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REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT

Operation of the High Flux Reactor in the period 2012-2013

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On 13 November 2012, the Council adopted a four-year (2012-15) supplementary research programme for the HFR (Council Decision 2012/709/Euratom)[1] —), to be implemented by the Joint Research Centre (JRC) on the operation of the High Flux Reactor (HFR) located in Petten, The Netherlands. Under Article 4 of this Council Decision, the Commission must keep the European Parliament and the Council informed by producing a mid-term report on the implementation of the supplementary research programme. This report addresses this obligation, and covers the 2012-13 period.

In operation since 1961, the HFR reactor provides a variety of irradiation location possibilities (reactor core, reflector region and in the poolside).

The main objectives of the supplementary research programme are:

To ensure the safe and reliable operation of the HFR, in order to guarantee the availability of the neutron flux for experimental purposes.

- To allow an efficient use of the HFR by research institutes in a broad range of disciplines: improvement of the safety of nuclear reactors, health including the development of medical isotopes, nuclear fusion, fundamental research and training, and waste management including the possibility to study the safety issues of nuclear fuels for reactor systems of interest to Europe.

The HFR is used for the commercial production of radio-isotopes and also acts as a training facility for doctoral and post-doctoral fellows, allowing them to perform research activities through national or European programmes.

1. Safe operation of the HFR

The European Atomic Energy Community (Euratom) is the owner of the HFR (for a lease of 99 years). The HFR reactor is operated by the NRG (Nuclear Research and Consultancy Group) which operates and maintains the plant and manages the commercial activities around the reactor. It has an operating licence granted by the Dutch national regulator KFD (Kernfysische Dienst). As for nuclear power plants, the HFR is subject to legally required 10-year periodic safety reviews which are performed by the NRG.

The 2012-13 period was characterised by several events that affected the availability of the neutron flux.

Initially, tritium was detected in the groundwater around the reactor building (traced back to an underground leak in a water pipeline) as well as a leak path between the primary cooling water system and the bottom plug cooling system (part of the pool cooling system). Both issues were of separate origin and were investigated and repaired and the reactor was restarted safely

The NRG then faced another distinct unplanned outage of two nuclear facilities, namely the high flux reactor (HFR) and the molybdenum production facility. The NRG put all its facilities and processes in a temporary safe standby mode to focus on global improvements

[1] OJ L321 of 20.12.2012, p. 59.

in technology, procedures and organisation.

By the end of 2013, improvements were being carried out and implemented. The HFR and the other nuclear facilities once meeting all safety requirements, were authorised by KFD to return back in operation in early 2014.

In 2012, the planned cycle pattern consisted of a scheduled number of 296 operation days and one maintenance period of 31 days in March. The in-service inspection of the north and south reducer, welds of the reactor vessel and the annual leak test of the reactor containment were performed during this period. In reality, due to unplanned outages, the HFR was in operation for 253 days, which corresponds to an actual availability of 85.26 % compared with the original schedule. Its nominal power was at 45 MW, and the total energy production for 2012 was approximately 11 313 MWd, corresponding to a fuel consumption of about 14.12 kg U-235.

In 2013, the planned cycle pattern consisted of a scheduled number of 166 operation days and a maintenance period of 18 days during the month of August. In reality, due to unplanned outages relative to the aforementioned issues, the HFR was in operation during 81 days, which corresponds to an actual availability of 49.07 % compared the original schedule. Its nominal power was at 45 MW, and the total energy production for 2013 was approximately 3661 MWd, corresponding to a fuel consumption of about 4.57 kg U-235.

Maintenance activities consisted of preventive, corrective and regular maintenance of all systems, structures and components. They were carried out with the objective of ensuring the HFR's safe and reliable operation. The main activities carried out during the maintenance period were the following:

(a) a major containment leak test (0.5 bars overpressure — 48 hour duration);

(b) an in-service inspection of the north and south reducers and the welds of the reactor vessel;

(c) repair maintenance of the concrete pipeline for secondary cooling water between the North-Holland Canal and the HFR secondary pump building;

(d) the secondary outlet pipeline was extended further into the North Sea;

(e) the remote monitoring system (used to monitor important reactor parameters during emergencies) was completed;

(f) the alternative shutdown system (used if the normal shutdown system is not functioning) was completed

2. Research and isotope production

2.1 Research

The following scientific activities were performed in 2012-13:

- fuel irradiation experiments to reduce the radiotoxicity of nuclear waste relative to minor actinide transmutation technological issues (i.e. fission products retention capabilities, dust-free process, helium swelling);
- fuel and graphite qualification for high-temperature reactors;
- experiments to investigate the reactor's structural material degradation under irradiation (graphites, model steels, welds, etc.);

- fusion reactor technology used in the irradiation and post-irradiation examination of material planned to be used in ITER's shielding blanket;
- standardisation of the neutron diffraction method for residual stress measurement (e.g. in thick bi-metallic fusion welds).

2.2 Isotope production

Isotope production was severely affected due to the disruption of the HFR's operation between 2012 and 2013.

The HFR had a normal operational production schedule for isotope production up to mid-November 2012, when the reactor was stopped. Consequently, only nine full cycles of normal isotope production were achieved and 1.5 cycles of production were lost. The 2013 production was also severely disrupted, with only around 49 % of the normal operating schedule available.

In the period until the HFR stopped, the value of isotopes and associated services supplied was higher than in the preceding year. Furthermore, a number of new product development ideas continued to progress, both in conventional application areas and in some ground-breaking areas of technology (e.g. neutron transmutation doped silicon for high-voltage power electronics, high-speed trains, and green technologies).

The HFR's unplanned outages reinforced the need to support the coordinated efforts necessary to minimise the future risks to the security of supply of critical medical isotopes identified by the OECD/NEA high-level group on the security of supply of medical isotopes. The NRG continued to work closely with other actors in the medical isotope supply network, as well as with the medical community, governments, the European Commission, AIPES and the IAEA on important issues such as full-cost recovery pricing, outage reserved capacity provision, future infrastructure investment, and conversion to low enriched uranium targets for Mo-99 production.

3. Financial contributions to the programme's implementation

In 2012-13, the following financial contributions were received from Member States for the implementation of the supplementary programme:

- Belgium: EUR 300 000 (2012) + EUR 300 000 (2013)
- France: EUR 300 000 (2012) + EUR 300 000 (2013)
- The Netherlands: EUR 7 250 000 (2012) + EUR 7 250 000 (2013),

for a total of EUR 15 700 000. These contributions cover the expenses specified under Annex II of Council Decision 2012/709/Euratom. The European Commission does not cover any operational deficits, including potential costs of maintenance or repair.

Financing for the decommissioning fund and other expenditure linked to the Commission's management of the supplementary research programme comes out of this amount.

Since 2004, due to a re-evaluation of decommissioning costs, the annual contribution of the supplementary programme to the decommissioning fund increased from EUR 400 000/year to EUR 800 000/year. This amount is taken from (a) the regular budget of the supplementary research programme, and (b) the interest earned on the bank account of the decommissioning fund of the supplementary research programme. For example, in 2013 the estimated amount of interest generated by the decommissioning fund was EUR 145 000. Therefore, only EUR

655 000 was added from the regular supplementary research programme budget to reach the 800 000 €/year. As of 31 December 2013, the total amount in the decommissioning fund is EUR 15 639 000. This fund will contribute to the future decommissioning costs of the HFR (to be borne by Euratom), estimated at EUR 72 600 000 in the most recent decommissioning study available[2].

Other expenditure incurred by the JRC during the reporting period and paid directly from the supplementary research programme budget includes:

- direct staff costs (e.g. supplementary research programme management): EUR 345 000
- HFR support costs (e.g. legal advice): EUR 66 000
- utilities (e.g. electricity, water, heating): EUR 993 000
- spent fuel management costs: EUR 1 902 000

The accompanying staff working document presents the results of the HFR's operation in 2012-13 in more detail.

[2] Communication from the Commission to the Council and the European Parliament on Decommissioning of Nuclear Installations and Management of Radioactive Waste: Management of Nuclear Liabilities arising out of the Activities of the Joint Research Centre (JRC) carried out under the Euratom Treaty — COM(2013) 734 final.