Nuclear Gateway Statement

Innovative Solutions for the Identification, Mobilisation and Removal of Solid Accumulations in Complex Process and Storage Systems

Nuclear Gateway Overview

Solid accumulations within process systems, tanks, vessels and storage areas can become immobile over time, leading to blockages, reduced operational efficiency, impaired monitoring and control functions, and constraints on downstream processing and storage capacity. These accumulations often occur within complex internal geometries where access is restricted, visibility is limited and conventional inspection or remediation methods are difficult to deploy.

Deposits may develop within process equipment, around internal structures, within nozzles, interfaces, support arrangements and flow paths. Over time, they can restrict functionality, reduce available capacity and create uncertainty regarding asset condition and future operation. Existing removal methods may be ineffective, resource-intensive or unsuitable for the operating environment.

There is a need to identify and deploy safe, effective and practical solutions that can reliably identify, characterise, mobilise, remove and transfer accumulated solids, restoring functionality and enabling continued processing, treatment and storage operations.

Current Situation

Accumulated solids can form gradually over extended operating periods and may become compacted, settled or difficult to access. In many cases the location, distribution and extent of the material is difficult to determine due to restricted access, limited visibility and complex plant layouts.

The physical behaviour of these materials can vary significantly. Representative accumulations may behave as a fine, free-flowing powder when dry, with characteristics similar to chalk dust, but can consolidate into a cohesive, hardened or cement-like mass when exposed to moisture or process liquors. This transition can significantly influence inspection, mobilisation, retrieval and transfer activities.

Accumulations may adhere to internal surfaces, build up around process features and partially or fully obstruct operational pathways. Current approaches to inspection and retrieval can be labour-intensive, reliant on specialist equipment and difficult to deploy within constrained environments.

Why is the Work Required?

Effective management of accumulated solids is essential to maintaining operational performance, asset availability and processing capability.

Without intervention, accumulations can:

- Restrict flow paths and process functionality.
- Reduce available capacity.
- Affect monitoring, instrumentation and control systems.

- Increase maintenance requirements and operational costs.
- Create uncertainty regarding future asset performance.
- Constrain future operational and recovery activities.

In some environments, accumulations may be located within radiological, contaminated or otherwise hazardous areas, increasing the complexity of inspection, monitoring and retrieval activities. Solutions that minimise worker exposure and reduce the need for direct intervention are therefore particularly desirable.

Innovative approaches are sought to improve understanding of accumulation behaviour, enhance inspection and visibility, enable effective mobilisation and retrieval, and support more informed operational decision making.

Generic Value and Wider Applicability

Although this challenge originates from the management of accumulated solids within complex process equipment, the underlying problem is not unique to a single sector.

Many industries experience similar issues associated with deposits, sediments, residues, scale, sludge and other solid materials accumulating within tanks, vessels, storage systems, process equipment and pipework networks. Common challenges include restricted access, limited visibility, uncertainty regarding accumulation extent, difficulties deploying equipment and the need to safely remove material from constrained environments.

The challenge extends beyond the accumulated material itself and includes the practical realities of operating within large, interconnected facilities where solutions may need to navigate complex plant layouts, work through existing access points and minimise disruption to ongoing operations.

Innovative solutions developed through this challenge may therefore offer wider benefits across:

- Utilities and infrastructure.
- Water and wastewater treatment.
- Chemical and process manufacturing.
- Mining and minerals processing.
- Waste treatment and resource recovery.
- Defence and government infrastructure.
- Heavy industry and asset-intensive operations.

Solutions that demonstrate adaptability, scalability and transferability beyond a single application will be particularly encouraged.

Success Criteria

Solutions should demonstrate:

- Safe deployment in constrained or hazardous environments.

- Effective identification and characterisation of accumulated solids.
- Improved visibility and understanding of inaccessible areas.
- Effective mobilisation of settled, compacted or hardened materials.
- Capability to address materials that transition between free-flowing powders and consolidated masses.
- Reduced operator intervention and personnel exposure.
- Compatibility with existing infrastructure and access points.
- Minimal generation of secondary waste.
- Ability to recover and transfer material for subsequent treatment, storage or disposal.
- Reduced maintenance burden, outage duration and operational cost.
- Clear evidence of practicality, deployability and operational benefit.

Key Hazards

Potential hazards may include:

- Exposure to ionising radiation and contaminated environments.
- Spread of contamination during inspection or retrieval activities.
- Restricted access and limited visibility.
- Manual handling and ergonomic risks.
- Exposure to hazardous substances or process residues.
- Failure or loss of equipment within constrained environments.
- Release of accumulated materials during mobilisation or retrieval.
- Damage to existing plant, instrumentation or process systems.
- Environmental release resulting from unintended disturbance of accumulated materials.

Solutions should seek to minimise personnel exposure, reduce operator intervention and maximise the use of remote or automated techniques where practicable.

Key Constraints

Potential solutions should recognise that operational environments may involve:

- Restricted access routes and limited visibility.
- Complex internal geometries and equipment layouts.
- Congested plant areas and existing infrastructure constraints.
- Variable solid properties and accumulation mechanisms.

- Existing interfaces and dimensional restrictions.
- Challenging deployment and retrieval conditions.
- Limited opportunities for plant modification.
- Waste handling and packaging requirements.
- Regulatory, environmental and safety compliance obligations.

Nuclear Gateway One-Liner

Seeking innovative and transferable solutions to identify, characterise, mobilise and remove solid accumulations, including materials that can transition from free-flowing powders to consolidated solids, creating blockages, capacity constraints and operational inefficiencies within complex processing and storage systems.