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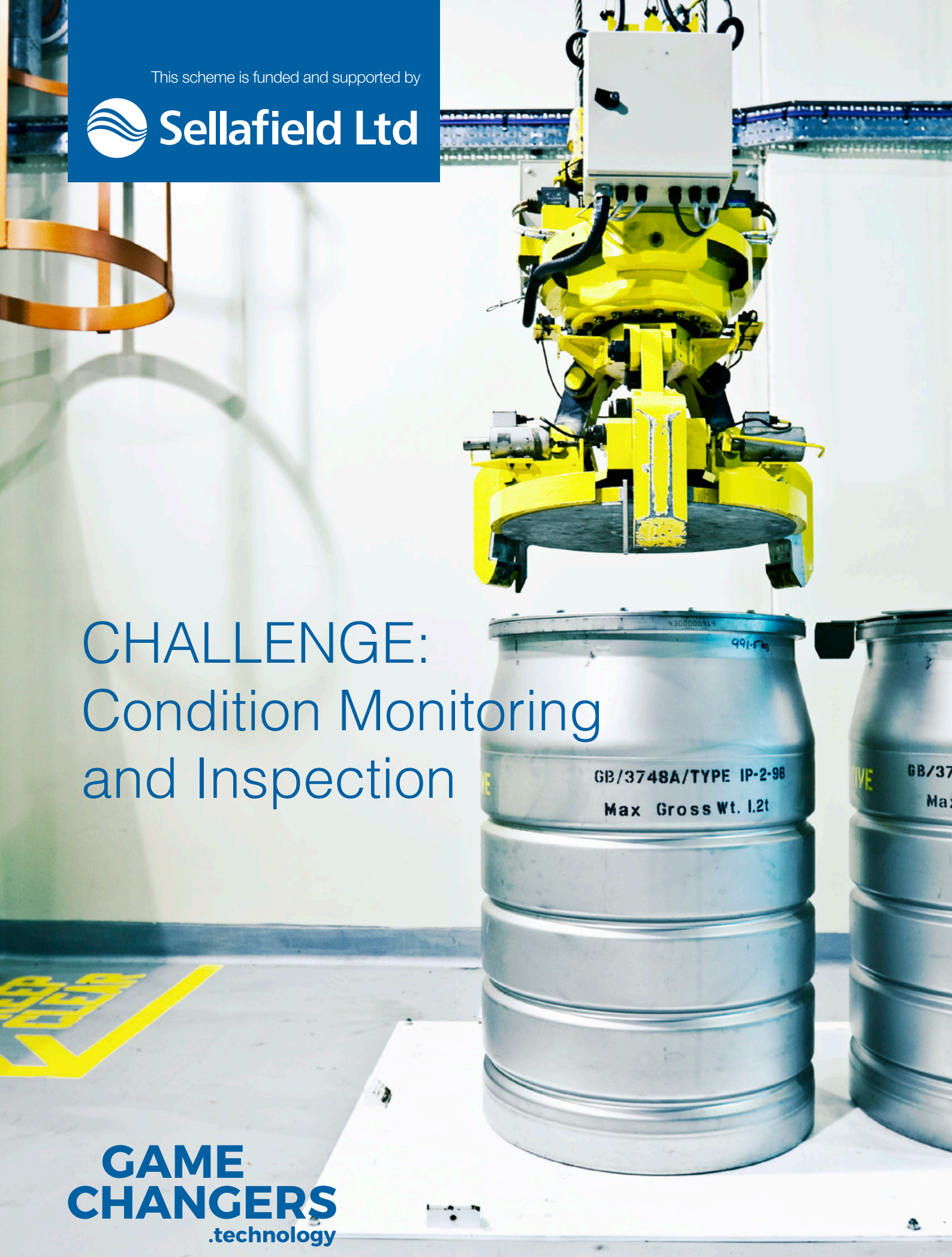
CHALLENGE: Condition Monitoring and Inspection



GAME CHANGERS .technology

Image: Intermediate Level Waste container (NDA, 2009)

THE SITUATION

There are tens of thousands of waste packages currently stored on the Sellafield site in west Cumbria, each containing materials and items which are the result of nuclear reprocessing or decommissioning activities over the past 60 years.

The packages range from cylindrical containers of 25-50 litres in size, 500 litre barrels or drums and, in future, the majority are envisaged to be $3m^3$ boxes.

Commonly, the construction material is stainless steel although there are instances where older packages were manufactured of other metals.

The contents of these packages vary in degrees of contamination and activity: in this instance, our interest is in the packages whose contents mean that they require remote handling.

The wastes in the packages include:

- dry materials;
- contained in a high performance cement 'grout';
- covered in water;
- generating heat and/or gases;
- vitrified;
- or any combination of these.

In many cases, it is expected that some degree waste evolution will occur. This could include, but is not limited to, expansive corrosion of reactive metals causing the waste to expand and potentially external corrosion of the waste container.

As the decommissioning activities progress over the next few decades, similar numbers of additional packages will be sent to above-ground stores.

Sellafield need to understand the rate of corrosion and its impact on the safety and security of the materials within.

The stored waste packages could be in place for many decades, and it is important that during this period, we can confirm that the performance of the packages is as expected, demonstrating control.

The behaviour of the waste is also of interest.

CURRENT PRACTICES

At present, the baseline methods for package monitoring is to remove individual packages and inspect manually.

This practice is both time consuming and, potentially, requires moving many packages if they are at the bottom of a stack.

CHALLENGE AIMS

Sellafield are seeking ideas, innovations and technologies that will deliver game-changing improvements over the current baseline options. which could include:

- The development of new 'smart packages' that monitor themselves and/or communicate warnings if they are not performing as expected.
- Large area scanning, such as deploying technologies akin to hydrocarbon detection on oil refineries or atmospheric monitoring.
- Technologies or techniques for visual observation and image analysis.

BENEFITS TO SELLAFIELD

It is expected that such solutions will bring primary benefits to Sellafield's decommissioning programme, namely:

- Improved efficiencies through reduced complexity of deployment.
- Reducing human intervention.
- Cost savings gained by eliminating over-engineered packages.
- Long-term cost savings.

Image: Intermediate Level Waste container (NDA, 2009)

CONSTRAINTS (Store and Package)

A number of constraints need to be considered when developing potential solutions, including:

- **Poor access** - packages stored in arrays with limited or restrictive access, often less than tens of centimetres.
- **Environment** - packages often stored in dark or poorly lit environments.
- **Lifespan** - the need to perform their role for many decades.
- **Radiation** - dose rates mean only remote handling.
- **Power Supplies** - no power supplies to the packages, ideally need to be self-sustainable.
- **Variable Packages** - many different designs, shapes, sizes and storage configurations currently in use.

FUNCTIONAL REQUIREMENTS

The proposed solutions for condition monitoring and inspection should include measurement of:

- Temperature of the package and its contents
- Pressure inside the package
- Package deformation
- Corrosion of package material both inside and outside
- Chemical analysis of gases
- Rate of change of the gas evolution

Reliability over a long period is key – as a baseline, the solution is anticipated to be in place above ground for a minimum of 50 years

Transmission of data to remote locations will allow operators to monitor and inspect packages from across the Sellafield site or further afield.

Options to retrofit solutions to the many older packages already on the Sellafield site would be an advantage.

How would you solve this problem?

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Get involved.

Should any of the challenges presented be of interest to you and your organisation, and you feel that you have the innovative technologies or techniques to help deliver the desired solutions, then we'd like to hear from you.

Visit **www.gamechangers.technology** to download or complete an application form online, or you can request an application form by email at **gamechangers@nnl.com**

The decommissioning of the Sellafield site is anticipated to take over 100 years, cost in excess of £50bn and creates challenges never encountered before. These challenges require investment in innovative technologies, concepts and methods.

Sellafield Ltd actively seek to engage with Game Changers - businesses, academia and individuals who can bring their innovations into the nuclear arena and help achieve the goals of accelerating the decommissioning programme whilst also reducing costs and upholding Sellafield's commitment to human and environmental safety.

Game Changers could also be technologies and methods which are already used in other industries which could be developed for use in the nuclear sector.

Funding for proposals is available to support development of these technologies: we invite proposals which clearly articulate the innovative technology development needed to meet Sellafield's decommissioning challenges.

Successful applicants are eligible for an initial £5,000 of funding and commercialisation support to present their innovations to Sellafield Ltd.

Further proof of concept and prototype development funding will be made available to any innovations identified by review panels to have significant commercial and operational potential.

Information about this initiative is available on the Game Changers website at **www.gamechangers.technology** or you can contact us by email at **gamechangers@nnl.co.uk**

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