

FROM RAY CATS TO DPC RAM:

HOW BEST TO PRESERVE A DIGITAL MEMORY OF THE NUCLEAR DECOMMISSIONING PROCESS

Michael Popham

*Digital Preservation Coalition
United Kingdom
michael.popham@dpconline.org
0000-0002-6842-4294*

Jenny Mitcham

*Digital Preservation Coalition
United Kingdom
jenny.mitcham@dpconline.org
0000-0003-2884-542X*

This paper describes the work and outputs of the joint NDA-DPC project “Reliable, Robust and Resilient Digital Infrastructure for Nuclear Decommissioning”. This four-year project has produced a number of important deliverables that have been widely adopted by the international digital preservation community, such as DPC RAM. As a result of this project the UK’s Nuclear Decommissioning Authority is now much better placed to face the very real digital preservation challenges of the future.

**Keywords – DPC, NDA, RAM, knowledge, sharing
Conference Topics – Resilience.**

I. INTRODUCTION

The civil nuclear industry in the UK has already been in operation for over six decades but the legacy of this work, and of future developments in energy production, will have an impact for many thousands of years to come affecting hundreds of generations. Unlike most other sectors, the nuclear industry has clear and demonstrable use-cases that will require digital preservation planning for millennia.

The Nuclear Decommissioning Authority (NDA) is charged with the complicated task of decommissioning and cleaning the seventeen principal nuclear energy plants in the UK, a task accurately described as the largest and most important environmental restoration program in Europe. The extended life cycle of the program, set alongside robust commitments to security, integrity and safety, means the NDA approaches its work with a profound commitment to long-term information management, ensuring the right information is available to the right people in a format they can use and with the confidence that it can be trusted.

Therefore, amongst its many challenges, the NDA is by default required to become a trusted leader for information management and digital preservation.

In November 2018, the NDA and DPC began a dedicated project: “*Reliable, Robust and Resilient Digital Infrastructure for Nuclear Decommissioning*” [1] with three broad aims, namely to enable the NDA to:

- access and secure critical legacy data and systems
- adapt current data and systems to ensure their long-term viability
- commission data and systems with long term resilience from the outset

Initial findings were presented in a panel session at iPRES 2019, “*Achieving Criticality of Preservation Knowledge: Sustaining Digital Preservation in the Nuclear Field*” [2], and the project fostered a number of activities (notably the development of the *DPC Rapid Assessment Model* [3]) which have been taken up by the wider digital preservation community. The project was subsequently extended by a further two years – until November 2022 – with the goal of producing some specific deliverables and guidance, which will be described in this paper.

II. SCALE AND SCOPE OF THE NDA’S DIGITAL PRESERVATION CHALLENGE

Operating at an industrial scale on the cutting edge of a highly technical and complex area of scientific activity for such an extended period, has meant that the seventeen sites for which the NDA is

responsible have an extensive legacy of digital data, applications, and systems. For much of the time vital records and data have been held on paper form, managed in line with prevailing records management and archival practices. However, in recent decades, ever-increasing volumes of information and data have been created, managed, and kept in digital form. Nowadays there are immense swathes of information, such as mapping data held in GIS systems, in Building Information Management systems (BIMs), and virtual simulations, which will only ever exist in digital form but which play a vital part in the operation and management of the UK's nuclear industry, and will need to be securely preserved for the future.

In 2011, the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD) sponsored an international initiative "*Preservation of Records, Knowledge and Memory (RK&M) Across Generations*" [4], which produced an extensive set of recommendations in its final report in 2019. The focus was particularly on documenting the final disposal of radioactive waste and protecting humankind and the environment against the effects of ionizing radiation, noting "...it is not just a question of handing down a message, but of keeping that message interpretable, meaningful, credible and usable over time". (*ibid.* page 13). Earlier efforts around RK&M had focused on "avoiding inadvertent human intrusion [at disposal sites] through messages and methods focusing on danger and promoting aversion" (*ibid.*). One such effort is described in the short section on "The Ray Cat" (*ibid.* page 24):

Philosophers F. Bastide and P. Fabbri also responded to the 1984 poll asking how to communicate across 10,000 years Their proposal consisted of two steps:

1. Engineer a cat that changes color in response to radiation.

2. Create a culture around this cat, such that if your cat changes color, everybody knows you should move someplace else.

Ray cats would be genetically modified as to change color when coming near to radioactivity, thus serving as living indicators of

danger... The choice for a cat was due to their long history of cohabitation with humans. In order to transport the message, the importance of the cats would need to be set in collective societal awareness. To this aim, Bastide and Fabbri proposed storytelling and myths, which could be transmitted through poetry, music and painting. As such, the meaning of the "feline Geiger counter" should spread and become culturally embedded over time.

Nearly 40 years later, our thinking around the appropriate documentation of nuclear waste disposal sites has moved on somewhat, although it is much more prosaic – concentrating on topics like suitable long-term digital file formats and appropriate metadata fields i.e. the typical concerns of digital preservationists and archivists. However, these aspects seem far more likely to ensure that messages (aka information) remain "...interpretable, meaningful, credible and usable over time" (*ibid.*) when compared to poetry or tinkering with feline DNA, although perhaps some of our colleagues working on DNA-based digital storage might disagree?

The initial work of the NDA-DPC project involved DPC staff visiting several of the nuclear sites around the UK, and having discussions with colleagues across the NDA group on how best to manage and preserve their digital records and data.

III. DEVELOPMENT OF THE RAM

It was as result of efforts to assess the preservation readiness of the NDA that the DPC developed its Rapid Assessment Model (DPC RAM), a new digital preservation maturity model for organizations with a need to preserve digital content for the long-term. This tool was publicly released in September 2019, and was enthusiastically received by many digital preservation practitioners as both an easy-to-use self-assessment tool, and a helpful aid in discussing digital preservation capabilities and aspirations with colleagues.

The DPC RAM has been used by many organizations both large and small, and in response to feedback from the wider digital preservation community, a revised version of RAM was released in

March 2021. Version 2 of RAM retains the 11 sections and 5 maturity levels of the original model, but enhancements were made in a number of areas, including an increased emphasis on user needs, and greater attention given to the legal aspects of digital preservation activity. Both versions of the RAM were tested with the NDA, and information managers across the NDA group were actively encouraged to undertake their own RAM assessment to gain insights into their preparedness for digital preservation.

IV. DEVELOPING KNOWLEDGE AND SKILLS

The NDA employs around 300 people but has overall responsibility for a large and diverse workforce, almost 20,000-strong. It was envisaged from the outset of the project that in order to make progress towards its digital preservation goals, the NDA would need to develop the knowledge and skills of its people. Given the limited time and resources available, the NDA asked the DPC to commission the production of a number of data type guidance notes, based on the successful series of Technology Watch reports already published by the DPC.

Released in July 2021, the Data Type Series of Technology Watch Guidance Notes were written by experts at Artefactual Systems, working in collaboration with staff from the DPC. Each of these short documents is designed to provide a primer on the current state of community knowledge about preserving common types of data, such as documents, spreadsheets, and moving images. Ten such reports are available at the time of writing but their successful reception has encouraged the DPC to consider them a useful model for future publications on a specific theme.

Publications have also been accompanied by some face-to-face activities, albeit slightly hampered by the advent of covid-19. The NDA asked the DPC to establish a dedicated taskforce to develop some advice and guidance on the preservation of records held within an Electronic Document and Records Management System (EDRMS). Eighteen people from across the DPC's membership contributed to the work of the taskforce, which resulted in a Briefing Day (Unbroken records: A briefing day on Digital Preservation and EDRMS) and an online booksprint to produce the EDRMS Preservation Toolkit.

The project has also enabled the DPC to redevelop and enhance its thinking around workforce development, by defining the knowledge, skills, and capabilities required to fulfil particular

roles in the digital preservation lifecycle. Although earlier models exist (such as the DigCurV framework), which have been widely adopted within the preservation community, they have not been maintained and updated to reflect the developments in digital preservation that have emerged within the past decade. The collaboration between the NDA and the DPC provided the impetus to develop a new framework and audit tool, which the NDA could use to identify and fill gaps in the knowledge and skills of its workforce. At the time of writing, this framework and audit toolkit were scheduled to be publicly launched at the iPRES2022 conference.

V. SO WHAT ELSE IS NEW?

The joint NDA-DPC project has also prompted activities in two other key areas that are of widespread interest to the international digital preservation community. In the spring of 2022, the DPC publicly released a statement of the ten high-level function requirements for a digital preservation system. This document was originally developed to inform an assessment of the capabilities of the NDA's core digital preservation infrastructure, addressing aspects originally identified by the NDA's own RAM exercise. It soon became apparent that this document could be adapted to simplify and enhance digital preservation system procurement for both the procurer and for 3rd parties responding to procurement exercises – as challenges around this process had been previously identified in a workshop attended by DPC Members and Supporters. Although the statement of requirements is closely coupled to the DPC's Member-only Procurement Toolkit, it was agreed that given the NDA's public mission and the potential benefit to the wider digital preservation community, this document would be made publicly available.

Discussions with information managers across the NDA also confirmed that they recognized the challenges of preserving databases, of which a huge variety exist across the 17 sites managed by the NDA. They shared the challenge faced by many large, complex, and long-lived organizations of having important records languishing in legacy databases, as well as databases which are still being actively consulted despite having reached end-of-life and no longer being actively supported. In response to the challenges and risks presented by these data, the NDA and Sellafield Ltd. commissioned the DPC to undertake a focused one-year sub-project to develop some good practice guidance for the preservation of

databases. This work began in February 2022, and we anticipate that initial findings may be presented at iPRES 2022.

VI. CONCLUSION

Whilst it seems unlikely that the preservation of the nuclear industry's digital records, knowledge and memory will ever depend on color-changing Ray Cats, colleagues within the NDA are now relying on a new maturity model called the RAM and the combined knowledge of their staff and the wider digital preservation community to help ensure their vital digital records are retained and maintained through future generations. Through its collaboration with the DPC, the NDA has been able to both draw upon the expertise of the wider digital preservation community, and also share its own knowledge and findings for the benefit of all.

ACKNOWLEDGMENT

The authors are indebted to colleagues across the NDA for their time, energy, and support with the work of this project.

1. REFERENCES

- [1] <https://www.dpconline.org/digipres/collaborative-projects/nda-project>
- [2] <https://ipres2019.org/program/?session=46>
- [3] <https://www.dpconline.org/digipres/dpc-ram>
- [4] https://www.oecd-nea.org/jcms/pl_15088