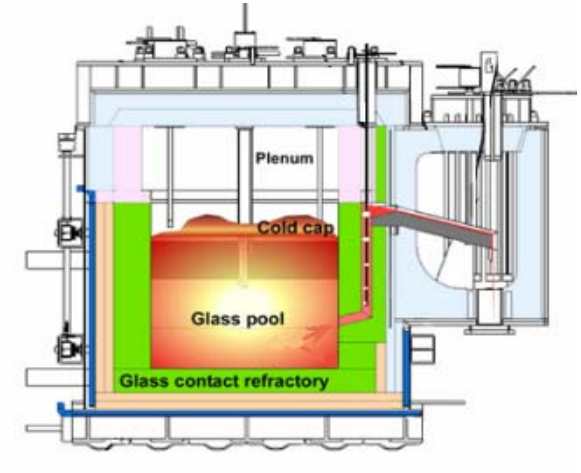
Deployment Plan Overview for Next Generation Melter at WTP



Ron Calmus, WRPS
Terry Sams, WRPS

November 17, 2010

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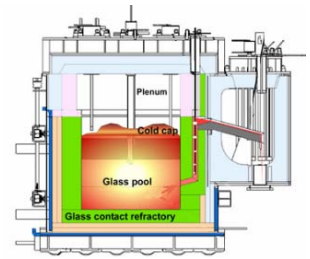
Presentation Outline

- Introduction and Background
- Project Goals and Objectives
- Key Programmatic Decisions
- New Generation Melters (NGM) Development and Deployment Planning (AJHCM & CCIM)
- NGM Development and Deployment Activities and Interfaces
- Near-Term NGM Development Costs
- Summary - Focus Areas



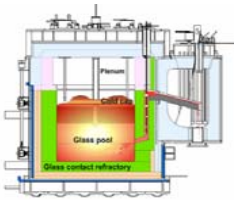
Program Drivers

- **National Academy of Sciences (NAS) Recommendations**
  - In 2009 the NAS stated in it's report that:

    "existing knowledge and technologies are inadequate for EM to meet all of its cleanup responsibilities in a safe, timely, and cost effective way. Meeting current and future EM challenges will require the results of a significant, ongoing research and development program"

  - **A key specific recommendation noted that:**

    "increased vitrification capacity may be needed to meet schedule requirements of EM's high-level wasted Programs"

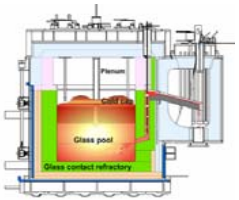


Introduction and Background (cont.)

Program Drivers (cont.)

- **DOE-EM Tank Waste Research and Development Plan (6/10)**
  - Increase tank waste loading in the glass and increase tank waste melter throughput.
  - Includes initiatives in five areas:
    - Alternatives Waste Pretreatment
    - Improved Vitrification Capacity
    - Increased Waste Loading
    - Accelerated Waste Retrieval and Closure
    - Advanced Unit Operations

- **Hanford HLW and LAW System Planning and Enhanced Tank Waste Strategic (ETWS) planning**

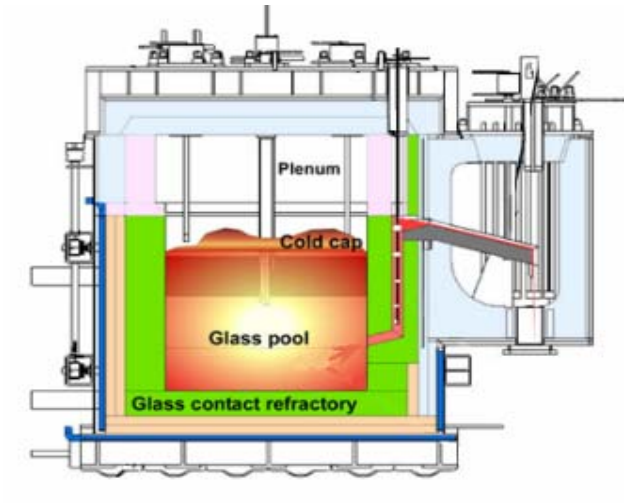


Introduction and Background (cont.)

NGM Technologies

Energy Solutions & Catholic University of America – Vitreous State Laboratory

- Joule Heated Ceramic Melter (AJHCM)
- Glass Formulation, Glass Processing, Waste Form Qualification



Courtesy Energy Solutions (Brad Bowan)

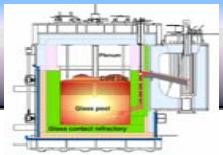
AREVA Federal Services, Idaho National Laboratory

- Cold Crucible Induction Melter (CCIM)
- Small pilot-melter preliminary runs
- Additional glass formulation support as needed

650mm CCIM, Marcoule, France
Courtesy AREVA (Eric Tchemitcheff)

Introduction and Background (cont.)

Key Activities To Date



- EM established specific NGM R&D tasks (consistent w/ EM R&D Plan)
- WRPS is organizing the efforts of ES/CUA and AREVA for DOE to perform the NGM Development and Engineering
- Two NGM technologies (AJHCM and CCIM) for both HLW and LAW vitrification at Hanford
- In FY2010 the two technology providers initiated planning, engineering studies, and development of the NGM concepts
- Extensive interfaces have been established between EM tasks required to develop and deploy technologies
- Establishing the interface with Hanford Waste Treatment Plant (WTP) is ongoing
- FY11 work is currently on hold pending resolution of funding

Project Goals and Objectives

Goals and Objectives

1) **Design/Build/Test NGM Technologies to Technology Readiness Level 6 for transfer of technology for initial stages of deployment (2016)**
   - Develop design packages for AJHCM & CCIM
   - Perform NGM technology down-select (2013/2014)
   - Designs must include WTP Balance-of-Plant (BOP) considerations
   - Systems sized to scale to 8 (HLW) & 42 (LAW) MT/day Glass
2) **Define acceptable processing envelopes for Hanford HLW and LAW wastes**
   - Acceptable processing regions
     - Waste loading and compositional boundaries
   - Provide pilot-plant performance test program
     - Reflect Tank Farm projections
     - Typically defined by limiting species (high Cr, Bi, Al, etc.)
3) **Establish baseline throughput**
   - Defined by waste loading and melt/pour rate
   - Process models updated to reflect Next Gen. operations

Project Goals and Objectives

HLW & LAW Throughput Rates (MTG/day)

HLW	Unit Melter Design Capacity	# Units	Design Basis HLW Capacity	HLW Throughput Rate(70% TOE)
Hot/Cold Comm.	3	2	6.0	4.2
Plant Capacity per contract	3.75	2	7.5	5.25
NGM Program	5 - 5.75	2	10 - 11.5	7 - 8*

LAW	Unit Melter Design Capacity	# Units	Design Basis LAW Capacity	LAW Throughput Rate(70% TOE)
Hot/Cold Comm.	15	2	30.0	24
Plant Capacity per contract	15	2	30	21
NGM Program	25 - 30	2	50 - 60	35 - 42*

Project Goals and Objectives

Keys to Successful NGM Deployment at WTP

T&D

- **Down Select** - select the most viable high-throughput NGM technologies
- **TRL6** – perform engineering/pilot-scale or similar validation in a relevant environment
- **Define T&D deliverables** - ensures the T&D effort is consistent with the needs of the development and deployment project
- **T&D Integration** - numerous technology elements need integration to ensure successful technology insertion
- **T&D transition to deployment** – prepare project-level definition and planning

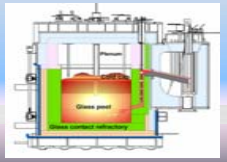
WTP

- **WTP input to T&D** – develop detailed WTP engineering, commissioning and operations information for use in key NGM development phases (WTP limitations on NGM design/throughput)
- **Understanding of WTP retrofit (if required)** - define the scope and breadth of required WTP retrofit in a radioactive operating facility

Project Management

- **Schedule** - deployment timing/duration based on degree of facility modifications and overall project scope
- **Cost** - Continuous and rigorous life-cycle cost estimating of the Project during development and early stages of deployment

Programmatic Decisions



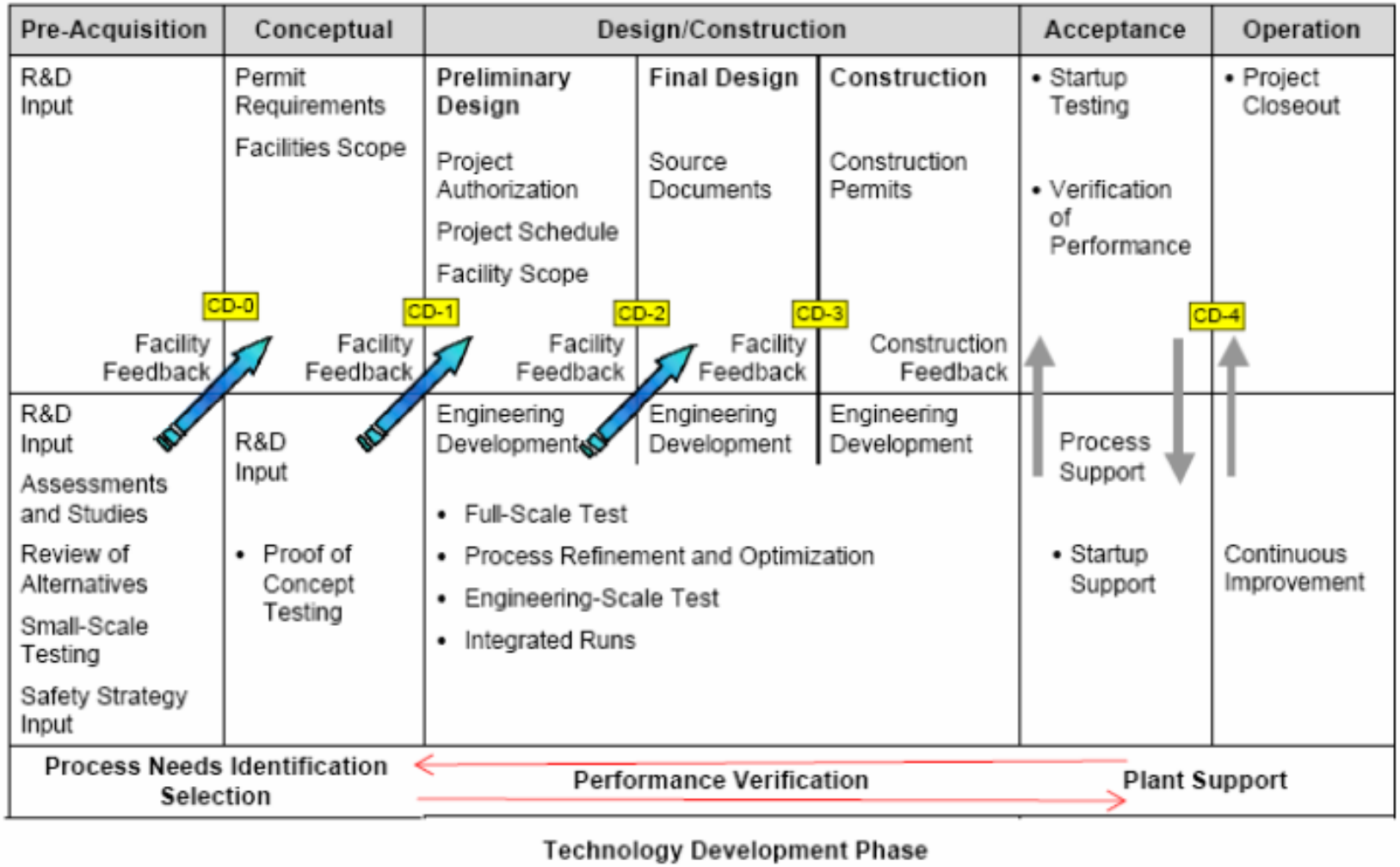
Primary NGM Decisions

Primary NGM Decisions (DOE-EM R&D Plan)	Time Frame
➢ Select NGM Test Platforms for R&D	2011
➢ Down-Select NGM Melter Technologies	2013/14
– Select HLW and LAW NGM	
– Decision Analysis process	
– Not all Technologies may be at TRL6	
– Evaluation criteria and consistent data/info.	
➢ NGM Pilot-Melter Scaled Testing (for TRL 6)	2016/17
- Transfer NGM for WTP deployment	
Start WTP Hot Operations	2019
➢ First WTP Melter Changeout	2024/25

DOE-EM NGM Interfaces and Teams

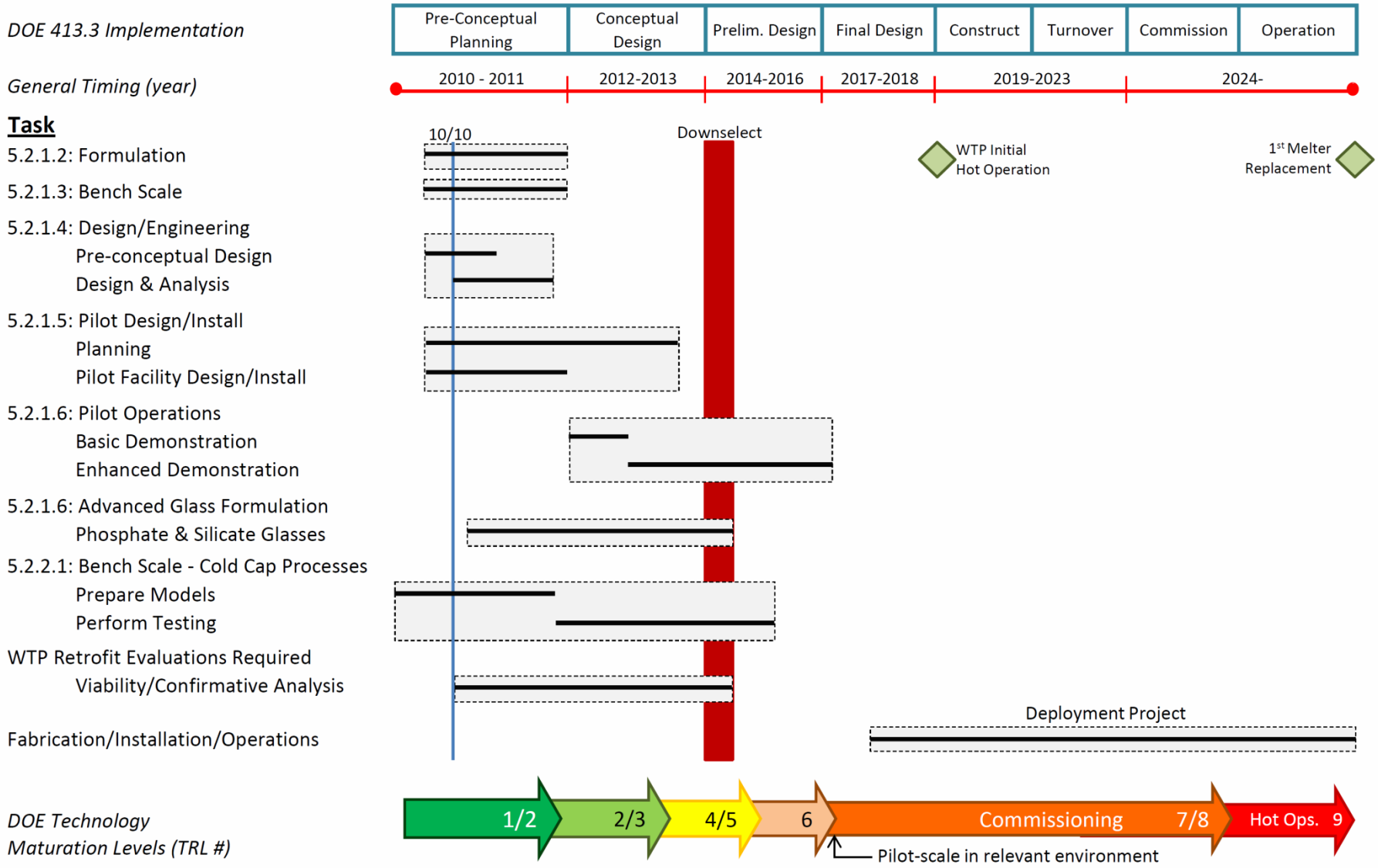
DOE-EM R&D Plan NGM Tasks	Team Members (Lead)
5.1 Alternative Waste Treatment	
5.1.2 Determine Technetium Behavior in Waste Processing Unit Operations	PNNL, ES/CUA, WRPS
5.2 Improved Vitrification Capacity	
5.2.1 Develop next Generation Melters	
5.2.1.1 NGM Glass Melter Workshop (Complete in 2010)	INL, PNNL, CUA, SRNL, DOE, SRNL
5.2.1.2 Glass Formulation for NGMs	AFS, ES, SRNL, CUA, PNNL
5.2.1.3 NGM Bench-Scale Testing	CCIM – AFS, WRPS, INL JHCM – ES, WRPS, VSL
5.2.1.4 NGM Development and Engineering	CCIM - AFS, WRPS JHCM – ES/CUA, WRPS
5.2.1.5 Design, Fabrication, and Installation of NGM Test Systems	AFS, ES, WRPS, DOE
5.2.1.6 NGM Testing and Component Improvement	*Not Identified*
5.2.2 Advanced Process understanding and predictive tools for CC Chemistry	SRNL, CUA, UNLV, PNNL
5.2.2.1 Bench-scale testing of cold cap processes	
5.2.2.2 Cold-Cap Reaction Simulation Code Development	
5.2.2.3 Improvement of Existing DWPF Melting Rate Model	
5.3 Improved Waste Loading	
5.3.1 Advanced Waste Formulations to Increase Waste Loading and Melt Rate	
5.3.1.1 Phosphate Glass Development and Demonstration	INL, PNNL, MS&T, CUA, CEES, SRNL
5.3.1.2 Advanced Silicate Glass Development and Demonstration	CUA, PNNL

Project Phase Life Cycle



As shown in DOE 413.3, Figure 1

Schedule to Develop and Deploy NGM (HLW/LAW)



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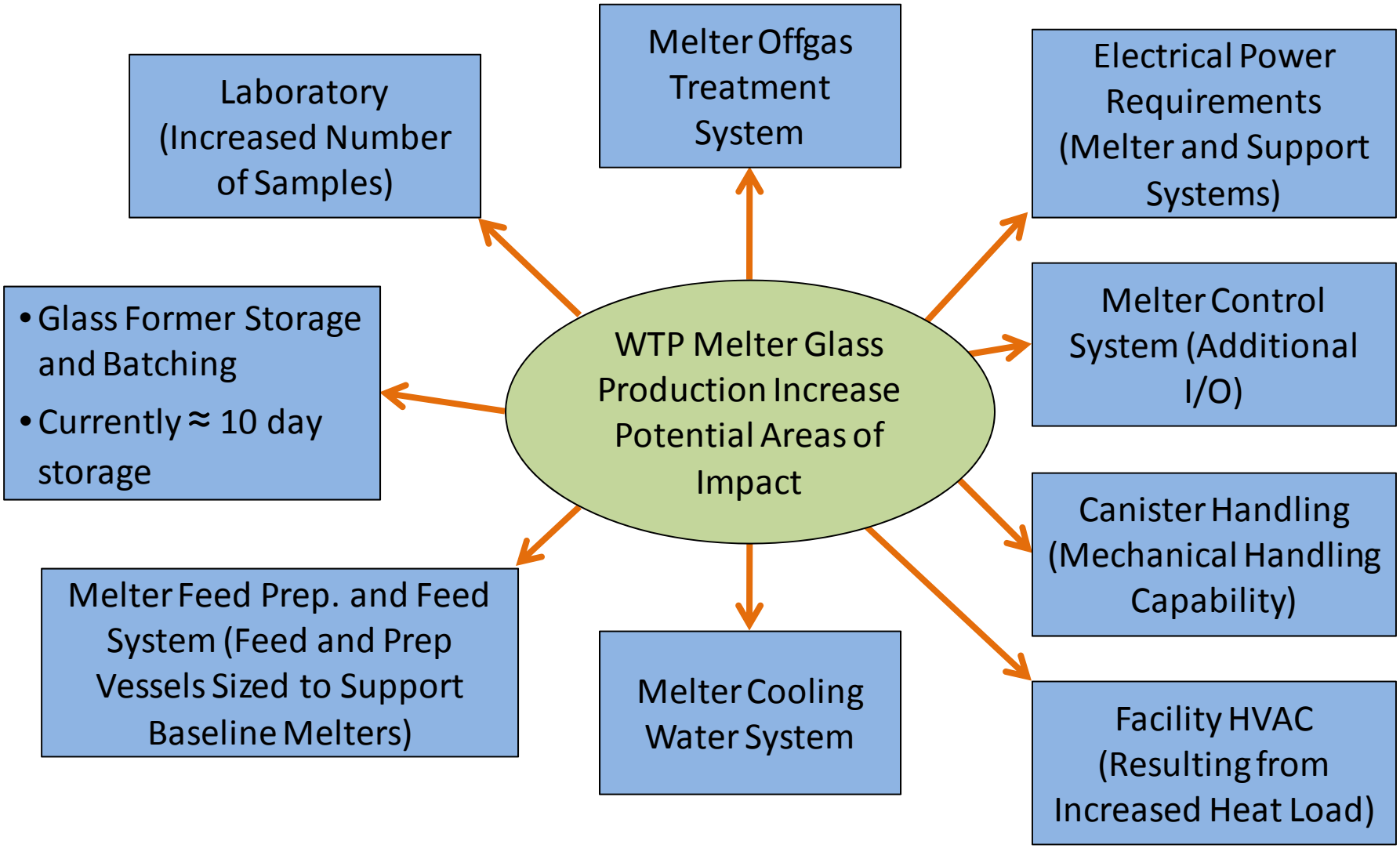
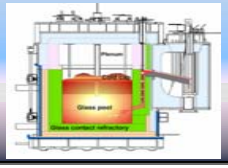
Potential WTP Impacts



Near-Term Cost for NGM Development

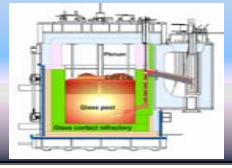
Near-Term Cost for NGM Development



- Costs estimates generated by technology providers as part of initial NGM development planning activities
- Average T&D development costs for combined AJHCM and CCIM is approx. $20M to $25M per year for combined HLW and LAW (thru down-select – 4 years)
- Assumes NGM technology down-select decision made by the end of FY2014
- HLW costs are approximately double LAW development costs
- WTP Balance-of-Plant evaluation costs not currently in scope (not costed)
- NGM Technology Development Costs include:
  - Development and Engineering (5.2.1.4)
  - Design/Fab/Install of Test Melter System (5.2.1.5)
  - Testing and Component Improvement (5.2.1.6)

Summary – Focus Areas

Summary – Focus Areas



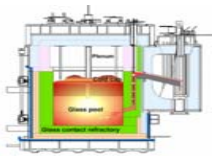
- Successful Deployment will require increased focus on the following areas:
  - ✓ Interface management and down-selection
    - Manage Complex interfaces
    - Focus on data/information to make down-selection
    - Effective Integration of EM task deliverables and schedules to meet Hanford mission milestones and decision targets
    - Annual refinement of decision analysis process
  - ✓ Balance-of-Plant (BOP)
    - Limitations or constraints on melter development (NGM requirements)
    - Options for BOP modifications
    - Cost and schedule impacts
  - ✓ Funding
    - Consistent funding at required levels
    - Resources/funding to perform WTP BOP evaluations

Next Generation Melter Program Contacts

- Terry Sams — Manager, WTP Support, TD&D
- Ron Calmus — Project Manager, NGM (ronald_b_calmus_@rl.gov)
- Gene Ramsey — Technical Lead, NGM
- Mike Gray — Project Engineer, NGM

- Brad Bowan — Energy Solutions (AJHCM)
- Ian Pegg — CUA / VSL (AJHCM)
- Eric Tchemitcheff — AREVA (CCIM)

- Gary Smith — EM WP 4/5 Lead
- John Vienna — EM WP 4/5 Coordinator (PNNL)



- Q & A