Operation Fieldfare - Scope of Works

The provisions for services to collect, transport and process existing High Activity Sealed Radioactive Sources (SRS) using a pre-determined disposal route.

Background

The Home Office are leading a cross government programme of activities which seeks to replace caesium-137 irradiators used in biological and biomedical research facilities within the UK, where a viable alternative technology or solution exists.

The Nuclear Decommissioning Authority (NDA) with Nuclear Transport Solutions (NTS) acting as their agent has been instructed by the Department for Energy Security and Net Zero (DESNZ) to establish and support the collection of High Activity Sealed Radioactive Source (HASS) through a suitable disposal route.

The NDA Group have been tasked with enabling a disposal route for these sources into Sellafield. Note, Sellafield is the current waste management route for sealed sources.

NTS is a wholly owned subsidiary of the NDA which has extensive and proven expertise in irradiated fuel management and transporting nuclear materials.

Disposal Programme Scope

- Number of irradiator units – approximately 67
- Number of sources – approximately 145 Cs-137 sealed sources (it is not known at this stage how the total number of sources is split across the 67 irradiator units)
- Geographical area – United Kingdom
- Highest source activity – approximately 70 TBq (as of 2019)
- 7 – 10 irradiator unit collections from the User per annum, it is the responsibility of the Supplier.
- The Supplier is to dismantle the irradiator, remove the Cs-137 sealed source(s), and place them in a disposable liner in preparation for collection. (See Figure 1 at the end of this document). Note, depending on the activity of the sources, up to 3 sources would be placed in one disposable liner.
- The disposable liners will then have to be placed in a 1648C Type B(U) packaging (see Figure 2 at the end of this document).
- The 1648C package(s) will then be collected by the NDA Group from the Supplier premises. The current proposal is 4 campaigns per year, with a collection roughly every 3 months.
- It is estimated that this way 14 – 21 sources would be collected from the Supplier per annum.

- A universal transport frame (UTF) is being designed that can accommodate up to 3 x 1648C transport packages, as such there is to be a single vehicle collecting up to 3 no. of 1648C packages from the Supplier premises per campaign.
- There will be up to 3 x 1648C flasks available per campaign; fewer flasks will be delivered if not required 3, as advised by the Supplier. If more than 3 filled liners are prepared, the additional liners would remain at the Supplier until the next campaign, or additional collections would need to be arranged depending on transport package availability.
- Collections from the Supplier: at the designated campaign date, the Sellafield driver will take a single vehicle and UTF loaded with up to 3 empty 1648C flasks to the Supplier site. The Supplier will unload the 1648C flasks into the building and transfer the filled liners into the flasks. The flasks are then transferred back onto the vehicle ready for transport.

Duration of the disposal programme: 7 years with the option to extend by 1 + 1 years.

The anticipated start date for the disposal programme/first irradiator collection is late 2024.

(These numbers could be subject to change)

Information related to Supplier set up costs and site modification requirements:

The NDA understands that the Supply Chain may not necessarily have all the required capabilities in place to deliver the full scope of work due to project specific requirements such as handling bespoke equipment. Therefore, as part of the contract, the winning bidder(s) will be eligible to receive a limited amount of funding (up to £1m each) to cover part of or all of (depending on the estimated costs) the cost of enabling works for site and facility preparation that may be required to take place prior to starting the operations under the contract. During the ITT process, the bidders' response will need to explain the work that would need to be carried out before operations start, including duration and costs of modification and/or installation, underpinned by supporting evidence.

This could include:

- Upgrade of existing capabilities to allow handling and processing of HASS in line with the scope described below;
- Installation of new capabilities to allow handling and processing of HASS in line with the scope described below.

Note:

Due to the nature of this investment, the supplier will own these assets however, if the contract is terminated early by the Supplier, repayment charges may apply. These charges will be set out in the contract.

Supplier requirements

There are four key stages to the disposal route:

1. Pre-collection

When the User is ready for releasing the irradiator, the Supplier will be notified by the NDA Group and it is to perform the necessary site surveys and administrative arrangements to prepare for the collection of the irradiator unit from the User's premises. This will typically include:

- Site survey/evaluation visits to determine access/egress routes, floor conditions, security concerns, etc. Note, any required remedial works to be the responsibility of the User (incl. provision of safe access, any site or road closures).
- Report writing.
- Commence preparation of appropriate RAMS, route planning, security and transport contingency arrangements, etc.
- Perform all necessary activities in relation to environmental permitting requirements.

2. Collection of the source from the User's site

The Supplier is to prepare the irradiator containing the source for collection from the User premises and load into a fully licensed transport package. Then the irradiator is to be transported back to the Supplier's facility for processing.

Depending on the irradiator model, some sources could be removed in situ using a modular-type flask design, however this method is not acceptable, and the irradiators will be required to be removed and transported to a decommissioning facility to retrieve the source(s).

The conveyance, transport package and other ancillary equipment to be the responsibility of the Supplier.

Note:

The contract provisions will make provision for the Supplier to sub-contract the transport of the sources from the User premises to the Supplier premises. As the sub-contractor will not be entering into the Framework Agreement/Call-Off Agreement – the Supplier will need to remain contractually liable for the transport of the Sources from the User premises in the Call-Off Agreement (and would then need to pass down the liabilities to its sub-contractor). The NDA will need to approve the Supplier's sub-contractor and carry out appropriate due diligence to ensure that there is an appropriate flow-down of liabilities i.e. that the Supplier will be able to meet its contractual liabilities to the NDA in the Framework Agreement/Call-Off Agreement.

Supplier's responsibilities also include:

- Volume and mass reduction of the irradiator if required.
- Disposal of all parts of the irradiator if volume and mass reduction is required.

Note:

Capability to decommission any models will be required from the start of the programme, including separation of active components from non-active components and disposition of the

secondary non-active waste arising from the decommissioning process (e.g., lead source containment vessel, electrical components etc). Active components (Cs-137 sources) will be consigned by the Supplier into the 1648C packaging for collection by the Contracting Authority, subject to contract.

- Compliance with the correct handling and loading procedures.
- Compliance with ADR and IMDG regulations.
- Provision of emergency response, recovery and transport contingency arrangements and comply with The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (as amended).

Note:

ADR requires that Carriers, consignors, and other participants specified in ADR 1.4.2 and ADR 1.4.3 engaged in the carriage of high consequence radioactive material (HCRM) shall adopt, implement and comply with a security plan; Cs-137 is considered high consequence above 1TBq (ADR, 2023, p. 99). Similarly, the general provisions of ADR concerning radioactive material provide that people, property and the environment are further protected from the potentially harmful effect of radioactive material through planning for emergency response.

3. Processing of the source at the Supplier's premises

The Supplier is to arrange the appropriate storage of the irradiator at their facility and prepare the source in readiness for collection.

For information only, Figure 3 below shows a list of the most common type of irradiators in the UK (in alphabetical order), with the most common irradiator being from the Gammacell range:

Irradiator Models
Gammacell-1000
Gammacell-1000 Elite
Gammacell-3000
Gravatom
Gravatom RX30/55M
Gamma Service C1
Gamma Service C1M
Gamma Service D1
IBL 437C
IBL 437C Type H
IBL 637

Figure 3: Irradiator types

The Cs-137 sources will be contained inside shielded containment vessels (SCV), which will have already been removed from the main irradiator units and packed into a Type-B transport package. It can be confirmed that most Gammacell SCVs have fully welded containment mechanisms, which means the decommissioning facility will require specialist tooling to retrieve the HASS from these irradiators. Best Theratronics own the intellectual property to

these Gammacell brand of irradiators, and all Gammacell SCVs are the same general construction, however the source cavity is closed either by a continuous weld, four bolts or by double retaining rings. A welded SCV will require specialist machine tooling to cut the welds and retrieve the shield plug. It is suggested that most irradiator SCV will follow the same general constructions.

NDA understands that some irradiators were manufactured not in accordance with the original design drawings and elements were subject to change without accurate records being drawn up. This may prevent the ability to safely remove sources from a unit. Contingency arrangements will be put in place if necessary to ensure non-conforming materials have a guaranteed route to disposal.

It will be the responsibility of the Supplier to ensure they have access to a suitable storage facility that meets all regulatory and licence requirements. The storage facility must be capable of storing multiple sources as some irradiator units can contain up to 4 sources.

The activity of the sources ranges from approximately 20-70 TBq and have an average activity of approximately 33 TBq. Figure 4 below shows the estimated source activity (as of 2019) for sealed sources used in blood irradiators after several years of operation.

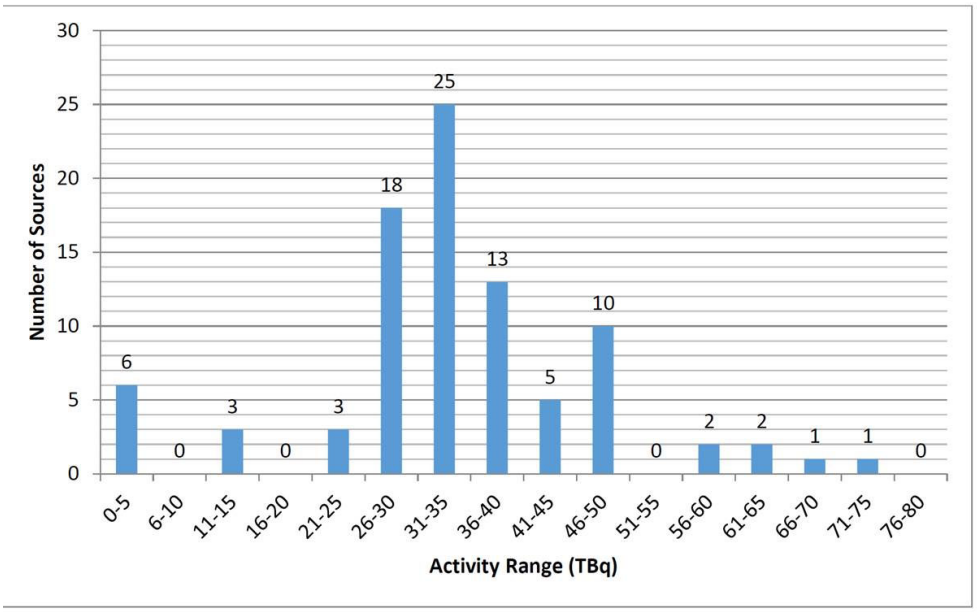

Figure 4: Estimated source activity for in-scope sealed sources (as of 2019)

Radiological, environmental permitting and security requirements must be met in order to store and process sealed sources of this activity in this number.

The Supplier must ensure the applicable provisions of the Ionising Radiation Regulations 2017 (as amended) are met in full. The sources will also be regulated by the RSR Environmental Permitting regime whilst being stored and processed at the Supplier's premises (which are a non-licensed nuclear site). It is likely that the Supplier will need to seek a variation of its existing environmental permits to allow the Supplier to receive, hold and process the Sources at their premises, this is the responsibility of the Supplier.

Principles of ALARP must be adhered to.

The Supplier will be responsible for removing the source from the irradiator and transferring it into a shielded disposable liner.

The sources will be stored on the Supplier site until the next collection date is agreed and arranged. Collection is planned on a quarterly basis.

4. Consignment of material to Sellafield

The Supplier is to prepare the source and complete the administrative requirements in preparation for Sellafield to collect the source and transport it to the Miscellaneous Beta Gamma Waste Store (MBGWS).

The Supplier will only be liable for costs associated with the administrative arrangements and logistics required to consign the material to Sellafield including the emergency response provision.

The Supplier will be responsible for:

- **Loading the source into a disposable liner.**

A disposable liner is currently being designed in order to transport the sources.

There will be a common design of shielded liner, that can accommodate all the defined source activities and geometries. This liner will be designed to accommodate 1-3 sources. Where possible, the number of sources per liner will be maximised, but a single source per liner may be selected for the higher activity sources; a detailed shielding assessment will be produced to assist with this.

The liner is in the detailed design phase and is based on an existing 28L liner. The features of the design include lifting hooks, a spring-loaded pin mechanism to secure the lid, internal shielding and a physical constraint to position the source(s) in slots inside the liner preventing horizontal and vertical movement. NTS will work with the Supplier to ensure the sources can be remotely loaded into this liner design and to ensure it accommodates all sources that fall under the scope of this Programme.

It will be the responsibility of the Supplier to procure the disposable liner and appropriate liner lifting tools. The relevant drawings and supporting documentation will be provided by NTS.

- **Removing the NTS transport package from the Sellafield conveyance when it arrives.**

The transport package will be sat on a stillage which enables the use of a forklift. The transport package has lifting trunnions which enables the use of a crane. The combined weight of the transport package and stillage is 5 tonnes. The weight of just the transport package is 4 tonnes. A lifting beam to enable crane usage will be provided by NTS. A Lifting Operations and Lifting Equipment Regulations 6 monthly examination certificate and an end-user handling manual will be provided with these assets. The Supplier will be liable for the use of the assets in accordance with the handling manual.

NTS are in the process of designing an asset to tie down the transport package on the back of the conveyance. NTS will work with the Supplier to ensure their functional requirements are included in the design.

- **Loading the disposable liner laden with source into the transport package and loading the transport package back onto the Sellafield conveyance.**

The Supplier will handle the NTS transport package and disposable liner in accordance with the latest revisions of the handling manuals supplied by NTS.

The Supplier will ensure all applicable HSE and/or ONR site licence conditions are met in relation to the handling of the sources, filling the liner and the packing of the filled liner into the NTS transport package.

The inventory contained within the liner must meet the MBGWS conditions for acceptance (CfA), the competent authority certificate of approval of package design for the NTS transport package (CAA) and the requirements of ADR.

Where there is a conflict regarding the limits of the allowable radioactive contents between CfA, CAA and ADR, the Supplier will only consign radioactive contents according to whichever is most restrictive from the CfA, CAA or ADR.

Loading and unloading of the packed NTS transport package onto and from the conveyance shall be conducted away from public access, and appropriate measures put in place to protect people, and the environment as per IRR17 and REPIR (as amended).

- **Provide the required MBGWS consignment documentation to Sellafield**

Suppliers who have never consigned material to Miscellaneous Beta Gamma Waste Store will be required to attend a one-day training course to fully understand consignment requirements.

The Supplier would need to ensure compliance with waste store Condition for Acceptance (CfA).

Consignment Documentation: this documentation includes proof of the physical, chemical, and radiological characteristics of the source. The Supplier will be responsible for providing the required waste store consignment documentation and all other consignment documentation required to comply with the ADR/CDG Regulations together with complying with the waste store CfA. Three Sellafield Limited forms will need to be completed before the 1684C flask containing the Sources is dispatched from the Supplier premises, being:

- **The ILW-1 – Notification of Estimated Waste Arisings** – an overarching document that is valid for 5 years and renewed annually. It informs the waste store of the intended dates of consignments, the intended inventory and the intended volumes of HASS involved;

- **The ILW-2 – Consignment manifest**, outlines the upcoming consignments, alpha and beta activity and the total activity, the volume of waste, and the Gamma dose rate; and

- **The ILW-3 – Fissile or neutron information form**, outlines fissile content, Gamma dose rate, alpha fissile content, total activity, neutron material content and neutron dose rate.

The ILW-2 form (statement of compliance from the consignor (Supplier) to the consignee (SL at the waste store) confirms that the inventory meets the CfA. The form is provided to NTS for further assurance prior to being provided to the waste store.

- **The provision of emergency response requirements in line with ADR during the transportation to Sellafield**

Note:

Regarding an Emergency Response Plan, the 1648C packaging is designed to withstand accident conditions, so it is unlikely that there would be a release of contents during an accident, but the Supplier will have to have adequate provisions in place. NTS has the capability to provide Emergency Response services to the Supplier if the Supplier wishes to enter into an agreement with NTS. The emergency response plan will supplement the security plan.

Note:

NTS will be required to ensure that the transport package adheres to its license conditions before each transport. There will be consignment limit for the 1648C package, and the highest activity of a single source is expected to be 70TBq. Note that a source containment vessel could contain up to 222TBq of activity made up of multiple sealed sources. NTS will provide the 1648C packaging with a special liner designed to contain the retrieved sources and consign to Sellafield. Note, that that the activity limit of the 1648C is not yet known. One up to 70TBq source can definitely be transported but the activity limit when transporting multiple sources is TBC.

NTS will make the necessary arrangements with the Supplier to comply with this requirement.

If the consignment is rejected for reasons outside of the Supplier’s control, arrangements will be made so the sealed source in not stored indefinitely at the Supplier’s premises.

Figure 1a: Concept design of liner that will carry sealed sources

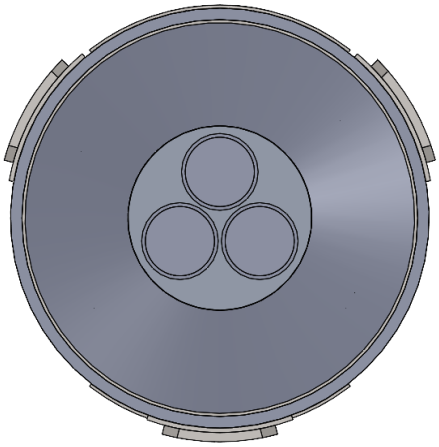

Figure 1b: Top-down view of concept liner with lid removed

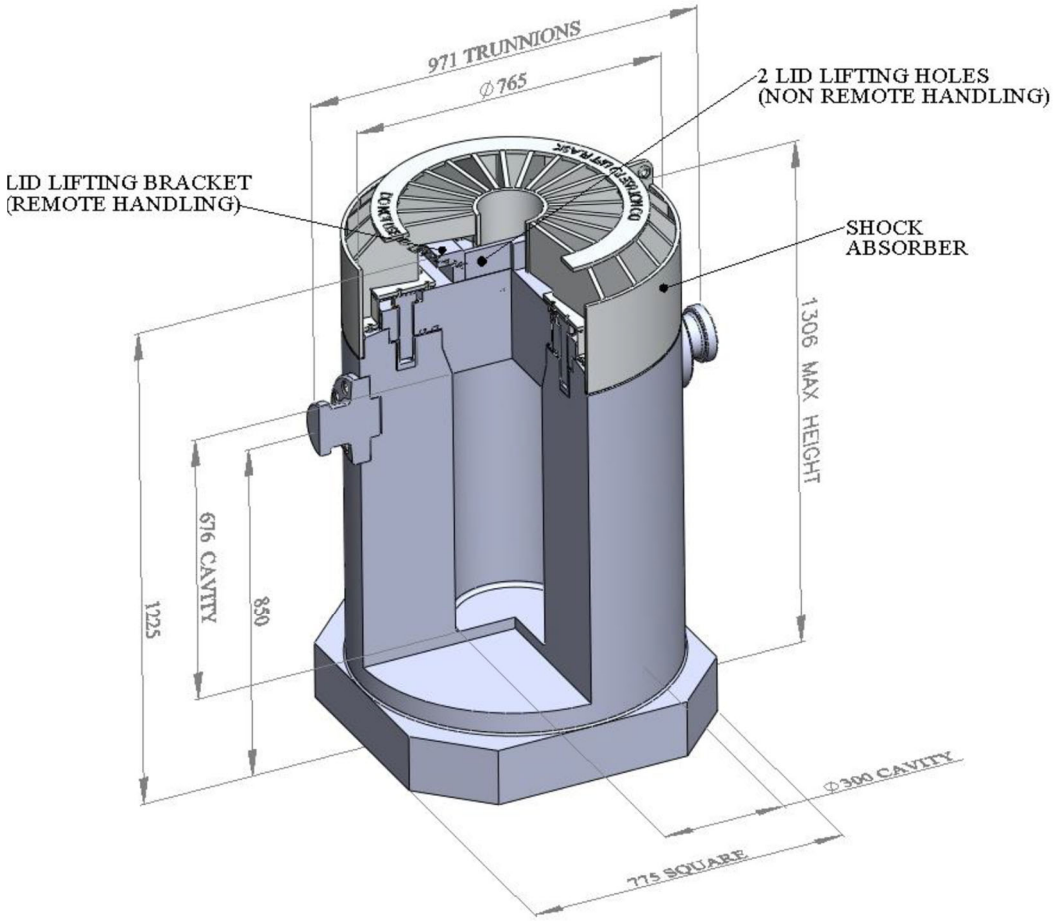

Figure 2: Schematic of 1648C transport package