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### **Abstract**

Florida International University's Hemispheric Center for Environmental Technology (FIU-HCET) was established in 1995 by the University and the United States Department of Energy-Office of Science and Technology (DOE-OST) to research, develop, and demonstrate innovative environmental technologies and to establish alliances that support the implementation of these technologies. FIU-HCET's research and development (R&D) activities support U.S. Department of Energy-Environmental Management (DOE-EM) programs in the areas of deactivation and decommissioning; mixed waste; characterization, monitoring, and sensor technology; subsurface contamination monitoring; radioactive tank waste remediation; and international technology integration. FIU-HCET has established a reputation for cost-effective, non-biased, independent testing of innovative environmental technologies. Since many environmental problems in the Western Hemisphere cannot currently be resolved using existing technologies, progress in technology innovation is a logical extension of the problem-resolution process.

FIU-HCET forms partnerships with small businesses and inventors, assisting them in the evaluation of the market potential and, if warranted the development of their new technology concepts. These partnerships result in a greater opportunity for technology demonstrations, provide access to potential funds for demonstrations and commercialization, and increase the commercial sector's access to federally developed technologies.

## **FY01 Projects**

The projects proposed by FIU-HCET for FY01 aim to make technical advances, achieve cost savings, and facilitate technical implementation to benefit DOE-OST and DOE-EM. FIU-HCET's work is organized in four programs: 1) Deactivation and Decommissioning (D&D); 2) Mixed Waste; 3) the Tanks (TFA) Program; and 4) Subsurface Contamination. The specific projects to be discussed in this presentation include:

- D&D Focus Area
  - D&D Technology Assessment Program
  - D&D Technology Information Management and Dissemination
  - Technology Development, Integration and Deployment
  - Worker Health & Safety Research & Technology Development
  - D&D Waste Disposition & Treatment
  - Long-Term Monitoring & Stewardship for DDFA
- Transuranic & Mixed Waste Focus Area
  - T&MWFA Technology Assessments
  - Treatability Studies and Treatment Technology Development
- Tanks Focus Area
  - Waste Conditioning for Tank Slurry Transfer
  - Plugging and Unplugging for Waste Slurry Transfer Pipelines
  - Investigation of Waste Glass Pouring Behavior Over a Knife Edge
  - Solids Formation and Feed Stability During Waste Slurry Transfer
  - Evaluation and Demonstration of Alternative HLW Canister Decontamination Techniques
  - Center for Expertise for the Development and Deployment of Tank Slurry Monitoring
- Subsurface Contamination Focus Area
  - Long-Term Monitoring and Technical Assistance



# FY 2001 FIU-HCET EM-50 Research and Development Program

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Florida International University

# Selected Research Activities

## D&D Focus Area

- D&D Technology Assessment Program
- D&D Technology Information Management and Dissemination
- Technology Development, Integration and Deployment Program
- Worker Health & Safety Research and Technology Development
- D&D Waste Disposition & Treatment
- Long-term Monitoring & Stewardship for DDFA

## Transuranic & Mixed Waste Focus Area

- T&MWFA Technology Assessment
- Treatability Studies and Treatment Technology Development

## Subsurface Contamination Focus Area

- Long-Term Monitoring and Technical Assistance

## Tanks Focus Area

- Waste Conditioning for Tank Slurry Transfer
- Plugging and Unplugging of Waste Slurry Transfer Pipelines
- Investigation of Waste Glass Pouring Behavior over a Knife Edge
- Solids Formation and Feed Stability During Waste Slurry Transfer
- Evaluation and Demonstration of Alternative HLW Canister Decontamination Techniques
- Center of Expertise for the Development and Deployment of Tank Slurry Monitoring

## International Technology Integration Program

- Opportunities to Market U.S. Technologies Throughout the Western Hemisphere

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# D&D Focus Area

# Technology Assessment Program

## Needs Statement

<b>DOE Need ID No.</b>	<b>DOE Need Title</b>	<b>FIU-HCET TAP Project Area</b>
OH-M901 ORDD-12	Improved Facility Survey Techniques Improved Characterization of Buildings & Facilities	Facility Characterization
AL-07-01-12-DD	New Technologies to Decontaminate and Decommission Radioactively Contaminated Facilities	Metal and Masonry Decontamination
OH-F027	Improved Equipment Dismantlement	Equipment Dismantlement
RF-DD11 RF-DD21 RL-DD02	Size Reduction Of Contaminated Equipment and Demolition Waste Removal of Glove Box Lead Shielding Glove Box Size Reduction System for PFP	Glove Box and Tank Size Reduction
ID-7.2.2.8 ORDD-07	Remote demolition of concrete structures Remote dismantlement methods	Facility Dismantlement



# Technology Assessment Program

## ☀ Expected Outcome

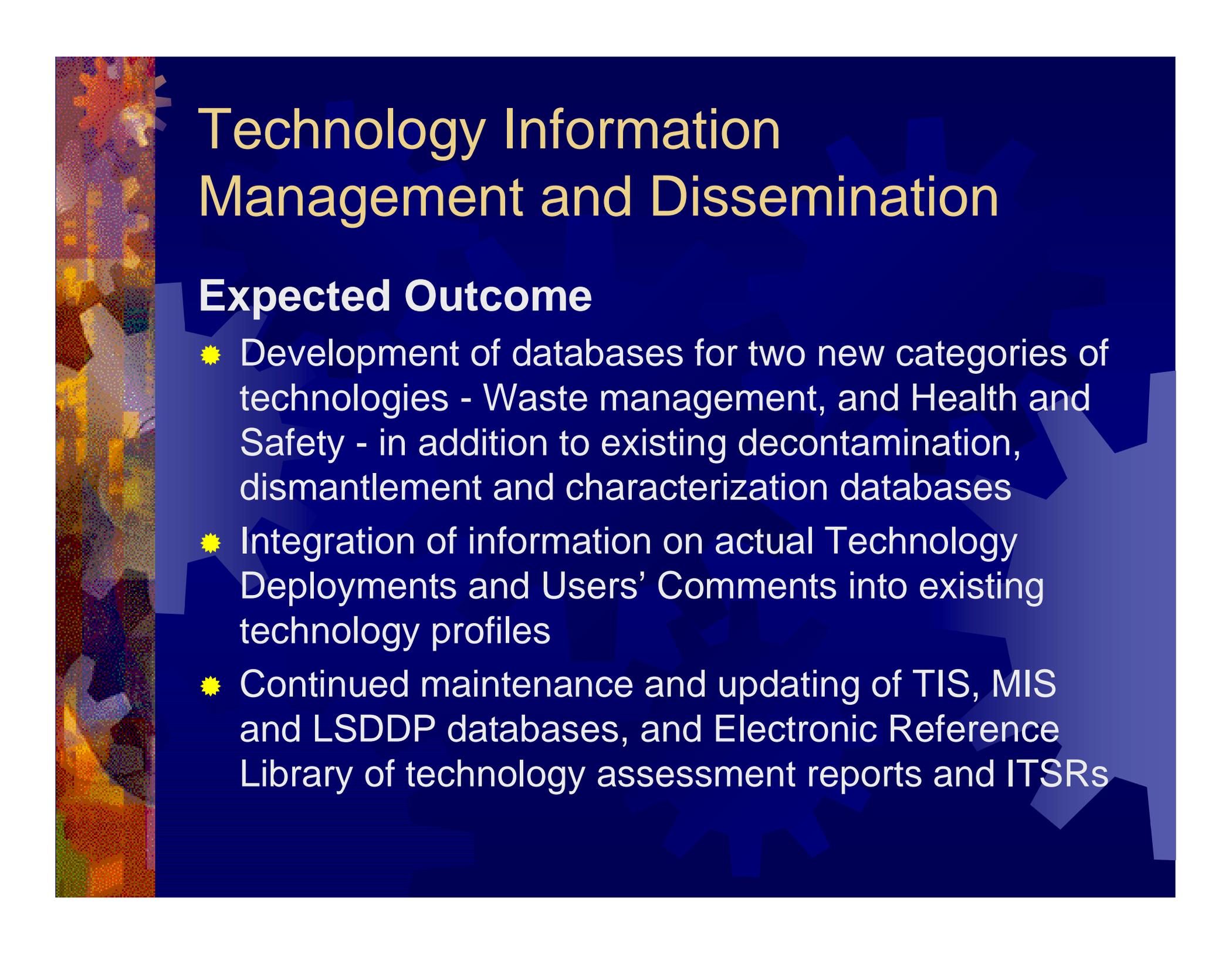
- ☀ Evaluation of technologies in a standardized manner
- ☀ Generation of comparable data on both baseline and innovative technologies
- ☀ Dissemination of data to technology need holders/end users through written reports and the Internet
- ☀ Over 80 technologies have been demonstrated to date
  - FY 01 demonstrations planned in:
    - Facility Characterization
    - Equipment Dismantlement (including gloveboxes)
    - Facility Dismantlement
    - Integrated “Multi-Purpose” D&D Technologies



# Technology Information Management and Dissemination

## Needs Statement

- ✦ To develop information systems that provide project managers across the DOE Complex with ready access to up-to-date, accurate technology information that can assist them in identifying solutions to cleanup problems
- ✦ Accomplishments to date
  - The DDFA technology information management and decision support repository - **Gateway to Environmental Technology (GET)** – is accessible at <http://www.DandD.org>



# Technology Information Management and Dissemination

## Expected Outcome

- ✦ Development of databases for two new categories of technologies - Waste management, and Health and Safety - in addition to existing decontamination, dismantlement and characterization databases
- ✦ Integration of information on actual Technology Deployments and Users' Comments into existing technology profiles
- ✦ Continued maintenance and updating of TIS, MIS and LSDDP databases, and Electronic Reference Library of technology assessment reports and ITSRs

# Technology Development, Integration and Deployment Program (TDID)

## Needs Statement

- ★ The FIU-HCET TDID provides DOE with new and innovative technology alternatives for actual field demonstrations and deployments. The technology being developed by TDID answer unmet technology needs across the Complex

<b>DOE Need ID No.</b>	<b>DOE Need Title</b>	<b>FIU-HCET's TDID Technology Development Projects</b>
AL-07-01-12-DD	New Technologies to Decontaminate and Decommission Radioactively Contaminated Facilities	IVOD/MIP-DC/On-Line Decontamination technologies
OH-F027	Improved Equipment Dismantlement	Equipment Dismantlement
RF-DD02	Characterization of Contaminated Surfaces (Low Level Versus Free Release)	IVOD/MIP-DC/On-Line Decontamination technologies
AL-00-01-05-DD	Alternative Cutting Techniques for Piping	Improved Cutting Technologies for D&D
CH-DD01-99	Reduced Emission Metal Cutting	Improved Cutting Technologies for D&D

# Technology Development, Integration and Deployment Program (TDID)

## Expected Outcome

- ☀ Demonstrate and deploy technologies developed and integrated at HCET at various DOE site or commercial utilities sites. Commercialization and technology transfer is also anticipated. An example of possible demonstration/deployment sites is provided below.

<b>Technologies for Demonstration and Deployments</b>	<b>Potential Deployment Site</b>	<b>Application</b>
<b>MIP-DC</b>	<b>DRS (Oak Ridge) Rancho Seco (SMUD), Fernald Site, INEEL</b>	<b>Characterization and decontamination of Large Bore Pipes (6 inch &lt;Diameter&gt;24 inch).</b>
<b>IVOD</b>	<b>Mound, Rancho Seco (SMUD), INEEL, Rocky Flats</b>	<b>Characterization and decontamination of concrete walls and floor surfaces.</b>
<b>On-Line</b>	<b>Mound, Rancho Seco (SMUD), INEEL</b>	<b>Characterization and decontamination of concrete floor surfaces.</b>
<b>In-Situ Pipe</b>	<b>Rancho Seco (SMUD), INEEL</b>	<b>Decontamination of In-Situ pipes, drainage pipes, and buried pipes.</b>

# Worker Health and Safety Research and Technology Development

## Needs Statement

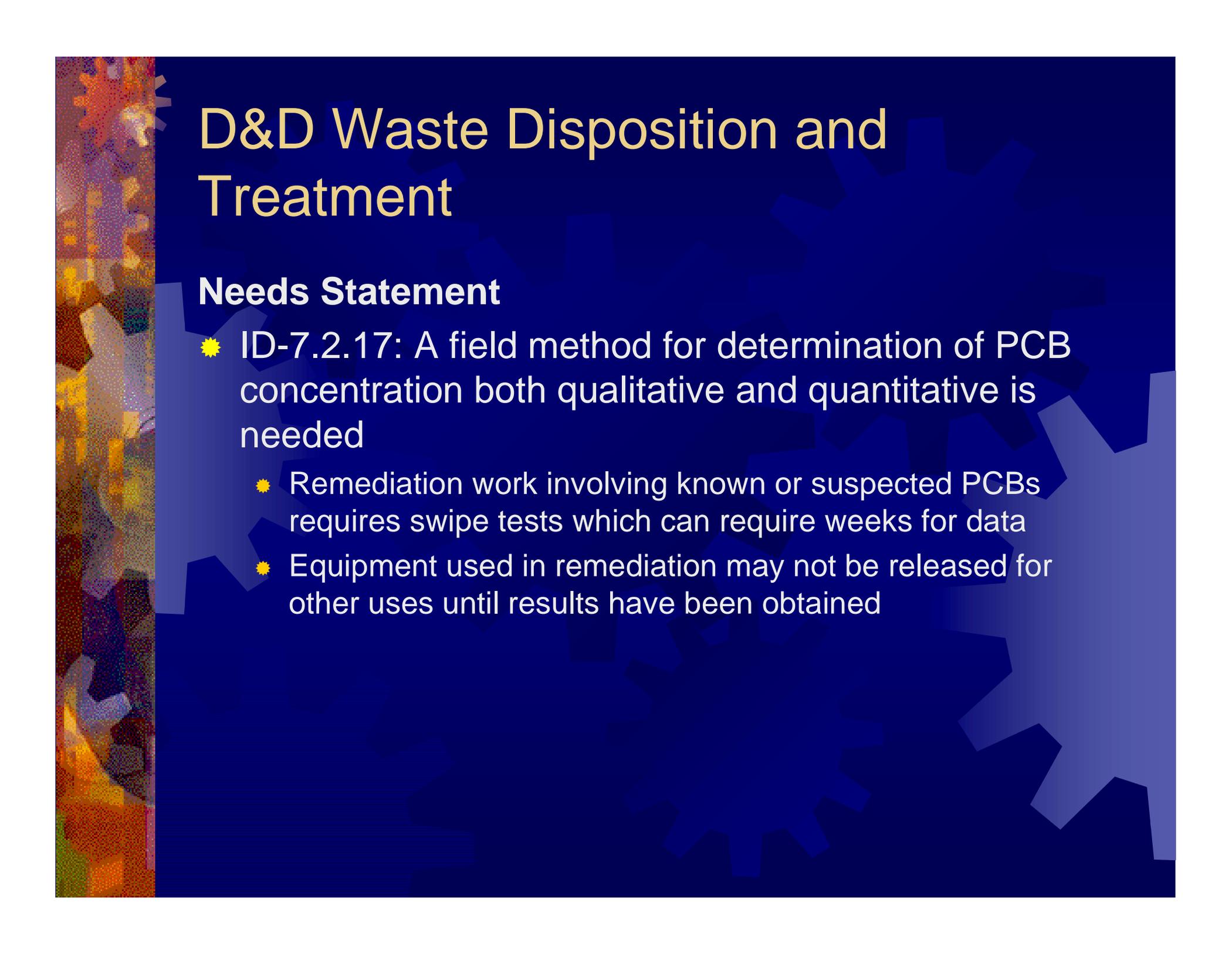
Needs Identification No	Title
AL-09-01-02-DD-S	Radiological Air Monitoring Needs for Current D&D / ER Operations
AL-00-01-07-DD	Ex-Situ Glove Box Size Reduction System
RF-DD18	Real-time Radiation Air Monitoring During Building Demolition
RL-DD025-S	Effluent Capture
RL-DD02	Glove Box Size Reduction for PFP
RF-DD03	Improved Interior Airborne Particulate Control
CH-DD06-99	Size Reduction of Massive Metal Structures



# Worker Health and Safety Research and Technology Development

## Expected Outcome

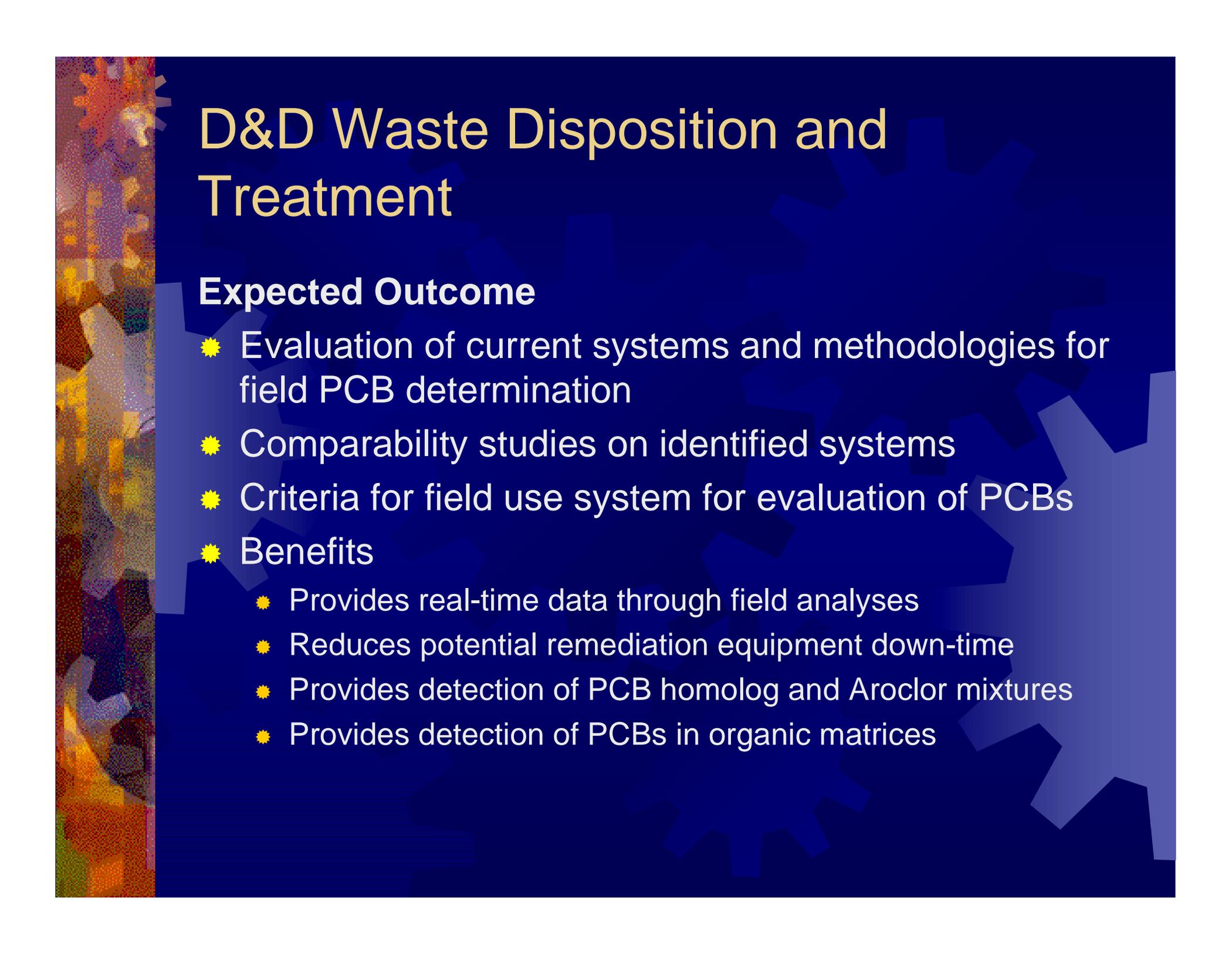
- ✦ Recommendations of state of the art technologies for measuring concentration of airborne during D&D operations
- ✦ Generation of data on size distribution, respirable fraction and concentration of aerosols generated during metal cutting. Useful for:
  - ✦ Assessment of inhalation exposures and control. Planning respiratory equipment & exposure times will result in efficient utilization of skilled work force
  - ✦ Designing and use of suitable prefilters will extend the life of expensive HEPA filters



# D&D Waste Disposition and Treatment

## Needs Statement

- ✦ ID-7.2.17: A field method for determination of PCB concentration both qualitative and quantitative is needed
  - ✦ Remediation work involving known or suspected PCBs requires swipe tests which can require weeks for data
  - ✦ Equipment used in remediation may not be released for other uses until results have been obtained



# D&D Waste Disposition and Treatment

## Expected Outcome

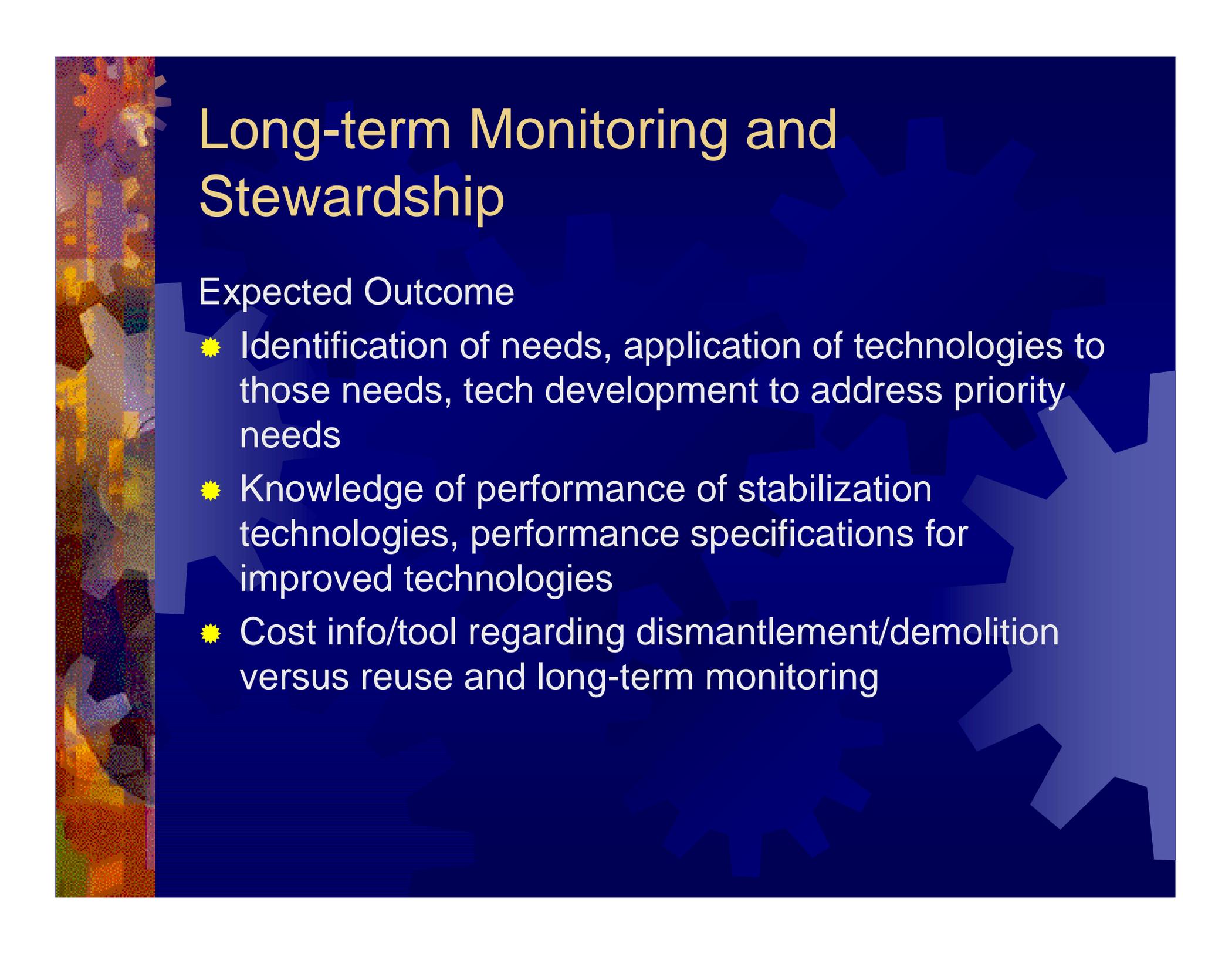
- ✦ Evaluation of current systems and methodologies for field PCB determination
- ✦ Comparability studies on identified systems
- ✦ Criteria for field use system for evaluation of PCBs
- ✦ Benefits
  - ✦ Provides real-time data through field analyses
  - ✦ Reduces potential remediation equipment down-time
  - ✦ Provides detection of PCB homolog and Aroclor mixtures
  - ✦ Provides detection of PCBs in organic matrices



# Long-term Monitoring and Stewardship

## Needs Statement

- ★ To provide identification of:
  - ★ Long-term monitoring requirements in DOE facilities (e.g., contaminants movement, structural integrity, water and air infiltration, climate, flora, fauna)
  - ★ Stabilization technologies and decision analysis tool for facility reuse
- ★ STCG Needs: AL000102DD; AL000103DD; AL090102DD-S; ID7.2.06; SR004012; SR004013; RLDD07; RLDD011,32,45,50,52,55,56



# Long-term Monitoring and Stewardship

## Expected Outcome

- ✦ Identification of needs, application of technologies to those needs, tech development to address priority needs
- ✦ Knowledge of performance of stabilization technologies, performance specifications for improved technologies
- ✦ Cost info/tool regarding dismantlement/demolition versus reuse and long-term monitoring

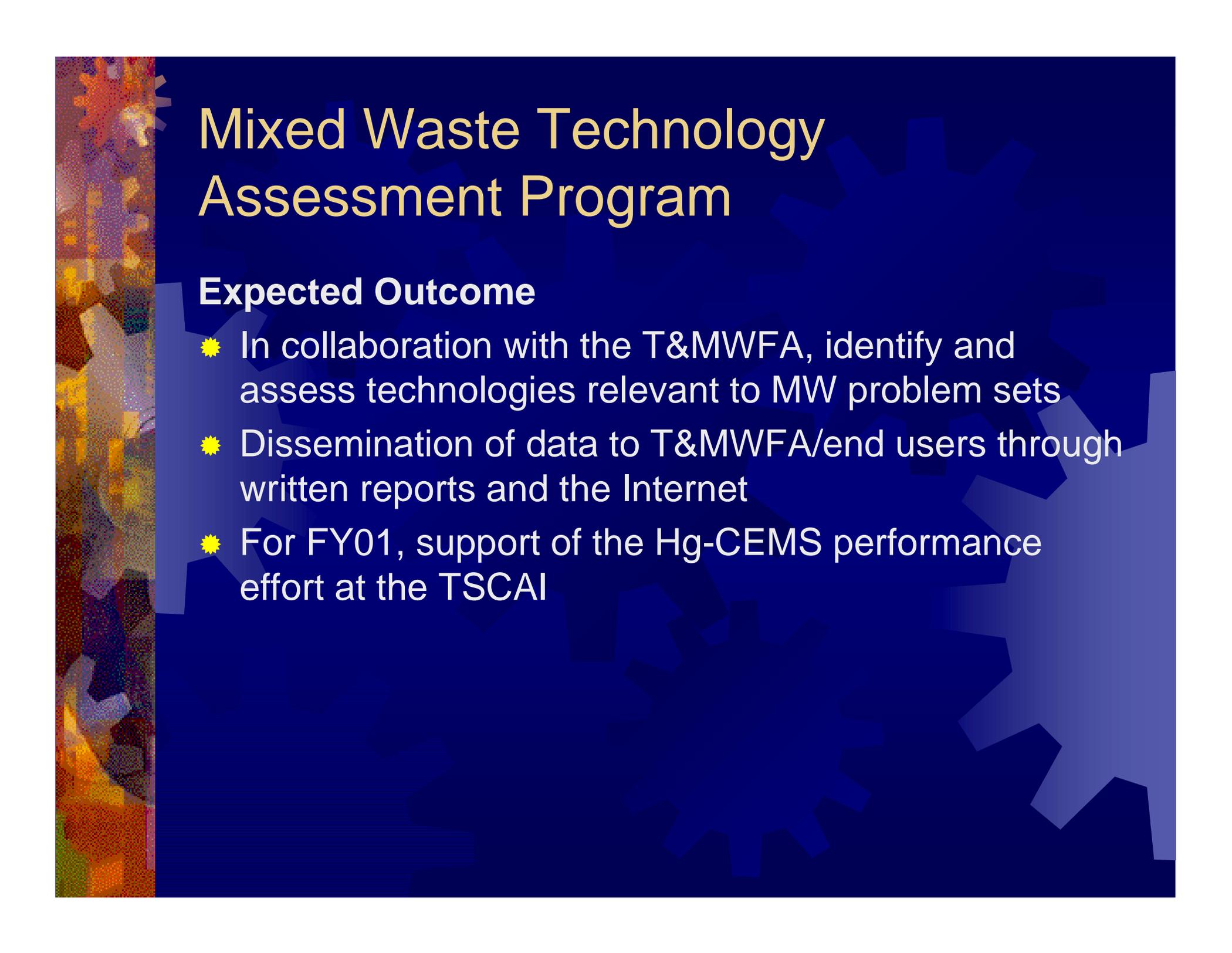


# Transuranic & Mixed Waste Focus Area

# Mixed Waste Technology Assessment Program

## Needs Statement

<b>DOE Need ID No.</b>	<b>DOE Need Title</b>	<b>Associated MWTAP Project Area</b>
OR-WM13	Metals Monitoring of Gaseous Emissions	Waste Characterization
SR00-1004	Need for Continuous Emission Monitors for Measurement of Hazardous Compound Concentrations in Incinerator Stack Gas	Waste Characterization
ID-3.2.3.2	Develop Thermal Treatment Unit Offgas CEM Monitors	Waste Characterization
ID- S.1.02 ID- 2.1.18	Continuous Emissions Monitors for Offgas Analysis	Waste Characterization



# Mixed Waste Technology Assessment Program

## Expected Outcome

- ✦ In collaboration with the T&MWFA, identify and assess technologies relevant to MW problem sets
- ✦ Dissemination of data to T&MWFA/end users through written reports and the Internet
- ✦ For FY01, support of the Hg-CEMS performance effort at the TSCAI

# Treatability Studies and Treatability Technology Development

## Needs Statement

<b>DOE Need ID No.</b>	<b>DOE Need Title</b>	<b>FIU-HCET's RWM Technology Development Projects</b>
CH-MW02-99 CH-MW04-99 CH-MW05-99	Treatment of PCB-Contaminated Low Level Radioactive Waste	Alternative PCB Treatment Technology
OH-AB-010	PCB Treatment Technologies	Alternative PCB Treatment Technology
OH-F043	Mixed Waste Treatment Projects	Alternative PCB Treatment Technology
OK99-09	Destruction of Mixed Chlorinated Solvents	Alternative PCB Treatment Technology
RL-MW06	Treatment of CH TRUW Liquid Wastes Contaminated with PCBs	Alternative PCB Treatment Technology



# Treatability Studies and Treatability Technology Development

## Expected Outcome

- ✦ Execution of project activities includes obtaining sample matrix material from participating sites for laboratory treatability studies.
- ✦ Extent to which project activities address specific needs include potential identification of treatment disposition path for “unique” orphan waste streams.

The background features a dark blue field filled with numerous interlocking gears of varying sizes and shades of blue. On the left side, there is a vertical strip with a complex, colorful, and somewhat abstract pattern, possibly representing a cross-section of geological layers or a microscopic view of a material.

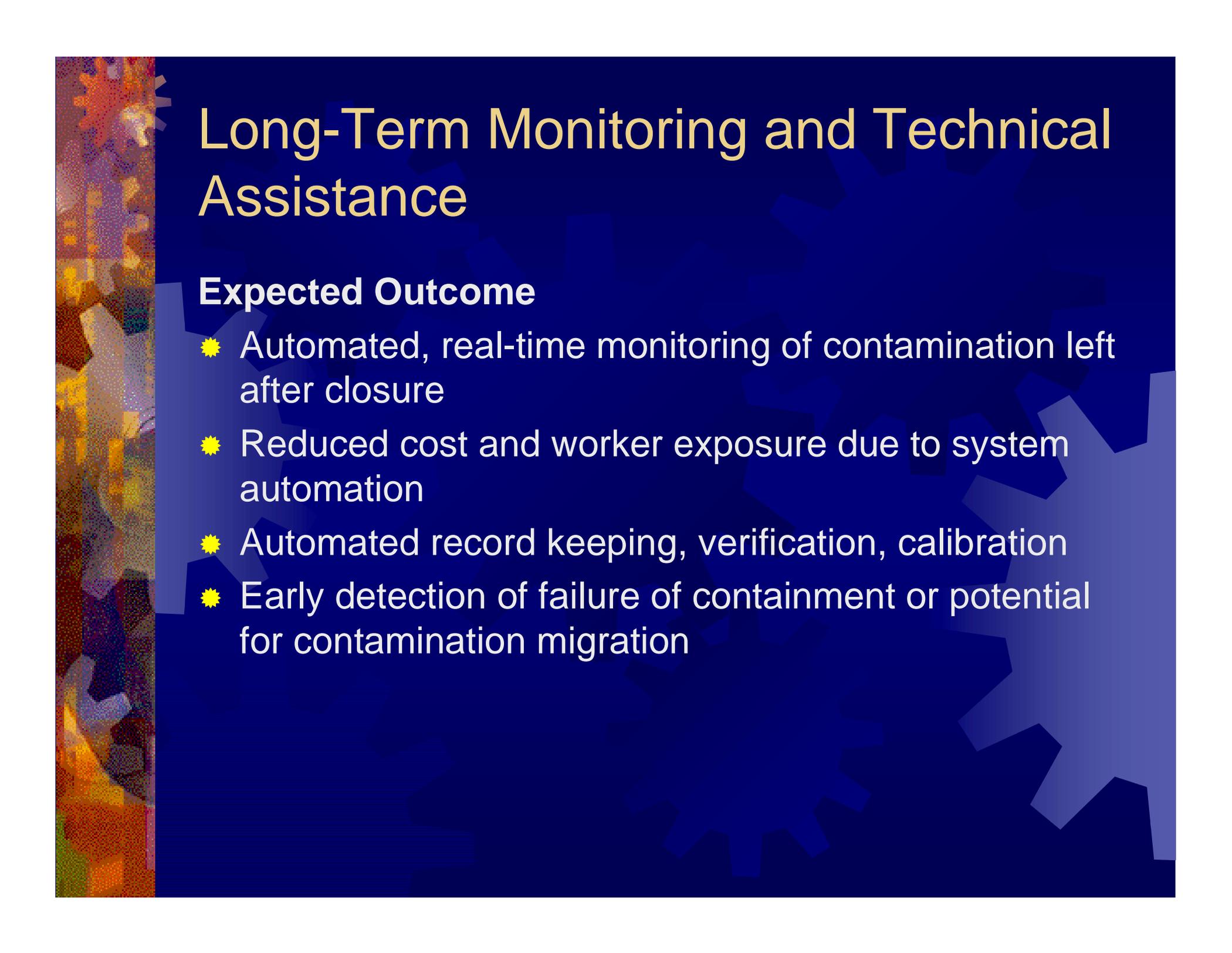
# Subsurface Contamination Focus Area

# Long-Term Monitoring and Technical Assistance

## Needs Statement

- ✦ A long-term monitoring system is needed for the post-closure phase of site with contamination left in soil

STCG Need ID No.	Need Title
AL-07-09-02-SC-S	Hydrologic Performance Monitoring of Covers
ORBW-08	Long-Term Performance Assessment
NV18-9903-04S	Optimized Monitoring in Vadose Zone
SR00-3025	Verification of In Situ Stabilization and Solidification



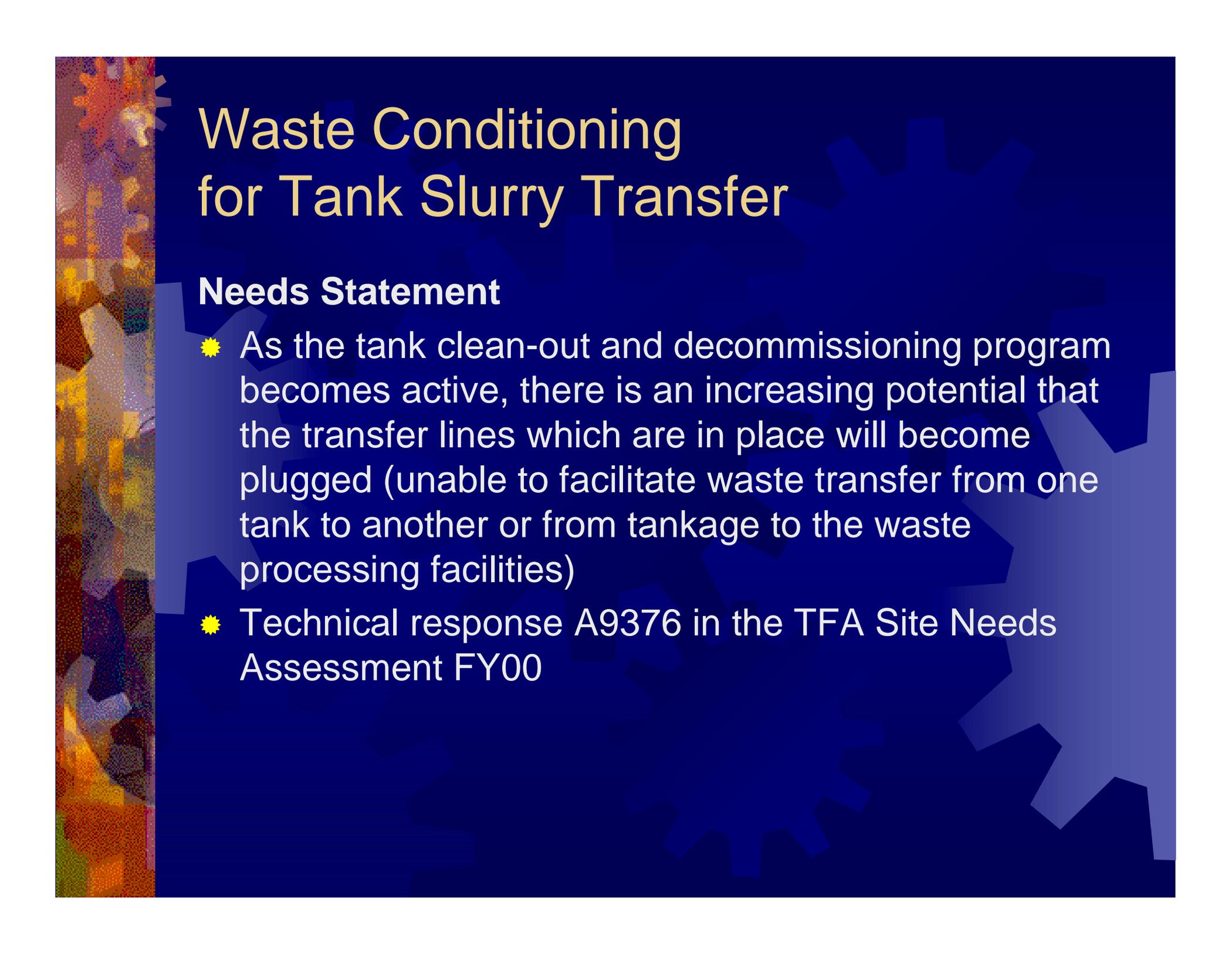
# Long-Term Monitoring and Technical Assistance

## Expected Outcome

- ✦ Automated, real-time monitoring of contamination left after closure
- ✦ Reduced cost and worker exposure due to system automation
- ✦ Automated record keeping, verification, calibration
- ✦ Early detection of failure of containment or potential for contamination migration

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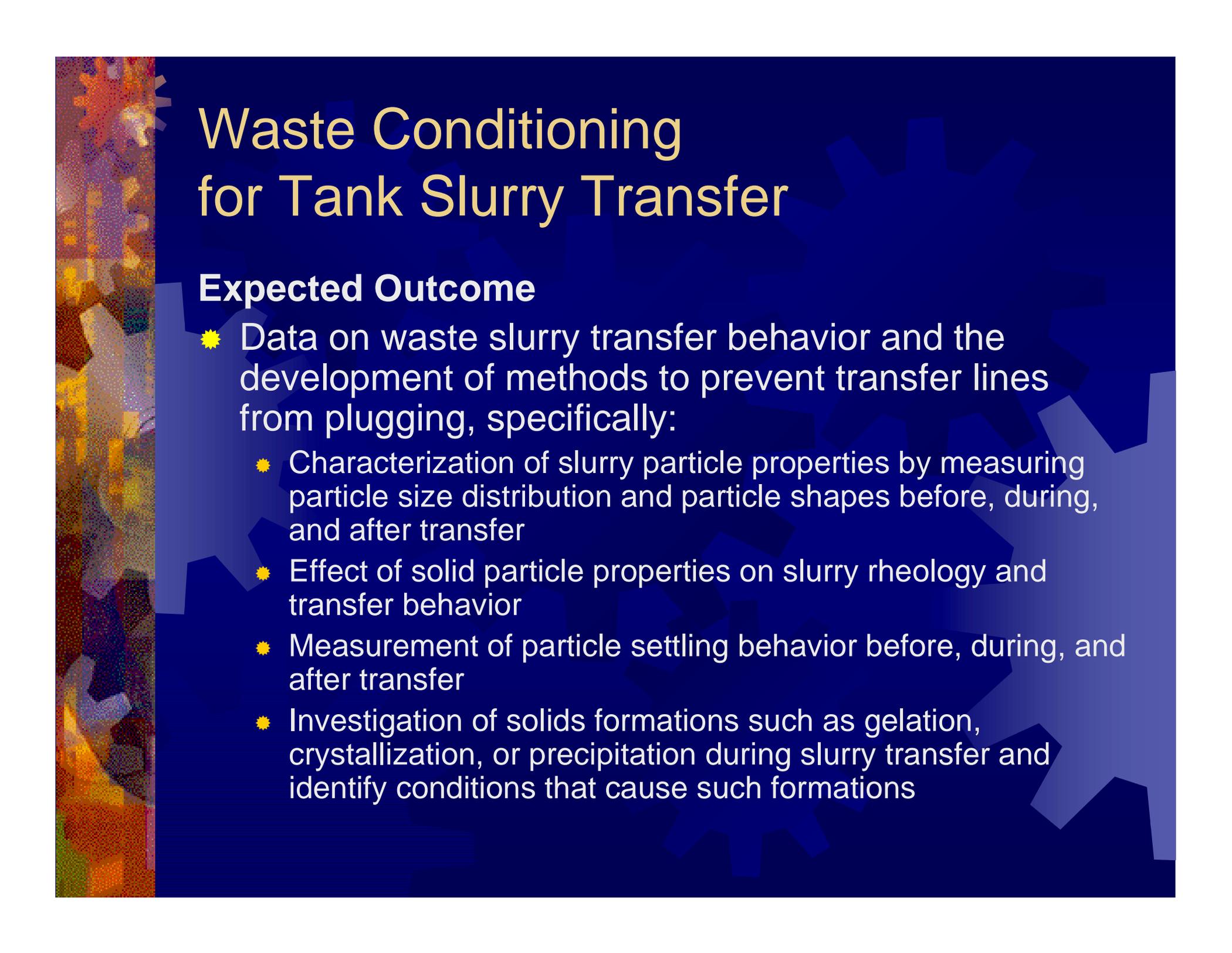
# Tanks Focus Area



# Waste Conditioning for Tank Slurry Transfer

## Needs Statement

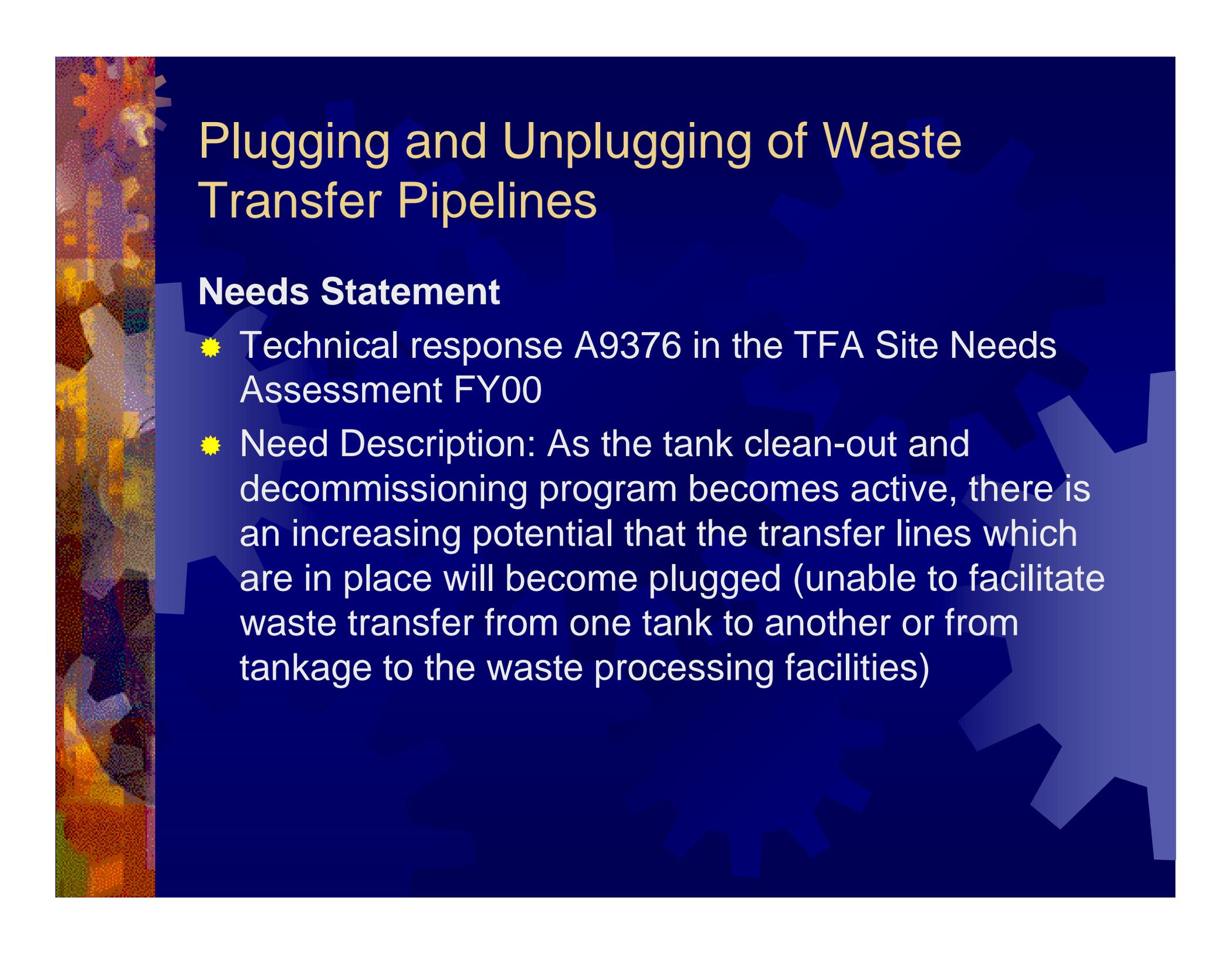
- ★ As the tank clean-out and decommissioning program becomes active, there is an increasing potential that the transfer lines which are in place will become plugged (unable to facilitate waste transfer from one tank to another or from tankage to the waste processing facilities)
- ★ Technical response A9376 in the TFA Site Needs Assessment FY00



# Waste Conditioning for Tank Slurry Transfer

## Expected Outcome

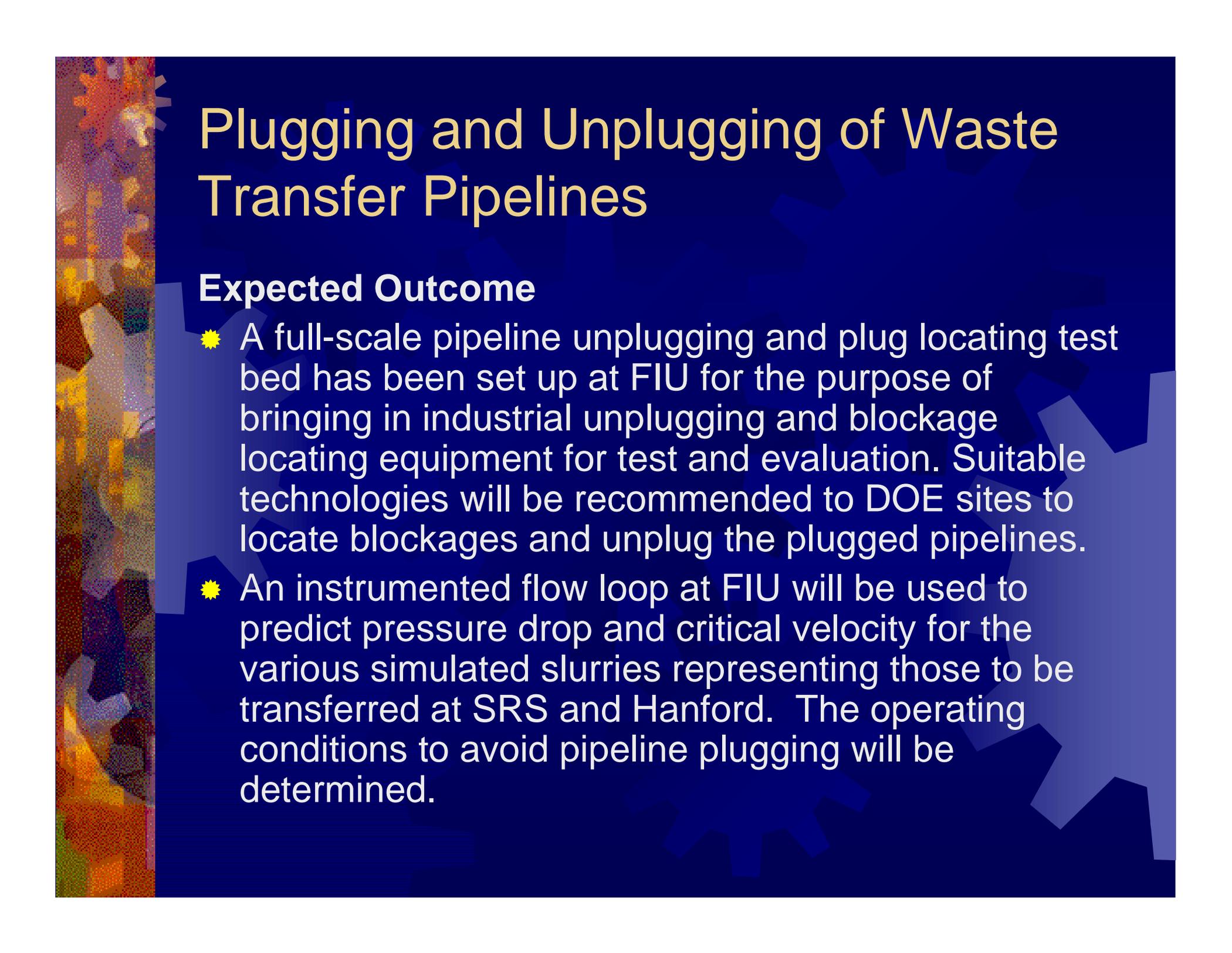
- Data on waste slurry transfer behavior and the development of methods to prevent transfer lines from plugging, specifically:
  - Characterization of slurry particle properties by measuring particle size distribution and particle shapes before, during, and after transfer
  - Effect of solid particle properties on slurry rheology and transfer behavior
  - Measurement of particle settling behavior before, during, and after transfer
  - Investigation of solids formations such as gelation, crystallization, or precipitation during slurry transfer and identify conditions that cause such formations



# Plugging and Unplugging of Waste Transfer Pipelines

## Needs Statement

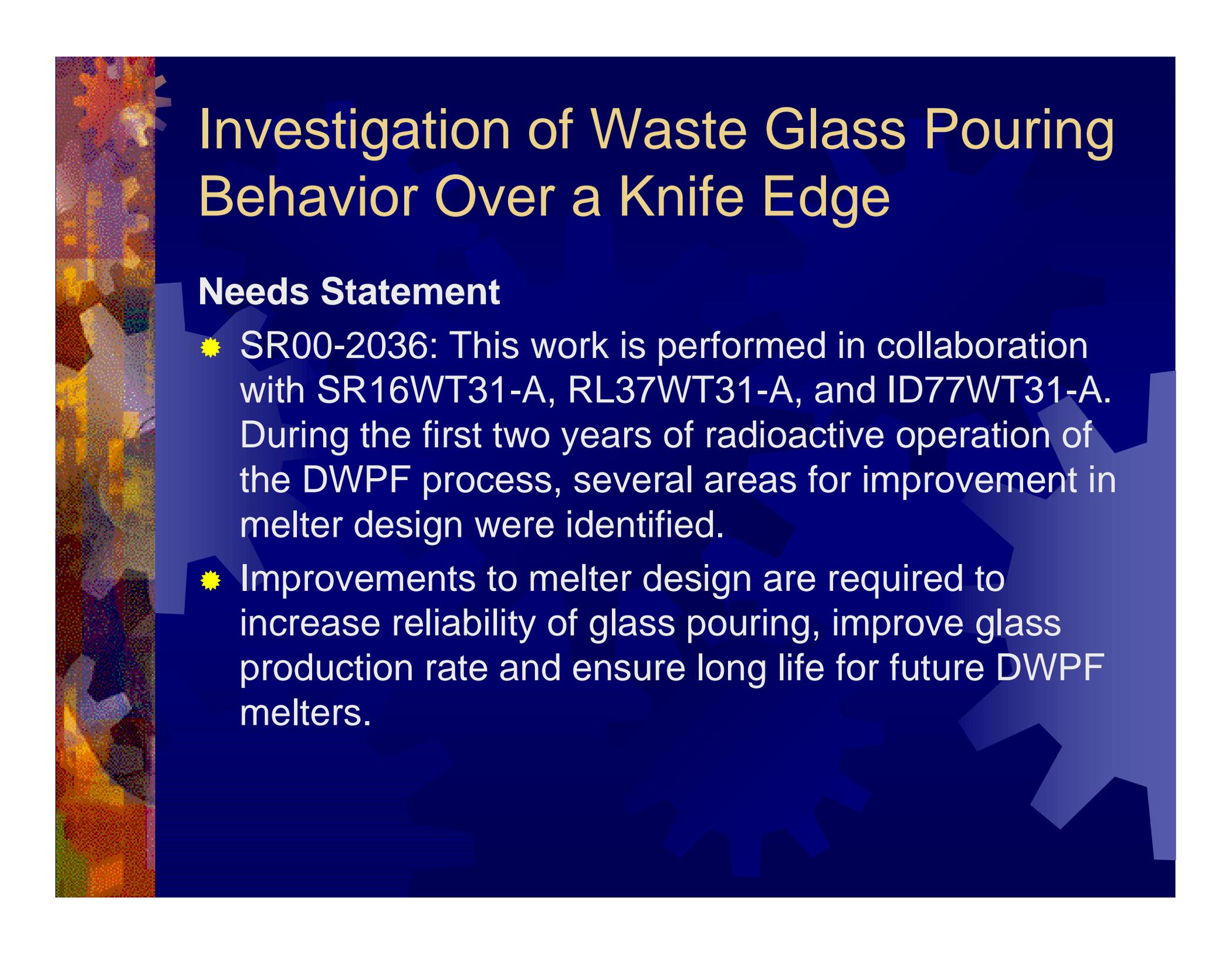
- ★ Technical response A9376 in the TFA Site Needs Assessment FY00
- ★ Need Description: As the tank clean-out and decommissioning program becomes active, there is an increasing potential that the transfer lines which are in place will become plugged (unable to facilitate waste transfer from one tank to another or from tankage to the waste processing facilities)



# Plugging and Unplugging of Waste Transfer Pipelines

## Expected Outcome

- ✦ A full-scale pipeline unplugging and plug locating test bed has been set up at FIU for the purpose of bringing in industrial unplugging and blockage locating equipment for test and evaluation. Suitable technologies will be recommended to DOE sites to locate blockages and unplug the plugged pipelines.
- ✦ An instrumented flow loop at FIU will be used to predict pressure drop and critical velocity for the various simulated slurries representing those to be transferred at SRS and Hanford. The operating conditions to avoid pipeline plugging will be determined.



# Investigation of Waste Glass Pouring Behavior Over a Knife Edge

## Needs Statement

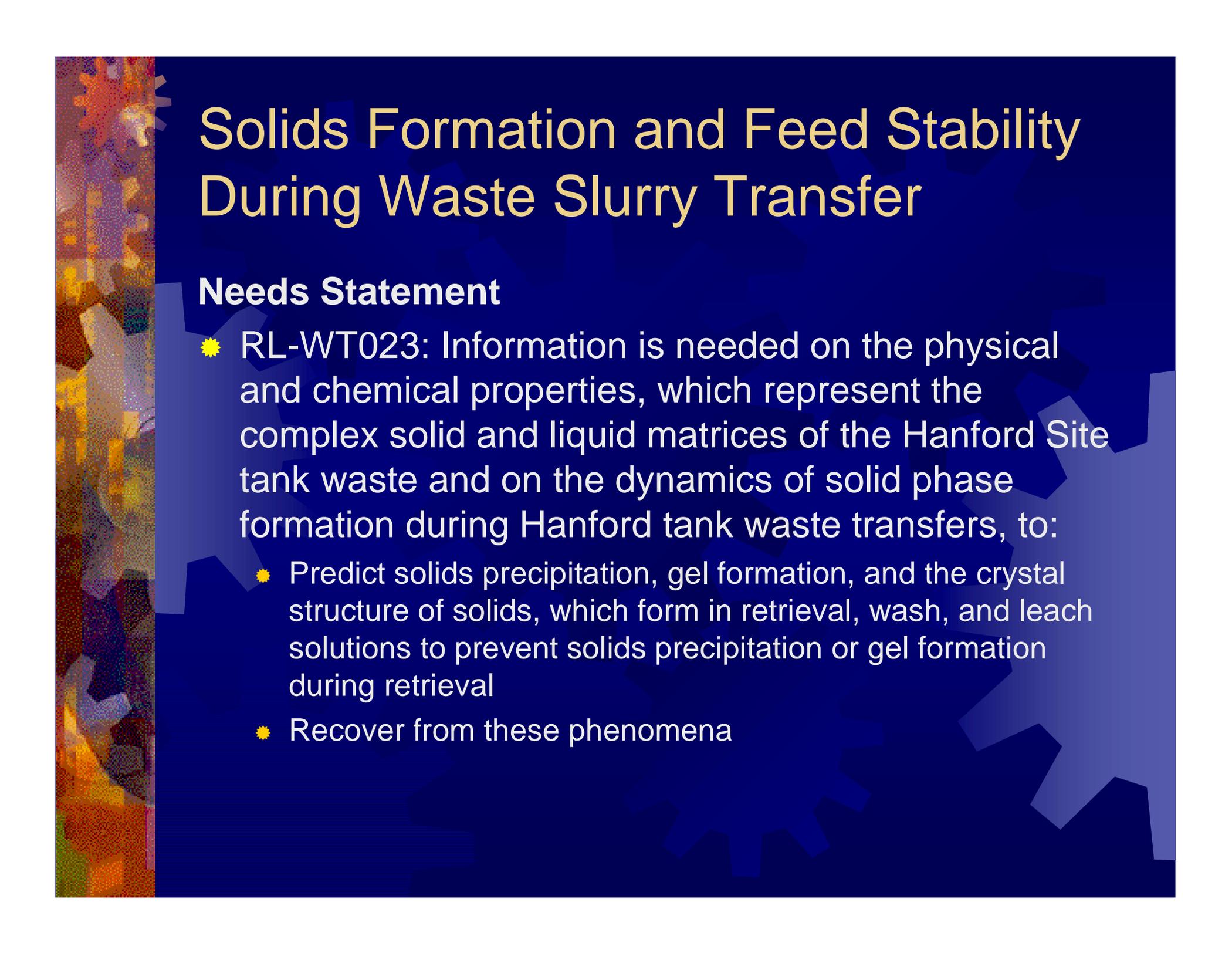
- ✦ SR00-2036: This work is performed in collaboration with SR16WT31-A, RL37WT31-A, and ID77WT31-A. During the first two years of radioactive operation of the DWPF process, several areas for improvement in melter design were identified.
- ✦ Improvements to melter design are required to increase reliability of glass pouring, improve glass production rate and ensure long life for future DWPF melters.



# Investigation of Waste Glass Pouring Behavior Over a Knife Edge

## Expected Outcome

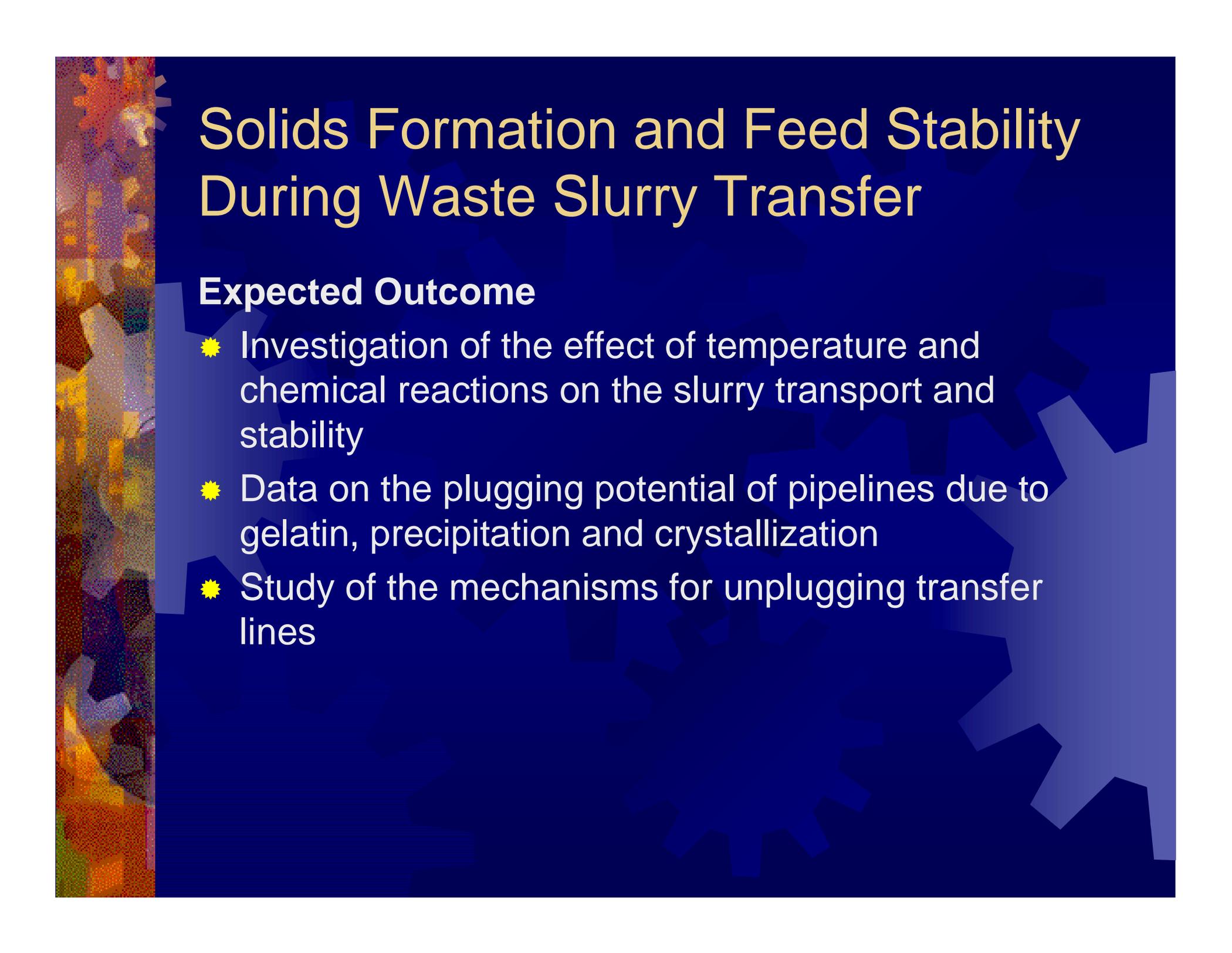
- ✦ Investigation of the pouring behavior of molten glass over a pour spout knife edge
  - ✦ Experiments are run using surrogate glass (provided by DWPF) containing the same chemical formulation as the radioactive sludge glass, but without radioactive contaminants
- ✦ Glass profile data to provide an overall understanding of the physics of liquids flowing over a knife edge
- ✦ Computational fluid dynamic (CFD) models
- ✦ Identification of process conditions for “wicking”
- ✦ Test-bed for DWPF inserts



# Solids Formation and Feed Stability During Waste Slurry Transfer

## Needs Statement

- ★ RL-WT023: Information is needed on the physical and chemical properties, which represent the complex solid and liquid matrices of the Hanford Site tank waste and on the dynamics of solid phase formation during Hanford tank waste transfers, to:
  - ★ Predict solids precipitation, gel formation, and the crystal structure of solids, which form in retrieval, wash, and leach solutions to prevent solids precipitation or gel formation during retrieval
  - ★ Recover from these phenomena



# Solids Formation and Feed Stability During Waste Slurry Transfer

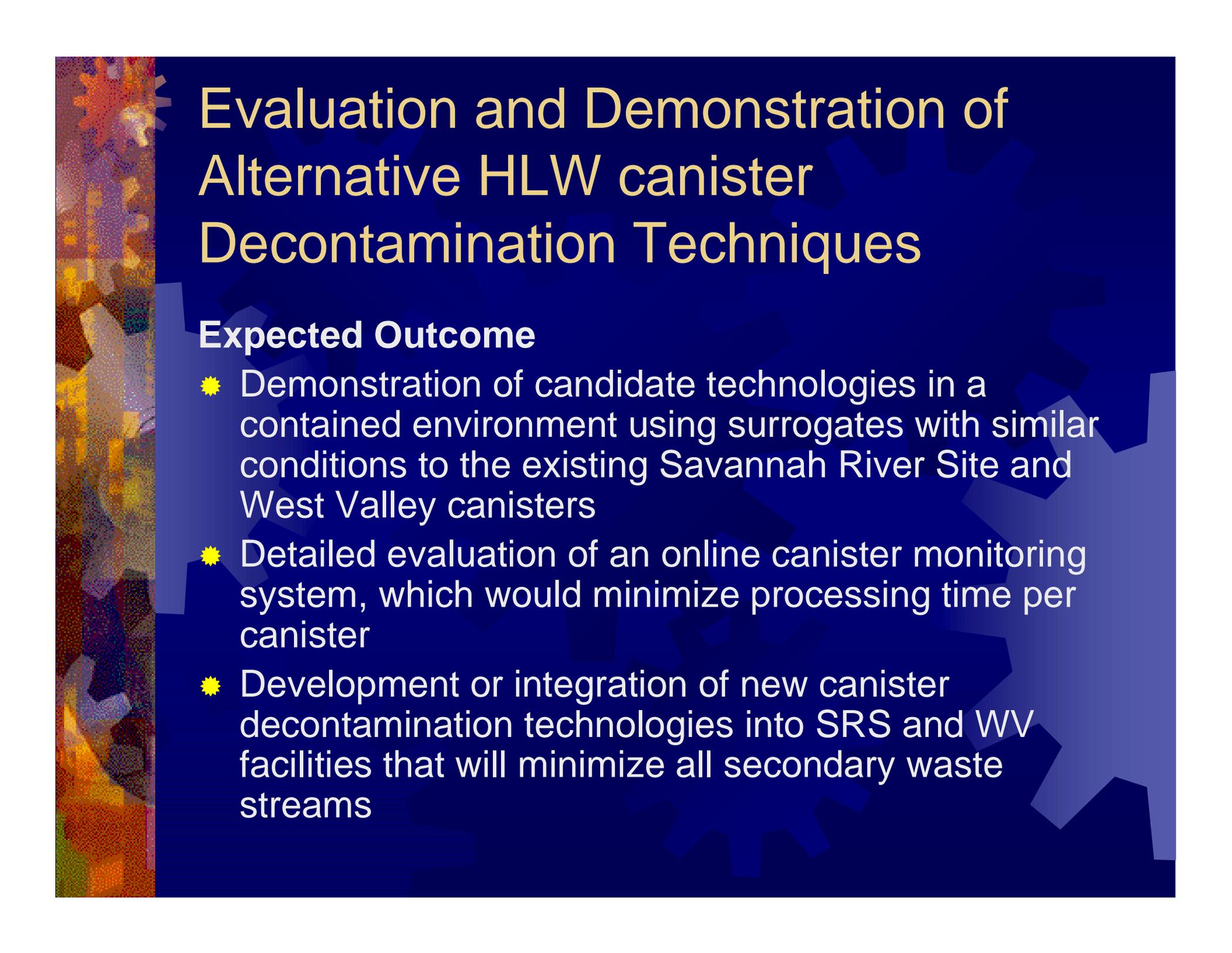
## Expected Outcome

- ✦ Investigation of the effect of temperature and chemical reactions on the slurry transport and stability
- ✦ Data on the plugging potential of pipelines due to gelatin, precipitation and crystallization
- ✦ Study of the mechanisms for unplugging transfer lines

# Evaluation and Demonstration of Alternative HLW canister Decontamination Techniques

## Needs Statement

<b>Need</b>	<b>Description</b>
SR00-2029 Alternative DWPF Canister Decon Technology	A decontamination method is required which will remove the oxide layer from the exterior surface of the DWPF stainless steel canister. The contamination level of the exterior surface must be less than 2200 dpm/10 cm <sup>2</sup> beta gamma and 220 dpm/100cm <sup>2</sup> alpha.
OH-WV902 Decontamination of High-Level Waste (HLW) Canisters	Prior to transport off-site for continued interim storage or disposal, the outer surfaces of more than 230 canisters of HLW (with a limited number to be generated in the future) must be cleaned to remove radioactive contamination resulting from filling, and from storage in a contaminated environment. The decontamination process should produce a secondary waste stream that can be managed readily for packaging, storage, and disposal.



# Evaluation and Demonstration of Alternative HLW canister Decontamination Techniques

## Expected Outcome

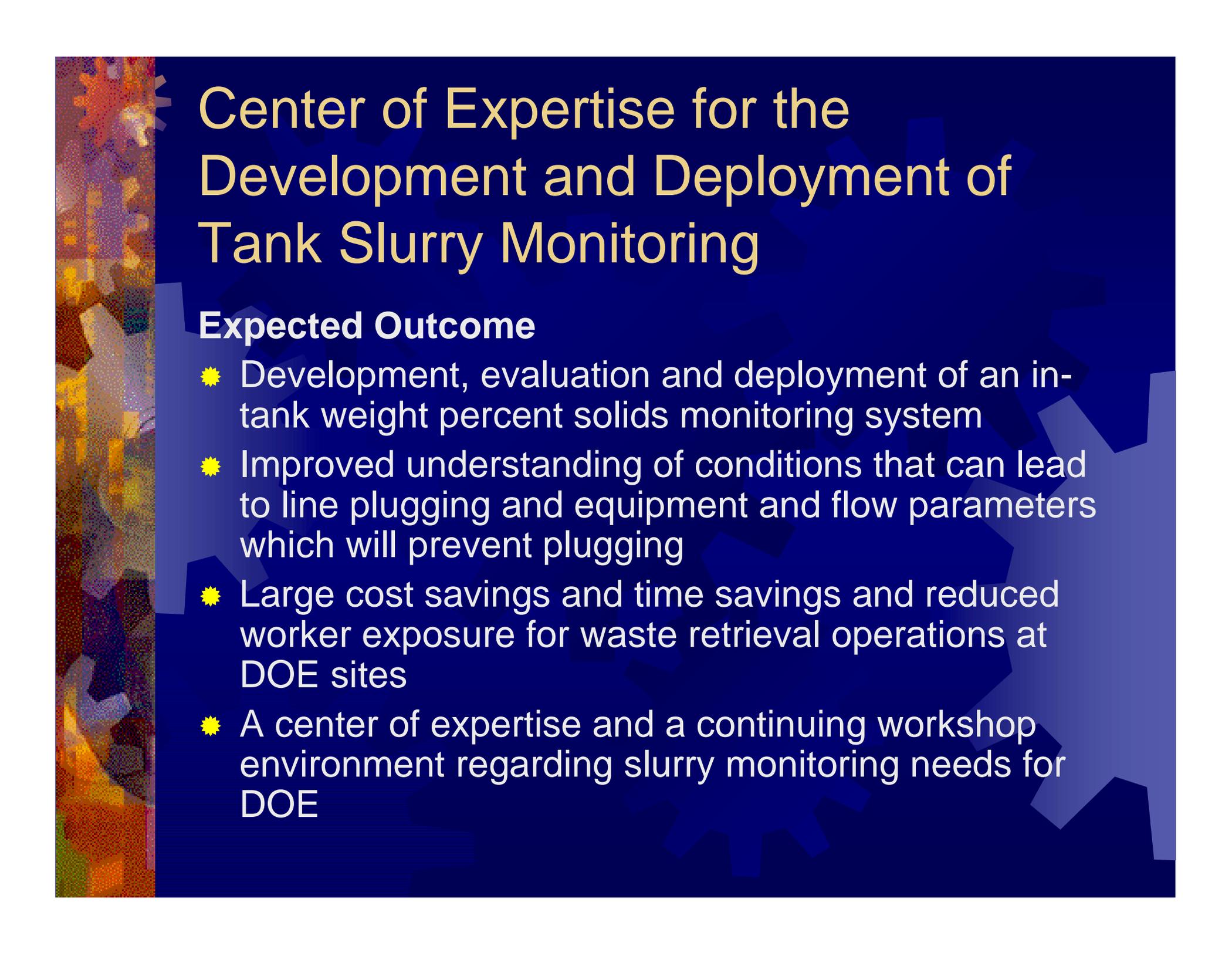
- ✦ Demonstration of candidate technologies in a contained environment using surrogates with similar conditions to the existing Savannah River Site and West Valley canisters
- ✦ Detailed evaluation of an online canister monitoring system, which would minimize processing time per canister
- ✦ Development or integration of new canister decontamination technologies into SRS and WV facilities that will minimize all secondary waste streams



# Center of Expertise for the Development and Deployment of Tank Slurry Monitoring

## Needs Statement

- ✦ Methods are needed to prevent plugging high-level waste transfer lines and to reduce time and cost of current sample collection and analysis procedures
- ✦ STCG Needs
  - ✦ OR-TK-04 Sludge Mixing and Slurry Transport
  - ✦ SR99-2037 Tank Heel Removal/Closure Technology



# Center of Expertise for the Development and Deployment of Tank Slurry Monitoring

## Expected Outcome

- ✦ Development, evaluation and deployment of an in-tank weight percent solids monitoring system
- ✦ Improved understanding of conditions that can lead to line plugging and equipment and flow parameters which will prevent plugging
- ✦ Large cost savings and time savings and reduced worker exposure for waste retrieval operations at DOE sites
- ✦ A center of expertise and a continuing workshop environment regarding slurry monitoring needs for DOE



# International Technology Integration Program



# Opportunities to Market U.S. Technologies Throughout the Western Hemisphere

## Expected Outcome

- ✦ Detailed environmental market assessments in Latin America and the Caribbean
- ✦ Information on technologies and services to facilitate environmental projects in the region
- ✦ Partnering private and public sectors to facilitate exchange of environmental technologies
- ✦ Coordination and management of international government and non-government programs



# Opportunities to Market U.S. Technologies Throughout the Western Hemisphere

## ☀ Samples of ITI Current Projects

- ☀ Facilitate activities between the U.S. and Argentina under the Joint Coordinating Committee for Radioactive Mixed Waste Management (JCCRM). For example: Responsible for preparing the official Record of Visit at the last Tank Focus Area meeting held in Argentina, May 2000
- ☀ Advancing international integration and transfer of environmental technologies through partnerships, teaming agreements, and other cooperative efforts. For example: Metropolitan University of Caracas; FACEX a private environmental consulting company in Venezuela; the University of Peru; and the Environmental Quality Center, Mexico
- ☀ Coordinate the organization of international symposia that facilitate information exchange in environmental technologies (ex., IDS 2000)

# Contact Information

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