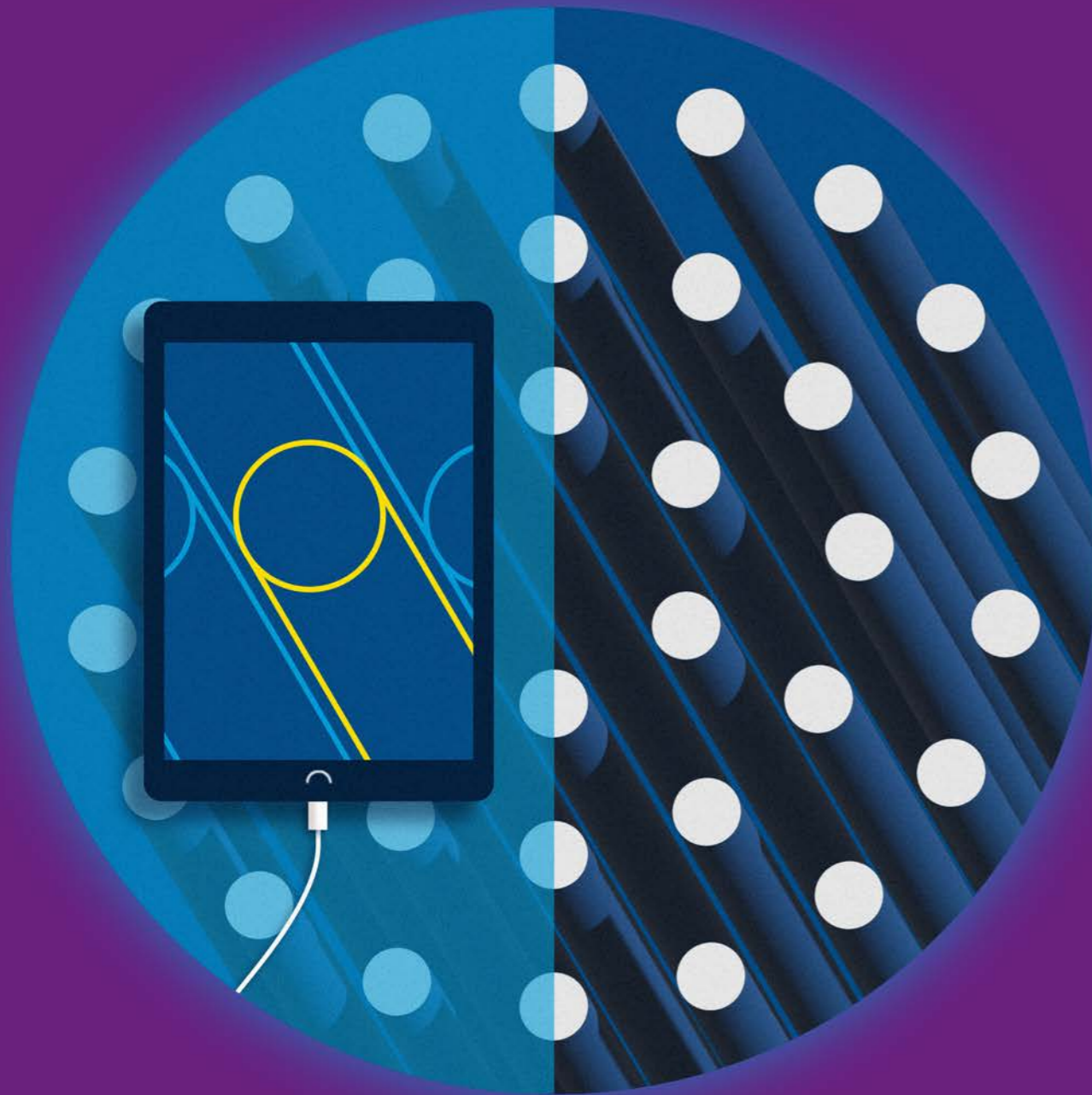


3 | Innovation

An **innovative new app** to support inspection of nuclear fuel



Decades of experience managing nuclear materials safely has equipped us with the knowledge and expertise to explore new techniques, such as our DEPEND mobile app, which enables safe inspection of used fuel.

Inspection of nuclear fuel stored underwater in engineered ponds is vital for ensuring safe operations on reactor sites.

The ponds keep the used fuel cool and provide radiation shielding. NNL's endoscopy team surveys in-pond fuel at all the UK's advanced gas-cooled reactor (AGR) power stations, operated by EDF. This involves using a video camera underwater to assess the integrity of the fuel and look for deposits that may have formed while the fuel was inside the reactor core. During the inspections, information is recorded by the pond-side endoscopy team, using pen and paper.

Keeping track of the paperwork, collating the information and consolidating it into a valuable report for the reactor operator is a significant and important part of the work. Making a move to using a mobile device that collates the same information pond-side will streamline data collection and ensure robust data management while also helping to retain expert knowledge from an incredibly experienced workforce.

As a result of this innovative work, the DEPEND (DEPosit recording from ENDoscopy surveys) app captures this expertise, thereby safeguarding this important aspect of nuclear safety and facilitating efficient delivery of work by the endoscopy team. ●

Quality

Upholding our strong track record in safety and security

Endoscopy is specialist work and is vital for operators to meet regulatory requirements, by ensuring safe storage of the fuel as it cools in-pond and enabling safe and efficient operation of the reactor. The DEPEND app was developed in partnership with experts in app development, tested during site surveys and modified based on feedback from our expert endoscopy team.

Inside the core of a nuclear reactor, coolant circulates to remove the useful heat generated. The chemistry of this coolant can be adjusted to minimise the formation of deposits on the surface of the fuel. These deposits can affect heat transfer from the fuel to the coolant which reduces the efficiency of the reactor. Understanding what these deposits look like, and how thick they are, helps reactor operators understand the conditions that lead to their formation. ●

“As the UK's AGR stations are nearing the end of their life, the endoscopy work is still providing high value information to support continued generation. The results have been used to help to substantiate relevant safety cases and give assurance to the Office for Nuclear Regulation {ONR} and Sellafield Limited on the condition of fuel which is important for both operations and future storage of fuel. The build-up of carbonaceous deposit on AGR fuel pins reduces heat transfer and affects the reactor efficiency, so the work of the endoscopy team to assess the deposit and understand the deposit properties supports safe continued operation of the reactors.”



Laura Jenkins
AGR Fuel Post-Irradiation Examination
Co-ordinator for EDF


Partnerships

Combining unique skill-sets to deliver a valuable solution

The DEPEND app was created in close collaboration with Cumbrian-based small-medium enterprise, Mobetrics, who are experts in delivering intuitive mobile solutions. The endoscopy team worked closely with Mobetrics at every step of the journey to design, build and test the app.

A member of the endoscopy team identified an opportunity to innovate and move to a digital solution for recording and processing inspection data. Through NNL's innovation programme, the concept was developed into a partnership opportunity. This innovation process has enabled our people to highlight

a challenge and work with external experts to find a solution. In doing so, NNL has combined nuclear know-how and experience with Mobetrics' expertise in coding. The outcome is a fantastic solution that will deliver significant value for nuclear power plant operators.

This innovation project has led to the digitisation of a manual process and resulted in the development of an entirely new tool which will be ready for use in the near future. The endoscopy team used their vast experience and knowledge of the current method for recording endoscopy inspection data and, in partnership with Mobetrics, came up with a creative approach that is both quick to use and easy to learn. 

“As mobile app developers, it is always exciting to be offered an opportunity to collaborate with a world-class specialist such as NNL and see software making a real difference in the workplace.

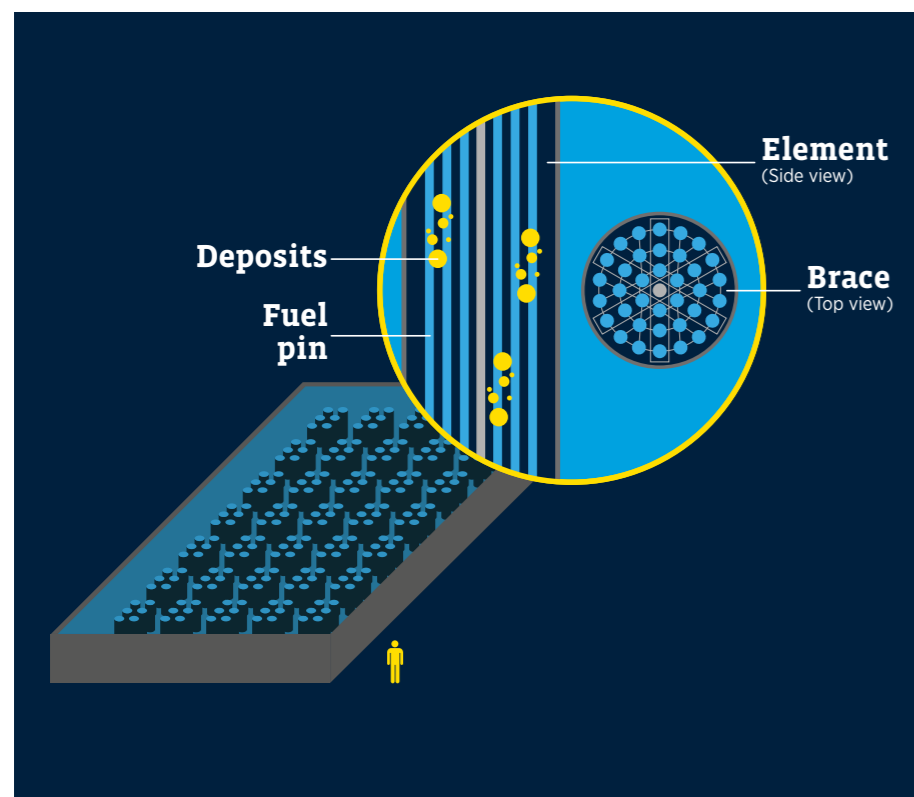
By working closely with their endoscopy team we were able to establish what features would make the greatest improvements to their existing workflow and develop an app that was easy to use in a challenging environment.

The NNL team were always looking to take advantage of the possibilities that a mobile digital platform would offer them and develop a template that could be reused for future projects within the business. It was particularly great to see that NNL were keen to work in a flexible, agile manner that delivered the best possible product.”



Marc Morrison
Co-founder of
Mobetrics

Fuel pins stored underwater are inspected for deposits and wear on the brace which holds them in the fuel assembly used in the reactor core.



Talent

Sustaining vital expertise to assure reactor performance

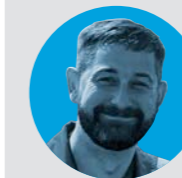
The expertise of our endoscopy team had been gained over decades. There is a need to train new experts to continue to uphold the high standards that the industry sets itself. The DEPEND app can assist in skills and knowledge retention.

The traditional method of managing and collating the inspection data that the team currently uses is labour-intensive, requiring expert knowledge of the data and the reporting process to manage the workload effectively. This expertise has been incorporated into the app, to free up time so the team can focus on other vital aspects of work in the future.

Analysing the deposits during an endoscopy inspection requires familiarity with the fuel elements. Images from the camera are displayed on a screen and the team must use their expert judgement to decide on the texture, coverage and thickness of the deposit.

Their findings are recorded in the DEPEND app, along with images of the deposits.

“The DEPEND app can make a huge difference to the team. Right now, transcribing the information from inspection sheets to reports is a lengthy process that requires verification. Having an app to do this not only saves a substantial amount of time, but it also removes the risk for transcription errors that arise from transcribing large amounts of data.”



Dave Wilkinson,
Endoscope Survey
Team Leader for NNL




Impact

Innovation makes excellent use of resources

The inspections carried out by the endoscopy team have enabled the UK's fleet of currently operating AGRs to safely extend their operations. This directly leads to a saving in greenhouse gas emissions compared with using fossil-fuel-based forms of energy. Keeping reactors operating also safeguards jobs.

Additionally, the inspections generate vast amounts of paperwork. Stretching back decades, this paperwork is currently archived by NNL. Moving to a fully digital method of handling information will not only provide our experts with more time, but it will also deliver results to plant operators quickly and efficiently while reducing the environmental impact.

Integration with reporting systems is now being finalised, ready for full deployment of the DEPEND app. The endoscopy team is also considering additional features to be developed in the future. 

Dave Wilkinson carrying out an inspection pond-side