Permitting decision

Radioactive Substances Regulation (nuclear sites)

We have decided to issue an Environment Agency initiated variation for Sellafield site operated by Sellafield Ltd. The decision is effective from 1 April 2021 in variation V012 of permit number KP3690SX.

We consider in reaching our decision that we have taken into account all relevant considerations and legal requirements and that the permit will ensure that the appropriate level of environmental protection is provided.

Purpose of this document

This decision document sets out the reasons for our decision.

Part 1: Variation for the disposal of radioactive waste

Introduction

The Magnox Swarf Storage Silo (MSSS) is a facility on the Sellafield site primarily for the underwater storage of Magnox fuel cladding waste generated during Sellafield reprocessing operations. It was constructed in stages between 1960 and 1983 and comprises an Original Building (OB) and 3 extensions. MSSS OB predominantly contains cladding material (swarf) that was removed from used Magnox nuclear fuel rods and has now corroded to magnesium hydroxide sludge. Its radioactive content is such that it is classified as Intermediate Level Waste (ILW)[1]. The cover water (known as silo liquor) is periodically topped up to replace losses including through evaporation. The established permitted disposal route for waste silo liquor is via the Effluent Distribution Tank (EDT) to the Site Ion Exchange Plant (SIXEP). SIXEP removes much of the radioactive content, transferring it into a solid radioactive intermediate level waste, which is stored on site pending treatment and disposal in a geological disposal facility. Treated effluent is discharged to sea.

MSSS OB has leaked below ground in the past (late 1960s to early 1980s) through cracks in the concrete superstructure. The exact locations of these leaks to ground are not known, and potential locations are not directly accessible as they are below ground and in areas with significant radiation levels. These cracks are believed to have resealed by sludge and/or precipitates.

Sellafield Ltd (SL) has recently reported detection of further leakage from the MSSS OB[2]. The event has been classified as level 2 (incident) on the International Nuclear and radiological Event Scale (INES)[3]. The leak is believed to have commenced in July 2019 and was reported formally to us on 13 November 2019. The leak continues and the leak rate has increased with time. The current leak rate remains within the bounds of the environmental risk assessment and risk management plan developed by SL, but the cause of this further leakage is currently unknown.

The potential for another leak to occur from the MSSS facility has been recognised for a long time and over the last decade work has been undertaken to enhance leak detection and monitoring arrangements and to establish possible risk mitigation options. This culminated in the development of a MSSS leak to ground risk management Plan in 2017, which was updated 2019. SL has engaged the regulators on these developments. Our formal agreement of these matters was to be determined following an assessment of SL's submission against a recommendation in our compliance assessment report (RASCAR SEL 15 025[4]). Closure of this recommendation has been overtaken by events.

Initially SL followed the pre-prepared plan to address the leak and this work has been consolidated into a high level work plan that was provided to us in May 2020. Monthly meetings have taken place between SL and regulators since December 2019 at which SL has shared plans and progress and taken account of regulator input. The SL programme of work is being expanded to reconsider the overall management of the leak. Whilst SL's plan covers a wide range of matters associated with the leak we consider that:

[1] https://ukinventory.nda.gov.uk/site/sellafield/
[2] https://www.gov.uk/government/collections/sellafield-ltd-incident-reports-and-notices
[3] https://www-news.iaea.org/EventList.aspx
[4] RASCAR SEL 15 025 recommendation: SL should demonstrate that the development and deployment of capability to detect and monitor 'leakage' of mobile radioactive inventory from the MSSS; and implementable techniques to mitigate against any associated environmental impacts should a leak arise, comply with Part 2 – 'Operations', Conditions 2.3.1-2.3.6 of the Permit KP3690SX.

- the plan and work to date has been primarily focused on monitoring and surveillance of the leak and we expect progress to made in seeking to prevent, minimise, mitigate or remediate the leak
- there is a need to increase the pace of the response and secure the necessary resources for the overall work plan. However, we recognise that SL is in the process of securing additional resource and developing the management arrangements to address this.

Whilst there are no immediate radiation dose consequences to people and the environment (see radiological assessment section below), we consider that the continuing leak is unacceptable and the disposal of MSSS silo liquor to the environment must only made in accordance with the conditions of SL's permit (KP3690SX) and using best available techniques (BAT). We are also concerned about the potential for escalation in the leak rate and associated consequences.

To ensure that SL's response to the leak addresses our concerns, we have decided to vary KP3690SX to insert a series of improvement requirements. These improvements requirements seek to:

- ensure we have appropriate oversight of SL's work plans and progress in response to the leak (see improvement requirements S1.2.10 and S1.2.11 in the Table S1.2 below)
- establish an understanding of why the leak has both occurred and increased with time to facilitate the implementation of appropriate measures which seek to stop/minimise the ongoing leak and prevent future leaks from occurring (see S1.2.12 in the Table S1.2 below)
- ensure the BAT solution is established and implemented which seeks to stop/minimise the leak, prevent future leaks, minimise the migration of associated contamination in the ground/groundwater and remediate contamination in the ground/groundwater from the current leak (see improvement requirement S1.2.13 in the Table S1.2 below)
- ensure the BAT solution is established and implemented which seeks to identify the location of the leak and the movement of associated contamination within the ground (see S1.2.14 in the Table S1.2 below).

We do recognise that SL has long-term plans which include remediation of some of the contamination associated with the past leak and believe that in seeking BAT solutions to address the current leak this could potentially offer opportunities for earlier remediation of contamination associated with the past leak.

This permit variation arises from our protective response to the leak which seeks to ensure the leak and its impact on both people and the environment is minimised. Put simply, the improvement requirements seek to understand: why the leak is occurring; where it is going; how to stop/minimise it (and prevent future leaks); and how to minimise its impact. We will continue to monitor SL's progress closely and will place additional requirements if progress does not meet our expectations.

We have been investigating the current leak from MSSS and permit breaches that we believe may have been committed in relation to this. We are still making enquiries into this matter and will separately advise SL of the outcome at the earliest opportunity.

Transboundary contamination (previously Euratom Article 37)

Following EU Exit, the UK is no longer bound by the requirements of Article 37 of the Euratom Treaty. Instead, BEIS has issued a Direction to us (the Transboundary Radioactive Contamination (England) Direction 2020), which requires applications for certain, new, radioactive substances activities to be accompanied by a far field dose assessment covering notifiable countries (Member

States of the European Union and/or Norway). The same requirement for a transboundary dose assessment is placed on applicants seeking to increase discharge or disposal limits by variation for certain radioactive substances activity permits. The Direction does not apply to regulator initiated variations.

However, we recognise that BAT solution(s) could involve remediation activities which may or may not trigger the Transboundary Radioactive Contamination (England) Direction 2020 in future. This matter can only be addressed once the BAT solution(s) are identified and the implications have been assessed.

Disposal of Radioactive Waste

This variation does not make any changes to the permitted disposals of radioactive waste included in the permit. The improvement requirements we are placing on SL are targeted at the MSSS leak. They seek to stop/minimise the current MSSS OB leak and minimise the potential for further below ground leaks at MSSS in the future. Fully addressing these requirements will ensure that the disposal of MSSS silo liquor is only made in accordance with the conditions in KP3690SX.

Radioactive Waste Disposal Routes and Limits

This variation does not make any changes to the disposal routes and limits for the radioactive wastes that are currently permitted for disposal.

Monitoring

SL has put in place a significant monitoring and surveillance programme associated with the on-going leak from MSSS OB and continues to review this as more information becomes available. This is complemented by a wider routine environmental monitoring programme. However, we consider that other techniques may be available that could be employed to identify the location of the MSSS OB leak and its movement within the ground. These techniques may also support the implementation and validation of a solution which seeks to stop/minimise the leak and to minimise the migration of associated contamination in the ground and groundwater. Improvement requirement S1.2.14 is intended to address this matter.

We also undertake independent environmental monitoring and effluent check monitoring and are making some adjustments to these programmes in terms of sampling and analysis. To support these minor adjustments, the Compilation of Environment Agency Requirements (CEAR) document, which supports the Sellafield permit, was modified in October 2020.

Radiological Assessment

This radiological assessment is based on information provided by SL and only considers the leak from MSSS OB in order to provide background information relating to the permit variation. This is separate from the radiological assessment of the permitted discharges from the Sellafield site, details of which can be found in our recent major permit review decision document[5].

In the first 14 months since the leak commenced (July 2019), SL estimates that 514 m^3 silo liquor has leaked to ground, with a total activity of 35 TBq of caesium-137 and 2 TBq of strontium-90. This can be compared to the permitted discharges to sea from Sellafield over the same period of approximately 2 TBq of caesium-137 and 1 TBq of strontium-90, with discharges to air for the

[5] Environment Agency (2020). Decision document: Sellafield Ltd and Sellafield site. Environmental permitting: radioactive substances activities. 20 February 2020.

same period and same radionuclides being more than a thousand times lower. Discharges to sea and air impact quickly on people and the environment. SL's groundwater modelling and underpinning research concludes that any migration of the more significant contamination from the leak to ground would be very slow. Consequently, there are no immediate radiation dose consequences to the workforce or the public. Based on our knowledge of regional and local groundwater movement, there is no risk of public water supply abstraction boreholes being affected by the leak or drawing any contaminated groundwater towards them.

Whilst there is no immediate radiation dose consequences to the public or the environment, over the last year significant and increasing radiation dose rates have been detected in soil a few metres below ground, close to the MSSS OB structure. This may be related to the ongoing leak. The maximum measured levels are approaching 1 Gray per hour. Consequently, we expect the leak to result in significant contamination of the ground at Sellafield. This will ultimately require clean up, generating additional volumes of intermediate and low level radioactive waste.

Current environmental monitoring results indicate that there are low levels of tritium and technetium-99 in Sellafield beach springs and strontium-90 in the River Calder. These are believed to be connected with transport of contaminated groundwater from past leaks to ground at Sellafield. Similar environmental behaviour is expected for the ongoing leak over the long term, if it is from similar locations in the facility to previous leaks and no mitigation action is taken. However, whilst elevated levels of radioactivity have been detected in groundwater close to the MSSS facility since the leak was reported, currently there is no clear evidence that these relate to the current leak. SL considers that more rapid migration of contamination in features such as surface water drains is unlikely, but assessment and monitoring is being undertaken to confirm this is the case.

Based on our current understanding of the leak we conclude that any risk to the environment and public is expected to be very low and would be realised over an extended timescale. However, this situation could change if the leak rate increases and/or more rapid migration pathways occur.

Other

Working with ONR

We have worked jointly with the Office for Nuclear Regulation (ONR) and the summary output from our work was initially communicated through joint regulatory letters. ONR has placed a regulatory issue on SL seeking to ensure coverage of a broad range of matters. We are satisfied that our specific requirements are consistent and complementary to actions that ONR has placed on SL, whilst avoiding inappropriate duplication of regulation. Our requirements are specifically targeted at protecting both people and the environment and ensuring that public confidence is maintained. We will continue to monitor SL's progress closely and will place additional requirements if progress is unsatisfactory. We consulted ONR on this variation and received a response that ONR generally considers that the requirements set out in the permit variation are consistent with its Regulatory Issue 8145 and is supportive of the Environment Agency's approach. In line with the Memorandum of Understanding between our organisations, we will continue to work with ONR to ensure that our respective regulatory requirements do not place conflicting demands on Sellafield Ltd.

Groundwater protection considerations

In addition to our core considerations under Environmental Permitting Regulations 2016 (EPR 2016), we have also considered the obligations placed on us by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WER 2017). Paragraph 3(1) of WER 2017 requires the Environment Agency to "… *exercise its relevant functions so as to secure compliance with the requirements of the Water Framework Directive, Environmental Quality Standards Directive and Groundwater Directive*" (note that the Environmental Permitting (England

and Wales) (Amendment) (EU Exit) Regulations 2019 SI 2019 No. 39 has amended WER 2017 following EU exit day to retain these direct references to EU Directives in UK law). Paragraph 3(2) goes on to say that the Environment Agency:

"*must determine an authorisation so as, in particular-*

(a) to prevent deterioration of the surface water status or groundwater status of a body of water… and

(b) *otherwise support the achievement of the environmental objectives set for a body of water…*"

The environmental objectives for groundwater bodies include an objective to "*prevent or limit the input of pollutants into groundwater*". Radioactive substances are considered to be hazardous substances in groundwater[6] and so are subject to the requirement to prevent inputs. In paragraph 3(2) of WER 2017 "*determine an authorisation*" includes grant, vary or revoke, or impose conditions on an environmental permit under EPR 2016.

We consider that this permit variation, and the improvement requirements we are placing on SL, continue to ensure that our statutory responsibilities relating to groundwater protection are addressed.

Risk Reduction

We recognise the need for SL to progress the MSSS waste retrieval programme and more widely to deliver risk reduction and environmental remediation at Sellafield over the long term. However, the current schedule shows that the MSSS waste retrieval programme will not achieve this for many years and the programme continues to suffer from both major schedule delays and significant programme risk. We do not consider that it is acceptable for the leak to be allowed to continue, and potentially escalate, until the MSSS waste retrieval programme is complete, without seeking to take appropriate action.

Growth Duty

We have considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to issue this permit variation.

Paragraph 1.3 of the guidance says:

"The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are responsible. For a number of regulators, these regulatory outcomes include an explicit reference to development or growth. The growth duty establishes economic growth as a factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation."

We have addressed the legislative requirements and environmental standards to be set for this operation in the body of the decision document above. The guidance is clear at paragraph 1.5 that the growth duty does not legitimise non-compliance and its purpose is not to achieve or pursue economic growth at the expense of necessary protections.

We consider the requirements and standards we have set in this permit variation are reasonable and necessary to avoid a risk of an unacceptable level of pollution. This also promotes growth

[6] Environmental Permitting Guidance; Groundwater Activities, Defra 2010 (para 4.11) and subsequently confirmed by the Joint Agencies Groundwater Directive Advisory Group (JAGDAG) in 2017.

amongst legitimate operators because the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards.

Consultation

In view of the nature of this regulator initiated variation, we decided to consult with SL, ONR and Nuclear Decommissioning Authority (NDA) initially on our draft decision document and improvement requirements. All 3 organisations responded to the consultation and we have addressed the matters raised. Prior to issuing the permit variation we provided the decision document and improvement requirements to SL, ONR, NDA, Department for Business, Energy and Industrial Strategy, Department for Environment, Food and Rural Affairs and Public Health England to allow for any final comments and factual accuracy checking. Once the permit variation is complete we will inform wider stakeholders of this latest change to the permit.

Decision

Our decision is that we will issue a permit variation containing improvement requirements which seek to ensure that the disposal of MSSS silo liquor is only made in accordance with the conditions in KP3690SX.