Report on Joint Workshop of UK – Japan Civil Nuclear Research Program 2022/3

Malcolm Joyce, Lancaster University

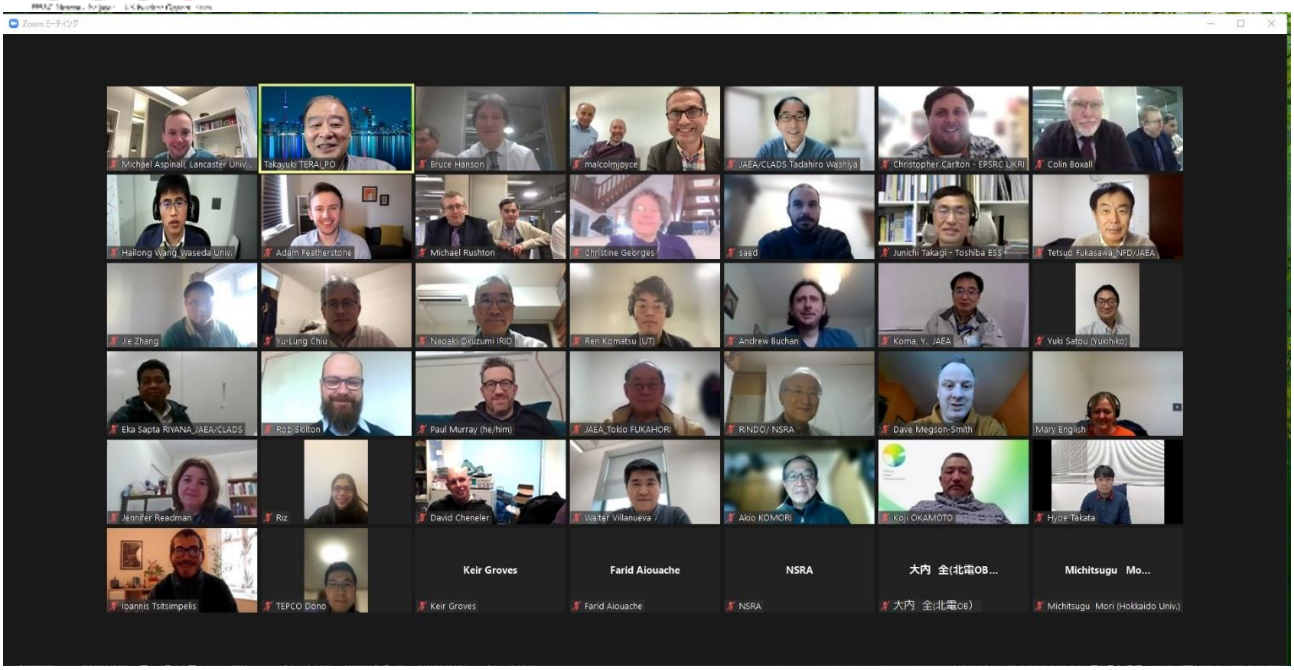
Introduction

The meeting and workshop attracted 82 delegates – 39 from the UK and 43 from Japan for two days of intensive knowledge transfer and collaboration building, from 23-24 January 2023. This report summarises the activities undertaken and the discussion and recommendations of the workshop activities. As per last year, this year the preparation phase, meeting and workshop took place entirely online due to continued travel restrictions because of the coronavirus pandemic. Nevertheless, delivery by video conferencing sustained the level of in participation. This confirms the sustained interest and awareness of the joint research programme, with there being several new attendees this year from both sides. The overlap of time zones between the UK and Japan provided a small window for joint sessions, working from 08.00 – 11.00 UK time (17.00-20.00 Japan time). The final agenda is appended to this report.

Preparation phase

November	Meetings with UK and EPSRC sponsors to agree transfer of leadership of the network.
December	Meetings with the UK and Japan sponsors to refine agenda Identify and invite keynote and project speakers. Develop and agree facilitation plan and workshop materials Set up registration portal Issue draft agenda and open registration
January	Meetings with UK and Japan sponsors to finalise agenda Finalise facilitation plan, workshop materials and joining instructions Meeting with UK and Japan sponsors to review registrations and agenda Send out introduction pro-formas Issue final agenda and joining instructions Deliver meeting and workshop Draft and issue post meeting and workshop report Post meeting and workshop wash-up meeting Issue final pack of meeting and workshop materials

Prior to the meeting, UK and Japan delegates were invited to complete an introduction pro- forma to assist in networking and knowledge exchange. The pro-forma captured key research interests, contact information, and collaborations wanted and offered by the participants.



Some of the participants at the UK – Japan Workshop, 22-23 January 2023.

The format of the discussion session followed the approach of 2022 ensuring a balanced presentation of topics from each partner country in the joint discussion session. The output report from the 2021/22 meeting and workshop was shared with participants ahead of the meeting; participants were asked to read this ahead of the in-country discussion meeting to inform a gap analysis, as in 2021/22.

Session1: Joint Review and Strategic Context of UK – Japan Joint Civil Nuclear Research Programme

The first part of the workshop was a joint review meeting of the UK – Japan Civil Nuclear Research programme. Joyce (Lancaster University) and Yamana (Nuclear Damage Compensation and Decommissioning Facilitation Corporation) presented the background to the UK – Japan joint programme, highlighting the importance of co-operative R&D to address joint challenges of decommissioning the Sellafield and Fukushima Dai-ichi sites. This was followed by two keynote presentations to set the strategic context for the joint research programme and workshop discussions, from the perspective of the UK and Japan. McKinney (Nuclear Decommissioning Authority) presented the organisation of decommissioning activity and its progress on the Sellafield site, within a recently launched corporate strategy. Examples of successful R&D deployment were highlighted, including retrieval, packaging, and storage of wastes from legacy ponds and silos, and post-operation clean-out of facilities entering decommissioning. Iizuka (TEPCO) presented an update of the status of Fukushima Dai-ichi decommissioning, with a focus on recent work toward fuel debris retrieval and contaminated water management. The detailed short- and medium-to-long term plans for these activities were presented and discussed.

The joint project review session considered the projects funded in Phase 7 and 8 of the joint programme, with complementary presentations from the UK and Japan partners. Cheneler and Kamada (Lancaster University and National Institute of Maritime, Port and Aviation Technology) presented the development of a continuum robotic manipulator and submersible probe. reported progress in the development of a semi-autonomous under-water decommissioning sample retrieval robot. The collaborative project effort succeeded in the design and fabrication of two continuum manipulators with gripper and grinder tools, which have been assembled, development of the control system is the focus of current activity. Hriljac and Asao (Diamond Light Source and Shinshu University) presented their joint investigation of ion exchange materials for decontamination of ^{90}Sr from solution. Improvement in the selectivity of the materials was achieved through compositional modification with state-of-the-art total scattering studies undertaken at Diamond Light Source to understand the mechanism of Sr adsorption and release. Finally, Scott and Miwa (University of Bristol and the University of Tokyo) and Parween and Asama (University of Sussex and the University of Tokyo) presented on their Phase-8 projects.

Session 2: Discussion of UK decommissioning research priorities and ideas

This discussion and workshop session focused on the development of ideas and priorities for future research in Phase 10 of the joint research programme, within three parallel sessions, as described above. In advance of the discussion session, UK participants were offered the opportunity to produce a one-slide summary of research ideas, with a view to ideas of common interest, informed by consideration of NDA Strategy 4, Sellafield R&D Requirements 2022, the TEPCO Mid-to-Long Term Roadmap for decommissioning of Fukushima Dai-ichi, and Technical Strategic Plan 2022 for Decommissioning of the Fukushima Dai-ichi Nuclear Power Station (links to documents provided to participants). The slides were provided to discussion participants in advance to enable identification of common themes and potential joint collaboration between UK partners and Japan.

The key topics identified for collaborative R&D from the UK side were:

Radioactive waste treatment, packaging, and storage

- Long-term management and disposal of degraded fuels
- Innovating application of the waste hierarchy to improve radioactive waste management

Remote handling, robotic, and autonomous systems in decommissioning

- Robotic deployment systems, surface and underwater, deployment through narrow access ports
- Digital technologies, digital twin, planning, and autonomy
- Inspection, in-situ characterisation and decontamination, and in-situ chemical analysis and mechanical testing, including underwater.
- Methods for collecting fuel debris and other materials

Environmental behaviour of radionuclide release and management of risk and degraded infrastructure

- Leak detection, contamination countermeasures, and clean-up
- Data analytics, artificial intelligence, machine learning
- Digital technologies, digital twin, planning, and autonomy to manage risk

The summary of discussion was presented in a workshop plenary and a gap analysis undertaken. The detailed topic summaries were captured on slide presentations to inform the subsequent joint discussion session.

Session 3: Joint session to develop UK - Japan decommissioning priorities and ideas for research in Phase 10

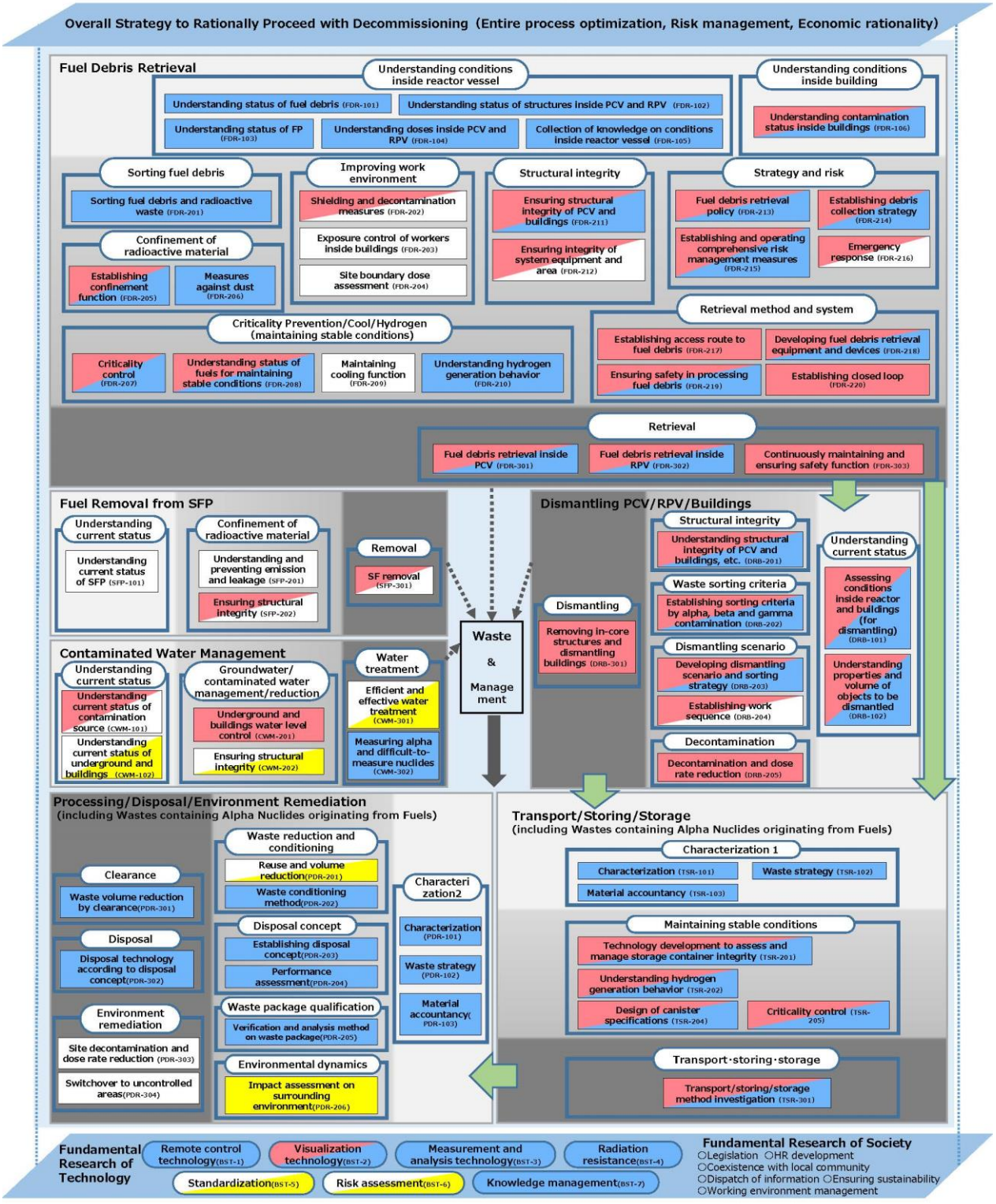
This session opened with a presentation to outline the key research priorities identified for consideration and discussion, through the in-country meetings. Joyce presented the summary output of the UK and Japan sessions held the previous day, elaborating on the specific research questions to be addressed within the broad challenge areas highlighted above. Terai (Program Officer for NSRA) discussed the positioning of the research priorities within the Overall Map of Basic and Fundamental Research for Decommissioning of the Fukushima Daiichi Nuclear Power Plant (see below). The need to focus on fundamental research was emphasised, but with a clear route to practical implantation. It was highlighted that research proposed by the Japan side should be mindful of being complementary to the larger needs-led METI and MEXT funded in country programmes and avoid duplication.

The UK and Japan participants split into three parallel discussion groups to share their perspectives with the objective of defining a prioritised set of common research challenges and needs. The following paragraphs summarise the synthesis of those discussions.

Decommissioning Science Diagram
mainly for basic and fundamental R&D
(Detailed Version) ⇨ Outline of Decommissioning Workflow

Preparation | Design | Action

- Pursuit of basic and fundamental research will lead to solution of issues
- Applied and practical research and development will lead to the solution of issues
- Basic and Fundamental Research will lead to accumulation of knowledge
- Basic and Fundamental Research may lead to knowledge acquisition in the future



Please note that this English text is a provisional translation of the Japanese original.

Overall Map of Basic and Fundamental Research for Decommissioning of Fukushima Daiichi NPP

Group 1: Radioactive waste treatment, packaging, and storage

Although fuel debris is not classified as waste in the decommissioning of Fukushima Daiichi, it is widely related to waste management issues from the viewpoint of temporary storage after removal, treatment, and disposal, so this Group recognized it as an important issue and decided to discuss it. Specifically, the group pointed out the following issues: technologies for understanding the nuclear material inventory of fuel debris, remote characterisation and safety management of criticality using sensors, etc., and sorting, drying and container design for stable storage after removal.

Recovered waste requires automated classification and separation techniques to minimize dose uptake by means of the application of artificial intelligence and enable the most effective waste disposal solutions through the application of classification of waste.

1.1 Long term management and disposal of degraded nuclear fuels

There is a need to predict the state of nuclear fuel prior to the Fukushima Dai-ichi accident and understand the behaviour of the degraded fuel under environmental conditions. The transition from wet to dry storage needs to be underpinned, including fuel drying, corrosion, radiolytic hydrogen production, and treatment to assure passive safety. Approaches to safeguarding of degraded fuels and potential recovery of nuclear materials may be required. The research will underpin Phase 3 of the Fukushima Dai-ichi Decommissioning Roadmap after fuel retrieval and will broadly support the management of UK nuclear fuels in a broader context.

1.2 Development of analytical/evaluation methods for efficient characterisation

Radiochemical assay of solid radioactive wastes is required to enable segregation and management according to radiological risk, on both the Fukushima Dai-ichi and Sellafield site. There is a need to develop high throughput analytical protocols and technology, for example automated pre-treatment of analytical samples, triple quadrupole ICP-MS, and laser ablation ICP-MS. Statistical correlation techniques are required to enable estimation of radionuclides based on determination of, i.e., Cs-137, to reduce the number of samples required to be analysed. Application of machine learning and artificial intelligence models would enable automated identification of correlations and management of big data.

1.3 Innovating application of the waste hierarchy to improve radioactive waste management

Application of the waste hierarchy will reduce the cost and timescale of decommissioning the Fukushima Dai-ichi and Sellafield sites, and improve sustainability outcomes, by ensuring maximum value is obtained from waste materials and minimising the use of national disposal facilities. A broad range of technological advances are required, in addition to improved analytical methods discussed above, including decontamination of surfaces to enable reuse or recycle of materials, or management at a lower classification; advanced ion exchange materials for decontamination of decommissioning effluents; and development of advanced waste treatment processes and materials to produce passively safe products, reducing the packaged waste volume, and number of packages, compared to current baseline.

Group 2: Remote handling, robotic, and autonomous systems in decommissioning

2.1 Robotic deployment challenges and systems for inspection and in situ characterisation

Decommissioning of Sellafield and Fukushima Daiichi facilities requires remote inspection, radiation mapping and decontamination technologies. Research is needed to develop robotic platforms capable of underwater deployment and access through narrow

ports and pipes. These systems will need to be equipped with suitable sensors for in-situ localisation and to undertake measurements and characterisation in high radiation level environments. There is a need for development of in-situ mechanical and chemical analysis tools, such as laser induced break down spectroscopy (LIBS) and hyper spectral imaging, for contamination assessment and verification, enabling the effectiveness of decontamination to be assured. Digital capture and multi-sensor fusion of survey and radiological data is also desirable.

2.2 Methods for collecting fuel debris and other materials during decommissioning

Retrieval of degraded fuels from the Fukushima Daiichi reactors and Windscale piles requires research to enable risk-aware planning methods. Robotic platforms are required with improved situational awareness in remote fuel debris removal (i.e., virtual reality), together with tactile and haptic interactions and anti-collision capabilities. There is a need to design light-weight end effectors for enhanced mobility, ease of deployment and improved dexterity. Consideration needs to be given to the mobilisation and collection of underwater or air dispersed solids during retrieval operations. Hence, there is a need for the development of underwater and in-air machining to size-reduce debris prior to retrieval and for the maintenance and repair of critical infrastructures. The release and dispersion of contaminants during such activities must be characterised and efforts taken to minimise the disruption of material configurations to avert potential criticality risks. Intermediate and high reliability neutron detection devices, signal processing and transmission, including high dose tolerant and shielding free detectors, are required to monitor sub-criticality response of fuel debris materials. Automated sort and segregation technologies are required for retrieved wastes, potentially via the application of artificial intelligence, to minimise dose uptake and enable the most effective waste treatment solutions.

2.3 Digital technologies: digital twins, planning, and autonomy

A variety of digital tools are required to help inform and progress decommissioning plans. These include the construction and real-time adaptation. The development of real-time digital twins will support the planning and execution of decommissioning operations through linked sensor arrays and wireless data transfer. There is a need to deal with uncertainty effectively through optimisation, capture and the modelling of data. Colleagues from Japan showed the R&D project technologies that are currently being targeted to the decommissioning of the Fukushima Daiichi Nuclear Power Plant. There are several basic and elemental research themes on the UK side that can be applied, and those interested in partner matching in this topic should reach out to interested persons using the partner introduction handbook.

Group 3: Environmental behaviour of radionuclide release and management of risk and degraded infrastructure

In risk management, issues such as aerosol generation associated with on-site work and tritium measurement technology were raised. At Fukushima Daiichi, the development of a rapid tritium measurement system for monitoring the discharge of the treated water into the sea was pointed out. In addition, similar needs were assumed for tritium measurement technology at Sellafield in the UK, which could be considered to have a commonality with the case in Fukushima Daiichi. In particular:

・It was pointed out that there may be more interest in social science research topics in the UK side than in the Japan side.

・As with the Fukushima Dai-ichi building damaged in the accident, countermeasures against aging of the pond facilities at Sellafield, UK, are an urgent issue, and it was pointed out that it is also important to evaluate the aging deterioration of infrastructure facilities.

3.1 Monitoring and remediation of the environment and infrastructure

Understanding and controlling subsurface release of radioactivity is key to defining and demonstrating site end points and managing risk to exposed persons. Research is required to detect, monitor, and remediate radionuclides dispersed in the near sub surface, and understand their environmental behaviour. The migration and attenuation of radionuclides in sub-surface ground water, both on site and off site, requires investigation and understanding, to develop effective remediation methods. Both Sellafield and Fukushima Dai-ichi have degraded and high hazard infrastructure, condition monitoring and repair is required to ensure safe operation and decommissioning. Technology is required for the long-term monitoring and *in situ* repair of degraded infrastructure, waste stores, and facilities under care and maintenance, to assure their structural integrity until dismantling.

3.2 Risk: assessment, prioritization, perception, and communication

The assessment, prioritisation, perception and communication of risk underpin all decommissioning and remediation activities. There is a need to understand the perception of risk among social stakeholders which is critically important for the acceptance of technology and policy development. Therefore, methods and tools are required to define and assess objective (expert) and subjective (lay) assessments of risk and to manage risk flexibly under uncertainty. Understanding objective and subjective perceptions of risk (and how these map on to psychological constructs such as trust, values, attitudes), is necessary to inform and develop effective communication and engagement programmes. The application of these methods, tools and understanding to the management of environmental wastes arising from the Fukushima Daiichi accident, such as contaminated soil, water, wood, and concrete, is essential for their minimisation during clearance and confidence in the remediation end point by residents. To enable the most effective management and outcomes, quantification, and decontamination of radionuclides in environmental wastes must be achieved, and disposal at an earlier stage than anticipated in the current baseline plan.

3.3 Data analytics, artificial intelligence, machine learning and simulation

Site decommissioning will produce large data sets that can be more effectively used to improve decision making with application of advanced data analytics methods. However, there is a challenge in the quantification of uncertainty and automation of analytics, and model validation is essential. Enabling use of data in real time, with analytics and high-level simulations, could improve operational decision making and risk management. High fidelity and fast models for detection and monitoring of radioactive releases are required. Through life asset management could be improved by application of analytics to legacy data and purpose designed and built sensor arrays.

Session 4: Presentation of Phase-10 Call Opportunity

The planned Phase-10 Call Opportunity was presented by Carlton (EPSRC) and Washiya (JAEA/CLADS). For planning purposes, the arrangements are summarised as follows:

- The overall timetable will be approximately the same in the UK and Japan, as for Phase 9. The call is expected to be open for proposals in April, with a deadline of submission in July.
- The proposals will be submitted according to the guidance provided by EPSRC and NSRA, which with the format expected to be similar to that in Phase 9. The

proposal review will have the same format on the UK and Japan side as in Phase 9.

- The Japan side conducts a document review and an interview before the joint assessment panel. It was emphasised that if proposals are found to be incomplete at the preliminary document check, they will be dropped from the selection process.
- The expectation is for two joint projects to be funded, with a budget of £1M on the UK side.
- The expectation is for two joint projects to be funded, with a budget of ￥120M on the Japan side.

Synthesis of workshop output – priorities areas for Phase 10 Call

The joint workshop discussion sessions were successful in producing detailed research challenge statements within each thematic area. Following the workshop, the outputs from the discussion groups were synthesised to define the prioritised areas for joint research and collaboration four research themes in Phase 10, which were harmonised with input from JAEA/CLADS. There is some significant evolution in the thinking and priorities in each of the themes, compared to those proposed for the Phase 9 Call.

Theme 1: Radioactive waste management

(Key word: Waste Characterisation, treatment and immobilization of radioactive wastes, sludge and slurry treatment)

- Waste characterisation using statistical correlation techniques to reduce analytical sampling, by radionuclide estimation based on Cs-137 determination, assisted by machine learning and artificial intelligence.
- Application of the waste hierarchy to reduce the cost and timescale of decommissioning, including decontamination of surfaces to enable reuse or recycle of materials or management at a lower classification, and advanced ion exchange materials for decontamination of decommissioning effluents.
- Development of advanced waste treatment processes and materials to produce passively safe products, reducing the packaged waste volume, and number of packages, compared to current baseline.
- Automated sort and segregation technology is required for retrieved wastes, by application of artificial intelligence, to minimise dose uptake and enable the most effective waste treatment solutions through application of the waste hierarchy.
- Management and minimisation of environmental wastes arising from the Fukushima Dai- ichi accident, such as contaminated soil water, wood, and concrete. Quantification and decontamination of radionuclides in environmental wastes must be achieved, and disposal at an earlier stage than anticipated in the current baseline plan.

Theme 2: Robotic and autonomous systems for decommissioning

(Key word: Remote handling, remote inspection, radiation hardened detector, integrated robotic systems, digital twins, artificial intelligence)

- Development robotic platforms capable of underwater deployment and access through narrow ports and pipes, to undertake inspection, characterisation, and decommissioning operations (e.g., cutting and retrieval).
- Integration of sensors in robotic platforms for in situ localisation, radiation monitoring, and mechanical and chemical analysis, in harsh radiation environments,

including under water.

- Robotic platforms with improved situational awareness for remote fuel debris retrieval, together with tactile and haptic interactions and anti-collision capabilities. Design and light-weighting of end effectors for mobility, deployment and dexterity in fuel debris retrieval.
- Intermediate and high reliability neutron detection devices, signal processing and transmission, including high dose tolerant and shielding free detectors, are required to monitor sub-criticality response of fuel debris materials.
- Development of real time digital twins to support the planning and execution of decommissioning operations through linked sensor arrays and wireless data transfer, with capability to effectively deal with uncertainty through capture and modelling of data.

Theme 3: Fuel debris materials

(Key word: Fuel debris characterization and aging, characterisation of radioactive aerosols, modelling of debris behaviours)

- Prediction of the status and behaviour of degraded nuclear fuels and underpinning of fuel debris retrieval, the mid- and long-term management and storage. In particular, aerosol and dust generation, the transition from wet to dry storage conditions, including fuel drying, corrosion, radiolytic hydrogen production, and treatment to assure passive safety, with a focus on modelling of release, transport.
- Technology to allow high-throughput rapid screening allowing large volumes of material to be characterized quickly, and monitoring of radionuclides, tritium, and the pre-conditioning of ion exchange materials.
- Research is required to detect, characterise, and monitor radionuclides dispersed in the near sub surface, and understand their migration and attenuation, to develop effective remediation methods.

Theme 4: Decommissioning technology

(Key word: Monitoring, in situ repair, risk management, advanced data analysis and modelling)

- Technology is required for the long-term monitoring and *in situ* repair of degraded infrastructure post-accident, inc. waste stores, remaining containments and facilities under care and maintenance, to assure their structural integrity until dismantling.
- Understanding the perception of risk among social stakeholders which is important for the acceptance of technology and policy. Methods and tools are required to define, understand, and assess objective (expert) and subjective (lay) assessments of risk and to manage risk flexibly under uncertainty.
- Application of advanced data analytics and modelling to large data sets produced during decommissioning and to enable use of data in real time, to improve operational decision making and risk management, focused on removing people from harm, digital delivery and data-based decisions.

Agenda: UK – Japan Meeting and Workshop 2022/23

Monday 23 January 2023

Japan	UK	Activity
15.30-16.45		**Japan Session only.** Greetings: Koji Okamoto, CLADS (5min) **Instructions for UK-Japan workshop**(15min) Nuclear Safety Research Association **Explanation of the call for proposals**(10min) CLADS **1F Decommissioning information** ・**Possibility of joint research between UK research seeds and the needs of 1F decommissioning** Takayuki Terai (PO), Institute of Applied Energy(15min) ・**How academia should contribute to the decommissioning of 1F** Noriko Asanuma, Tokai University(15min) ・**Explanation of the current status of 1F decommissioning work** Naoto Iizuka (PO), Tokyo Electric Power Company Holdings, Inc. (15min)

Japan	UK	Activity
17.00-20.10	08.00-11.10	**Joint UK - Japan Session** **Co-Chairs: Malcolm Joyce (UK) and Takayuki Terai** **(JPN) Link to join meeting:** https://us02web.zoom.us/j/85779304878?pwd=Nm5WRUhwcVdWTEt6cGd5Y0pwYkpSUT09 Please join up to 15 min before the start so we can begin promptly.
17.00	08.00	**Opening remarks** **Malcolm Joyce**, Lancaster University, UK **Hajimu Yamana (PD),** Nuclear Damage Compensation and Decommissioning Facilitation Corporation, Japan *by video due to unavailability to attend in person
17.15	08.15	**Keynote: Progress in Sellafield and UK nuclear decommissioning** **James McKinney**, Nuclear Decommissioning Authority, UK
17.35	08.35	**Keynote: Overview of Fukushima Daiichi nuclear decommissioning** **Naoto Iizuka,** Tokyo Electric Power Company Holdings, Inc., Japan
17.55	08.55	**Questions for keynote speakers**
18.00	09.00	**David Cheneler,** Lancaster University, UK, and **So Kamada**, National Institute of Maritime, Port and Aviation Technology, Japan (Phase 7)
18.15	09.15	**Joe Hriljac,** Diamond Light Source, UK and **Naoki Asao,** Shinshu University, Japan (Phase 7)
18.30	09.30	**Comfort break – 15 mins**
18.45	09.45	**Tom Scott**, University of Bristol, and **Shuichiro Miwa**, The University of Tokyo, Japan (Miwa not attending) (Phase 8)
19:00	10.00	**Rizuwana Parween,** University of Sussex, UK and **Hajime Asama**, The university of Tokyo, Japan (Phase 8)
19.15	10.15	**New partner matching talks** 40 min: 10 x 4.5 min introduction talks with 1 slide per person (4 min talk, 0.5 min changeover); 5 x UK talks, 4 x Japan talks. 10 min: plenary feedback and advice session.

		• **Hailong Wang**, Waseda University, Japan • **Jie Zhang**, University of Bristol, UK • **Yogarajah Elakneswaran,** Hokkaido University, Japan • **Farid Aiouache**, Lancaster University, UK • **Ren Komatsu**, The University of Tokyo, Japan • **Walter Villanueva**, Bangor University, UK • **Hyoe Takata**, Fukushima University, Japan • **Bill Nuttall**, Open University, UK • **Colin Boxall**, Lancaster University, UK		
20.10	11.10	**Close of first Joint Session (Malcolm Joyce, UK)**		
Japan	**UK**	**Activity**		
	11.30-12.45	**UK Session only.** Discussion of UK decommissioning research priorities and ideas for Phase 10, in four key themes. Delegates will have the report from the joint meeting and workshop in 2021-22, circulated in advance, and focus on prioritising research areas and identifying gaps to address. Results are captured on a PowerPoint template to form a summary presentation for second joint session. Each session produces 3 x power point slides. **Link to join meeting:** https://us02web.zoom.us/j/82279731379?pwd=MENaRWxPNnVhUFBGOWhQbzJOSyt2Zz09 Please join up to 15 min before the start so we can begin promptly.		
	11.30	**Introduction to parallel discussion sessions and task** Malcolm Joyce, Lancaster University, UK		
	11.40	**1. Radioactive waste treatment, packaging, and storage** Michael Rushton, Bangor University, UK	**2. Remote handling, robotic, and autonomous systems in decommissioning** Michael Aspinall, Lancaster University, UK	**3. Environmental behaviour and impacts of radionuclide release & Management of risk and degraded infrastructure** Malcolm Joyce, Lancaster University, UK
	12.25	**Plenary discussion and feedback – 5 min per group** Discussion chairs will summarise key research priorities and ideas. Opportunity to identify gaps / further consideration by participants.		
	12.45	**Wrap up and close of UK Only Session (Malcolm Joyce, UK)**		

Tuesday 24 January 2023

Japan	UK	Activity
17.30-20.15	08.30-11.15	**Joint UK – Japan Session** Discussion of UK and Japan decommissioning priorities and ideas for research in Phase 10, in three key themes. The discussion will use the input captured in the PowerPoint templates from the UK and Japan only sessions as a starting point. **Link to join meeting:** https://us02web.zoom.us/j/83548913577?pwd=VGkyOFpOZURaMkhhdlZiZE9ndnlIdz09 Please join up to 15 min before the start so we can begin promptly.
17.30	08.30	**Welcome and orientation** **Malcolm Joyce,** Lancaster University, UK
17.35	08.35	**Summary presentation of UK - Japan decommissioning priorities and ideas for research**, in three key themes **Malcolm Joyce**, Lancaster University, UK **Takayuki Terai**, Institute of Applied Energy, Japan

17.55	08.55	**Introduction to parallel discussion sessions and task** Malcolm Joyce, Lancaster University In each parallel session: the session co-chairs will in turn present one of the three research topic slides prepared in the prior UK or Japan community session. The group will discuss each slide suggesting how the research topic could be shaped and focused to best meet the joint research needs of the UK and Japan. The group will identify potential participants in the UK and Japan who could participate in the research topic and potential topic leads who could develop a research proposal. The group should spend around 10 min on each slide.		
18.00	09.00	**1. Radioactive waste treatment, packaging, and storage** Michael Rushton, Bangor University, UK. Hiroshi Rindo, Nuclear Safety Research Association, Japan.	**2. Remote handling, robotic, and autonomous systems in decommissioning** Michael Aspinall, Lancaster University, UK. Michitsugu Mori, Hokkaido University, Japan.	**3. Environmental behaviour and impacts of radionuclide release & Management of risk and degraded infrastructure** Malcolm Joyce, Lancaster University, UK. Tetsuo Fukasawa, Nippon Nuclear Fuel Development, Japan.
19.15	10.15	**Plenary discussion and feedback (with English to Japanese translation)** Discussion chairs will summarise key research priorities and ideas (3 x 5 min). Opportunity to identify gaps / further consideration by participants (3 x 5 min) Note: there will be English to Japanese translation available in this session, please pause frequently in feedback and discussion to allow the translation.		
19.55	10.55	**Presentation of Phase 10 Call and Q&A** EPSRC & CLADS		
20.15	11.15	**Close of second Joint Session, Meeting and Workshop (Takayuki Terai, Japan)**		