



DRAFT – 6 October 2021

Terms of Reference

Updated Reference Accident for visiting Nuclear Powered Vessels

Definition of Reference Accident

Reference accident – credible worst-case accident, taking likelihood into account, that represents an upper bound risk to surrounding population for the purpose of emergency planning.

Context

Visits to Australian ports from allied Nuclear Powered Vessels (NPV) presents a potential risk to the local community should there be an accident resulting in a release of radionuclides to the environment. Appropriate plans and arrangements need to be in place within the relevant jurisdictions to minimise the impact of an accident. Australia relies on an accident scenario (herein 'Reference Accident') to assist with the development of plans and arrangements for visiting NPV¹.

The Reference Accident has been created for two vessel types, namely Nimitz class carriers and Los Angeles class submarines. The type of accident, a Large Break Loss of Coolant Accident (LB-LOCA) with diffuse leakage, was first recommended by the Australian Atomic Energy Commission (AAEC) as the most appropriate accident scenario in the 1980's. Other accident sequences such as Steam Generator Tube Ruptures, Heat Removal rupture etc. which may result in larger releases, were at the time considered to be of a likelihood that was too low to be considered for Australian port assessments. In 1989 a Senate Committee supported the use of this Reference Accident to assist the development of plans and arrangements for visiting NPV².

In 1996 the Visiting Ships Panel Nuclear (VSP(N)) requested a review and update of the reference accident used in port assessments. In 2000, the update was published, and various parameters of the Reference Accident were altered based on more up to date information, while still maintaining the LB-LOCA as the accident sequence¹. The 2000 Reference Accident remains the current basis for conducting port assessments.

In 2020 ARPANSA in collaboration with our regulatory counterpart DSA in Norway, commissioned Vysus group to undertake a review of the current 2000 Reference Accident methodology. The review identified a number of parameters that require updating or sensitivity analysis to determine their appropriateness. The review also found that other accident sequences beyond the LB-LOCA should be considered. Based on this

¹ The 2000 reference accident used to assess the suitability of Australian ports for visits by NPVs

https://www.arpansa.gov.au/sites/default/files/ref_acc.pdf

² Senate Standing Committee on Foreign Affairs and Defence Inquiry

https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/Completed_inquiries/pre1996/nuclear_warship_visits/index

review, an ARPANSA evaluation determined that a holistic review and update of the current Reference Accident methodology within the next 3 years was appropriate.

Objectives of the proposed work

ARPANSA will deliver to the VSP(N) an updated Reference Accident for NPVs that may visit Australian ports by addressing:

- The occurrence and features of nuclear reactor types found in nuclear powered vessels likely to visit Australian ports now and into the future.
- The factors that influence core fission product inventory estimates in different nuclear reactor types.
- The different accident sequences and their likelihood to release radionuclides to the environment.
- Evidence-based validation of one or more Reference Accidents.

Scope

ARPANSA will inform its work and gather data based on open-source information and expert knowledge to examine different accident sequences. Specifically, ARPANSA will undertake the following activities:

- Collate data from open-source information to examine different accident sequences.
- Consult with relevant experts with experience in application of modern codes and models to investigate reactor design and accident progression.
- Undertake comparative assessments, dispersion modelling and sensitivity analysis of key parameters.
- Evaluate the impact of various accident sequences using generic environmental conditions to establish one or more Reference Accidents.

ARPANSA will deliver:

- An overview of current NPV that may visit Australian ports, including nuclear reactor types.
- A revised estimate of the core fission product inventories based on comparative analysis between the current simplified Bateman equation approach and reactor simulation using modern high-fidelity codes.
- An investigation of accident sequences to estimate likelihood, release amounts and pathways of human exposure based on using the current simplified parameter approach and modelling accident progression using modern codes.
- Comparative analysis of consequences of various accident sequences using atmospheric dispersion modelling with generic environmental conditions. A short review of releases to the marine environment will be undertaken.
- Recommendations on fission product inventories and accident sequences for one or more Reference Accidents

The following items are out of scope:

- Development and validation of accident sequences resulting in releases to the marine environment.
- Development and validation of consequence assessment methodology.
- Port-specific consequence assessment based on local weather conditions, land use, terrain and population density.

Governance

ARPANSA will deliver this work as a 'project' using the ARPANSA project management system to initiate, plan, execute and close. ARPANSA projects are subject to reporting and approval by the ARPANSA Executive Group (EG).

Deliverables

ARPANSA will deliver an interim report and one final Report.

- An interim report will be produced by ARPANSA to reflect initial findings and next steps. The interim report will be delivered to Visiting Ships Panel (Nuclear) for review.
- A final report in the ARPANSA Technical Report format providing the evidence base for one or more Reference Accidents.

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