



## Challenge AS4

Develop new design solutions for Analytical Services facilities to improve efficiency and operability at reduced cost.

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.**

This scheme is funded and supported by



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## CHALLENGE AS4

Develop new design solutions for Analytical Services facilities to improve efficiency and operability at reduced cost.

### THE SITUATION

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Safety considerations tend to foster a conservative approach to the design of nuclear facilities. Accordingly, Sellafield Limited and partners are utilising proven engineering and design philosophies to deliver a new analytical capability. However, there could be alternate design solutions capable of delivering the functional, technical and safety requirements whilst also providing significant reductions in capital and operational costs.

### THE CHALLENGE

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Novel thinking has the potential to improve delivery with reduced capital and operational costs. Some potential areas for improvement are:

- Management of nuclear wastes i.e. remediation and storage
- Design of fume hoods, containment enclosures, cells and ventilation systems
- New ventilation technology
- Design philosophy of shielded cells and remote operations
- New way of integrating new techniques into enclosures
- Improved transfer between containment areas (e.g. bagless transfer)
- Improvement of obsolescence management in hostile environments
- Use of new materials and nanotechnology, e.g. corrosion mitigation by internal coating of glove boxes or development of peelable coatings
- Use of 3D printing to improve in the design process or obsolescence management e.g. rapid prototyping or use of printed spares

### CONSTRAINTS

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- Safety related controls often default to known technologies/solutions
- Engineering solutions in complex, contaminated environments are often bespoke
- Proven engineering solutions in other industries require further development to meet nuclear challenges e.g. high radiation

*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 AS4 CHALLENGES

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### CHALLENGE AS4.1

The type of enclosures used for analytical work at Sellafield is well established, e.g. cells, gloveboxes and fumehoods.

### DESIRED SOLUTION

The design philosophy of containment enclosures (cells, gloveboxes and fumehoods) is rigid and new thinking could deliver improved operability and flexibility whilst maintaining the safety envelope. Examples include the incorporation of Lazy Susans, mirrors and intelligent shielding solutions e.g. shielded sashes, down draft extractor benches, bubble fumehoods, modular and portable enclosures.

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### CHALLENGE AS4.2

Current sample transfer protocols between containment areas (e.g. between gloveboxes) are time consuming, risk cross contamination and generate excessive waste.

### DESIRED SOLUTION

Engineering solutions are required to reduce the amount of packaging required for sample transfers and to significantly compact waste involved in transfers i.e. plastic bottles and containers. Bagless transfer technology is a potential solution but utmost consideration must be given to operator safety and the prevention of cross contamination.

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### CHALLENGE AS4.3

Servicing and repair of equipment in nuclear facilities is extremely time consuming. Analytical equipment can become contaminated and external service engineers are often unfamiliar with nuclear working practices.

### DESIRED SOLUTION

A different philosophy is required whereby instruments are replaced more regularly and minimal servicing is required. This philosophy is already employed in many electronic products.

Simple servicing and repair could be performed in-house (perhaps with telephone or video support) with key components easily replaceable.

This philosophy is also relevant for in-situ instruments.

## THE TEAM

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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@nnl.co.uk](mailto:gamechangers@nnl.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](http://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](http://www.gamechangers.technology) to download or complete an application form online, or you can request an application form by email at [gamechangers@nnl.com](mailto:gamechangers@nnl.com)

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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](http://www.gamechangers.technology) or you can contact us by email at [gamechangers@nnl.co.uk](mailto:gamechangers@nnl.co.uk)



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