Report on Joint Workshop of UK – Japan Civil Nuclear Research Program 2021/2

Neil Hyatt, University of Sheffield

Introduction

The meeting and workshop attracted 114 delegates – 59 from the UK and 55 from Japan for two days of intensive knowledge transfer and collaboration building, from 18-19 January 2022. This report summarises the activities undertaken and the discussion and recommendations of the workshop activities. This year the preparation phase, meeting and workshop took place entirely online due to continued travel restrictions as a result of the coronavirus pandemic. Nevertheless, delivery by video conferencing enabled further growth in participation, with the highest number of participants achieved so far for this annual event (98 participants for the 2020/21 event). This evidences a sustained and increasing interest and awareness of the joint research programme. 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 and 17.00-20.00 Japan time. The final agenda is appended to this report. Attendance at the 2021/2 meeting and workshop peaked at 106 delegates simultaneously participating in the online meeting.

Preparation phase

The timetable for the preparation phase of the meeting and workshop was slightly advanced to that of 2020/21, to enable closure of registration before the winter break and a briefing session with discussion group chairs:

October	UK side developed draft initial meeting and workshop agenda Meetings with UK and Japan sponsors to refine agenda Agree dates for meeting and workshop
November	Meetings with UK and Japan sponsors to refine agenda Identify and invite keynote and project speakers Pre-registration and save the date notification Develop and agree facilitation plan and workshop materials Set up registration portal
December	Meetings with UK and Japan sponsors to finalise agenda Finalise facilitation plan, workshop materials and joining instructions Issue draft agenda and open registration Close registration on 23 December 2021
January	Meeting with UK and Japan sponsors to review registrations and agenda Compile introduction pro-formas and discussion slides Issue final agenda and joining instructions Briefing session with discussion group chairs 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. New and amended pro-formas were added to the existing partner matching handbook which now has entries for over 90 programme participants. The feedback from

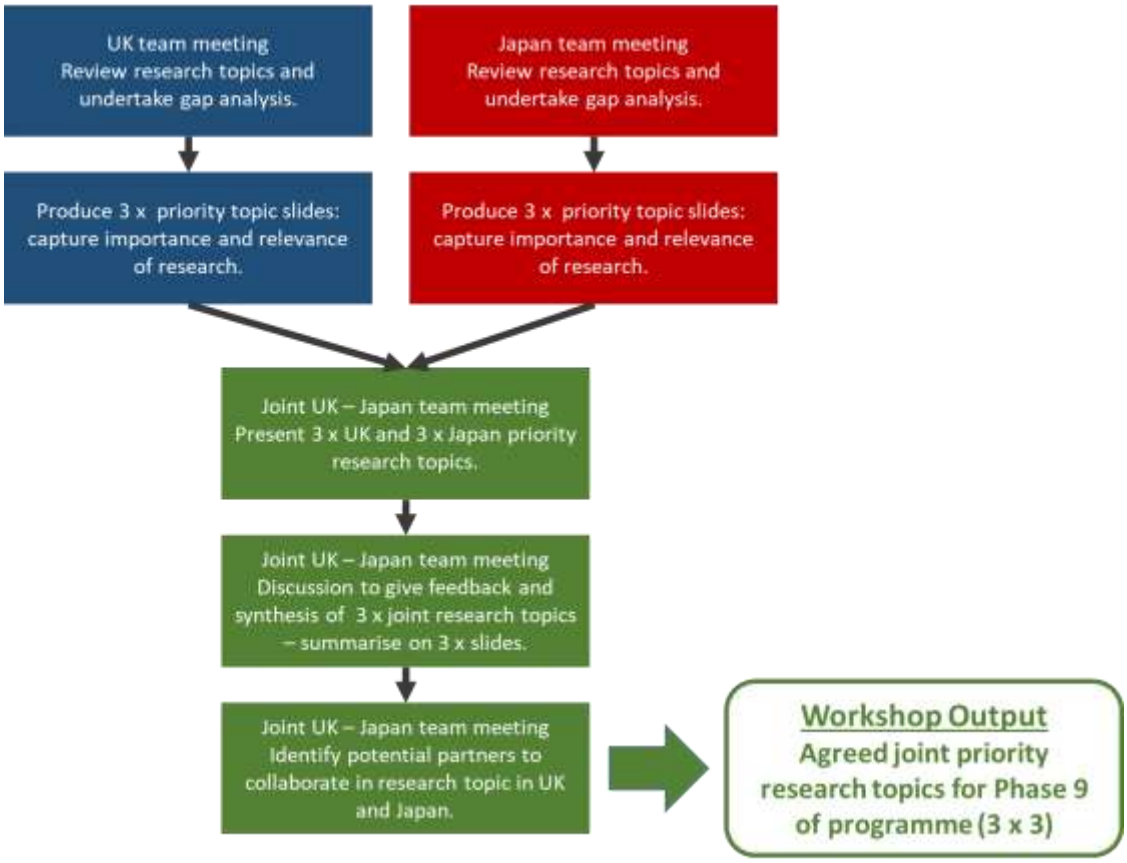
participants was that this had allowed them to both prepare for discussion in the joint workshop sessions and identify new potential partners for collaboration.

Some of the participants at the UK – Japan Workshop, 18-19 January 2022.

The format of the discussion session was modified, following feedback from the last workshop, to allow a more balanced presentation of topics from each partner country in the joint discussion session. The output report from the 2020/21 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 in response to the following questions:

- Are the topics still relevant to the UK, Japan and joint decommissioning programmes?
- Are the research topics still timely and in need of being addressed?
- Are there new topics should be added to address gaps in the research programme?
- Are there topics which have been well studied and should be of lower importance?
- Are there particular research topics which should be of higher or lower priority?

The outcome of the in-country discussion session was the identification of three or four priority research topics, each summarised on a power point slide. In the second joint session, the UK and Japan teams alternately presented their topic slides with the aim of identifying and agreeing three joint research challenges. The process is summarised in the following figure, with an example of the style and depth of output expected, summarised on a power point slide.



UK: lead contact point	Japan: lead contact point
Email:	Email:

Title: In-situ barriers, infrastructure repair and decommissionable concrete	**Theme: 3**
What is the research challenge (50 word limit)? • Nuclear infrastructure is largely degraded and damaged. How can we inhibit radionuclide migration during waste retrieval and decommissioning processes? • Can we design new materials to increase the volume and activity of contaminated infrastructure/soils to decay on-site, in-situ, reducing waste volumes for disposal? • Can we deploy biomineral or nano-particulate silica-based grouts to repair fractured waste packages?	**Potential partners in UK**
Why is the research relevant to both the UK and Japan decommissioning programmes (50 word limit)? • Radiologically contaminated land in both the UK and Japan where very low pressure injectable barriers would be advantageous. • Degraded nuclear assets (infrastructure and waste packages) in which non-invasive mineral-based repair/sealing strategies would be advantageous	**Potential partners in Japan**
Japan comments and suggestions to UK side?	**Other comments**

Summary of facilitated discussion process and output to identify priority research topics for Phase 9 of the joint UK – Japan Civil Nuclear Programme.

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. Hyatt (University of Sheffield) 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. Matthews (Sellafield Ltd) 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. Ishikawa (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 6 and 7 of the joint programme, with complementary presentations from the UK and Japan partners. Aspinall and Watanabe (Lancaster and Shizouka universities) presented the development of a radiation tolerant detector capable of rapid criticality monitoring, e.g. within fuel debris. Detector development was undertaken by Lancaster University, with evaluation and testing of radiation hardness by Shizouka University. Collectively the team have progressed to demonstration of a radiation tolerant detector and analytical system. Provis and Sato (Sheffield and Hokkaido universities) summarised the development of novel geopolymer formulations for the encapsulation of spent high dose adsorbents. Progress in the optimisation of these materials for improved sorption and retention of anionic radionuclides was discussed. 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, Cheneler and Kamada (Lancaster University and the National Maritime Research Institute) 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.

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 9 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 2021, the TEPCO Mid to Long Term Roadmap for decommissioning of Fukushima Dai-ichi, and Technical Strategic Plan 2021 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

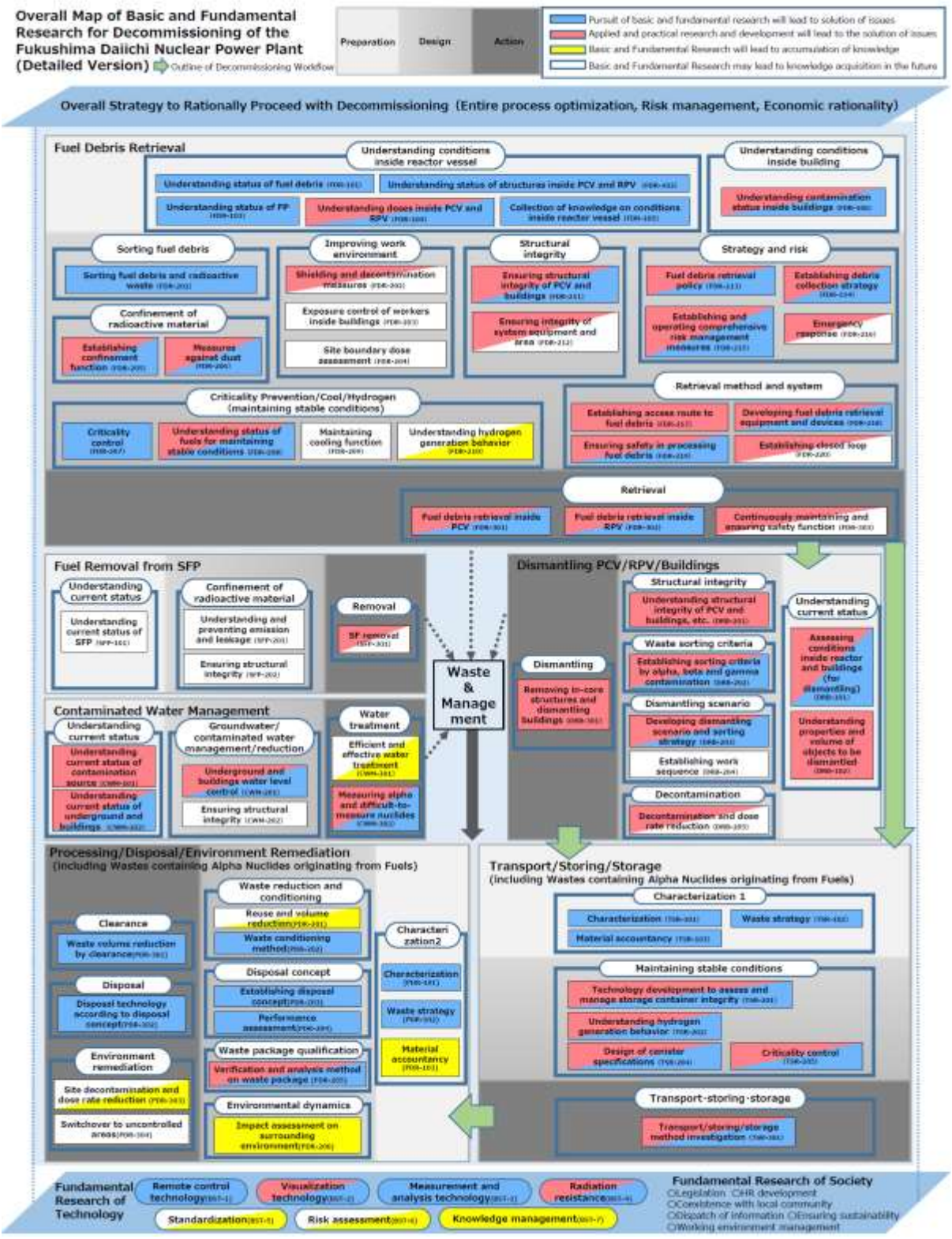
- Leak detection, contamination countermeasures, and clean up
- Data analytics, artificial intelligence, machine learning
- Digital technologies, digital twin, planning, and autonomy to manage risk

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 (available in final delegate pack).

Session 3: Joint session to develop UK decommissioning priorities and ideas for research in Phase 9

This session opened with a presentation to outline the key research priorities identified for consideration and discussion, through the in-country meetings. Hyatt 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.



Overall Map of Basic and Fundamental Research for Decommissioning of Fukushima Dai-ichi NPP

Group 1: Radioactive waste treatment, packaging, and storage

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 e.g. 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 Dai-ichi facilities requires remote inspection, radiation mapping, and decontamination technologies. Research needs to develop robotic platforms capable of underwater deployment, including inflatable systems, 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 environments. There is a need for development of in situ mechanical and chemical analysis tools, such as laser induced break down spectroscopy, for contamination assessment and verification, enabling the effectiveness of decontamination to be assured. Capability is required for digital capture and multi-sensor fusion of survey and radiological data.

2.2 Methods for collecting fuel debris and other materials during decommissioning

Retrieval of degraded fuels from the Fukushima Dai-ichi 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 (e.g. virtual reality), together with tactile and haptic interactions. There is a need to design and light-weight end effectors for mobility, deployment and dexterity. Retrieval operation will lead to disruption of material configurations, with 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. Consideration needs to be given to mobilisation and collection of underwater or air dispersed solids during retrieval operations. Automated sort and segregation technology is required for retrieved wastes, by application of artificial intelligence, is required 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. 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 effectively deal with uncertainty through optimisation, capture and 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 3/4: Environmental behaviour of radionuclide release and management of risk and degraded infrastructure

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 Dai-ichi 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 9 Call Opportunity

The planned Phase 9 Call Opportunity was presented by Eustace (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 8. 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 8. The proposal review will have the same format on the UK and Japan side as in Phase 8.
- It was emphasised that proposals would be gated by an interview on the Japan side, with successful proposal proceeding to the joint assessment panel.
- 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.

Further details are available in the slides provided in the final delegate pack.

Synthesis of workshop output – priorities areas for Phase 9 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 9, 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 8 Call.

Theme 1: Radioactive waste management

- 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

- Development robotic platforms capable of underwater deployment, including inflatable systems, 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. 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: characterization and handling

- 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.

Theme 4: Decommissioning technology and risk management

- 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
- 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.
- 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.

FINAL Agenda: UK – Japan Meeting and Workshop 2021/22

Tuesday 18 January 2022

Japan	UK	Activity
15.30-16.20		**Japan Session only.** Greetings: Koji Okamoto, CLADS (3min) **1F Decommissioning information** Masumi Ishikawa(PO), Tokyo Electric Power Company Holdings, Inc. Explanation of the current status of 1F decommissioning work (15 min) Questions (5-10 min) **How academia should contribute to the decommissioning of 1F** Hiroshi Miyano, Atomic Energy Society of Japan (15min) **Possibility of joint research between UK research seeds and the needs of 1F decommissioning** Takayuki Terai(PO), Institute of Applied Energy (10-15min)
16.20-16.40		**Instructions for UK-Japan workshop** Nuclear Safety Research Association (10-15 min) **Explanation of the call for proposals** CLADS (5min)

Japan	UK	Activity
17.00-20.10	08.00-11.10	**Joint UK - Japan Session** **Co-Chairs: Neil Hyatt (UK) and Takayuki Terai (JPN)** **Link to join meeting:** please join up to 15 min before the start so we can begin promptly https://zoom.us/j/97596523019?pwd=elJvd2w0L2NsMlJPZXhNM3JlTFphZz09
17.00	08.00	**Opening remarks** Neil Hyatt, University of Sheffield, UK Hajimu Yamana, Nuclear Damage Compensation and Decommissioning Facilitation Corporation, Japan
17.10	08.10	**Keynote: Progress in Sellafield and UK nuclear decommissioning** Ed Matthews, Sellafield Ltd.
17.30	08.30	**Keynote: Overview of Fukushima Daiichi nuclear decommissioning** Masumi Ishikawa, Tokyo Electric Power Company Holdings, Inc.
17.50	08.50	**Questions for keynote speakers**
18.00	09.00	**Michael Aspinall,** Lancaster University, and **Minoru Watanabe,** Okayama University (Phase 6)
18.15	09.15	**Hajime Kinoshita,** University of Sheffield, and **Tsutomu Sato,** Hokkaido University (Phase 6)
18.30	09.30	**Comfort break – 15 mins**
18.45	09.45	**David Cheneler,** Lancaster University, and **So Kamada**, National Institute of Maritime, Port and Aviation Technology (Phase 7)
19:00	10.00	**Joe Hriljac,** Diamond Light Source, and **Naoki Asao,** Shinshu University (Phase 7)
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, 5 x Japan talks. 10 min: plenary feedback and advice session. • Jenny Readman, UCLAN, UK.

		• Ken Kurosaki, Kyoto University, Japan. • Simon Middleburgh, Bangor University, UK. • Hirohisa Tanaka, Kwansei Gakuin University, Japan. • Ipek Caliskanelli, UKAEA, UK. • Shinji Tokonami, Hirosaki University, Japan. • David Harbottle, University of Leeds, UK. • Shinji Kawatsuma, National Institute of Technology, Fukushima College, Japan. • Philip Thomas, University of Bristol, UK.
20.10	11.10	**Close of first Joint Session (Neil Hyatt)**

Japan	UK	Activity		
	11.30-12.45	**UK Session only.** Discussion of UK decommissioning research priorities and ideas for Phase 9, in four key themes. Delegates will have the report from the joint meeting and workshop in 2020-21, 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:** please join up to 15 min before the start so we can begin promptly https://zoom.us/j/99560032638?pwd=bjRlTjBDMXYydDZwa096NEFPU0o4Zz09		
	11.30	**Introduction to parallel discussion sessions and task** Neil Hyatt, University of Sheffield		
	11.40	**1. Radioactive waste treatment, packaging, and storage** Neil Hyatt, University of Sheffield	**2. Remote handling, robotic, and autonomous systems in decommissioning** Rob Skilton, UK Atomic Energy Authority	**3. Environmental behaviour and impacts of radionuclide release & Management of risk and degraded infrastructure** Edoardo Patelli, Strathclyde University
	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 (Neil Hyatt)**		

Wednesday 19 January 2022

Japan	UK	Activity
16.40-17.10		**Japan Session only** **Instructions for parallel discussion sessions** (20min) **and Questions** (10min) Nuclear Safety Research Association

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 9, in four 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:** please join up to 15 min before the start so we can begin promptly https://zoom.us/j/92979450168?pwd=WERIQjBJMlNNWkN0VEJobIF0Slc3dz09
17.30	08.30	**Welcome and orientation** Neil Hyatt, University of Sheffield

17.35	08.35	**Summary presentation of UK - Japan decommissioning priorities and ideas for research**, in four key themes Neil Hyatt, University of Sheffield Takayuki Terai, Institute of Applied Energy		
17.55	08.55	**Introduction to parallel discussion sessions and task** Neil Hyatt, University of Sheffield 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** Neil Hyatt, University of Sheffield Hiroshi Rindo, Institute of Applied Energy	**2. Remote handling, robotic, and autonomous systems in decommissioning** Rob Skilton, UK Atomic Energy Authority Michitsugu Mori, Hokkaido University	**3. Environmental behaviour and impacts of radionuclide release & Management of risk and degraded infrastructure** Edoardo Patelli, Strathclyde University Tetsuo Fukasawa, Nippon Nuclear Fuel Development
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 9 Call and Q&A** EPSRC & CLADS		
20.15	11.15	**Close of second Joint Session, Meeting and Workshop (Takayuki Terai)**		