

# **ENSREG/ONR Stress Test Submission Nuclear Fuel Production Plant Licensed Site Executive Summary**

This report presents a summary of the stress testing of the Nuclear Fuel Production Plant Licensed Site at Rolls-Royce Raynesway Derby, required by the NSREG/ONR stress test requirements. The site has been assessed against a selection of challenging performance requirements. A brief description of the site is provided. The strategy and approach adopted in performing the stress tests are discussed. The report summarises the capabilities and performance of the site and its facilities against a range of potential extreme events. The specific extreme events addressed are earthquake, flooding, snow and wind loading, fire/explosion and complete loss of all off-site power supplies. The resilience of the site against the selected potential extreme events and combinations of events is summarised. The report indicates that a number of recommendations have been made to enhance the capabilities of the site.

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## **1 Introduction and Scope**

1.1.1 Rolls-Royce Marine Power Operations Limited (RRMPOL) in Derby, Derbyshire, carries out the manufacture of nuclear fuel for UK Naval Nuclear Propulsion Programme. They also operate a low energy naval research reactor (Neptune). This submission in response to the ENSREG / ONR stress tests (Reference 1) considers only the nuclear fuel manufacturing licensed site.

1.1.2 The fuel manufacturing site exists to support the UK defence programme, and as such details relating to its operations are subject to limited disclosure in the interests of national security. This report is a summary of detailed work conducted by the licensee.

1.1.3 Two of the three key nuclear fuel production plant areas were constructed in the early 1960s and a third area was constructed in the 1990s. All were designed to provide adequate resistance in accordance with standards in place at the time.

## 2 Approach

2.1.1 The operations at the manufacturing site have been subject to systematic examination against the ENSREG / ONR stress test requirements. The performance of facilities and emergency arrangements against progressive increases in challenge has been considered, including:

- a) Earthquake;
- b) Flooding;
- c) Post Earthquake Flood;
- d) Prolonged Loss of Off-Site Power.

2.1.2 In addition to these, the screening exercise included reviewing applicability of other single events, and combinations of events, for which relevant events identified include:

- a) Snow / Wind Loading;
- b) Fire;
- c) Earthquake with Snowfall;
- d) Earthquake with Fire.

2.1.3 The effect of these events on the safety functional objectives specified in the ENSREG / ONR stress tests specification was examined, with the exception of the safety function associated with the need for an ultimate heat sink. As there are no holdings of cooled irradiated fuel and neither a capability nor a requirement to take the reactor components critical, there is therefore no decay heat removal requirement at any point on the site.

## 3 Performance of the Facilities

### 3.1 Earthquake

#### Design Basis

3.1.1 An operating basis earthquake was defined for the site at 0.05 g pga (approximately a 1 in 200 y event), against which the site has been qualified.

3.1.2 The site design basis earthquake has been established at 0.25 g pga, which is equivalent to a  $1 \times 10^{-4}$  per annum event. This design basis event level is consistent with the ONR's Safety Assessment Principles (both 1992 and 2006 versions). For older buildings a 0.1 g pga ( $1 \times 10^{-3}$  per annum) level has been applied to provide an appropriate 'test' for the facilities.

3.1.3 Buildings and equipment on the site are suitably qualified against earthquakes where the potential for significant consequences could arise from earthquake initiated failures alone (including any interfacing structures or services).

## **Evaluation of the Margins**

3.1.4 In beyond the design basis earthquake there are two areas where there is a potential for consequences at the site fence and three additional areas if there was concurrent flooding of the site.

## **3.2 Flooding**

### **Design Basis**

3.2.1 The Rolls-Royce Derby site is located in Derbyshire more than 50km from the coast. Flooding from seaward inundation can be dismissed as a concern.

3.2.2 The site is located on the floodplain of the River Derwent. The site is protected by flood defences which offer resistance to site flooding for river flows up to the 1 in 100 year event. Potential causes of flooding on the site are from the River Derwent, failure of dams on the river Amber and River Derwent upstream of the site and heavy rainfall.

### **Evaluation of the Margins**

3.2.3 The most recent flooding assessment identifies that the site is resilient to a 1 in 100 year flooding event. Additionally, arrangements are in place for the Environment Agency and Severn Trent to supply the site with early warning of extreme flood events. In the event of such a flood warning being received, vulnerable material can be moved to safe locations to further minimise any potential consequences.

## **3.3 Other Extreme Natural Events**

### **Wind/Snow**

3.3.1 The buildings have variable levels of withstand against extreme wind and snow loadings (these loadings were evaluated for the  $1 \times 10^{-4}$  per annum event). Whilst several parts of the site are susceptible to these loadings, there is negligible effect.

### **Fire/Explosion**

3.3.2 Whilst there is a possibility of fire or explosion on the site, especially following a severe earthquake, these events will have no substantial effect on the potential for off-site consequences.

### **Earthquake and Snow**

3.3.3 The consequences of post earthquake snowfall are bounded by those of post earthquake flood. Although the potential for off-site consequences is lower than for flooding.

## **3.4 Loss of Electrical Power**

3.4.1 The site facilities are not susceptible to prolonged loss of off-site or on-site power; the site possesses limited uninterruptible power supply (battery) and diesel generator back up supplies for longer periods of outage. Key items of equipment and emergency lighting include further separate battery backups. There is no dependence on these systems to prevent off-site consequences.

## **4 Severe Accident Management**

4.1.1 Some enhancements in equipment, facilities and infrastructure have been proposed to ensure effective resilience of emergency response capability for extreme events (particularly for flooding and severe earthquakes).

## **5 Key Findings**

5.1.1 Opportunities for improvement have been identified with regards to performance against the stress test conditions where the potential for off-site consequences could arise. Recommendations have been made to enhance the licensed site.

## **6 Glossary and Abbreviations**

AOD        Above Ordnance Datum  
ENSREG    European Nuclear Safety Regulators Group  
ONR        Office for Nuclear Regulation  
RRMPOL    Rolls-Royce Marine Power Operations Limited

## **7 References**

1. Declaration of ENSREG, Annex I, EU “Stress Tests” Specification