RRA01/6

Review of Radiological Accident Probability Assessments and Radiological Probabilistic Assessment for Vanguard Class SSBN whilst on the Shiplift at HMNB Clyde

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ABBREVIATIONS

AWE	Atomic Weapons Establishment
DOSGST2	Defence Ordnance Safety Group Risk Assessment
HMNB	Her Majesty's Naval Base
MC	Missile Compartment
NW	Nuclear Weapon
RAPA	Radiological Accident Probability Assessment
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations
RPRA	Radiological Probabilistic Risk Assessment
SPSCs	Safety Principles and Safety Criteria
SSBN	Ship Submersible Ballistic Nuclear

1. INTRODUCTION

DOSGST2a has an ongoing task to undertake Radiological Accident Probability Assessments (RAPA) and Radiological Probabilistic Risk Assessments (RPRA) for Vanguard Class Ship Submersible Ballistic Nuclear (SSBN) whilst on the Shiplift at Her Majesty's Naval Base (HMNB) Clyde with its Trident Weapon System onboard. The RAPA and RPRA are required to inform on the hazards and risks associated with the quiescent storage of the Trident Missile System within the SSBN whilst on the Shiplift.

The existing RAPA/RPRA has lapsed and requires review and rewrite. There is also a requirement to be able to place a SSBN on the Shiplift at relatively short notice, if required.

2. SCOPE OF WORK

The work associated with the production of the RPRA/RAPA to support future use of the Shiplift has been split into two phases:

1. Establish and review previous work undertaken for previous RAPA/RPRA for Shiplift and to undertake an assessment to determine whether the data/assessments remain valid; and

2. Develop the RAPA/RPRA to take into account recent changes in national and MoD regulations such as The Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) and Nuclear Weapon (NW) Safety Principles and Safety Criteria (SPSCs).

Part of the RAPA process involves the support of Atomic Weapons Establishment (AWE) Aldermaston in which calculations of radioactive material dispersion are undertaken.

This report covers the first phase the work, i.e. the review of previous assessments to determine how much of the data remain valid.

3. REVIEW OF PREVIOUS WORK

A number of documents were reviewed during Phase 1 of the project to determine whether the probability values given to AWE (Aldermaston) were valid. The documents were as follows:

- A Radiological Probabilistic Risk Assessment of the Faslane Shiplift for Vanguard Class Submarines with Strategic Weapons Embarked [1];

- Accident Probability Assessment of Faslane Shiplift for Vanguard Class Submarines with Strategic Weapon System Embarked [2]; and

- DSWS T2053, Issue 2, Change 2 [3].

The Accident Probability Assessment [2] used DSWS T2053 [3] to determine the probability values which were then fed into the Radiological Probabilistic Risk Assessment [1].

4. RESULTS

The probability values assessed in the Accident Probability Assessment [2] have been carried through to the Radiological Probabilistic Risk Assessment [1].

Upon review of the base data and event trees within the Accident Probability Assessment [2], the following observations were made:

1. No mention of spontaneous ignition of propellant was made. Since the propellant within the weapon system is nitrate ester, spontaneous ignition of propellant as a result of depleted stabiliser is a hazard. This should be identified within the Accident Probability Assessment [2] because it is a credible hazard whilst the SSBN is on the Shiplift with its Strategic Weapon System embarked.

2. Internal Fire. The probability range for missile cook-off within DSWS T2053 [3] was as follows:

   Optimistic Estimate [redacted]
   Best Estimate [redacted]
   Pessimistic Estimate [redacted] s26

   Whereas the Accident Probability Assessment [2] used the following probability range:

   Optimistic Estimate [redacted]
   Best Estimate [redacted]
   Pessimistic Estimate [redacted] s26

   This change in probabilities needs to be justified since the Compliance Factors may be reduced if the values in DSWS T2053 [3] were used.

   Within the event tree for internal fire the probability of fire not extinguished by nitrogen drench has been claimed twice, however, this is only a typographical error and the heading for the 2nd claim should be probability re-entry team do not extinguish fire.

3. The external fire event tree included probability of fire within Missile Compartment (MC) for 150 days occupied which is considered to be double counting for internal fire. However, the value for external fire does not change if the probability for fire in MC is removed.

4. Aircraft Crash for Type 3, Type 4 and Type 5 aircraft. The probability range for failure of the platform and block failure as a result of Type 3, 4 and 5 aircraft crashes has been taken as:

Platform Failure
Optimistic Estimate [redacted]
Best Estimate [redacted]
Pessimistic Estimate [redacted] s26

Block Failure
Optimistic Estimate [redacted]
Best Estimate [redacted]
Pessimistic Estimate [redacted] s26

Which is the same as for light aircraft Type 1 and 2. It is the opinion of the reviewer that the platform would collapse and the block would fail as a result of Type 3, 4 and 5 aircraft crashes and therefore the probability of failure of both platform and block failure should tend towards 1. This view is consistent with DSWS T2053 which uses a probability of 1 for platform failure and block failure following Type 3, 4 and 5 aircraft crashes.

If the probabilities of failure of platform and blocks were to increase towards a value of 1 the Compliance Factors may be reduced.

5. All other hazards and risk assessments were considered to be valid.

5. CONCLUSIONS

It is concluded that the majority of the assessments remain valid and will not change the assessment of Compliance Factors. However, justification for the probability of missile cook-off is required. If adequate justification cannot be provided the DIFFAL calculation may need to be re-run.

It is recommended that probability assessments for Type 3, 4 and 5 aircraft crashes should be recalculated to take into account the increased probability of failure of platform and failure of the blocks as a result of these aircraft crashes. A judgement will then need to be made to determine whether the increase in probabilities will affect the calculated Compliance Factor values. If it is believed that the increase in failure probabilities will have a significant affect on the calculated Compliance Factor values, the DIFFAL calculation may need to be re-run.

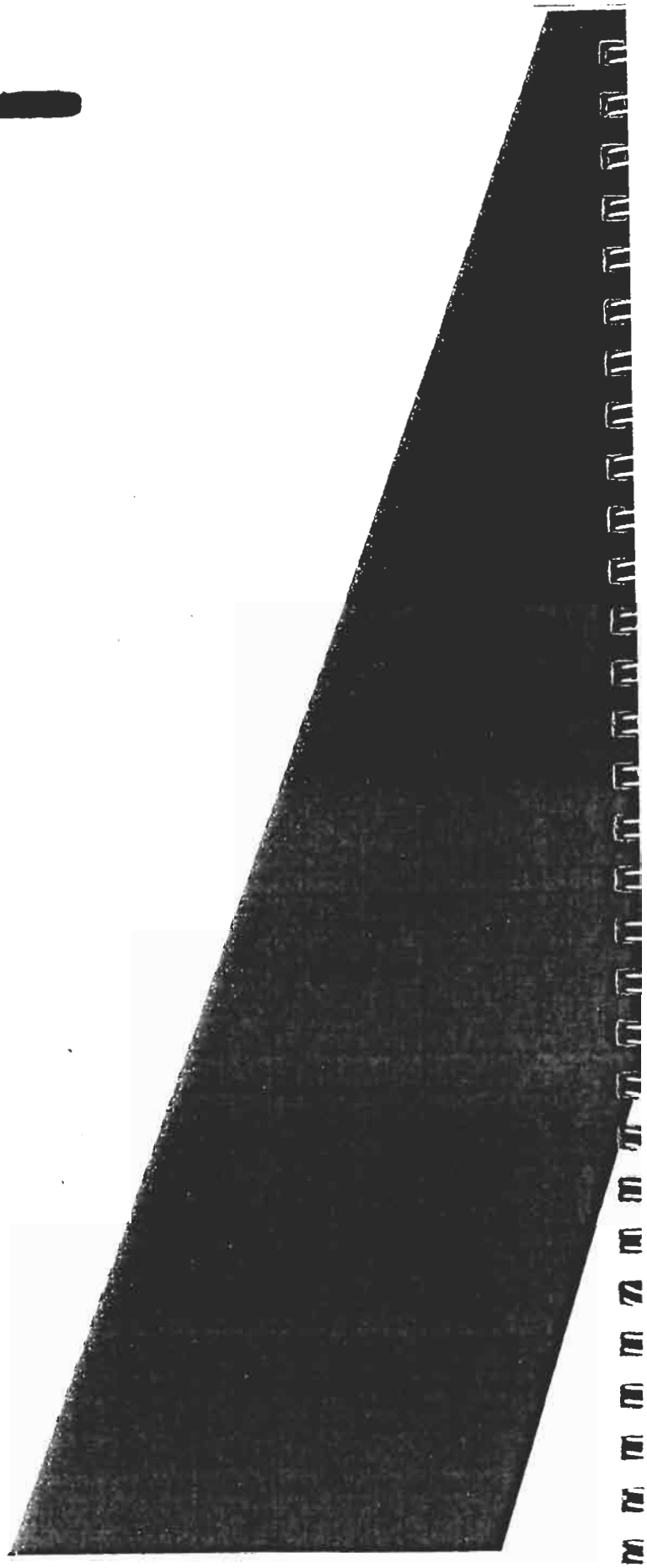
Spontaneous ignition of propellant should be identified as a hazard associated with the SSBN whilst on the Shiplift with Strategic Weapon System embarked.

6. REFERENCES

1 A Radiological Probabilistic Risk Assessment of the Faslane Shiplift for Vanguard Class Submarines with Strategic Weapons Embarked. AWE/DWE06/98/SL0009, Issue 3, November 2000.

2 Accident Probability Assessment of Faslane Shiplift for Vanguard Class Submarines with Strategic Weapon System Embarked. ES352/98/58, Issue 3, August 2000.

3 DSWS T2053, Issue 2, Change 2.



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