



# R&D Initiatives for Decontamination and Demolition

**The Path Forward**

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- OECD/NEA R&D and Innovation Needs for Decommissioning Nuclear Facilities
  - Published Summer 2014
  - Scope and Budget Awarded End of 2011
  - Objective describe challenges, survey current technologies and R&D, and lay out research objectives across 5 themes
    - Characterization and survey prior to dismantling
    - Technologies for segmentation and dismantling
    - Decontamination and remediation
    - Materials and waste management
    - Site characterization and environmental monitoring

# BROAD SPECTRUM INITIATIVES

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- Broad spectrum initiatives have application and impact across all or most themes
- Provide capabilities and architecture to support and enable other D&D innovation initiatives
- Examples are
  - Wireless communications and data sharing technologies
  - Scanning and pattern recognition technologies

# RADIO FREQUENCY IDENTIFICATION (RFID) TAGS

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- These tags contain a worker's ID details or the info on an object.
- They are accessible wire-free via software readable on a tablet.
- E.g.:
  - To verify that the initial condition of the equipment and components is correct for commencing work.
  - To verify that the employee has the required qualifications.
  - To verify that the instrument being used is correctly calibrated...
  - identification of samples (place, time) and automatic connection to the measurement results.
- Permanent link to the wireless control platform (improved management of employee safety, better control of the work on the systems, ad hoc memorisation)

# INDOOR AND OUTDOOR POSITIONING

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- Real-time knowledge of coordinates X, Y, Z and T via the GPS.
- Accuracy of 10 cm for the interior and exterior of the installations
- Positioning of the RFID tag on the tablet, on the employee's badge or on the waste container, etc. being monitored.
- The project's real-time status is known in 3D on the CAD.
- 3D vision and automatic updating very important for installing automatic equipment (cut-out) in order to verify the safety locks and thus protect personnel and the equipment.
- Data transmitted via the cloud (coordinates X,Y,Z and T...) to the external systems (wells, reservoirs, pipes, cathodic protection, etc.) linked to the coordinating GPS.

# BROAD SPECTRUM INITIATIVES

Pattern recognition

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- Personnel, objects and equipment identified from video or drones in real time.
- Data used to control the engines remotely without personnel close by (benefits in terms of safety)
- Technique already implemented for the contractual GC (Building Information Networks (BIN))
- Development of autonomous engines operable from a centralised post which monitors the locations of personnel and equipment via tags (RFID)

# THEME SPECIFIC INITIATIVES

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1. Characterization and survey prior to dismantling (C&S)
2. Technologies for segmentation and dismantling (S&D)
3. Decontamination and remediation (D&R)
4. Materials and waste management (M&W)
5. Site characterization and environmental (S&E) monitoring

**ONLY A FEW ARBITRARY EXAMPLES  
PRESENTED FOR EACH THEME**

# THEME 1 (C&S) GEOSTATISTICAL EURSSEM

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- Objective – Update EURSSEM, MARSSIM, MARSAME for use of geostatistics.
- Purpose
  - Enable best use of emergent mapping and data logging and RFID sample tracking capabilities with  $x,y,x,t$  to understand distribution and concentration of contaminants.
  - More efficient characterization, higher certainty
  - Provide guidance for characterization and final status survey design and implementation to verify compliance with site clearance criteria.





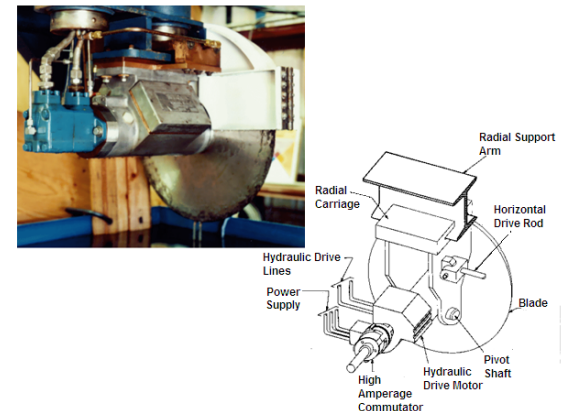
# THEME 1 (C&S) ALPHA CAMERA SENSITIVITY

- Objective – Increase sensitivity of alpha camera through advances in UV cameras and laser induced fluorescence
- Purpose
  - Current system sensitivity to high 1 kBq (60,000 dpm) to detect loose surface alpha contamination hazards
  - Alpha, beta, gamma ionize N in air. 4% N ions fluoresce in UV spectrum
  - New more sensitive UV cameras have developed in last two years
  - Laser pulse can cause remaining to fluoresce)



# THEME 2 (S&D) REACTOR INTERNALS SEGMENTATION

- Objective – Evaluate new underwater cutting technologies – arc saw, laser
- Purpose
  - Increase speed and efficiency of reactor internal segmentation
  - Perform small scale testing using underwater mock-up
  - Develop large scale working design



# THEME 3 (D&R) UNDERWATER CUTTING CAPTURE SYSTEMS

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- Objective – Develop an improved system for collecting swarf and radioactive gases at the source.
  
- Purpose
  - Enable wider array of cutting methods on activated internals including high temperature methods
  
  - Minimize clean-up and demobilization time by capturing contaminants at point of generation
  
  - Reduce water clarity and secondary waste handling down time and radiation exposures

# THEME 4 (M&S) TANK HEELS DECONTAMINATION

- Objective – To develop mechanical solutions that integrate with the waste transfer, heels removal, final decontamination and decommissioning of tanks

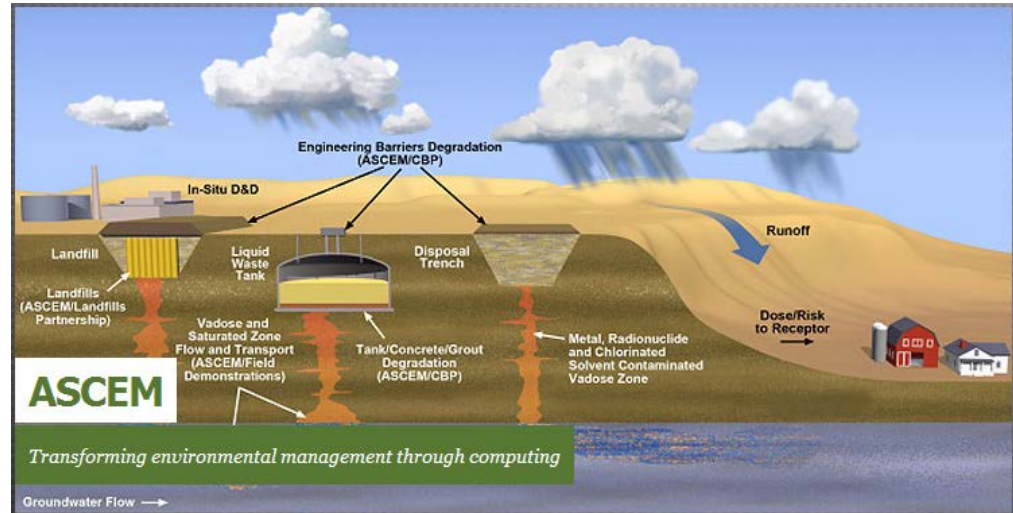


- Purpose

- Improve mechanical and chemical methods to deploy equipment, remove heels and decontaminate tank residues and lock down tank interior for demolition.
- Provide modular system for tank heels removal, and decontamination for decommissioning and demolition

# THEME 5 (S&E) COMPLEX FATE AND TRANSPORT CODE

- Objective – Update and fuse existing codes such as RESRAD, DUST-MS, ASCEM



## ➤ Purpose

- Simplify modeling of complex geometries and multiple sources.
- Provide more accurate higher confidence modeling capabilities