

Nuclear Waste Services (NWS) Post-Doctoral Call:

Non-Radiological Pollutants PDRA: PVC Degradation under GDF-relevant Conditions

Guidance for submission and evaluation criteria

Nuclear Waste Services (NWS) is requesting applications for a Post-Doctoral Research Associate (PDRA) project entitled “**PVC and associated additives degradation under GDF-relevant conditions**”.

This research project is expected to have a duration of **24 months**, and the target date for grant award is **December 2026**. NWS is seeking proposals from academic lead investigators for a PDRA based project within their group. The lead investigator will be responsible for recruiting a suitable candidate by the target award start date.

Call Structure

Request for proposal issued on:	13/10/2026
Clarification period closes on:	10/11/2026 at midnight
Application period closes on:	17/11/2026 at 17:00
Contract award no later than:	08/12/2026

All clarification questions (including commercial, technical and terms and conditions) must be sent to AcademicEngagement@nuclearwasteservices.uk before the clarification period is closed. Any clarification questions to the **scope of the project** and/or **grant agreement terms** will only be considered during the Clarification period stated above and will not be accepted after proposal submission.

Proposals will be accepted as .pdf documents and supporting materials emailed to the Academic Engagement inbox: AcademicEngagement@nuclearwasteservices.uk. Exchanges between academics and NWS staff during the tender period is strongly discouraged. Applications will be assessed by an NWS panel of key stakeholders.

Funding Available

NWS is able to offer a budget of up to **£240,000** (split across FY26/27 and FY27/28) and welcomes additional investment and/or efficiencies/savings in support of the project. Project proposals of longer duration, proposing more efficient use of available funds, are welcome.

Regarding payment, 50% will be paid following project award, candidate appointment, and contract signature to enable project kick-off; the remaining 50% of the award will be paid according to pre-defined project milestones (to be outlined in any proposal submitted).

A proposal should confirm that the lead institution will facilitate project kick-off by **31 March 2027**.

Technical Scope

Nuclear Waste Services (NWS) is responsible for delivering a Geological Disposal Facility (GDF) to provide a permanent solution for the UK's most hazardous radioactive wastes. The GDF will employ a combination of engineered barriers and a suitable geological environment to isolate and contain waste over long timescales, protecting people and the environment. Demonstrating the long-term safety of a GDF requires a robust understanding of the processes that may influence the release, transport and evolution of both radiological and non-radiological contaminants present within the Inventory for Geological Disposal (IGD).

This project will focus on safety-relevant organic substances within the Low Heat Generating Waste (LHGW) component of the IGD. These substances, and their degradation products, may comprise hazardous and non-hazardous pollutants whose releases may need to be demonstrated to be prevented, minimised or appropriately controlled to protect groundwater and other environmental receptors.

A key component of the inventory of organic substances in the IGD is polyvinyl chloride (PVC) and other halogenated plastics, containing a range of additives, plasticisers and stabilisers. These materials are of interest to NWS because, (1) they represent the largest organic material inventories within the IGD, of which PVC and associated additives are the dominant component; and (2) there is uncertainty in their long-term evolution compared to other bulk organics (e.g. ion exchange resins, cellulose), particularly under conditions where radiolytic degradation may occur.

Previous studies showed radiolysis of plasticised PVC generates a diverse suite of organic degradation products. However, there remains insufficient confidence regarding which products are credibly formed under GDF-relevant conditions, how product distributions vary with additive composition, and whether accelerated irradiation studies can be extrapolated to GDF conditions. This uncertainty limits confidence in the PVC-derived contaminants of potential concern for a future Safety Case.

Key questions for the GDF Safety Case related to PVC degradation include:

- What degradation pathways are plausible for PVC and associated additives under GDF-relevant conditions, and what is currently known from the literature regarding their degradation behaviour?
- What degradation products are credibly formed, in what quantities and over what timescales, and how sensitive are these outcomes to material formulation, additive composition and disposal conditions?
- Can observations from accelerated irradiation experiments be reliably extrapolated to GDF-relevant conditions, including the long-term evolution of degradation products within waste packages and the surrounding near field?
- Which PVC-derived degradation products are most relevant to the GDF Safety Case, considering the quantities generated, persistence, mobility, toxicity, environmental behaviour and potential relevance to future GDF safety assessments?

The project will be undertaken in the context of the EURAD-2 TOxic Substances & Chemicals behaviour Assessment (TOSCA) work package,¹ which aims to address the behaviour and significance of emerging contaminants in radioactive waste disposal systems. This will provide the researcher with opportunities to exchange knowledge and contribute findings to this broader international programme, ensuring the research remains aligned with evolving priorities across the European radioactive waste management community. The scope should retain flexibility to consider additional substances identified through the EURAD-2 TOSCA programme, or through other emerging NWS priorities.

Access to irradiation facilities, associated experimental infrastructure (including the required sample handling and analytical facilities to identify and quantify degradation products across the

¹ <https://www.ejp-eurad.eu/implementation/toxic-substances-chemicals-behaviour-assessment-tosca>

gas, aqueous and solid phases), and any related costs shall be the responsibility of the successful applicant and should be included within the proposal where required. Applicants should demonstrate that the proposed facilities are available and suitable for delivery of the project scope.

Objectives

The overarching objective of the project is to provide key experimental evidence required for NWS to develop a defensible, evolved inventory of non-radiological contaminants arising from degradation of PVC and associated additives under GDF-relevant conditions, and to identify those degradation products most relevant to future GDF safety assessments.

Specific project objectives include:

- Review the nature and scale of PVC and associated material (additives and plasticisers) in the GDF LHGW inventory.
- Synthesise the available literature on their potential degradation mechanisms, rates and products under GDF-relevant conditions (e.g., chemical, thermal, microbial and radiolytic pathways).
- Understand the impact of accelerated irradiation experiments on the speciation and concentrations of the degradation of PVC and associated additives.
- Determine the degradation products from PVC and associated additives most relevant to a future GDF safety case considering inventory significance, environmental persistence, mobility, and toxicity.

The project can be defined in 3 linked Tasks.

Task 1: Inventory relevance and material selection (~6 months)

Review relevant IGD information and the wider literature relating to PVC, associated additives, and their degradation products, with a focus on radiolysis to aid with material selection for experimental planning of Task 2. The review should:

- Identify the GDF-relevant environmental conditions most likely to influence degradation behaviour and contaminant evolution, including consideration of factors such as radiation field, porewater chemistry, pH, redox conditions, material composition and bioavailability for microbial degradation.
- Review available literature on relevant plasticised PVC material and its potential presence in the IGD. Particular attention should be given to plasticiser and additive families that are credibly associated with PVC in the LHGW inventory, including commonly used phthalate plasticisers, phosphate-ester plasticisers or flame retardants, stabilisers, fillers and any legacy additives identified through inventory evidence. Material selection should consider changes in PVC formulation and manufacturing practices over the period represented by the waste inventory.
- Evaluate available evidence relating to PVC radiolysis under GDF-relevant conditions, including the influence of material formulation, additives, dose rate and cumulative absorbed dose.
- Identify credible PVC- and additive-derived degradation products reported or predicted under GDF-relevant conditions, and assess the strength and limitations of the supporting evidence.
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- Review available literature on the trade-offs of accelerated experiments using high irradiation dose rates.
- Develop a conceptual model and associated evolved inventory hypothesis to underpin experimental testing.
- Select and justify representative PVC formulations, additives and experimental conditions for subsequent testing.

This task should deliver a justified experimental programme capable of reducing the highest-priority uncertainties in NWS understanding of PVC degradation pathways relevant to the IGD and a future Safety Case. Experiments should focus on radiolytic degradation, whilst recognising that hydrolytic and other degradation mechanisms may contribute to, modify, or control the longer-term evolution of degradation products.

Task 2: Targeted degradation experiments and reporting (~15 months)

Undertake targeted degradation experiments on representative PVC materials and associated additives under GDF-relevant conditions.

Subject to the Task 1 review, it is assumed that experiments will investigate:

- Radiolytic degradation products of representative plasticised PVC formulations in cement-buffered systems (e.g. saturated $\text{Ca}(\text{OH})_2$ or representative cement porewaters), including appropriate controls;
- The influence of material formulation and additive composition on degradation-product speciation, concentration and distribution, and the associated uncertainties;
- Multiple absorbed doses covering early and advanced stages of degradation, and multiple dose rates spanning accelerated laboratory conditions and lower dose-rate conditions more representative of repository evolution. Particular emphasis should be placed on understanding whether accelerated irradiation studies produce degradation products that are representative of those expected under long-term repository conditions;
- Characterisation of the gas, aqueous, and solid phases using a variety of techniques, including but not limited to GC-MS, LC-MS/MS, ion chromatography, TOC analysis, NMR and high-resolution mass spectrometry, in order to produce a defensible, evolved inventory that defines and quantifies the principal PVC (and associated additives) degradation products, together with a clear understanding of remaining uncertainties (through the use of mass balance calculations).

The work should quantify degradation products, generation rates, dose-response relationships, and associated uncertainties to improve confidence in the evolved inventory and support future safety assessments.

Task 3 Safety Case Interpretation (~3 months)

Integrate the literature review, inventory assessment and experimental datasets to identify degradation products of greatest relevance to the GDF Safety Case. Not all compounds identified during the project are expected to be of equal significance; many may be produced only in trace quantities, may degrade rapidly under repository conditions, or may have limited mobility within the near-field environment. The objective of this task is therefore to distinguish between compounds that are merely detectable and those that represent credible contaminants of concern.

Working with NWS SMEs, a systematic prioritisation framework will be developed and applied to all identified degradation products. The prioritisation framework will be developed and applied through structured engagement with NWS SMEs, including provision for one in-person workshop (at the start of Task 3) at the host institution, and monthly online meetings.

This assessment should consider:

- **Toxicity and environmental hazard** – available toxicological and environmental information that may indicate potential risks to groundwater, surface environments or future receptors.
- **Persistence** – the extent to which compounds are expected to remain within the disposal system over relevant assessment timescales, including consideration of further degradation through radiolytic, hydrolytic or microbial processes.
- **Inventory significance** – whether the compound is generated in sufficient quantities, or from sufficiently significant waste inventories, to contribute meaningfully to the overall evolved inventory.
- **Mobility** – the likelihood that compounds can be transported through engineered barriers or the surrounding geosphere, including consideration of aqueous solubility, partitioning behaviour and interactions with geological materials.
- **Safety Case relevance** – whether the compound could influence environmental safety assessments directly, or indirectly through impacts on processes such as radionuclide complexation, gas generation, redox evolution, corrosion or microbial activity.

Using these criteria, degradation products should be classified according to their safety significance.

The outcome should be a prioritised list of PVC-derived contaminants relevant to the GDF safety case, distinguishing:

- **High-priority contaminants**, for which there is strong evidence of formation, persistence and potential safety relevance;
- **Medium-priority contaminants**, for which evidence of formation and persistence exist but important uncertainties remain regarding quantities or environmental behaviour;
- **Low-priority contaminants**, which are either produced in minor quantities, are unlikely to persist, or are judged to have limited relevance to the GDF Safety Case.

The task should also identify key remaining knowledge gaps, ensuring that subsequent work focuses on contaminants and processes that have the greatest potential to influence long-term environmental safety assessments.

Expected deliverables

Proposals should confirm deliverables and associated milestones, based on the following expectations:

D1. Literature Review and Experimental Plan (Month 6)

A technical report delivering the scope described in Task 1, describing a defensible conceptual model and experimental strategy discussing how PVC degradation products are expected to form and evolve under GDF-relevant conditions, together with a clear justification for the

materials, additives, environmental conditions and irradiation scenarios selected for experimental investigation.

D2. Interim Experimental Progress Report (Month 11)

An interim report summarising:

- Experimental progress and methods.
- Preliminary degradation product identification.
- Initial observations regarding dose-response relationships and dose-rate effects.
- Any proposed refinements to the experimental programme.

D3. Experimental Dataset and Interpretation (Month 21)

A comprehensive experimental dataset and interpretation, including:

- Quantified degradation products from selected materials.
- Characterisation of gas, aqueous and solid phases.
- Assessment of degradation pathways and product yields.
- Evaluation of dose-rate and total-dose effects.
- Assessment of variability and uncertainty.
- Clear documentation of experimental conditions, assumptions and limitations.
- Plan for peer-reviewed journal publications

D4. Safety Case Interpretation (Month 24)

A technical report will be produced in conjunction with NWS, containing:

- A defensible list of PVC- and additive-derived degradation products arising from the investigated materials.
- Application of the prioritisation framework to identified degradation products.
- Identification of degradation products of high, medium and low relevance to the GDF Safety Case.
- The underpinning evidence, assumptions and uncertainties supporting each classification.
- Identification of remaining knowledge gaps and an indication of what further evidence might be required.

Proposals Evaluation Criteria

The details requested from applicants and how these will be evaluated are as follows:

Confirm that the grant agreement would be signed in time to issue an initial invoice to NWS.

Applicants are requested to confirm that the grant agreement could be signed in sufficient time to issue NWS with an invoice for the initial payment no later than the **1st of March 2027**.

Where recruitment is required, a candidate for the position should be found within a reasonable timeframe following contract award, to be no later than the **1st of March 2027**. The successful applicant shall provide NWS with the CV of the preferred PDRA candidate for review prior to

appointment. NWS reserves the right to require an alternative candidate to be proposed where the preferred candidate is not considered to possess the skills, qualifications or experience necessary to deliver the proposed research scope.

Applicant to confirm ability to sign grant agreement by 1st of March 2027: PASS/FAIL
PASS/FAIL: Please state “Yes” or “No” on the application form. Other answers will be deemed non-compliant.

3) Evaluation criteria:

Scoring criteria	Score	Weighting (out of 100%)	Description and guidance notes
Acceptance of NWS Terms and Conditions	Pass/Fail	N/A	• Acceptance of the attached terms and conditions is mandatory. A completed grant agreement is not needed with the application but will be required if funding is awarded. • If the grant agreement is not signed on award, then funding will not be issued. • If after the grant award the grant agreement is not signed within 30 days, then NWS reserves the right to withdraw the award of the grant.
Demonstration of capability	Pass/Fail	N/A	Successful applicants will demonstrate that they have academic track record and capability to undertake all proposed work (either in-house or through collaborative arrangements).
Research Excellence	/4	45%	• The response will clearly define the scope, milestones and deliverables from the project. • Describe how the work builds upon previous work or experience of the team and why this research in this proposal is the best method. • A demonstrable understanding of the technical and research background of the challenge area. • The suitability of the methodology to achieve the project's aims. • The ambition and transformative aspects or potential outcomes that the proposed research might achieve.
Fit to Scheme	/4	20%	• Refer to specific NWS challenges that exist now or are likely to become issues in the future. • Alignment to the brief or justification as to how the proposal meets NWS challenges. • Describe how the proposed research relates to those challenges and how they will tackle them/ increase understanding of them/ contribute to or produce an alternative tool or technique for dealing with them.
Project Management	/4	15%	• Include an approximate breakdown of costs to the nearest £1k showing how the funding will be split between labour, equipment, and consumables etc.: ○ Fees (including overheads, staff costs, estate costs) ○ Research training support (e.g., travel and subsistence, conference registration fees, training courses) ○ Equipment and consumables (equipment >£1K should be itemised)

			○ Include an estimate of when (month) expenditure will be required. • Incorporate a project plan/Gantt chart showing the durations of the key phases of the work and identifying key milestones and deliverables. • Identify any major risks to the research and associated mitigation that can be considered against these risks. • Demonstrate value for money for any equipment (costing more than >£1K) required to deliver the research, including in-kind access to equipment where appropriate. • Itemise any leverage associated with the research. This can include use of existing facilities, in-kind support from other areas/projects, use of NNUF or other national infrastructure. • Demonstrate that any proposed active work has been discussed in advance with the relevant facility owners/ operators and is feasible within the bounds of the proposal.
Knowledge Exchange and Impact	/4	10%	• Describe what will be done by the researcher and academic PI to ensure that the learning from the project is incorporated into the NWS Knowledge Base. • Is visible to, and accessible by, the wider community (e.g., other academics, industry supply chain). • Describe how the work will be made accessible to and/or could be applied by those working within the NWS or the supply chain. • Identify other industries who might benefit from this knowledge
Cost	/4	10%	• The total available budget is £240,000. • Provide a cost for the full duration of the project, including all costs i.e., labour, equipment, and consumables. • Identify any cost saving that could be made to reduce cost. • Price analysis will be carried out to ensure like for like costs capture the full project scope, deliverables, and milestones.
Total Score			

Scoring criteria:

0= No response or response does not meet any requirements

1= Marginal response with significant drawbacks or omissions

2= Acceptable response, meeting most criteria with only minor drawbacks or omissions

3= Good response which meets all requirements

4= Excellent response which meets and exceeds requirements

Security and Publication Restrictions

To be agreed with the Funder prior to contract award and commencement of project.

T&Cs (attached or linked)

Terms and Conditions link is included within the webpage submission to support the application.