



# Study on the Licensing Framework for Land Facilities Supporting Nuclear-powered Submarines in the United Kingdom

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## 1. Introduction

The use of nuclear-powered submarines represents a remarkable achievement of nuclear technology applied to naval engineering. These submarines perform a crucial function in the armed forces of nations possessing them, providing significant deterrence power to ensure the defense and security of their maritime territories. These vessels require a highly specialized land support infrastructure to be safely and effectively operated. Due to the nuclear nature of the operations and materials involved, specific regulations and licensing within the nuclear domain are necessary. The Brazilian Navy is committed to develop its first Conventionally Armed Nuclear-Powered Submarine (SCPN) and deploy the Specialized Maintenance Specialized Maintenance Complex (CME). This land support complex is essential to conduct maintenance, repair, fuel replacement, and waste management activities related to the SCPN. In this context, the United Kingdom stands out as one of the six countries currently operating nuclear-powered submarines, with a long tradition in the development and operation of these submarines and their land support facilities. This study focuses on the research results regarding regulations, licensing processes, and nuclear regulatory bodies in the United Kingdom (UK) responsible for granting licenses for land support facilities for nuclear-powered submarines. The objective of this paper is to describe the analysis of relevant aspects providing valuable insights which may be adopted as a model in the CME project.

## 2. Methodology

The objective of this study is to provide a comprehensive bibliographic analysis of the regulations and procedures adopted in the United Kingdom for the nuclear licensing of land support facilities for nuclear-powered submarines. The proposed study was conducted through searches on open-access sources on the internet, primarily on the website of the Office for Nuclear Regulation<sup>1</sup> (ONR) and the

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<sup>1</sup> [www.onr.org.uk](http://www.onr.org.uk)

Defence Nuclear Safety Regulator<sup>2</sup> (DNSR) under the Ministry of Defence<sup>3</sup> (MOD). The [Ref.1] establishes the General Agreement between the Ministry of Defence and the Office for Nuclear Regulation regarding the regulation of the Defence Nuclear Programme (in which the Naval Nuclear Propulsion Programme – NNPP is involved). Based on [Ref.1], many websites were visited so that standards, guidelines, and other documents, including government policies, regulations, and legislations could be accessed. Its important to acknowledge the limitations of this bibliographic review since the topic addressed involves strategic, military and defense aspects. Therefore, the investigation was conducted utilizing open-access sources due to the inherent sensitivity of the subject matter.

### 3. Results and Discussion

#### 3.1 UK Nuclear Facilities – “Submarine Facilities” and “Defence Facilities”

Nuclear Submarine Facilities – it refers to specific facilities dedicated to activities related to nuclear submarines. This may include shipyards, naval bases, and other specialized locations designed for the construction, maintenance, repair, and operation of submarines equipped with nuclear propulsion. These facilities deal with the complexities associated with nuclear technology on board submarines (Figure 1).

Nuclear Defence Facilities – it is a broader term that encompasses sites associated with various nuclear defense activities. It may include facilities related to the storage, handling, maintenance, or production of nuclear weapons, as well as facilities involved in nuclear propulsion programs and other nuclear defense activities. These sites are under the supervision of the Ministry of Defence and nuclear regulators (Figure 1).

| SITE/FACILITY                                    | Licensed | Facility  | Activities   |
|--|----------|-----------|--|
| Devonport Royal Dockyard                         | ✓        | Submarine | Maintenance and refueling of submarines.   |
| Barrow – BAE Systems                             | ✓        | Submarine | Construction and commissioning of submarines.  |
| Rosyth Royal Dockyard                            | ✓        | Submarine | It was used for the refurbishment, repair, and maintenance of nuclear submarines from the 1960s until 2003. At the end of its operational life, the submarine was decommissioned and stored on-site. |
| Aldermaston – AWE                                | ✓        | Defence   | Manufactures and maintains nuclear warheads used by submarines of the United Kingdom.  |
| Burghfield – AWE                                 | ✓        | Defence   | Manufactures, maintains, and decommissions nuclear warheads used by submarines of the United Kingdom.  |
| Rolls Royce Submarines Limited (RRSL), Raynesway | ✓        | Defence   | Manufacturing nuclear fuel for submarine reactors. They also operate a low-power naval research reactor.   |
| Devonport Naval Base - MoD                       |          | Defence   | operational base   |
| Clyde Naval Base - MoD                           |          | Defence   | Operational base and storage facility for nuclear weapons for the British Trident nuclear deterrent submarine fleet.   |
| Vulcan Naval Reactor Test Establishment - MoD    |          | Defence   | Facility used for testing nuclear reactors, decommissioned in 2015.  |
| UK Submarine Operational Berths - MoD            |          | Defence   | A variety of operational berths for submarines throughout the UK, including Southampton, Portsmouth, Portland, Devonport, and Clyde.   |

Figure 1: “Submarine Facilities” and “Defence Facilities” in the UK.

#### 3.2 Defence Facilities – “Nuclear Licensed Sites” and “Nuclear Non-licensed Sites”

According to [Ref.2], current nuclear activities in the UK consist of:

- generating electricity through power-producing nuclear reactors;
- producing and reprocessing nuclear fuel through non-power nuclear facilities;
- decommissioning of nuclear power reactors and other facilities;

<sup>2</sup> [www.gov.uk/government/groups/defence-nuclear-safety-regulator-dnsr](http://www.gov.uk/government/groups/defence-nuclear-safety-regulator-dnsr)

<sup>3</sup> The subordination of the DNSR to the MOD occurs through the Defence Safety Authority (DSA).

- building new nuclear facilities; and
- deploying defence facilities (licensed and non-licensed sites).

There are seven nuclear licensed sites which, under the Ministry of Defence (MOD), provide and maintain the warheads for the UK’s nuclear deterrent, and support for the UK fleet of nuclear-powered submarines, including [Ref.2]:

- submarine reactor fuel manufacturing, including a test reactor research facility;
- submarine construction and commissioning;
- submarine maintenance and refuelling.

Several naval sites involving nuclear-related activities are exempt from accomplishing ONR regulation as they are under the control of the Crown (MOD). On these sites, nuclear and radiation safety is regulated jointly by the Defence Nuclear Safety Regulator (DNSR) and ONR. ONR is also the enforcing authority for conventional safety regulation within these sites [Ref.2]. These sites are naval bases at Devonport and Clyde (comprising the Faslane and Coulport sites), the Vulcan Naval Reactor Test Establishment at Dounreay, 5 Basin at Devonport and a range of operational berths around the UK, including Southampton, Portsmouth, Portland and Clyde.

### 3.3 Nuclear Regulatory Bodies – ONR x DNSR

There is a General Agreement [Ref.1] between the ONR and the DNSR for joint collaboration in the Naval Nuclear Propulsion Programme (NNPP), as illustrated in Figure 2.

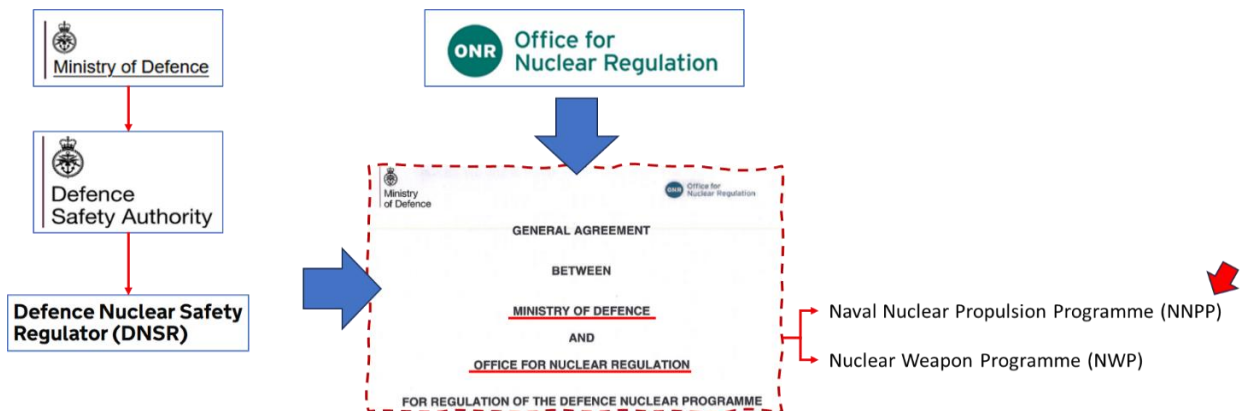


Figure 2: Correlation between nuclear regulatory bodies in the UK (ONR e DNSR) and the Naval Nuclear Propulsion Programme (NNPP)<sup>4</sup>.

### 3.4 Applicable Standards and Guidelines

#### Licensing nuclear installations – ONR [Ref.3]

In its introduction, it says: *“This document describes, how we administer the process to enable nuclear installations in GB to gain a nuclear site licence as required by the Nuclear Installations Act 1965 (NIA 1965). Such installations include nuclear power stations, nuclear fuel manufacturing facilities, nuclear defence facilities for weapons manufacturing and fuelling/maintenance of nuclear submarines...”*<sup>5</sup>.

<sup>4</sup> The Defence Nuclear Enterprise (DNE) comprising the Naval Nuclear Propulsion Programme (NNPP) and the Nuclear Weapon Programme (NWP) of the Ministry of Defence.

<sup>5</sup> GB – Great Britain; NIA – Nuclear Installations Act

### **Safety Assessment Principles for nuclear facilities – ONR [Ref.4]**

In its introduction, regarding regulatory background, sites for building, maintaining, and refueling nuclear submarines are defined as nuclear licensed sites.

### **Defence Nuclear Safety Regulations of the Defence Nuclear Enterprise (DSA02) – DNSR [Ref.5]**

It was produced for the Regulation of the Defence Nuclear Enterprise (DNE). This document defines and promulgates the nuclear regulatory regime for the DNE

### **Defence Nuclear Safety Regulations of the Defence Nuclear Enterprise (DSA03) – DNSR [Ref.6]**

As well as other considerations about the NNPP, it includes the Annex I: Interpretation of Safety Assessment Principles for Naval Nuclear Propulsion Application

The DSA02 and DSA03 are issued<sup>6</sup> by the Defence Nuclear Safety Regulator and form the basis of MOD's regulatory framework for the Defence Nuclear Enterprise comprising of the Nuclear Propulsion Programme and the Nuclear Weapon Programme.

## **4. Conclusions**

In this study, it was observed that the nuclear regulation of the United Kingdom stands out for presenting clear considerations and applications of its standards, in publicly accessible sources, as well as the relationships between its regulatory bodies in the nuclear field. This is evidenced by establishing specific criteria and guidelines for the safety analysis of land facilities dedicated to the maintenance and refueling of nuclear-powered submarines. Consequently, the adoption of UK standards as a reference for the licensing processes in Brazil may have significant gain concerning the establishing of a robust regulatory framework in the safety analysis of facilities supporting nuclear-powered submarines.

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- [3] Office for Nuclear Regulation – ONR. Licensing nuclear installations, 2021.
- [4] Office for Nuclear Regulation – ONR. Safety assessment principles for nuclear facilities, 2017.
- [5] Defence Safety Authority – DSA. Defence Nuclear Safety Regulations of the Defence Nuclear Enterprise - DSA02–DNSR, 2021.
- [6] Defence Safety Authority – DSA. Defence Nuclear Safety Regulations of the Defence Nuclear Enterprise – Guidance - DSA03–DNSR, 2021.

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<sup>6</sup> DSA02/DSA03–DNSR replaces the “Part 1: Directive” and the “Part 2: Guidance” from the:

- JSP 518 – Regulation of the Naval Nuclear Propulsion Programme V4.1 Jul 14; and
- JSP 538 – Regulation of the Nuclear Weapon Programme V3.1 Jul 14.