line Pluggage
- Coal Carryover
- Corrosion and Materials of Construction

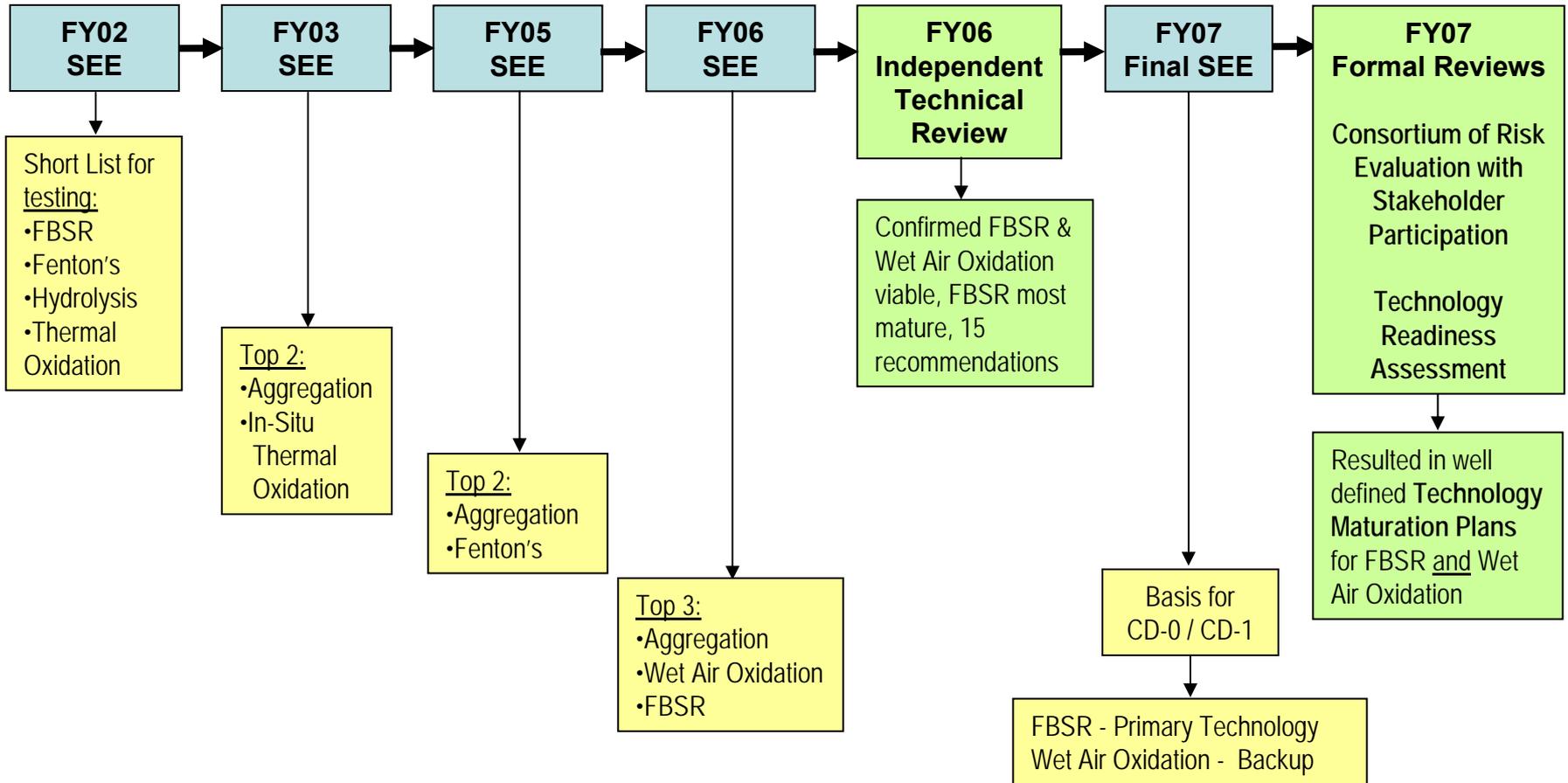




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Study	Simulant or Radioactive	Performing Organization + Year	Resulting Product(s)
Sealed Crucibles	Simulant	SRNL (2003)	Carbonate
Pilot Scale (6" DMR)	Simulant	SRNL + INL + SAIC-STAR + TTT (2003-4)	Carbonate
Hazen Research Inc. (15" DMR)	Simulant (Scoping Study)	SRNL/SRS + TTT (2006)	Carbonate
Hazen Research Inc. (15" DMR)	Simulant (Sustained Ops)	SRNL/SRS + TTT (2008, 2009)	Carbonate
Sealed Crucibles Shielded Cell Facility (SCF)	Radioactive - Actual T48 Waste	SRNL (2008)	Carbonate
Bench Scale Steam Reformer (BSR) in SCF	Radioactive - Actual T48 Waste	SRNL (2008)	Carbonate





- Verification testing of the THOR® FBSR process
- Phase 2 testing
  - Demonstrate the capability of the Product Handling System (PHS) to collect, transfer, and dissolve the solid product generated by the FBSR process.
- Phase 3 testing
  - Develop product solubility and other physical/chemical characteristics
  - Demonstrate the capability of the FBSR integrated with the PHS



- Demonstrated
  - Sustained operation (5 days) and organic destruction
  - Large scale dissolution of dry product and provided physical characteristics of slurry (SRNL)
  - On-line particle size determination of DMR product solids
  - Benzene generation less than 3% LFL
- Technical Issues
  - Agglomeration
  - Line Pluggage
  - Coal Carryover
  - Materials of Construction



## Agglomeration

- **ISSUE:** Agglomeration could lead to DMR shutdown and cleanout from off-normal events.
- **ACTION:** Prevention through design and mitigate
  - Prevention:
    - Interlocks (e.g., Temp, Flow)
    - Support system reliability (N2)
    - Design Review Process
  - Implementation:
    - Training and Procedures
  - Mitigation:
    - Dissolution of agglomerate

## Line Pluggage

- **ISSUE:** Line pluggage was observed in the dry product lines and in the DMR off-gas line
- **ACTION:** Prevention through design
  - DMR Disengaging Section Cooling
    - CFD modeling for appropriate nozzle configuration and flow rate
    - Insulate & Heat Trace to Prevent Condensation
    - Nitrogen Purging of Lines
    - Appropriate Line Sizes
    - Design Review Process
  - Mitigation
    - Flushing

## Coal Carry-Over

- **ISSUE:** Increased coal content in the product
- **ACTION:** Optimize design and LW system capability
  - Project optimization: Increase the DMR height
    - Reduce elutriation of particulates containing coal
  - System planning: Sludge batch planning/DWPF WAC
    - Evaluate Tank Farm and DWPF coal capability

## Materials of Construction

- **ISSUE:** ESTD testing identified the potential for sulfidation and pitting corrosion
- **ACTION:** Mitigate corrosion potential through selection of MOCs and design
- Project Path Forward:
  - Selection of C276 and 625 alloys
  - Refractory line vessels
  - Inspectable/maintainable/replaceable components

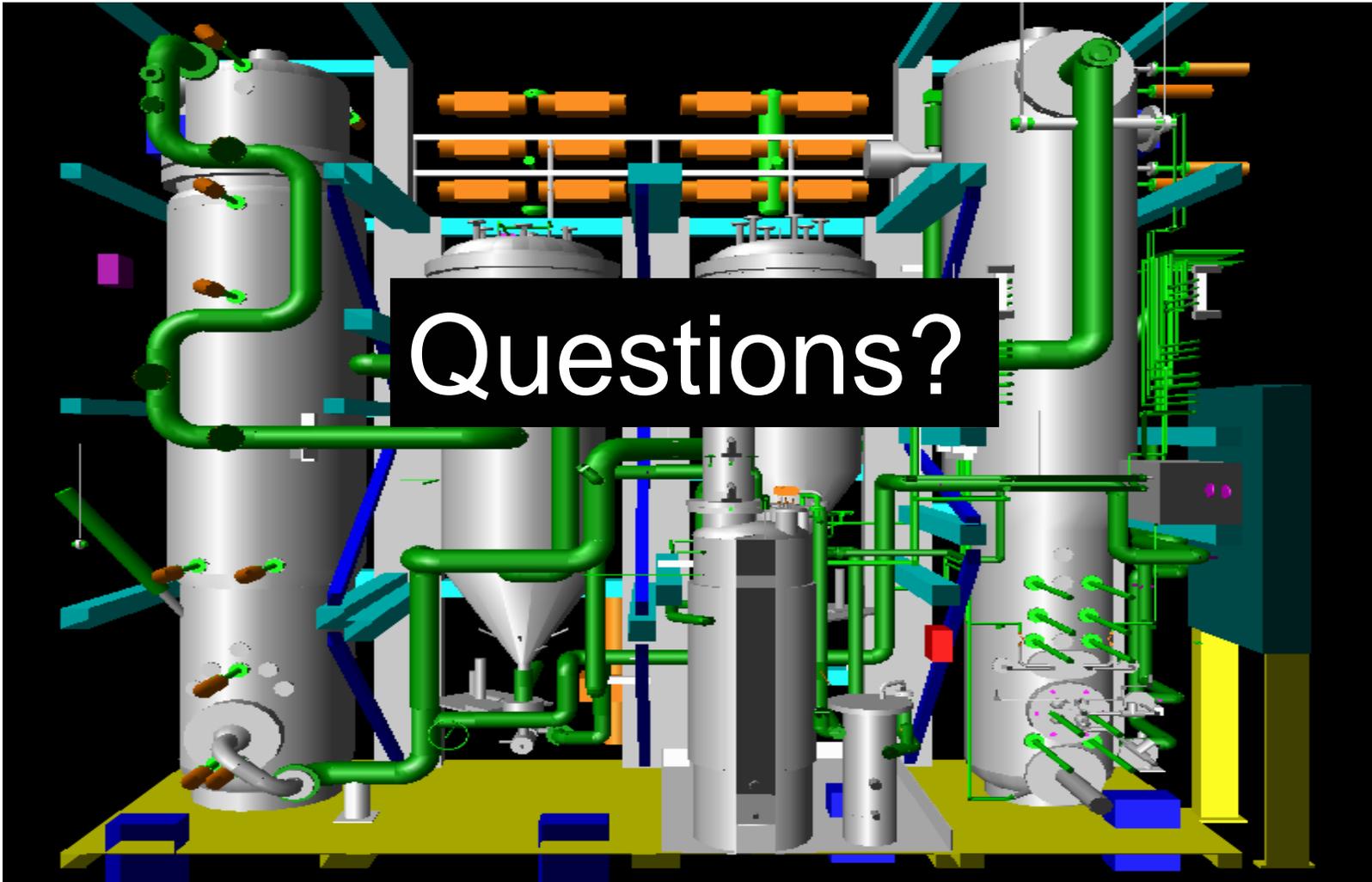


- Based on the integrated design review of Preliminary Design, the FBSR weight and space could exceed existing building limitations
- Multiple opportunities have been pursued to optimize design
  - Alternative disposal options for OGF solids
  - Catalytic thermal oxidizer
  - Electrically heated CRR (CRR<sub>e</sub>)



- Key optimization attributes
  - Weight reduction
  - Space minimization
  - Cost and schedule
- The CRRe is the preferred alternative and preliminary design documentation is in development
- A systems engineering evaluation will be performed to identify the optimum alternative





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# Back-up Slides



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## Agglomeration Resulting from Loss of Steam during Phase 3 Testing



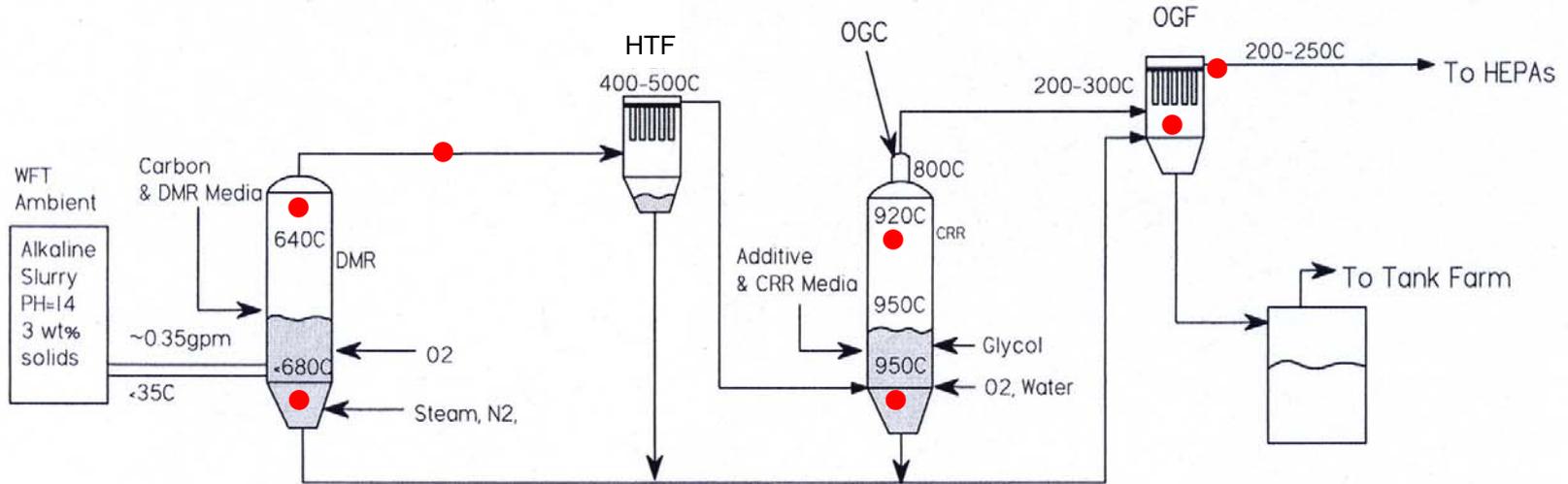
**DMR access door,  
refractory block removed**



**Feed nozzle block**

**Two large agglomerations:  
Approx. 6" X 12"**





Test Temperatures:  
DMR Bed 640-674C  
DMR Freeboard 581-605C  
DMR Outlet 516-542C

Design Data:  
DMR,  $-29C \leq T \leq 770C$ ,  $0 \text{psig} \leq P_i \leq 18 \text{psig}$ ,  $P_e = 0 \text{psig}$   
PGR,  $T = 750C$ ,  $P_i = 13 \text{psig}$ ,  $P_e = 0 \text{psig}$   
CCR=???

5 year Design Life  
2 year Operational Life  
24/7 Operation with 90% Duty Cycle  
75% utilization with 10% duty Downtime and 15% WSRC downtime  
Rate=184000gal/yr=0.35gpm

## ● Coupon Locations



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# Corrosion Coupons



- CHA Consolidated Hazards Analysis
- CRR Carbon Reduction Reformer
- CSEP Coal Separator unit
- DMR Denitration and Mineralization Reformer
- ESTD Engineering Scale Technology Demonstration
- FBSR Fluidized Bed Steam Reforming
- MOC Materials of Construction
- OGC Off Gas Cooler
- OGF Off Gas Filter
- PDT Product Dissolution Tank
- PHS Product Handling System
- PSF Product Separation Filter
- SRNL Savannah River National Laboratory
- TPB Tetra phenyl borate
- WAC Waste Acceptance Criteria

