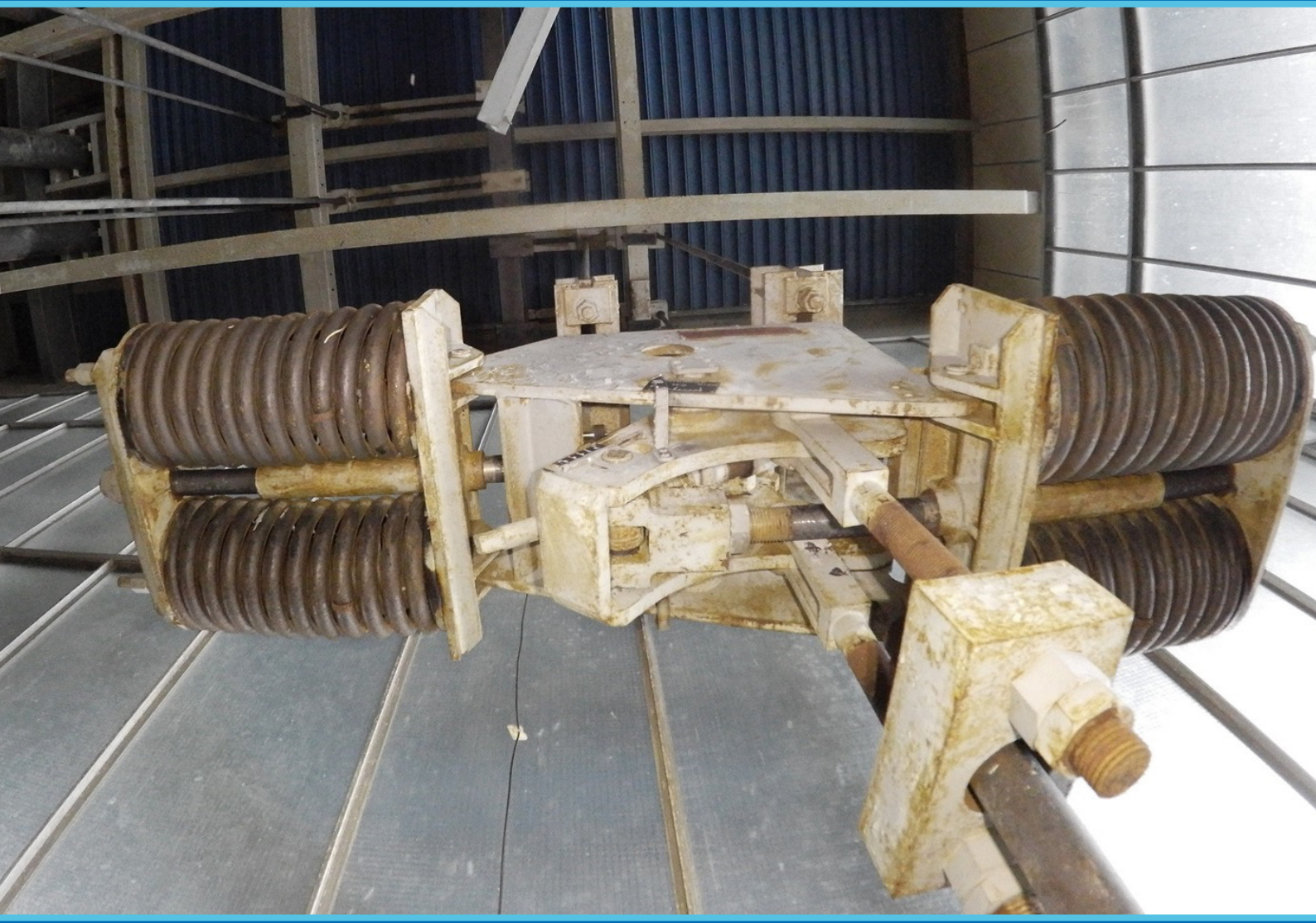
NRS
Nuclear Restoration Services

GAMECHANGERS
DELIVERING NUCLEAR INNOVATION



CHALLENGE:

Immobilising spring hanger assemblies for safe decommissioning

Nuclear Restoration Services Ltd (NRS) is decommissioning the former Magnox power stations. These contain hard-to-access structures that are supported by constant load spring hangers. This challenge is seeking solutions that will provide immobilisation of these structures during the decommissioning process.

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United Kingdom National Nuclear Laboratory

Introduction

The former Magnox nuclear power stations are now being decommissioned by Nuclear Restoration Services Ltd (NRS). Integral to these plants are the reactor gas (primary) circuits and the steam (secondary) circuits. When the Magnox plants were operational, the ducting that forms these pressurised circuits was subject to vibration and movement as a result of thermal expansion and contraction. To prevent transfer of this vibration and movement to the surrounding building structure, the circuit ducting is supported by spring mass dampers, which are referred to as **spring hangers**. These are commonly deployed on processing industry plants, including petrochemical, to protect systems from vibration and movement.

The typical structure of a spring hanger includes a helical spring, a tie rod, and mechanisms for connecting the spring to both the overhead building structure and the required ducting load. The spring hanger supports the weight of the ducting and compresses or expands to dampen any movement. During installation of larger spring hangers, the internal spring is pre-compressed before the load is applied; these are referred to as **constant load spring hangers**.

There are in excess of 10,000+ legacy spring hangers across NRS sites. The vast majority are smaller, variable load spring hangers that have not been pre-compressed, so the stresses on the spring hanger are directly proportional to the load. These can be easily de-energised by simply supporting the load or removing it. These are not problematic and therefore not under consideration in this challenge.

Across NRS sites, there are around 1,000 constant load spring hangers that were designed to carry larger loads and manage vibration and displacement of the most critical operational plant. These vary in size and magnitude of the spring energy, which is a key risk factor. If those spring hangers failed, the potential energy of the spring could launch the central tie-rod, which can be likened to a metal spear, over a considerable distance at high speed. NRS has taken a number of measures to mitigate against this; more details are given in the Current Practice section.

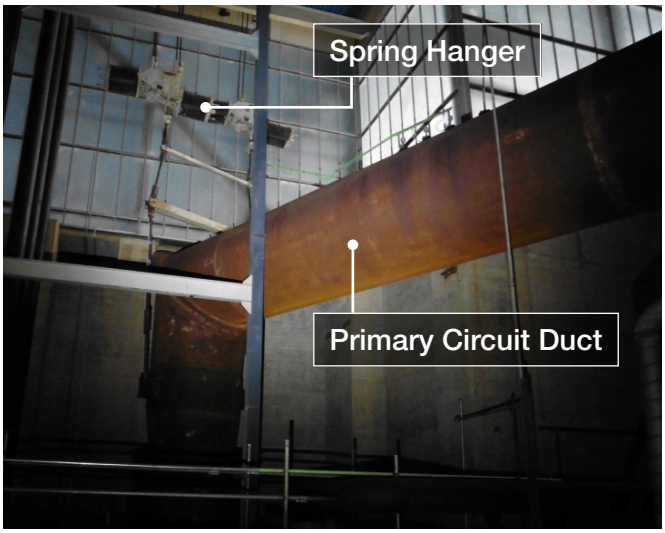


Figure 1: Hinkley A, top duct with hanger

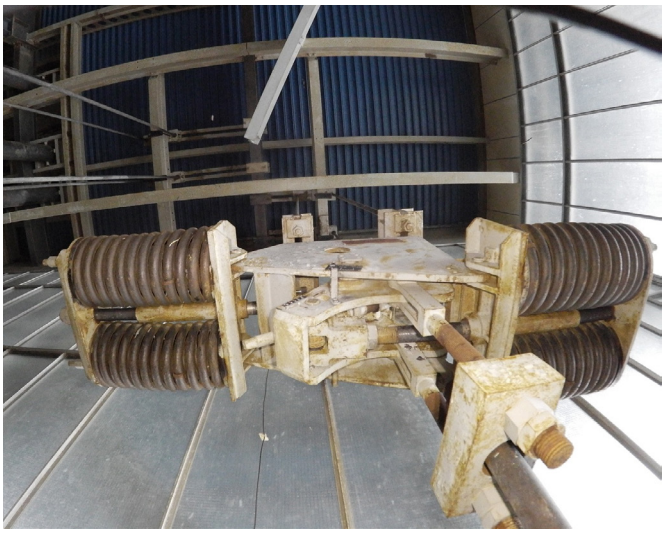


Figure 2: Hinkley A, top duct hanger assembly

In some cases, these constant load spring hangers continue to provide essential structural support to prevent movement of the ducting. There are examples of this at Hinkley Point A (see Figures 1 and 2), where constant load spring hangers are integral to the support of the primary circuit gas ducting. Any movement of the ducting being supported by spring hangers during decommissioning could result in a rupture of the welded joint between the gas duct and the reactor pressure vessel.

It is therefore essential to mitigate against the movement of the supported ducting during decommissioning operations. This is the focus of this challenge.

Current Practice

All work to date has been focused on preventing the central tie rod of legacy spring hangers being ejected in the event of spring failure. This has been driven by high-profile cases where springs have failed due to stress-corrosion cracking, with the resultant high-energy launch of the tie rod over a considerable distance.

Between 2017 and 2020, NRS developed a number of solutions:

- Restraint with polypropylene strapping (Figure 3)
- Clamping for springs with an outer housing, referred to as a can (Figure 4)
- Polypropylene strapping of a double spring hanger (Figure 5)
- De-energising springs by flame and laser cutting (Figure 6)

These methods provide a "toolbox" of solutions that are available to NRS to optimise the safe management of legacy spring hangers during decommissioning. However, these solutions have been developed to minimise harm to individuals and plant by preventing the central tie rod of a spring hanger from being ejected. **These solutions do nothing to prevent overall movement of the assemblies being supported by the spring hanger system during decommissioning, which is what this challenge is designed to explore.**

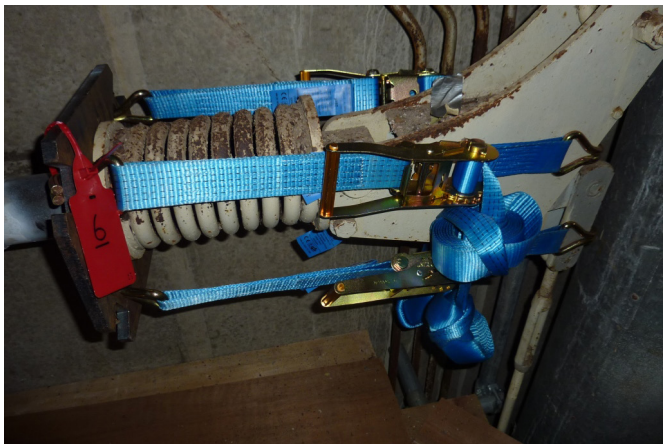


Figure 3: Strap-restrained hanger

Figure 4: Solid restraint on a canned spring

Figure 5: Double spring with polypropylene strapping

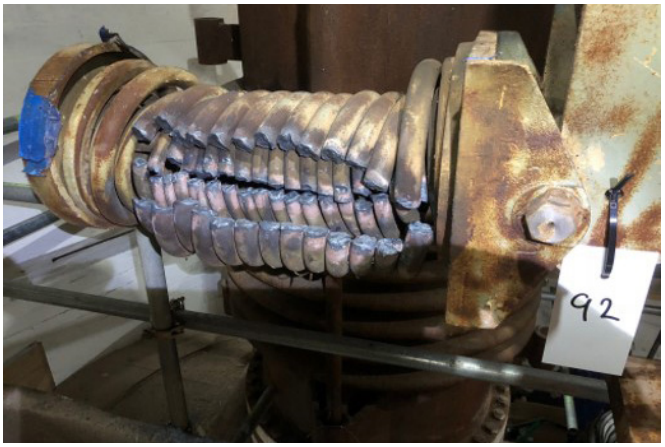


Figure 6: De-stressed spring after hot cutting

Challenge Aims

NRS is seeking solutions that will support and immobilise structures that are currently supported by spring hangers.

During decommissioning, NRS will need to remove all spring hangers, including those providing essential structural support. During this removal process, it is essential to provide alternative support for the structures that are currently suspended from spring hangers to maintain their structural integrity. These structures will need to remain in situ for a number of years whilst decommissioning operations are undertaken.

Ideally, any solutions to this challenge would be applied remotely, although this is not essential. Where solutions cannot be applied remotely, the use of specialist rope access or other means that avoid the need for scaffolding structures for access are preferred.

Ideally, solutions would be deployed in tandem with the protection methods described in the Current Practice section. Where this is not the case, solutions should also provide a means to prevent the ejection of spring hanger components in the event of tie-rod failure or spring-shatter/collapse.

NRS has an immediate focus on the hardest-to-reach assemblies at Hinckley Point A, but that particular scenario is not the limit of application for successful solutions to this challenge.

Benefits to the Challenge Owner

Mitigating against the risk of loss of integrity of plant during decommissioning is a very high priority. At Hinkley A, it is thought that movements as small as 50mm could stress the welded interface between the primary circuit and the reactor pressure vessel to failure. These welds have become particularly brittle in nature through their prolonged exposure to radiation. Finding a solution to this challenge that enables immobilisation of the plant infrastructure during the removal of spring hangers will benefit the decommissioning process by making it:

- Safer, due to the reduced risk to personnel and the remaining plant
- Faster, as there is currently no designed solution for removing the Hinkley A top duct spring hangers
- Cheaper, if a suitable alternative can be identified that removes the need for access scaffolding, which it is currently estimated will cost in excess of £1M

The current estimate for mitigating the eight most difficult assemblies at Hinkley A is circa £7.5M - £15M.

Suitable solutions for this challenge would have applications beyond Hinkley A, across the wider NRS estate and within other process industry sectors with primary and secondary circuits supported by spring hangers.

Constraints

The initial focus for this challenge is on the top ducts at Hinkley Point A, where access is extremely limited. Figure 1 shows a view **from** the nearest working platform and Figure 2 shows one of the hanger assemblies. What these photographs do not show is the approximate 50-metre drop below the point of suspension. The following access issues must also be considered:

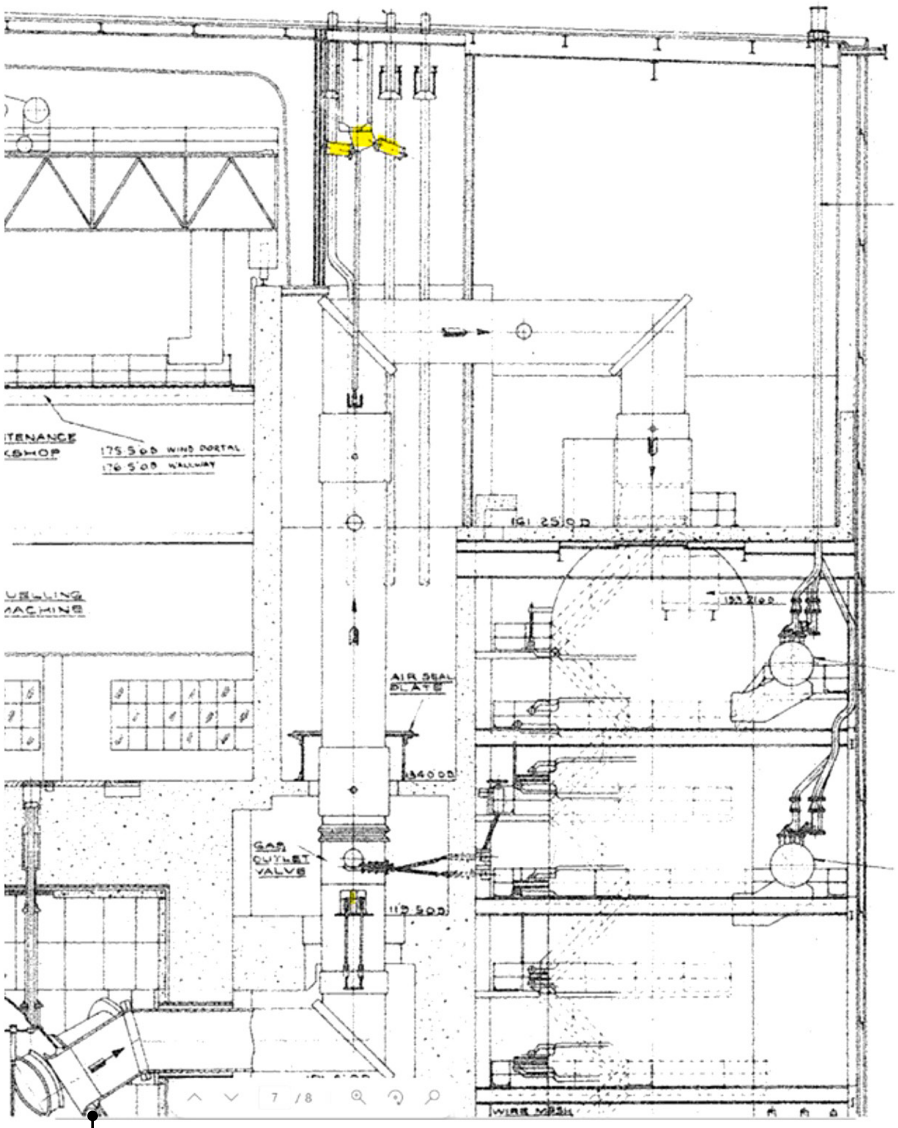
- The area directly adjacent to the primary circuit is classified as R2 in terms of radiation levels. This means it is a controlled area, but with minimal restrictions
- Overall access is extremely limited
- Any equipment would need to be transported via a goods lift that has a pedestrian access door
- The floor loading capacity is estimated conservatively at 500kg/M^2
- There is no installed equipment for elevating items above the ground, other than a goods lift
- It is preferred that solutions avoid the requirement for elaborate scaffold structures to access the spring hanger assemblies
- No equipment can be attached to the primary circuit
- Other structures within the building may be used for support within limits
- Any proposals to attach, modify or remove other structures will need to be carefully considered by NRS
- Power supplies and temporary lighting are available in the relevant area

Functional Requirements

The risks to plant during decommissioning of the top ducts at Hinkley Point A are significant. In the worst-case scenario, unmitigated failure of the spring hangers could result in the duct shown in Figures 1 and 7 dropping until it is arrested by the internal mechanical stops within the hanger. Movements as small as 50mm could stress the welded interface between the primary circuit and the reactor pressure vessel to failure.

Such sensitivity to movement is due to the brittle nature of the SMA (shield metal arc) and MMA (manual metal arc) welds that are known to embrittle under radiation conditions.
Any proposed solution to this challenge needs to provide a means of securing the position of the primary circuit, shown in Figure 7, to allow the safe removal of the existing spring hanger assemblies.

Figure 7: Partial General Assembly drawing of the primary circuit at Hinkley A. Top duct spring hangers are highlighted in yellow and the connection with reactor pressure vessel is indicated at the bottom left corner



Find Out More

Game Changers are hosting a workshop for this challenge where delegates will have the opportunity to meet challenge owners. Details are available on the Game Changers website www.gamechangers.technology.

If you have new ideas or innovations which can be applied to address this challenge, we invite you to join us. If you'd like more information about the funding available through the Game Changers programme, please visit Our Funding Process.

The deadline for applications for this challenge is 3pm on Tuesday 18th November 2025.

Delivered by

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