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Date: 20th September 2019

**BAE SYSTEMS MARINE LIMITED, DEVONSHIRE DOCK COMPLEX – RADIATION (EMERGENCY PREPAREDNESS AND PUBLIC INFORMATION) REGULATIONS 2019 (REPPiR 2019) – CONSEQUENCES REPORT**

1. BAE Systems Marine Limited has made an assessment pursuant to regulation 5(1), considering and evaluating a full range of the possible consequences of the identified radiation emergencies, at BAE Systems Marine Limited, Devonshire Dock Complex<sup>1</sup>. In accordance with regulation 7(3), a report setting out the consequences identified by that assessment is attached with this letter.
2. The operations considered when undertaking the hazard evaluation were:
  - a. Manufacture of Nuclear Powered Warships;
  - b. Commissioning of Nuclear Powered Warships; and
  - c. Berthing and movements of Nuclear Powered Warships.

The hazard evaluation identified all hazards arising from the work undertaken which have the potential to cause a radiation emergency.

3. The recommendations made in this consequences report are consistent with extant site arrangements and previous advice provided by the Business. BAE Systems Marine Limited formally invites the local authority to discuss the attached consequences report, in accordance with regulation 7(4).

Adam Hearnden  
Nuclear Safety & Security Director  
BAE Systems Marine Limited

F.A.O.: Cathy Collins, Principal Inspector Nuclear Safety, ONR.  
Darren Cummings, Nuclear Inspector Radiological Protection, ONR.  
Dave Smith, Principal Inspector Reactor Build, DNSR.  
Dave Dawson, Staff Officer Nuclear Emergency Response and Training, MoD.

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<sup>1</sup> BAE Systems, eDMS 1914002, Hazard Evaluation and Consequence Assessment, Issue 1, 20th September 2019.

# Consequences Report

## Part 1 – Factual Information

**1. Regulation 7(3) Schedule 4 Clause 1(a) – Name and address of the operator:**

BAE Systems Marine Limited.

BAE Systems Marine Limited, Warwick House, PO BOX 87, Farnborough Aerospace Centre, Farnborough Hampshire, GU14 6YU.

**2. Regulation 7(3) Schedule 4 Clause 1(b) – Postal address of the premises where the radioactive substance will be processed, manufactured, used or stored, or where the facilities for processing, manufacture, use of storage exist:**

BAE Systems Submarines, Bridge Road, Barrow-In-Furness, Cumbria, LA14 1AF, United Kingdom.

**3. Regulation 7(3) Schedule 4 Clause 1(c) – The date on which it is anticipated that the work with ionising radiation will commence or, if it has already commenced, a statement to that effect:**

- a. The Barrow-in-Furness site has worked with ionising radiation in the manufacture, commissioning, and berthing of Nuclear Powered Warships since 1960.

## Part 2 – Recommendations

**1. Regulation 7(3) Schedule 4 Clause 2(a) – The proposed minimum geographical extent from the premises to be covered by the local authority's off-site emergency plan:**

- a. The proposed minimum geographical extent from the premises to be covered by the local authority's detailed emergency plan is an area extending to a distance of 690 m from the Wet Dock Quay, Devonshire Dock Complex, Barrow-in-Furness (Grid Reference SD 19419 68822). This distance aligns with ONR's previous determination of the off-site emergency planning area<sup>2</sup>.
- b. An outline planning zone of 4 km has been determined for BAE Systems Marine Limited, Devonshire Dock Complex by the Secretary of State for Defence in accordance with regulation 9(1)(c)<sup>3</sup>.

**2. Regulation 7(3) Schedule 4 Clause 2(b) – The minimum distances to which urgent protective actions may need to be taken, marking against each distance the timescale for implementation of the relevant action; and Clause 3(a) – The recommended urgent protective actions to be taken within that zone, if any, together with timescales for the implementation of those actions:**

The following distances are recommended for the protective countermeasures of evacuation, sheltering, and stable iodine tablets (SITs). These are the distances determined by detailed consequence assessment of a range of source terms and include consideration of a range of weather conditions and populations over a two day exposure period:

a. Evacuation:

Controlled evacuation 30 m from the submarine in all directions, although this should be extended to 130 m at locations which are in line of sight of the berthed submarine.

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<sup>2</sup> ONR, ONR's statutory determination of the off-site emergency planning and public information areas for Barrow in accordance with the requirements of the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPPIR) regulations 9 and 16, Revision 0, 10<sup>th</sup> December 2014.

<sup>3</sup> Letter from Defence Nuclear Organisation to defence licensed and authorised sites and operational berths, 23<sup>rd</sup> April 2018.

- b. Shelter:  
Personnel to shelter indoors within the first few hours 630 m from the submarine in all directions.
- c. Stable Iodine Tablets:  
Provision and consumption of SITs within the first few hours 400 m from the submarine in the downwind sector.

It is recommended that the declaration of an Off-Site Nuclear Emergency by the operator to the local authority is the trigger for implementing the off-site emergency plan and initiating all of the above recommended protective countermeasures.

**3. *Regulation 7(3) Schedule 4 Clause 3(b) – Details of the environmental pathways at risk in order to support the determination of food and water restrictions in the event of a radiation emergency:***

- a. A release of radioactive material from the submarine could create the requirement for food and water restrictions. For a submarine, this can take the form of an airborne release and/or a marine release.
- b. For an airborne release, radioactive material will be dispersed downwind. A proportion of this material will fall to the ground – this material will be available for uptake into the terrestrial food chain via ingestion of contaminated foodstuffs. Radioactive material released to the air may also make its way into freshwater environment either through run-off or direct deposition on open water.
- c. For a marine release, radioactive material is deposited in the area surrounding the submarine – this may affect the marine food chain and pose a hazard via ingestion of contaminated seafoods.

**Part 3 - Rationale**

**1. *Regulation 7(3) Schedule 4 Clause 4 – The rationale supporting each recommendation made:***

- a. Evacuation:  
Controlled evacuation 30 m from the submarine in all directions, extending to 130 m at locations which are in line of sight of the berthed submarine, is based upon consideration of shielding and the directionality of direct gamma shine radiation. Evacuation is to protect against the direct gamma radiation hazards from the submarine in accordance with the upper Emergency Reference Level (ERL) for evacuation of 300 mSv.
- b. Shelter:  
Personnel to shelter indoors within the first few hours 630 m from the submarine in all directions is to protect against the direct gamma radiation hazards from the submarine and to protect against contamination following a release of radioactive material, in accordance with the lower ERL for shelter of 3 mSv.
- c. Stable Iodine Tablets:  
Provision and consumption of SITs within the first few hours 400 m from the submarine in the downwind sector is to protect against an uptake of radioactive iodine to the thyroid in accordance with the lower ERL for stable iodine of 30 mSv.
- d. The protective countermeasure distances have been made following consideration of a full range of possible consequences of the identified radiation emergencies under a range of weather conditions and populations over a two day exposure period.

- e. The proposed minimum geographical extent from the premises to be covered by the local authority's detailed emergency plan is an area extending to a distance of 690 m has been made following consideration of a full range of possible consequences of the identified radiation emergencies under a range of weather conditions and populations over a two day exposure period. These consequences were subsequently compared with the ERLs listed in PHE-CRCE-049<sup>4</sup>.
  - f. The Secretary of State for Defence has determined an outline planning zone distance of 4 km.<sup>2</sup>
2. ***Regulation 7(3) Schedule 4 Clause 5(a) – The rationale for its recommendation on the minimum distances for which urgent protective action may need to be taken:***
- a. The minimum distances recommended are based on a full range of possible consequences of the identified radiation emergencies evaluated in the consequence assessment made in accordance with regulation 5(1) and consider a range of weather conditions and populations over a two day exposure period. These consequences were subsequently compared with the ERLs listed in PHE-CRCE-049.
3. ***Regulation 7(3) Schedule 4 Clause 5(b) – The rationale for agreement that no off-site planning is required.***
- a. This clause does not apply to BAE Systems Marine Limited, Devonshire Dock Complex.

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<sup>4</sup> Public Health England, Public Health Protection in Radiation Emergencies, PHE-CRCE-049, May 2019.