

REGULATORY OBSERVATION

REGULATOR TO COMPLETE

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Revision:	0
Date sent:	12/04/19
Acknowledgement required by:	08/05/19
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TRIM Ref:	2019/110284
Related RQ / RO No. and TRIM Ref: (if any):	
Observation title:	Discharge estimates and limits
Lead technical topic: 20. Environmental	Related technical topic(s):

Regulatory Observation

Background

Pre-Construction Environmental Report (PCER) Chapter 6 [1] presents the estimates of discharges to atmosphere and marine environment and proposed limits to be set. Further detail on underpinning data and calculation methods are presented in supporting documents:

- OPEX data selected for quantification of discharges and limits for UK HPR1000 [2]
- Estimation of gaseous and liquid discharges and limits for UK HPR1000 [3]

OPEX

The operating experience (OPEX) data used to justify the discharge estimates is gathered from the existing Chinese fleet of predecessor reactor designs, the M310 and CPR1000. However, 10 of the 14 reactors have been operating for less than 5 years and the maximum period of operation is 22 years, for 2 reactor units. The proposed period of operation of the UK HPR1000 will be 60 years.

In PCER-6 [1], the Requesting Party identifies that the Regulation Environmental Principles (REPs) document [4] has a Developed Principle relating to limits and discharges (RSM DP12). The Developed Principle supporting text states that '*the process to determine discharge estimates and limits is to be based on a set of data of suitable quality and breadth*'.

Whilst 52 reactor-years of data is a good quantity of data, there is no justification to support the assumption that the data used will be applicable for the proposed full operational life of the UK HPR1000. It is important that this underpinning data for discharge estimates is justified as being wholly appropriate for the full operational life as the derived proposed limits are used as input data for the radiological impact assessment, which is then compared against UK dose constraints and legal dose limits.

Calculation Methodology

The Requesting Party has identified the appropriate guidance [6], and uses it correctly to identify significant nuclides that require limits. However, the calculation methodology used to define the discharge estimates, on which the proposed limits are based, does not fully align with our limit setting guidance [6].

In the supporting document 'Estimation of radioactive gaseous and liquid discharges and limits for UK HPR1000' [3], the Requesting Party has presented the discharge estimates as being the operational discharges under BAT, corrected for some operational differences, but without inclusion of any 'expected events'. Expected events are those operational fluctuations that can be reasonably expected to occur during the operational life of the plant. The proposed limits are then set using factors relating to expected events, (yet

to be defined) and uncertainty relating to new build plants. The current headroom factor component for uncertainty is not supported by any information, such as analysis of the variability in the OPEX data.

However, in our limit setting guidance [6], paragraph 37, we state that discharge estimates should be based on :

'Limits should be based on the discharges achievable through the use of BAT during normal operation (see paragraph 13) and so include infrequent but necessary operations (e.g. plant wash out) and foreseeable deviations from best operational conditions consistent with the use of BAT (e.g. occasional fuel pin failures in a reactor).'

This indicates that the discharge estimates should include any expected events. The headroom factor is then used to derive discharge limits and should only consider uncertainty and variability in the underpinning data.

Whilst all the necessary components are included in the current methodology used by the Requesting Party, and hence the difference in the numerical result may be minor, the methodology is not currently aligned with our guidance.

Data Presentation

In the PCER-6 [1], the Requesting Party has clearly identified the appropriate information requirements from the Environment Agency Process and Information Document (P&ID) [5]. This states that:

'Estimates of discharges and disposals should clearly show the contribution of each constituent aspect of normal operations, including:

- *Routine operation (that is, typically, the design basis or 'flowsheet design' and the minimum level of disposals*
- *Start-up and shutdown*
- *Maintenance and testing*
- *Infrequent but necessary aspects of operation, for example, plant washout; and the foreseeable, undesired deviations from planned operations (based on a fault analysis) consistent with the use of BAT, for example occasional fuel pin failures'*

At present, the analysis of the underpinning OPEX data does not separate out each constituent clearly and although 'average monthly' and 'maximum monthly' discharges are presented separately, it appears that the average includes all constituents of normal operation.

It is important that the operational phases are presented separately as the flushing of the gaseous waste treatment system at outage is likely to result in significantly different gaseous discharges during outage and operation. We believe that this difference needs to be made visible to the reader of the supporting information and also be made clear in the PCER.

Relevant Legislation, Standards and Guidance

Environment Agency, RSR1 – Radioactive Substances Regulation - Environmental Principles (REPs), version 2, April 2010.

Environment Agency Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs, version 3, October 2016.

Environment Agency, Criteria for setting limits on the discharge of radioactive waste from nuclear sites, version 1, June 2012.

Regulatory Expectations

OPEX

The OPEX data used is from the first few plant fuel cycles. It would not be unreasonable to expect that there could be long-term trends in the discharges as a result of a plant reaching a chemical equilibrium between the primary coolant and reactor components and accumulation of activity in the system from activation or corrosion products. The Requesting Party will need to demonstrate whether such trends are expected to have any significant impact on discharges. This may require the use of wider OPEX from older operating reactors.

Calculation

At present the headroom factors appear to be very large for some nuclides as a result of them including a factor for both expected events and uncertainty.

We expect the Requesting party to review their approach to calculating the discharge limits from the discharge estimate against the current limit setting guidance. We expect that the discharge estimates for normal operations will include those resulting from expected events within the plant operational life. The headroom factor used to derive discharge limits from the discharge estimates should account for any uncertainty in the discharge estimates.

Data Presentation

We expect the Requesting Party to present the discharge estimates, such that the contribution of each constituent of normal operations is clearly shown.

References

[1] Pre-Construction Environmental Report Chapter 6 - Quantification of Discharges and limits, revision 000-1, November 2018.

[2] OPEX data selected for quantification of discharges and limits for UK HPR1000, revision B, September 2018.

[3] Estimation of gaseous and liquid discharges and limits for UK HPR1000, revision B, September 2018.

[4] Environment Agency, RSR1 – Radioactive Substances Regulation - Environmental Principles (REPs), version 2, April 2010.

[5] Environment Agency Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs, v3 October 2016.

[6] Environment Agency, Criteria for setting limits on the discharge of radioactive waste from nuclear sites, version 1, June 2012.

Regulatory Observation Actions

RO-UKHPR1000-0010.A1 – Demonstrate that the OPEX used are representative of a full operational plant life

In response to this Regulatory Observation Action, GNS should:

- Demonstrate that the OPEX selected is likely to be representative of the full proposed operational life of a plant and not expected to be invalidated by any long term trends as the plant ages.

RO-UKHPR1000-0010.A2 – Demonstrate that the calculation of discharges and proposed limits are in line with relevant Environment Agency guidance

In response to this Regulatory Observation Action, GNS should:

- Demonstrate that the calculation of discharges and proposed limits are in line with relevant Environment Agency limit setting guidance [6].

- Provide supporting evidence for each factor applied to the baseline data (power output, process differences, expected events, uncertainty)

RO-UKHPR1000-0010.A3 – Show the contribution of each constituent of normal operations to the discharge estimates

In response to this Regulatory Observation Action, GNS should:

- Show the contribution of each constituent of normal operations to the discharge estimates as required by the P&ID [5]

Resolution required by '*to be determined by General Nuclear System Resolution Plan*'

REQUESTING PARTY TO COMPLETE

Actual Acknowledgement date:

RP stated Resolution Plan agreement date: