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Challenge AS3

Utilise recent developments in IT, computing and energy storage technology to transform the analytical operations.

The end of re-processing operations at the Sellafield Site will initiate an increase in remediation and de-commissioning activities, presenting new challenges to the Analytical Services teams.

Operations in the current laboratory are being phased out and the majority of the future work will be performed in a new purpose-built facility, the National Nuclear Laboratory Central Lab (NNLCL).

A review of current, historical and future anticipated activities has been performed.

It is recognised that there is an opportunity for operations in the new NNLCL to exploit the latest developments and so improve the efficiency, safety and quality of analytical work.

From this review, a series of challenge statements have been produced to illustrate the requirements and help interested organisations engage with Sellafield Ltd:

- Development of existing technologies and techniques.
- Deployment of new technologies and techniques.
- Use of emerging computer-based technologies.
- Utilisation of new engineering materials and design philosophy.

These challenge statements are designed to stimulate innovative thinking. Sellafield Ltd is keen that as many ideas as possible are heard and discussed, with the potential for their development and deployment in the nuclear decommissioning arena.

Sellafield want Game Changers.

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CHALLENGE AS3

Utilise recent developments in IT, computing and energy storage technology to transform the analytical operations.

THE SITUATION

The past 10-15 years has seen an explosion in Information Technology, computing processing power and energy storage/transfer technology. This has led to rapid expansions in mobile technologies, electric driverless cars and robotics. There is potential for these technologies to revolutionise the deployment of radiochemical, chemical and physical analysis and measurement applications in the nuclear industry.

THE CHALLENGE

Sellafield currently employ laboratory based techniques to manage the operations and safety envelope on the site. There is a potential to utilise new technologies to rationalise work through improved modelling, data management, in-situ technologies and improved laboratory techniques.

Areas where the new technologies could improve analytical delivery include:

- Collation and interpretation of data/knowledge management
- Improved modelling of analytical data
- Cost-Benefit analysis e.g. analysis vs theoretical characteristics
- Wireless communications
- Wireless electricity transfer on plant to difficult to access locations
- Online analytical diagnostics to provide early warning of potential instrument failure
- Smart, efficient archiving solutions for historic and future data.

CONSTRAINTS

- Communication through large reinforced concrete structures can be difficult.
- There are security implications for wireless data transfer
- Human access in radioactive environments is limited making installation of equipment difficult.
- Deterioration of sensors/instruments deployed in areas of higher radiation.
- Communication systems must be robust and accessible/updatable as required.

THE TECHNOLOGIES / EXAMPLES

- Legacy dataset conversion
- Reducing energy/ram material consumption
- Use of virtual reality tools
- Detectors and sensors network
- Intelligent sampling based on radiation measured
- Improvements in in-situ technologies

The current Analytical Services facility at Sellafield consists of 96 laboratories containing instrumentation and enclosures.

There is additional space for offices, storage and supporting infrastructure.

It is the size of four football pitches and sits within the controlled area at the Sellafield site (readily accessible to plants).

A large variety of analyses in terms of sample types and chemical species are measured:

>50,000 samples analysed per year

>200,000 analyses performed on these samples

The analytical techniques used in the department encompass a wide range of routinely used analytical techniques, including:

- *Mass Spectrometry*
- *Optical Emission Spectrometry*
- *Gamma Spectrometry*
- *Radiochemistry*
- *Ion Chromatography*
- *Titrimetric techniques*
- *XRF*
- *Physical analysis*

It is intended that the new NNLC facility should provide the bulk of the site's analytical service until at least 2035.

SPECIFIC AS3 CHALLENGES

CHALLENGE AS3.1

Mistakes associated with sample registration and labelling can lead to wasted time, quality events and safety issues.

DESIRED SOLUTION

It is highly preferable that registration of samples is contemporaneous with sampling and that as much information as possible is gathered in the process.

A portable scanner/label printer incorporating a camera and a radiation dose measurement would be invaluable in improving traceability.

CHALLENGE AS3.2

The current Sellafield Laboratory Information Management System (LIMS) is not integrated with instruments nor is there sufficient flexibility in the type of reports that can be produced. Reports, worklists and analytical instructions are routinely printed out leading to excessive low level waste generation.

DESIRED SOLUTION

A fully integrated fit for purpose LIMS system could dramatically improve operational efficiency and reduce the number of mistakes. This could include:

- Tracking of samples on plant for more accurate delivery times.
 - An alternate system to barcode reading for sample tracking; barcodes are difficult to use in Highly Active cells or on very small sample portions.
 - Workface instructions available electronically on tablets could incorporate voice and facial recognition and include timings and troubleshooting. This would help enable a truly paperless laboratory.
 - Instruments should be fully integrated with LIMS to prevent transcription errors.
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CHALLENGE AS3.3

The vast majority of analysis is still performed in the lab. Sampling and sample transfer is expensive, time consuming and potentially hazardous to operators.

DESIRED SOLUTION

The utilisation of the internet, Artificial Intelligence, robotics and new battery technology could generate brand new solutions and enable in-situ solutions to the analytical challenges.

THE TEAM

This challenge has been authored and commissioned by the Analytical Services Technical Team.

Should you have any questions about this specific challenge, please email gamechangers@npl.co.uk and your enquiry will be responded to by the appropriate member of the team.

Any further information which is deemed to be of potential use to other applicants may be published into the public domain.

Individual applicant's intellectual property shall be upheld.

Further enquiries and applications should be made via the Game Changers website at:

www.gamechangers.technology

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Get involved.

Should any or all of these challenge statements be of interest to you and your organisation, and you feel that you have the innovative technologies or techniques to help deliver the desired solution, 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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