



OPERATIONAL SAFETY CASE
FOR TRANSPORT OF NUCLEAR WEAPONS
EXECUTIVE SUMMARY
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**NUCLEAR MOVEMENTS AND NUCLEAR ACCIDENT
RESPONSE GROUP**

CONTENTS

1	INTRODUCTION.....	4
1.1	Purpose and Hazard Category of the Safety Case	4
1.2	Scope of the Safety Case	5
2	OPERATIONAL HISTORY	6
2.1	Review of Audit and Survey Reports	7
2.2	Review of Abnormal Events.....	8
2.3	Environmental and Personnel Monitoring Results	8
3	RISK ASSESSMENT	9
3.1	Introduction.....	9
3.2	Structure of the Risk Assessment	9
3.3	Normal Operations	10
3.4	Accident Conditions.....	10
3.5	Industrial Hazards	17
3.6	Conclusions of Risk Assessment	17
4	DEDUCTIONS FROM THE RISK ASSESSMENT	18
4.1	Identification and Review of Lines of Defence.....	18
4.2	Authorised Limit and Conditions.....	20
4.3	Safe Operating Envelope (SOE)	20
4.4	Examination Maintenance, Inspection and Testing (EMIT) Schedule.....	21
4.5	Contingency Plans.....	22
5	SAFETY MANAGEMENT SYSTEM.....	23
5.1	Local Application of Health and Safety Policy.....	24
5.2	Organisation for Safety	26
5.3	Monitoring Safety Performance	28
5.4	Audit and Review of Safety Arrangements	29
5.5	Workplace Assessment	30
5.6	Demonstration That “Specific Ensurances/Assurances” Important To The Safety Of Nuclear Weapon Convoy Operations Are Covered By Safety Management Systems	31
6	DECOMMISSIONING	32
7	DEMONSTRATION OF ACCEPTABILITY	33
7.1	Introduction.....	33

7.2 Discussion in Relation to Acceptability Criteria 33

8 CONCLUSION 34

9 REFERENCES TO EXECUTIVE SUMMARY 35

1 INTRODUCTION

1.1 PURPOSE AND HAZARD CATEGORY OF THE SAFETY CASE

- 1 This document presents the Safety Case for the road convoy operations associated with movement of Nuclear Weapons [REDACTED] S. 24/
[REDACTED] The responsibility for these operations rests S. 26
with the Director Nuclear Movements & Nuclear Accident Response Group (D NM&NARG).
- 2 The equipment used in the transport of nuclear weapons (NWs) and in particular the Package Design (PD) AWG 516 packages have been subjected to stringent engineering design assessments and tests that meet internationally accepted standards.
- 3 The safety justification philosophy used in this Safety Case is a two-fold approach. First, deterministic safety measures are highlighted and formal lines of defence are claimed. The deterministic requirement is that there are suitable and sufficient lines of defence to prevent an initiating fault from progressing into radiological consequences or nuclear yield. The methodology is discussed in Section 4.3.1 of the main document. Secondly, this deterministic safety assessment is followed by a probabilistic risk assessment which estimates the risk associated with the transport of NWs by road in the UK. This estimate of risk, which is conservative due to pessimistic assumptions therein, is then compared with the Nuclear Weapons Regulator's Basic Safety Limits (BSLs) and where relevant the Basic Safety Objectives (BSOs), with the aim being to demonstrate that the risk is below the BSLs and hence "tolerable". Furthermore, sufficient As Low as Reasonably Practicable (ALARP) considerations are made in order to demonstrate that the risk, along with being "tolerable", is also "acceptable".
- 4 In undertaking the deterministic assessment there are several key components of safety, which deliver the tolerability of risk. First, the NW itself is designed to be Single Point Safe: the occurrence of yield is extremely unlikely. Secondly, the PD AWG 516 packaging is extremely robust and has been designed to withstand severe fault conditions without releasing radioactive material. Thirdly, the Truck Cargo Heavy Duty Mark 2 (TCHD Mk 2), which envelops the PD AWG 516 package during transport, offers a significant amount of resistance against mechanical insults, and hence, is considered to be an important part of safety.
- 5 This Safety Case is owned and sponsored by D NM&NARG. The relevant procedure for production of the Safety Case was D NM&NARG Nuclear safety Procedure (NSP) 05 under Authorisation Condition 14. However, AWE Company Safety Procedure (CSP) 801, "Production of a Safety Case for an Existing Facility or Building at an AWE Site" (Reference ES2) has been used as guidance in achieving best practice. It should be noted that the use of AWE procedures as guidance is a result of the Safety Case being developed in parallel with the process of Authorisation, and the production of the D NM&NARG (NSPs). It also should be noted that CSP 801 is aimed at fixed buildings rather than mobile convoys. In addition, and perhaps the most marked difference, is that the NW Convoy operations are regulated by the Nuclear Weapons Regulator (NWR), rather the Nuclear Installations Inspectorate (NII), which is the case for [REDACTED] S. 26/
[REDACTED] In summary, this Safety Case has been S. 24
written to AWE format but to meet the requirements of the NWR's Safety Principles and Safety Criteria (SPSCs) (Reference ES9).
[REDACTED]

- 6 The NW Convoy operations are classified as belonging to Hazard Category 1 (as defined in D NM&NARG NSP 'Nuclear Safety Categorisation-NSP-04, Reference ES3).

1.2 SCOPE OF THE SAFETY CASE

- 7 The Safety Case covers the road transport of PD AWG 516 packages within the United Kingdom (UK); the only approved method of transporting these packages in the UK. Through out the safety case, reference is made to the PD AWG 516 package. This includes the packaging together with the Trident Re-entry Body Assembly (RBA). The RBA is simply referred to in this Safety Case as the NW. [REDACTED]

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- [REDACTED]

- [REDACTED]

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- 8 The scope of convoy operations is limited to those involving a fully constituted convoys [REDACTED] Convoys use Staging Posts (SP) or Crew Change Locations (CCL) between these termini as dictated by resting requirements etc. These provide elements of safeguard but may conversely introduce extra hazards (e.g. enhanced risk of aircraft crash if the SP or (CCL) happens to be an airfield). The safety case therefore considers potential modification of risks at SP and CCLs and refers to the site safety plans (SSP) written by Heads of Establishment (HoE) in accordance with Joint Services Publication (JSP) 483. The interfaces described in such plans are checked to ensure that they enable D NM&NARG to discharge responsibilities under Authorisation. This ensures that the process of assurance/ensurance extends as necessary into the safety management arrangements of the organisation responsible for the SP or CCL .

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- 9 The safety case covers all operations that are carried out at present together with those planned for the future. Continuous Running which will include running in the hours of darkness is included as a means of convoy operation although this has yet to gain full approval and will be covered by a separate safety case.

- 10 The PD AWG 516 packages shall remain closed throughout convoy operations and this includes stopovers at CCL and SP.

- 11 The Secretary Of State is the Competent Authority for the transport of military explosives. The relevant body that provides advice and recommendation, to the Nuclear Weapon Team Leader (NW TL), for approval of NW containers for on and off site use is the Radioactive and Special Materials Transport Approvals Panel RAMTAP.

- 12 The only package covered by this Safety case is the PD AWG 516 package. The design of the package has been approved by RAMTAP as meeting all the relevant requirements including the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material [Reference ES8]: Termed "fully compliant" in the Safety Case. The NW Integrated Project Team (NW IPT) are responsible for the design, construction and operation of the RBA and PD AWG 516 packaging, D NM&NARG is only responsible for transporting the complete PD AWG 516 package within the environmental limits set by NW IPT. NW IPT are responsible for assessing internal risks for the RBA. These are outside the scope of this safety case and are the basis of a separate Safety Case to be prepared by the NW IPT. Therefore, the D NM & NARG Safety Case treats the PD AWG 516 package as a "black box" for safety assessment purposes, i.e. [REDACTED]

hazardous challenges will be considered against this "black box" and credit taken principally for the PD AWG 516 packaging. Consideration of the ability of the RBA to withstand particular hazards will only be taken where these relate to the RBA rather than the PD AWG 516 packaging.

- 13 The definition of terminal points for convoy operations (for the purpose of this safety case) should be consistent with D NM&NARG responsibilities under Authorisation and are best defined in functional terms (i.e. when the activities for which [REDACTED] are responsible are complete and D NM&NARG activities start). D NM&NARG defines all NW road transport activities as starting when custody for a loaded TCHD is taken from the consignor and ending once custody is transferred to the consignee (as detailed in operating procedures). Such custody handover points will occur within an [REDACTED] S. 26/
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- [REDACTED] S. 26/
S. 24 The physical handover points relevant to this safety case are at the point at which the PD AWG 516 package is on the Load Transfer Platform Trolley (LTPT) either waiting to be transferred into the TCHD or waiting to be lifted from the LTPT by the facility crane. At both these points, the LTPT is in the raised position, is fully propped, jacked up and the end stop chocks designed to stop the package running off the end of LTPT are in place.

2 OPERATIONAL HISTORY

- 14 Section 3 of the main document presents a review of recent operational history relevant to NW transport by road convoy.
- 15 This section of the main document indicates that the nuclear safety of in service NWs is very closely controlled and the Ministry of Defence (MOD) has specified prescriptive safety requirements for their design, production, transport, and subsequent handling.
- 16 All mission critical support vehicles involved in the NW transport operation are owned by D NM&NARG and are maintained by [REDACTED] staff in accordance with Army Equipment Support Publications. The DA for the TCHDs is [REDACTED]. The vehicles were purchased by the MOD for use in their then current role by the Royal Air Force (RAF) Nuclear Weapon Convoy Group and transferred to D NM&NARG en bloc in 2002. In the lifetime of the current vehicles only minimal modifications have been made to them and these modifications have had a positive effect on safety. In addition, any changes made have been subject to change control with the design being controlled through a Design Change Safety Committee (DCSC) (previously known as the Configuration Control Committee (CCC)). [REDACTED] S. 26/
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S. 26
- 17 Generally, Radioactive Material (RAM) has been transported in the public domain between sites in accordance with the IAEA Transport Regulations [Reference ES8] since the regulations were first introduced in 1961. As such the IAEA Regulations have influenced the design of the current PD AWG 516 packaging for NWs. Indeed, the PD AWG 516 packaging employed in the movement of NWs, have all been procured for the specific purpose for which they are used, and designed in order to fulfil the requirements of the IAEA Transport Regulations.
- 18 In the unlikely event of an accident, the equipment relevant to Nuclear Accident Response (NAR), [REDACTED] is proprietary equipment designed and manufactured in accordance with approved standards and quality assurance procedures. It is used during training exercises, and is appropriately maintained. S. 26/
S. 31

Furthermore, no changes have been made to this proprietary equipment by any stakeholder operation involved in the convoy operations.

- 19 In Section 3 of the main document it is demonstrated that the key safety features for the equipment critical to NW convoy operations (i.e. TCHDs, and LTPTs), would be able to perform their intended safety functions. Indeed, because of the recent overhaul of the LTPTs, and the rigorous maintenance performed on the LTPTs and TCHDs, it is considered that these items of plant would operate as intended and that they would deliver their intended nuclear safety functions. With regards to the D NM&NARG owned TCHD, the systems that are crucial to safety such as braking/steering/and suspension, are all modular and proprietary. Consequently they are easily tested and maintained. There is no reason, providing they are correctly maintained that they should not operate as intended. Similarly, there is no reason why the NW IPT owned LTPTs should not operate as intended.
- 20 The PD AWG 516 packaging is certified as fit for purpose by RAMTAP for a limited period. In addition, should an incident occur that compromises the nuclear safety functions of the PD AWG 516 packaging, incident reporting systems exist that would initiate remedial action. It is considered that the incident reporting systems are robust enough to initiate appropriate remedial action for events of a magnitude that could damage the ability of the PD AWG 516 packaging to perform its nuclear safety functions. Remedial action could range from a rebuild of the PD AWG 516 packaging to its disposal. Any repairs/rebuild etc would be done according to a level of Quality Assurance that would be equal, or superior to, its original construction. The rebuild/ remedial action etc would be the responsibility of the Project Manager for Containers (PM(C)) who is responsible for the inspection, modification and change control of re-usable containers including the PD AWG 516 packaging. Therefore, because of the incident reporting systems in place, and with a robust container certification process, it is assumed that the PD AWG 516 packaging performs its intended nuclear safety function.
- 21 The processes involved in running the convoy are described in JSP 483 and amplified in the Ministry of Defence Police (MDP) Convoy Operating Procedures (COPs) (Reference ES 5 and ES4 respectively), and their supporting documents. Both the JSP and the MDP COPs are strictly adhered to [REDACTED] s. 24/
[REDACTED] Should there be a need s. 26
to deviate from the requirements within either JSP 483 or COPs [REDACTED] s. 31
[REDACTED] then such a deviation requires the prior approval of D s. 31
NM&NARG before being enacted. The post Movement Operation (MO) report produced by the [REDACTED] includes details of any approved deviations together with details of any changes s. 26
imposed [REDACTED]. Any such incidents are then reviewed at the post MO meeting. If necessary s. 26
the issues raised are referred back to the D NM&NARG Convoy Management Committee (CMC) for resolution of any policy implications, and any actions required are fed back from this forum into JSP 483 and/or COPs.
- 2.1 **REVIEW OF AUDITS**
- 22 An effective means of measuring the performance of a Safety Management System (SMS) is by audit. Audits of aspects of NW transport have been carried out by various internal and external agencies over recent years.
- [REDACTED]

- 23 Section 3.4 of the main document shows the audits used to measure the performance of the System. The key objective of this section is to provide assurances that a robust audit process is in place and, inter alia, that the SMS is working as intended.
- 24 In order to ensure that the required standards of training and competence are maintained (as well as proficiency, effectiveness and security), all elements of the convoy process, including supporting establishments, are examined annually by a D NM&NARG audit. The audits, known as the Convoy Operational Proficiency Inspection (COP), are the functional responsibility of D NM&NARG and are conducted by a Suitably Qualified and Experienced Personnel (SQEP) team. All aspects of the Convoy (including staging posts (SPs), stakeholders etc) are assessed against the policy laid down in JSPs. The D NM&NARG lead auditor and all other auditors are accredited [REDACTED] S. 43
[REDACTED] The assessment is carried out against approved procedures and conducted iaw ISO 9001:2000 compliant auditing standards..
- 25 In addition to internal reviews and COPs, a Department for Transport (DfT) audit of the Quality Assurance (QA) system at AWE(A) was performed in January 1993. The main conclusion of the 1993 audit was that the QA system was found generally to comply with the requirements of ISO 9001-1987. The main area affecting NW operations, which the DfT audit identified as not being sufficiently developed, related to Health Physics (HP) operations. However, since then HP has introduced a comprehensive QA system, which includes Working Instructions relating to the monitoring of packages.
- 26 As a result of the above audits, one major non-compliance, relating to the loading/unloading activities, has been raised. This resulted in a change to procedure to ensure this procedure was more clearly articulated and an additional level of task supervision was added. Minor non-compliances have been raised and cleared in a timely manner. This demonstrates that the audit system is robust and that the SMS has performed satisfactorily and as intended.

2.2 REVIEW OF ABNORMAL EVENTS

- 27 Review of the abnormal event data for the recent past shows that a number of significant events have occurred but that none of these had radiological consequences. Indeed, the Abnormal Events (AEs) that have occurred have been failures of post initiating event design basis safety systems or "near misses" rather than full fault sequences. It is not clear whether adequate arrangements have been made to prevent the recurrence of these faults, and recommendations have been made in relation to the SMSs associated with Incident Reporting/subsequent investigation/ remedial action. In addition, there have been several minor incidents at the SPs, which have recurred. Remedial recommendations have also been made to counteract this.

2.3 ENVIRONMENTAL AND PERSONNEL MONITORING RESULTS

- 28 The dosimetric dose data presented in Sections 3 and 4 of this Safety Case is the historic dose data [REDACTED] S. 26/
[REDACTED]. However, since the [REDACTED] staff would S. 24
be the most exposed convoy personnel because they are involved in the physical handling of the PD AWG 516 package and hence spend more time closer to the PD AWG 516 package than the S. 26/
MDP and Royal Marine (RM) Personnel, it is considered that the [REDACTED] staff would be the S. 24
most exposed convoy personnel. It is considered that the historical dose uptake to the MDP and S. 26/
Royal Marine personnel would be far lower than that received by the most exposed [REDACTED] S. 24
[REDACTED]

personnel. The main purpose of presenting the historic dose data in this Safety Case is to present evidence that the current and historic dose uptakes are, and have been in the past, minimal. As such, they provide assurances that the future dose uptakes will also be minimal. It is considered that this requirement has been satisfied by the inclusion of the [REDACTED] Convoy personnel historical dose uptakes alone, and that the presentation of the historical dose data for the RM and MDP would be superfluous to this safety argument. S. 26/
S. 24

29 The Review of the dosimetric data for [REDACTED] NW convoy personnel reveals that the transport of NWS is, and is likely to continue to be, a very low dose rate uptake operation. Individual doses represent only a small proportion of any limit or constraint and exhibit an overall downward trend. In the past four years the highest individual annual external dose uptake to [REDACTED] personnel (who are closest to the PD AWG 516 package) involved in the NW convoy operations was [REDACTED]. (Note that dose uptake is dominated by external radiation, internal dose uptakes are negligible.) [REDACTED] S. 26/
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3 RISK ASSESSMENT

3.1 INTRODUCTION

30 The Risk Assessment section of the Safety Case (Section 4 of the main document) presents the results of assessments of the following:

- Radiological doses from normal operations
- Radiological risks from accidents
- Risks from industrial hazards

3.2 STRUCTURE

31 The main document presents details of the following:

- Hazard Identification Procedures
- Consequence Assessment Methodologies
- Frequency Assessment Methodologies
- Risk Assessment

The main document also presents details of the probabilistic risk assessment and derivation of hazard category for the NW convoy operations.

32 Section 4 details the relevant NWR SPSCs (Reference ES9), against which the acceptability of the operations has been demonstrated.

3.3 NORMAL OPERATIONS

33 The normal operations dose uptake for operators and members of the public is assessed on the basis of historical dose record data for the NW convoy personnel currently participating in NW convoy operations. The doses to the public are demonstrated in Sections 3 and 4 of the main document to be negligible. For the [REDACTED] convoy personnel in the past 4 years the maximum dose uptake to a member of the workforce, from all sources, in any one year was [REDACTED]. The key components for transport operations which contribute to these low dose uptakes in normal operations, are the NW design and PD AWG 516 packaging. For the public, in addition to the NW design and PD AWG 516 packaging, any dose rates would decrease as their distance from the NW increases according to a $1/r^2$ law. The public are denied access to the NWs, therefore, the dose rates will be more trivial in comparison to the worker dose. [REDACTED]

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[REDACTED] Hence, the actual dose uptakes to the workforce resulting from NW convoy operations are a fraction of those represented by the historic data.

34 For past operations the normal dose uptakes have been minimal and consequently it is shown the normal dose uptake is considered to be as low as reasonably practicable (ALARP).

3.4 ACCIDENT CONDITIONS

3.4.1 Hazard Identification

35 A structured and methodological approach has been adopted to ensure that all relevant hazards associated with the transport operations have been identified. Radiological, nuclear yield and industrial (conventional) hazards have been considered.

36 Hazards have been identified using a Hazard and Operability (HAZOP) study (Reference ES11). This was selected as the most appropriate technique for the safety case since it is thorough, rigorous and suitable for a "process" with sequential steps such as transport, and especially since hazardous materials are involved.

37 A fault schedule has been produced (Reference ES.12) and represents a distillation of those faults identified in the HAZOP process regarded as being significant.

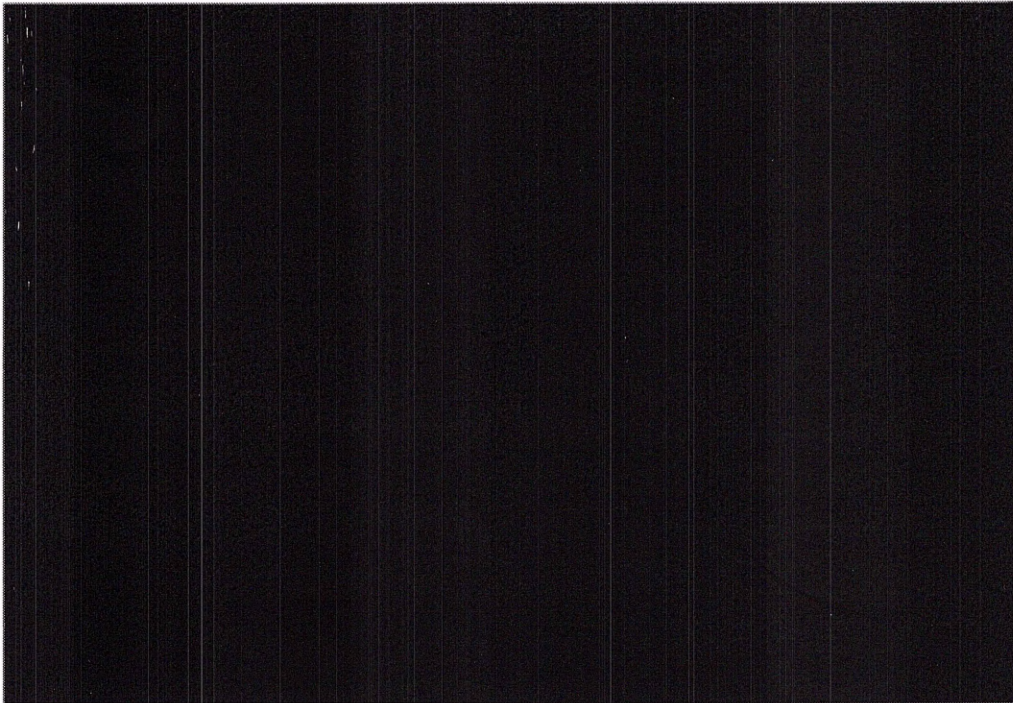
3.4.2 Deterministic Assessment

38 In the risk assessment in Section 4 of the main document it is demonstrated that the NW operations are deterministically safe by identification and subsequent justification of Lines of Defence (LODs) against fault sequences. These lines of defence are incorporated into the risk assessment (summarised below), and are as follows:

[REDACTED] S. 26/
[REDACTED] S. 24

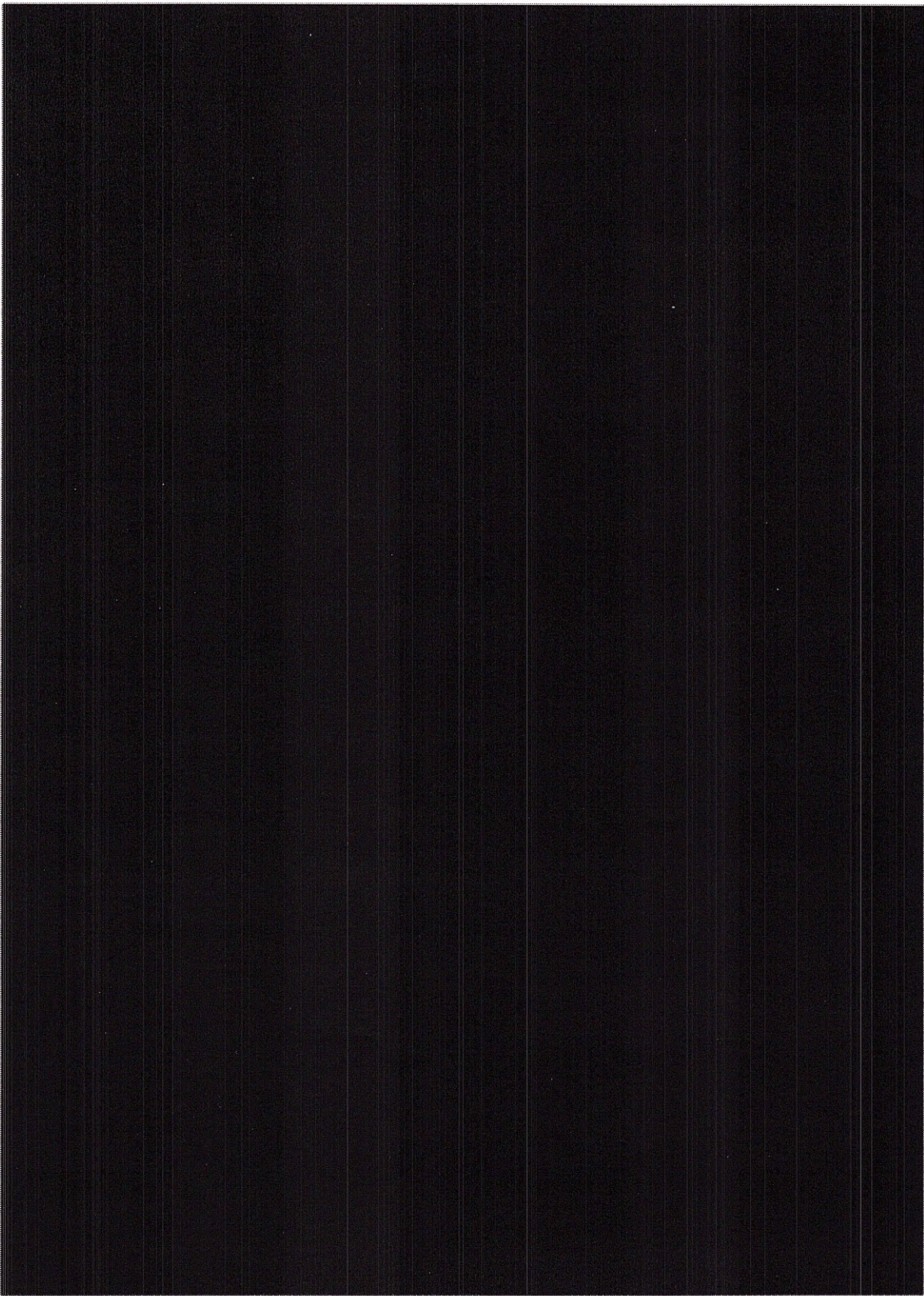
[REDACTED] S. 26/
[REDACTED] S. 24

[REDACTED]

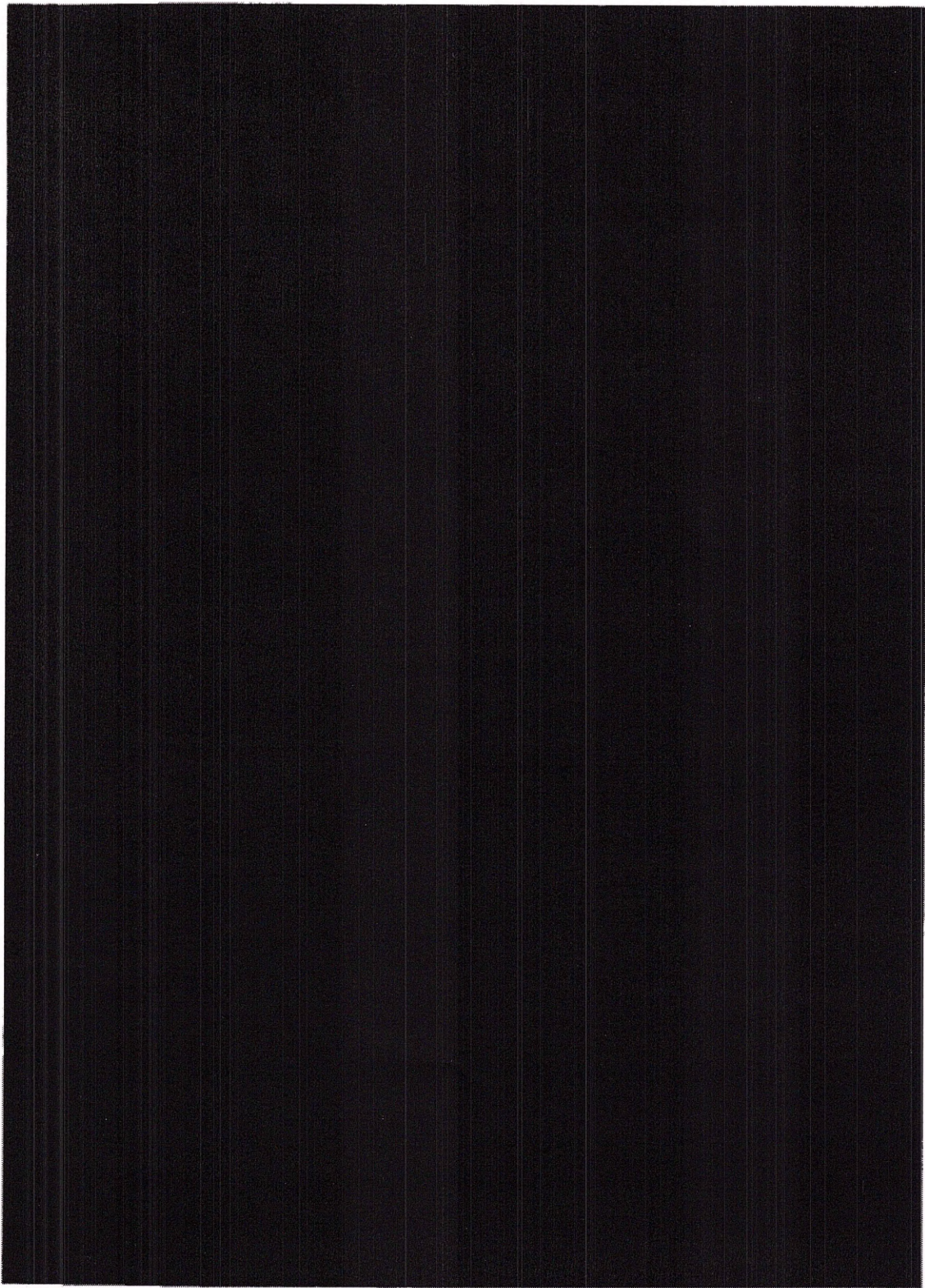


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- 40 Note that the general rules stating the preference for types of LOD are given in the NWR's SPSCs (Reference ES9).

3.4.3 Design Basis Assessment

- 41 The design basis for NWs pre-exists this safety case and is set out on the basis of a number of LODs, which have been designed for all activities under Stage 1 approval, including transport. Additional LODs and/or further details of existing LODs relevant to transport are raised as necessary in this safety case.

- 42 For this safety case the approach is one of considering the design basis which already exists (as described in the NW Design Safety Principles and NW Safety Guidelines together with the LODs relevant to transport); determining whether any of the hazards involved in the transport activity compromise the LODs.

- 43 Section 4 of the main document develops a Design Basis Envelope (DBE). The purpose in defining the DBE relevant to transport is to act as a reference for the capability of the design and a basis against which challenges can be assessed.

3.4.4 Risk Assessment Methodologies

- 44 The methodologies employed for the assessment of accident rates and consequences are described in Section 4 of the main document. In the following assessed radiological sections of this Executive Summary the risk is summarised for the workers, the public and risk of yield for several groups of faults (i.e. internally generated faults, man made external faults, and natural hazards).

3.4.5 Assessed Radiological Worker Risks from Accidents

- 45 Internal events are excluded from this Safety Case as they are assessed by NW IPT.
- 46 The total worker risk of death for man-made external faults (i.e. explosion, vehicle accident, aircraft crash) is calculated in Section 4 of the main document to be $1.7 \times 10^{-7} \text{ y}^{-1}$.
- 47 The total worker risk of death for natural external faults (i.e. seismic) is calculated in Section 4 of the main document to be $2.6 \times 10^{-9} \text{ y}^{-1}$.
- 48 The overall operator risk of death from all the identified fault sequences is therefore calculated to be $1.7 \times 10^{-7} \text{ y}^{-1}$.

3.4.6 Assessed Radiological Public Risks from Accidents

3.4.6.1 Overall Assessments (Public)

- 49 The consequences bands and assessed total frequencies (as assessed in Section 4 of the main document for the various faults) for each consequence band are summarised in the following table:



Consequences	Frequency (y^{-1})
0.1-1 mSv	N/A
1-10mSv	1.7×10^{-7}
10-100 mSv	N/A
0.1-1 Sv	N/A
1-10 Sv	2.3×10^{-9}
>10 Sv	N/A

3.4.7 Assessed Radiological Risks from Inadvertent Yield Accidents

50 Internal events are excluded from this Safety Case as they are assessed by NW IPT.

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53 The overall risk of an inadvertent yield from all the identified fault sequences is therefore estimated to be $2.4 \times 10^{-9} y^{-1}$.

3.5 INDUSTRIAL HAZARDS

54 Conventional hazards were considered in the HAZOP Study conducted on 8th January 2004. The main potential non-radiological hazards were identified as hazards associated with vehicle accidents, fire, missiles, vehicle exhausts, toxic hazards, falls, electrocution and impacts. The risk associated with these hazards is demonstrated to be low and ALARP.

3.6 CONCLUSIONS OF RISK ASSESSMENT

55 The relevant BSLs are given in the NW SPSCs (Reference ES9), and the following paragraphs indicates the percentage of the BSLs for yield, worker risk, and the public frequency BSLs for the various consequence bands, taken up by the estimated risk (frequency in the case of public) in each case.

56 The inadvertent yield criterion is a single BSL criterion of $10^{-8} y^{-1}$ from the NW SPSCs. The overall frequency of an inadvertent yield is $2.4 \times 10^{-9} y^{-1}$, i.e. 24% of the BSL. The key fault contributors to the overall frequency are vehicle accident in the event of multiple failures of

LODs, due to the predominance of vehicle accidents, and aircraft crash, as the NW may not retain its SPS nature. As discussed in Section 4 of the main document there are considered to be no additional protective measures that would reduce the frequency associated with these faults.

- 57 The public risks detailed in the table below are all below the applicable BSO levels and are therefore judged to be acceptable. In the 10-100-mSv category the risks are well below the BSO. The risk in the 1-10 mSv category is 1.7% of the BSO and this is mainly due to the risks from vehicle accidents as discussed in Section 4 of the main document. The risk in the 1-10 Sv category is 23% of the BSO, predominantly due to the risk from an aircraft crash as discussed in Section 4 of the main document.

Consequences	Frequency (y ⁻¹)	BSL (y ⁻¹)	BSO (y ⁻¹)	% BSL	% BSO
0.1-1 mSv	N/A	10 ⁻¹	10 ⁻⁴	N/A	N/A
1-10 mSv	1.7 x 10 ⁻⁷	10 ⁻²	10 ⁻⁵	1.7 x 10 ⁻³	1.7
10-100 mSv	N/A	10 ⁻³	10 ⁻⁶	N/A	N/A
0.1-1 Sv	N/A	10 ⁻⁴	10 ⁻⁷	N/A	N/A
1-10 Sv	2.3 x 10 ⁻⁹	10 ⁻⁵	10 ⁻⁸	2.3 x 10 ⁻²	23
>10 Sv	N/A	10 ⁻⁶	10 ⁻⁹	N/A	N/A

- 58 For the workers, the individual risk of death criteria is 10⁻⁴ y⁻¹ BSL, 10⁻⁶ y⁻¹ BSO (taken from the NW SPSCs – Reference ES9). The individual risk of death calculated in Section 4 of the main document is 1.7 x 10⁻⁷ y⁻¹, i.e. 17% of the BSO and 0.17% of the BSL. It can therefore be seen that the BSO is not exceeded and the risk is therefore judged to be acceptable in line with the NW SPSCs. As explained in Section 4, the key risks to operators arise from vehicle accidents, in particular a collision between a TCHD and a fuel tanker.
- 59 Even though the risk is demonstrated to be acceptable within the context of the SPSCs, Section 4 of the main document has identified recommendations which are detailed in the Forward Action Plan (FAP) (Reference ES.17) which could reduce further the risk.

4 DEDUCTIONS FROM THE RISK ASSESSMENT

4.1 IDENTIFICATION AND REVIEW OF LINES OF DEFENCE

- 60 Summarised in Section 4.2 of the main document are the identified hazards associated with the transport of NWs and the safeguards in place for their control. These hazards and controls were identified through a HAZOP study (Reference ES11). The HAZOP study was specifically carried out in support of this safety case and covers all transport activities including loading/unloading, on the road, rest breaks Crewe change location and SP activities

61 A comprehensive fault schedule has been produced for those radiological and conventional hazards involved in such operations (Reference ES12). Fault schedules have been reviewed to identify those items of equipment and procedure (LODs and their supporting elements) important to safety and as part of the design basis assessment in Section 4.3 of the main document. This has been carried out by the identification of safety functional requirements to demonstrate a clear and comprehensive linkage to the LODs required.

62 The adequacy of LODs has been considered deterministically in the Design Basis Assessment part of Section 4.3.3 of the main document. The adequacies of safety equipment and procedures that support these LODs have also been covered.

63 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] S. 26/ S. 24

4.1.1 Review of Safety Equipment

64 The following equipment is reviewed in Section 5 of the main document and is deemed fit for purpose with regards to delivering its LOD nuclear safety function.

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] S. 26/ S. 24

4.1.2 Review of Safety Procedures

65 The following procedures are reviewed in Section 5 of the main document and it is deemed that they adequately fulfil their nuclear safety functions:

- Package Approval Procedure (RAMTAP Certification, Incorporating Conditions for Acceptance) and Procedures for Container Documentation (Including Records and Archiving)

[REDACTED]

- Operator Training
- JSP 483, COPs and D NM&NARG Engineering Order Number 1.
- Experience Requirements for Operators and Supervisors
- Selection and Maintenance of Personal Protective Equipment
- Contingency Plans (Breakdown Recovery, [REDACTED] S. 26

4.2 AUTHORISED LIMIT AND CONDITIONS

66 The Section 4 of the main document review of the LODs shows that there are two authorised limits and conditions that are judged to have a critical influence which could result in a significant increase in risk. These are:

- PD AWG 516 package(s) passed to D NM&NARG for transport .
- That this package be transported in accordance with NW IPT Stage 1 Approvals.

Carried under these conditions the NWs' Single Point Safe claims and withstand capabilities are justified.

4.3 SAFE OPERATING ENVELOPE (SOE)

67 Section 4 of the main document defines the SOE as the applicable conditions that ensure the transport operations remain within the levels of safety and risk, which have been demonstrated and justified within the safety case. The SOE comprises parameters, which are derived from the definition of the design basis together with the assumptions that underpin the risk assessment; these are essentially the limits, conditions, systems, and procedures that define and support LODs. The SOE defines the region within which the risks have been demonstrated to be acceptable. An inadvertent breach of the SOE would constitute an excursion into an area of undetermined risk.

68 The objectives in defining the SOE are to provide all organisations involved with the following activities with a clear definition of the prerequisites and limits forming the boundary of safe operations. This is used as a feed into the arrangements, which ensure that transport activities are not carried out unless the specific limits and conditions are achieved.

- Planning
- Organisation
- Conduct of operations

69 The following list of SOE parameters is considered necessary to nuclear safety. These embody the operational conditions and limits associated with Full LODs (both engineered and procedural) and other aspects of facility operation considered necessary to safety. They are aligned to the scope defined in Section 1.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

S. 26/ S. 24

4.4 EXAMINATION MAINTENANCE, INSPECTION AND TESTING (EMIT) SCHEDULE

70 The EMIT schedule derived in this safety case has been developed for those items whose presence is demanded by the results of the risk assessments and which form significant supporting elements to LODs. This also includes equipment required to prevent or to mitigate against potential faults that would otherwise result in risks in excess of the BSO levels.

71 The EMIT schedule is only partially made up of the safety support equipment derived directly from the risk assessments. The EMIT schedule also address items with regulatory test requirements as well as any other non-essential safety support items which, in accordance with good practice, should be regularly maintained.

72 Section 5 of the main document identifies the following items of safety important equipment:

- The NW Design
- The PD AWG 516 packaging
- TCHD Design
- Lifting Equipment (LTPT)
- Facility Design
- Fire Tender

73 The EMIT requirements of these items are discussed in Section 5.3. In each case the equipment has not been placed on the EMIT Schedule for this Safety Case on the basis that either their EMIT is the responsibility of other Safety Cases (e.g. [REDACTED])

S. 26/
S. 24

[REDACTED]

[REDACTED] or because they do not make a contribution to nuclear safety. S. 26/
S. 24

4.5 CONTINGENCY PLANS

74 Modern safety cases develop accident response or contingency plans via a risk-based process. The risk assessment indicates the probability of an accident and this can then be considered to determine whether it is "reasonably foreseeable". The probabilistic risk assessment part of Section 4 indicates that a NW accident resulting in a hazard to the public (through RA release or inadvertent yield) is not reasonably foreseeable. Since NW accidents are not "reasonably foreseeable" there is no legal requirement to prepare contingency plans except in outline. However, in accordance with MOD policy the MOD has a responsibility to devise and exercise emergency plans. Under the terms of Authorisation Condition 11 D NM&NARG is required to ensure that the NW transport accident plans comply with the overall AC and MOD conditions.

75 Developing contingency plans starts with the fault schedule and identifies the Fault Sequences for which contingency plans should be prepared. These fault schedules form part of the safety Case. This ensures that comprehensive accident response measures are developed. A NAR capability already exists and has been in existence throughout the history of the MOD's ownership of nuclear assets. The Safety Case has reviewed the fault schedule, making reference to the NAR where applicable. NAR plans (including emergency response plans in operation at [REDACTED] are discussed in detail in Section 6 of the main document. S. 26/ S. 24

76 Examination of the Fault Schedule indicates that there are a number of Fault Sequences with potentially high off-site consequences, for which contingency plans should be prepared. The end points for the identified Fault Sequences may be classified into four categories as follows:

- High radiation dose rate
- High surface contamination
- Release of radioactivity
- Inadvertent Yield

77 Section 5 of the main document demonstrates adequate Contingency Plans are in place to deal with these fault sequences. The response to a NW accident during convoy operations is the same whether it involves the release of activity or an inadvertent yield and are within the scope of the current NAR plans (See Section 6 of the main document). In the event of a NW incident or accident involving the convoy [REDACTED]

S. 26/
S. 24/
S. 31

[REDACTED] In order to ensure an effective Nuclear Accident Response Organisation (NARO) the NAR plans for weapon accident scenarios are exercised to a depth and periodicity described in Reference ES7 (these are summarised in Section 6 of the main document).

78 Based on the information presented in Section 6 of the main document, Section 5 of the main document deduces that the contingency plans are adequate in the event of a release of radioactive material or an inadvertent yield.

[REDACTED]

5 SAFETY MANAGEMENT SYSTEM

79 Section 6 of the main document details the arrangements by which safety is managed and controlled by all of the stakeholders responsible for the planning, conduct and assessment of NW convoy operation. It demonstrates how compliance is achieved with the safety management policies of the stakeholder organisations involved. These concentrate on the Authorisation arrangements of D NM&NARG as the lead organisation in the management of convoy operations.

80 One of the important implications of Authorisation is that D NM&NARG has full responsibility for the tasks delegated by the Chief of Defence Logistics (CDL) via Director General Logistics Fleet (DG Logs Fleet). The safety management arrangements are the means by which D NM&NARG ensures (or seek assurance in the case of other MOD departments or external stakeholder organisations which provide support) that activities are correctly carried out. The means to carry these out typically involve direct line management, monitoring and internal audit or via written agreements providing assurance of the required support (usually subject to external audit).

81 Section 4 of the main document details items of equipment, which are important to safety. Consequently, it is necessary to demonstrate that this equipment is designed, manufactured, assembled, and used as intended in the course of NW Convoy operations (and as is claimed in the risk assessment in Section 4). The SMS is vital in this process to ensure that the integrity of the engineered protection systems is not compromised (i.e. LOD are recognised and maintained) and that operations remain, and can be demonstrated to have remained, within the SOE. In addition to describing the SMSs, Section 6 of the main document explains "how" the SMSs provide the required level of ensurance/assurance that the key safety related engineered systems are designed, manufactured, assembled, and used correctly in the course of transport operations. There is also a significant amount of equipment and personnel associated with the NARO and it is essential to the effectiveness of the NARO that all personnel are SQEP with regards to their safety roles. It is also necessary that the NARO equipment is properly procured, designed, manufactured, and maintained. Section 6 of the main document demonstrates that the SMS provides the necessary assurances that the NARO have SQEP personnel and suitable equipment.

82 Safety Management for convoy operations is considered under the following sub-headings:

- Local Application of Health and Safety Policy
- Organisation for Safety
- Monitoring Safety Performance
- Audit and Review of Safety Arrangements
- Workplace Assessment

5.1 LOCAL APPLICATION OF HEALTH AND SAFETY POLICY

5.1.1 Safety Policy

83 The D NM&NARG Safety Policy is implemented by the D NM&NARG SMS which in turn is consistent with Safety Policies of the Chief of Defence Logistics (CDL) and the Secretary of State (SoS) for Defence.

84 For AWE, the Company Safety Policy is implemented via the AWE Safety Manual. This satisfies the requirements of current legislation and is consistent with their obligation under the NII Nuclear Site Licence.

85 AWE Company Health and Safety Policy is promulgated via a framework of lower level safety documents known as Company Safety Instructions (CSIs) and Company Safety Procedures (CSPs). All operations on an AWE site are carried out in accordance with this safety documentation structure.

86 [REDACTED] S. 26/
[REDACTED] S. 31
The MDP COPs implement the MDP safety policy in relation to NW Convoy operation. The MDP COPs are controlled by D NM&NARG and therefore the MDP role in NW convoy operations will adhere to the D NM&NARG safety policy.

87 For [REDACTED] since it is part of the MOD, MOD policy applies. This means that the Health and Safety at Work Act 1974, the Environmental Protection Act 1990, as associated legislation are to be regarded as minimum standards by the MOD. Where the MOD has been granted exemptions from specific regulations, it is MOD policy that the Health, Safety and Environmental Protection standards and practices are as far as is reasonably practicable, at least as good as those required by statute. [REDACTED] S. 24/
[REDACTED] S. 26
[REDACTED] S. 31

5.1.2 Routine Operations

88 Routine convoy operations are described in JSP 483 Volume 2, and the MDP COPs. Chapter 2 of JSP 483, Volume 2 covers convoy management and describes the arrangements followed by MDP together with monitoring and support units at D NM & NARG, MDP and civilian police control, Heads of Establishment (HOE) at Crew Change Locations (CCL), SPs, [REDACTED] S. 26/
[REDACTED] Chapter 2 also covers the responsibilities of CDL for programme and movement S. 24
planning together with the NARO, MDP for the convoy itself and [REDACTED] for the S. 26/
maintenance and operation of convoy vehicles S. 24

89 In accordance with D NM&NARG Policy, all operations are undertaken having regard to all statutory and D NM&NARG requirements. D NM&NARG have brought the necessary NSPs into the D NM&NARG quality controlled documentation system. This will enable the Authorisee to carry out the responsibilities under Authorisation. The NSPs are prescriptive and perform the function of Safety Instructions.

[REDACTED]

- 90 All staff involved in the NW convoy operation are SQEP with respect to the duties which they are required to undertake. The PD AWG 516 Package loading and unloading activities are conducted by SQEP AWE personnel using D NM & NARG Engineering Order No1
- 91 For AWE, all operations take place in accordance with Company Policy, having regard to all statutory and AWE requirements. [REDACTED]
[REDACTED] S. 24/ S. 26
- 92 Maintenance operations are undertaken by [REDACTED] staff, and are planned against a programme of work agreed by the Head of Transport and Convoys, and in accordance with a maintenance schedule. The Deputy Transport Manager controls vehicle maintenance. In the event of building maintenance or special work being needed, this would be controlled by the [REDACTED] Work Control Centre (WCC) using the Work Authorisation Form (WAF) system. S. 26/
S. 24
- 93 For [REDACTED] all operations involving the NW are ultimately performed in accordance with the Special Weapon Operating Procedures (SWOPs). SWOPs are approved by the Trident Reentry System Procedure Approval Committee (TRESPAC) in accordance with JSP 372. For any operation relating to the NWs, [REDACTED] has procedural guides, which indicate the relevant sections of the SWOPs that are applicable to that operation. S. 26/
S. 24

5.1.3 Emergency Response Plans

- 94 The emergency response plans in the event of a NW accident are a key aspect of the preparations for the movements of NWs and are described in Section 2 of the main document. The development of contingency plans is discussed in Section 5 of the main document in relation to the consequences of a NW accident.
- 95 The NAR emergency response procedures are summarised in Chapter 9 of JSP 483 Vol. 2 and the arrangements are presented in detail in JSP 483 Volume 3.

5.1.4 Management of Design, Operation and Maintenance via Service Provider Agreements

- 96 NW Transport operations involve safety important equipment and hence there is a need to justify and underpin the adequacy of such equipment to formal requirements for the purpose of safety case assurance. The safety management arrangements to define the designer/operator/maintainer functions are via "Service Provider Agreements (SPA)". These provide the necessary ensurance or assurance that such activities will be carried out correctly when required [Note that the term "ensurance" is defined as the means by which direct line management and supervision ensures that a task is carried out correctly, and performed to the appropriate standard.]. Where stakeholders are other organisations outside the MOD, it is necessary for the SPA provisions to be incorporated into the contract, which procures the relevant support, [REDACTED] SPAs will describe the quality expectations of those providing the service (i.e. [REDACTED] MDP etc). Adherence of the Service Providers to the requirements of D NM&NARG with regards to quality assurance is checked via auditing by D NM&NARG. S. 43
S. 26/
S. 24

5.2 ORGANISATION FOR SAFETY

97 The overall responsibility for Operational Command (OPCOM) of NW convoys and maintaining the concomitant NARO is vested in CDL. CDL delegates the Operational Control (OPCON) of the overall task to DLO DG Logs Fleet. CDL also appoints DG Logs Fleet as the Military Co-ordinating Authority (MCA) to take charge of the NARO in the event of a nuclear weapon accident. Day to day OPCON for the planning and conduct of NW convoys has been delegated to D NM&NARG. D NM&NARG further delegates OPCON of a particular NW movement to Chief Constable MDP (CCMDP) immediately prior to the move taking place. On completion of the move or as required in an emergency during a movement OPCON transfers back to D NM&NARG. D NM&NARG provide a Special Safety Cell (SSC) which monitors the convoy on the road, and will initiate any emergency procedures required.

98

S. 26/ S. 24

99 At [REDACTED] the SMS is contained within a suite of documentation consisting of Divisional Quality Manuals, [REDACTED] and Work Instructions. Under this system the "Work Instructions" provide the local level guidance. S. 26/ S. 24

100 D NM & NARG, with the assistance of departmental heads, plays a key role in the organisation for safety within D NM & NARG. This is achieved by ensuring that there is adequate *control* of safety, effective *communication* with stakeholders leading to high levels of *co-operation*, and ensuring that staffs are *competent* to carry out their duties. "Communication", and "Co-operation", are discussed below. Note that "competency" and "control of safety are discussed within Safety Related Posts (SRPs) below.

101 In addition "planning for safety" is an important part of organising safety. This is also discussed below.

5.2.1 Safety Related Posts

102 The staff holding specific SRPs within the NW convoy operation are formally appointed by D NM&NARG (via Service Provider Agreements for the Stakeholder organisations) and [REDACTED] checks that all convoy personnel are SQEP for their roles prior to any particular convoy operation. S. 26/ S. 24

103 Each of the stakeholder organisations have different methods of defining posts of significance to safety and ensuring that they are filled with persons having the necessary skills and experience. A co-ordinated approach is taken however, by D NM&NARG as the sponsor for all convoy specific training and for the recording of competence (in accordance with the Convoy Personnel Training and Competence System (CPT & CS) (Reference ES13). This means that the CPT & CS applies to all convoy personnel regardless of the organisation to which they belong. The Safety Related Posts are as follows:

[REDACTED] S. 26/ S. 31

[REDACTED]

S. 26/ S. 31

104 Duly Authorised Persons (DAPs) are usually only appointed when there is a potential to breach Authorised Limits and Conditions. The only Authorised Limits or Conditions identified in this Safety Case relate to the requirements for NWs to be transported as approved under the Stage 1 Approval in approved PD AWG 516 packages. Therefore the only DAP appointed by the Authorisee for the NW convoy operations are the [REDACTED]. The [REDACTED] has the responsibility for ensuring that the NW accepted by the [REDACTED] on behalf of the Authorisee from [REDACTED] or [REDACTED] is the correct package and is transported in accordance with the Stage 1 Approval. S. 26/
S. 31
S. 26/
S. 24

5.2.2 Co-operation and Communication

105 The large numbers of stakeholders involved in convoy operations demands a high level of co-operation to ensure safety and efficiency. The means to achieve this are fostered by D NM&NARG as described in JSP 483, Vol. 2 (Reference ES5). This deals with the extensive measures taken regarding convoy planning and de-confliction.

106 Communication is complementary to co-operation. In order to promote high standards of communication, it is important that all levels of staff co-operate with each other on safety issues. Chapter 8 in JSP 483, Vol. 2 (Reference ES5) gives an overview of the communications between all authorities both MOD and civilian involved in NW convoy operations. Lower level documentation lays out the detailed arrangements for communications between internal and external convoy elements.

107 In addition, communication within the Convoy team is achieved by utilising:

- Movement Operation (MO) planning meetings;
- Pre-convoy briefings;
- Radios of various levels of security, [REDACTED] and satellite communications; S. 26/
S. 31
- Building PA systems [REDACTED] S. 26/
S. 24
- Routine and emergency procedures;
- [REDACTED] S. 26/
S. 31
- [REDACTED]
- Procedures for booking onto/off different Home Office and Scottish Police areas as the convoy moves along its route.
- Procedures for internal convoy communications;

[REDACTED]

- Procedures for communications by other MOD authorities associated with convoy operations;

5.2.3 Planning for Safety

108 In order to demonstrate the safety of convoy operations, it is necessary to show that they are adequately planned. All operations are covered by operating instructions, which identify the associated safety requirements. In addition, work place risk assessments are available (or undertaken) for all but trivial operations prior to commencement, and all convoy staff are SQEP in relation to the duties that they undertake. Maintenance work on convoy vehicles is only carried out as routine activities and only fully maintained vehicles are used for convoy operations. Convoys are equipped with spares and technicians to carry out repair en-route if necessary. All routine maintenance work at [REDACTED] is planned and agreed in advance. S. 26/
S. 24

5.3 MONITORING SAFETY PERFORMANCE

5.3.1 Introduction

109 Monitoring of Safety Performance is a routine mechanism for indicating how well a Facility is performing, and enables improvements in safety standards to be made.

110 There are two types of safety monitoring:

- Active - Monitors the achievements in comparison to the plans, and compliance with Safety Standards.
- Reactive - Monitors accidents and incidents, including the occurrence of sickness and diseases.

111 The information obtained from both types of monitoring is useful in ascertaining the adequacy of a SMS. In order to be effective, all aspects of convoy activities need to be monitored.

5.3.2 Active Monitoring

112 For NW Convoy Operations active monitoring is achieved by:

- Health Physics Radiation and Contamination Surveys.
- Air Sampling [REDACTED] S. 26
- Personal Radiation Dose Uptake Monitoring.

113 [REDACTED] are designated as S. 26
Classified or Monitored Radiation Workers under the Ionising Radiation Regulations (IRR) 1999 since they work in Controlled areas at other times. They are therefore subject to personal monitoring in accordance with Statutory and Company requirements. [REDACTED] S. 26

[REDACTED]

are not classified but Weapon Processing Staff do wear appropriate dosimetry and are radiation workers.

114 [REDACTED] dose uptake is assessed via radiation and contamination surveys. Radiation and Contamination surveys are carried out either against a programme prepared and maintained by the Area Health Physicist and Facility Manager, or by request in support of non-routine operations. Survey results are recorded and forwarded to the relevant Building Foreman/Supervisor. Any unsatisfactory results are highlighted for further investigation. S. 24/
S. 26

5.3.3 Reactive Monitoring

115 Reactive Monitoring is the recording and examination of deviations from normal operations or routine maintenance, usually resulting in injury to personnel or damage to plant/equipment. It can also include the occurrence of diseases/illness or the failure of an EMIT item on testing. Near misses are also reported. Reactive Monitoring within [REDACTED] is carried out in accordance with the requirements of the relevant Company Safety Instruction (CSI 601) "Management of Abnormal Events" (Reference ES14) and implemented locally by [REDACTED] Assembly Facility's FSI No. 7 "Reporting of Abnormal Events" (Reference ES15). The NW convoy mechanisms for reporting Abnormal Events is via the post Movement Operation report produced by the [REDACTED] in conjunction with the other MOD and AWE teams associated with the NW convoy operation. The subsequent discussion and resolution of issues not cleared at the working level is at the D NM&NARG chaired CMC meetings. At [REDACTED] any Abnormal Events are reported in accordance with the "Unsatisfactory Report" system which is detailed with the Royal Navy Administrative Instruction AI-017 "Incident Reporting". It should be noted that AI-017 only covers Nuclear Steam Raising Plant but nevertheless if any damage incurred to the NW it is still reported to Defence Ordnance Safety Group (DOSG) at Abbey Wood. These events are then discussed at the "Unsatisfactory Report" Board Meetings where appropriate action is decided as necessary. S. 24/
S. 26
S. 24/
S. 26
S. 26/
S. 31
S. 24/
S. 26

5.4 AUDIT AND REVIEW OF SAFETY ARRANGEMENTS

5.4.1 Introduction

116 In addition to the monitoring of safety performance described in Section 6.4 of the main document, Audit and Review of safety performance is carried out. This assures D NM&NARG that there are adequate and current management systems and that controls exist and that the arrangements are being implemented. D NM&NARG rely on the support of various other organisations to assist in this process. Formal means are employed to ensure that all authorities concerned provide effective support.

5.4.2 Quality Assurance

117 D NM & NARG maintain a quality management system accredited to ISO 9001:2000 to ensure that NW convoys operate effectively and continue to meet statutory as well as MOD requirements. They maintain high standards within the D NM & NARG organisation via regular review of operations within the Group, covering office as well as convoy operations.
[REDACTED]

Supporting stakeholders are required to operate quality management systems, which reflect MOD requirements.

5.4.3 Audits

118 The NW convoy and associated supporting establishments are examined annually by D NM&NARG by means of the COPI activity, supplemented by additional safety examinations if required.

5.4.4 Review of NAR Capability

119 JSP 471 sets out the requirements for assessment of the performance of NAR capability by the evaluation of exercises. The effectiveness of NAR plans is demonstrated by the assessment of these regular exercises by the NWR.

5.5 WORKPLACE ASSESSMENT

5.5.1 Introduction

120 Activities throughout convoy operations have been subject to safety assessment in accordance with statutory legislation. Manual handling issues mainly relate to [REDACTED] S. 24/
[REDACTED] and convoy operations are otherwise subject to general risk assessments S. 26 (e.g. driving, vehicle and load checking). The Risk Assessments contained within section 4 of the safety cases address major hazards and incidents that have the potential to result in serious, acute injury. This Workplace Assessment Section is intended to demonstrate that all of the convoy activities are subject to routine risk assessments, which lead to the identification and implementation of Management Controls.

121 Line management are responsible for carrying out risk assessments of all significant activities carried out by their area of responsibility. At AWE this is carried out in accordance with the requirements of CSI 701 - "Management of Risk in the Workplace" (Reference ES16). The MDP undertake workplace risk assessments in accordance with JSP 375 (ES19). The top-level document detailing what is required in terms of Work Place Risk Assessment is detailed in the NM&NARG "Business Management Document". For [REDACTED] Control S. 24/
S. 26 Procedures detail the requirements for Work Place Risk Assessments. For each organisation, the risk assessments performed are qualitative and are undertaken using a Risk Assessment form which identifies:

- Potential Hazards.
- Persons who may be harmed.
- Control measures already in place.
- Further measures required controlling the risk.

[REDACTED]

5.5.2 Configuration Management and Change Control

- 122 D NM&NARG ensures that safety related activities are subject to configuration and change control in accordance with the requirements of relevant Authorisation Conditions dealing with equipment and procedures. This ensures that whenever modifications to either engineered or procedural controls with the potential for reducing hazards are identified, they are thoroughly investigated and, if found to be reasonably practicable, implemented in a controlled fashion.
- 123 Changes to package design are implemented by PM(C), who is responsible for the procurement, inspection and maintenance of all containers at [REDACTED] PM(C) will ensure that the correct change control procedures are followed, that modification records are raised and drawing and issue numbers altered. Prior to the use of a modified package, approval and certification from RAMTAP must be sought. S. 24/
S. 26
- 124 The responsibility for maintaining all NW convoy vehicles used in the operations covered by this safety case rests with [REDACTED] Any modifications required as a result of specific requirements imposed by RAMTAP as a condition of approval for the use of a particular package, is the responsibility of PM(C). Whilst authorised minor repair/modifications may be carried out by [REDACTED] for any major modifications to trailers/vehicles/equipment, D NM&NARG will decide on a case by case basis which organisation to use. Major modifications will be required to have gone through "due process" (which would include approval by [REDACTED] and have been granted Approval To Proceed before being embodiment. S. 24/
S. 26
S. 24/
S. 26
S. 43

Demonstration That "Specific Ensurance/Assurances" Important To The Safety Of Nuclear Weapon Convoy Operations Are Covered By SMSs

- 125 Section 6 of the main document demonstrates that the SMSs in place deliver suitable and sufficient arrangements in order to provide the following required Ensurance/Assurances are important to safety:
- [REDACTED] the NW inside its PD AWG 516 packaging to the Convoy team, it is necessary to provide assurances that the [REDACTED] Staff have assembled the NW correctly and sealed the PD AWG 516 package correctly. S. 24/
S. 26
 - Since [REDACTED] design and maintain the PD AWG 516 packaging, it necessary to provide assurances that the PD AWG 516 packaging is designed and maintained appropriately. S. 24/
S. 26
 - Since [REDACTED] transfer custody of the NW inside its PD AWG 516 packaging to the convoy team, it is necessary to provide assurances that [REDACTED] have handed over a NW which along with its PD AWG 516 packaging, are both safe to transport. S. 24/
S. 26
 - [REDACTED] the NW inside its PD AWG 516 packaging to the convoy team, it is necessary to provide assurances that [REDACTED] have sealed/loaded the PD AWG 516 package correctly. S. 24/
S. 26
 - Since organisations external to D NM&NARG may be required to supply Convoy equipment (including replacement equipment for the TCHD) to D NM&NARG, it is necessary to provide assurances that the equipment is properly procured, designed, manufactured, and maintained.
- [REDACTED]

- Since [REDACTED] supply personnel to D NM&NARG for the convoy operation it is necessary to provide assurances that the personnel are SQEP (this includes personnel involved in planning, preparatory work, and execution of the convoy operation). S. 24/
S. 26
- It is necessary to ensure that MDP convoy team members are SQEP with regard to their safety roles (this includes personnel involved in planning, preparatory work, and execution of the convoy operation).
- If equipment and procedures are modified or changed without proper safety consideration and management knowledge, the Safety Case could be undermined. Therefore, it is necessary to provide assurances that appropriate change control measures are in place

Ensurances/Assurances Relevant to NAR

Since the Convoy personnel would form the Immediate Response Force (IRF) following a Nuclear Accident it is necessary to ensure that the Convoy personnel are SQEP for their role in the event of a Nuclear Accident.

- A Follow on Force (FoF) is organised by D NM&NARG which involves the use of the infrastructure and personnel of several other organisations, and as such it is necessary to ensure that the FOF personnel are SQEP for their role in the event of a Nuclear Accident.
- Since the [REDACTED] NAR equipment required by the convoy's IRF, it is necessary to provide assurances that this equipment is properly procured, designed, manufactured, transported and maintained. S. 26/
S. 31
- Since the FOF will bring its own additional equipment in the event of a Nuclear Accident, it is necessary to ensure that this equipment is properly maintained and transported.
- Since the FOF and IRF are controlled by a co-ordinating organisation (SSC), it is necessary to provide assurance that all the communicating equipment with the Convoy (and hence IRF), the FOF, and the SSC are properly procured, designed, manufactured, and maintained.
- Since the FOF and IRF are controlled by a co-ordinating organisation (SSC), it is necessary for the SMS section (Section 6 of the main document) to provide assurances that all the SSC staff are SQEP for their safety roles in the event of a Nuclear Accident.
- Since some part of any Nuclear Accident Response would involve civilian emergency services, it necessary for the SMS section (Section 6 of the main document) to provide assurances that systems are in place to inform the local civilian emergency services of an impending NW convoy through their local area.

6 DECOMMISSIONING

- 126 The responsibilities for decommissioning and disposal of redundant vehicles and equipment are clearly defined.
- 127 Existing disposal routes will be adequate for the disposal of redundant items of equipment and packaging.
- [REDACTED]
-

- 128 There are adequate procedures in place to ensure the monitoring and clearance of potentially contaminated items and to enable sentencing of redundant items to the appropriate waste streams.

7 DEMONSTRATION OF ACCEPTABILITY

7.1 INTRODUCTION

- 129 This section summarises the arguments presented in the Safety Case in justification of the safety of the NW transport operations. In particular it provides comparisons of assessed risks with the relevant acceptability criteria and NW SPSCs (Reference ES9).

7.2 DISCUSSION IN RELATION TO ACCEPTABILITY CRITERIA

- 130 Section 3.6 above summarises the demonstration of acceptability for the NW transport operations against the radiological/criticality acceptability criteria defined in the NW SPSCs (Reference ES9). For a summary of the discussion of acceptability in relation to NAR capability, modern standards, and industrial standards see Sections 7.2.1 and 7.2.2 below.

7.2.1 Assessment of NAR Capability

- 131 Section 6.5.4 of the main document details the requirements of JSP 471 (Reference ES7) in relation to the different exercises that must be conducted to ensure that the convoy NAR capability is adequate. Section 8 in the main document presents a review of the JSP 471 performance expectations regarding NAR Capability. In addition Section 6.5.4 of the main document details the procedures that ensure that demonstration exercises and capability assessments are conducted correctly.

- 132 Following transfer from the RAF, all exercises undertaken by the IRF and FoF have been assessed as satisfactory by the NWR. The reports of the exercises along with follow up of the recommendations continue to support the justification of the NAR capability of convoy operations. D NM&NARG address shortcomings arising from such exercises under D NM&NARG procedures by the necessary authorities, with responses co-ordinated.

7.2.2 Modern Standards

7.2.2.1 Packaging

- 133 The IAEA Transport Regulations (Reference ES8) were first issued in 1961, but are subject to a continuous revision process, which is implemented by the IAEA technical secretariat and overseen by the IAEA Standing Advisory Group for the Safe Transport of Radioactive Material. The current issue is the 1996 Edition (Revised).

- 134 Package approvals are generally issued by the DfT or MOD as Competent Authority for a period of three years and by RAMTAP for a period of five years. After this re-approval must be sought.

7.2.2.2 *Consideration of NAR Equipment in Comparison with Modern Standards*

- 135 The following bullets summarise the equipment used in the event of a nuclear accident. Comments are given regarding the extent to which the equipment can be considered to meet modern standards.

- NARO Communications Hardware – Much of this equipment is prescribed by MOD and comparison with modern standards is only relevant on a national scale.
- Monitoring Equipment – Hand held monitoring equipment is in accordance with modern standards.

7.2.3 **Industrial Hazards**

- 136 No aspects of the transport operations were identified as presenting potentially "high" risks. Section 4.3.4 of the main document demonstrates on a qualitative basis that risks from industrial hazards associated with the transport operations are acceptable and that adequate safeguards exist to restrict the risk from such hazards to a level that is as low as reasonably practicable.

8 **CONCLUSION**

- 137 The description of operations in Section 2 of the main document introduces the essential elements of the NW Convoy in terms of equipment. The subsequent sections of the main document provide substantiation that these items of equipment are fit for purpose with respect to fulfilling their nuclear safety functions.

- 138 The Operational History review in Section 3 of the main document reviews the historical dose rates, maintenance history, configuration change history, and historical Abnormal Events, in order to provide evidence that the assumptions used elsewhere in the Safety Case are applicable. The historical dose rates are demonstrated to be negligible. Given that there are no changes to either the NW, packaging or transportation arrangements, this provides confidence that the future dose rate uptake to convoy personnel will continue to be negligible. There are some deficiencies related to SMSs at SPs but actions have been identified to resolve these issues. In addition the review has identified some deficiencies in the incident reporting systems, resolution of which are under review. Section 3 provides evidence that the SMS described in Section 6 are effective if the actions identified are addressed. Safety Management is crucial to this safety case because without it there would be reduced confidence that the engineered systems, which deliver a tolerable risk, have been designed, procured, manufactured and, ultimately, are being used to a high standard. Therefore, only following implementation of the recommendations in the Section 3 supplement, will the other conclusions of this Safety Case be fully applicable.

- 139 Section 4 of the main document assesses the risk associated with NW convoy operations. Several recommendations are identified in Section 4 of the main document, which could reduce the risk further, and hence make the risk ALARP. However, the risk is demonstrated to be tolerable (i.e. below BSLs).
- 140 Section 7 of the main document indicates that due to the high integrity/high level of containment of the NW, and the PD AWG 516 packaging, the convoy equipment is not contaminated, and consequently decommissioning implications of the NW convoy operations are minimal.
- 141 Section 8 of the main document summarises and compares the risks/normal dose uptakes calculated elsewhere in the Safety Case against the NW SPSCs and concludes that any risks associated with NW convoy operations are tolerable in all respects.

9 REFERENCES TO EXECUTIVE SUMMARY

- ES.1 JSP 538, NWR Authorisation Conditions for NW Transport (Draft).
- ES.2 AWE/CSP4.1, CSP 801, Production of a Safety Case for an Existing Facility or Building at an AWE Site, Issue 1, August 1995.
- ES.3 NM&NARG Nuclear Safety Procedures: "Nuclear Safety Categorisation-NSP-04".
- ES.4 D/MDP/(Ops)/3/10/8 – Ministry of Defence Police Special Escort Group, Nuclear Weapon Convoy Operating Procedures, Issue 2.
- ES.5 JSP 483, Ministry of Defence, Defence Logistics Organisation Instructions for the Road Transport of Nuclear Weapons, Issue 2, July 2003.
- ES.6 AWE/MAN.Q/01 AWE Quality Manual.
- ES.7 JSP 471, Ministry of Defence, Nuclear Accident Response, May 2004.
- ES.8 Regulations For the Safe Transport of Radioactive Materials, 1985 Edition (As amended 1990), Safety Series No. 6, IAEA.
- ES.9 Ministry of Defence, Safety Principles and Safety Criteria for Nuclear Weapon Systems, Issue 1, September 2002.
- ES.10 Not Used.
- ES.11 EEUK/200426.03/R1, Hazard and Operability (HAZOP) I Study Report, Defence Nuclear Material Convoys Under NM&NARG Issue 1, January 2005.
- ES.12 EEUK/200426.03/R2, Fault Schedule, Defence Nuclear Material Convoys Under NM&NARG Issue 1, January 2005.
- ES.13 NM& NAR Group, Convoy Personnel Training and Competence System, Issue 5, October 2003.
- ES.14 Company Safety Instruction (CSI 601) "Management of Abnormal Events".

- ES.15 [REDACTED] Assembly Facility FSI No. 7 "Reporting of Abnormal Events". S. 24/
S. 26
- ES.16 AWE Company Safety Instruction 701 "Management of Risk in the Workplace".
- ES.17 Not Taken up
- ES.18 [REDACTED] S. 26
- ES.19 JSP 375 or other MDP document.