DATA ITEM DESCRIPTION

1. DID NUMBER: DID-ENG-SOL-HAR-V5.3
2. TITLE: Hazard Analysis REPORT
3. DESCRIPTION AND INTENDED USE

The purpose of the Hazard Analysis Report (HAR) is to document and communicate the results from a range of hazard analyses for achieving Materiel Safety and Environment related legislative compliance and contractual requirements. With regards to Materiel Safety and within the context of the individual report, the HAR demonstrates the achievement of Safety Outcomes. With regards to the Environment and within the context of the individual report, the HAR demonstrates the achievement of Environmental Outcomes. The HAR is used to report on a range of analyses, including the:

preliminary hazard analysis,

system hazard analysis,

subsystem hazard analysis,

operating and support hazard analysis,

health hazard assessment,

functional hazard analysis,

system-of-systems hazard analysis, and

environmental hazard analysis.

The Contractor uses the HAR to record and present the:

identified hazards to health, safety and the environment;

assessment of risks to health, safety and the environment associated with the identified hazards;

results of calculations, analyses, tests and examinations performed to confirm that:

Safety Outcomes will be, or have been, met; and

Environmental Outcomes will be, or have been, met; and

identified controls and follow-on actions to be used in order to achieve Safety Outcomes and Environmental Outcomes.

The Commonwealth uses the HAR to:

understand the hazards and associated risks to health, safety and the environment associated with the Materiel System;

evaluate the Contractor’s proposed controls for the identified hazards and risks;

assist with evaluating whether:

Safety Outcomes will be, or have been, met; and

Environmental Outcomes will be, or have been, met; and

determine any follow-up actions that need to be undertaken by the Commonwealth in order to achieve Safety Outcomes and Environmental Outcomes.

1. INTER-RELATIONSHIPS

The HAR is subordinate to the following data items, where these data items are required under the Contract:

Systems Engineering Management Plan (SEMP);

System Safety Program Plan (SSPP);

Contractor Engineering Management Plan (CEMP); and

In-Service Materiel Safety Plan (IMSP).

The HAR inter-relates with the following data items, where these data items are required under the Contract:

Project Management Plan (PMP);

Hazard Log (HL);

Safety Case Report (SCR);

System Specification (SS);

Support System Specification (SSSPEC);

Design Documentation; and

Failure Mode, Effects and Criticality Analysis Report (FMECAR).

1. APPLICABLE DOCUMENTS

The following documents form a part of this DID to the extent specified herein:

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| 1. ARPANSA Radiation Protection Series S-1 | 1. *Standards for Limiting Exposure to Radiofrequency Fields – 100 kHz to 300 GHz* *(2021)* |
| 1. ARPANSA Radiation Protection Series S-1 | 1. *Advisory Note: Compliance of mobile or portable transmitting equipment (100 kHz to 300 GHz) (2021)* |

1. PREPARATION INSTRUCTIONS
   1. Generic Format and Content

The data item shall comply with the general format, content and preparation instructions contained in the CDRL clause entitled ‘General Requirements for Data Items’.

The data item shall include a traceability matrix that defines how each specific content requirement, as contained in this DID, is addressed by sections within the data item.

When the Contract has specified delivery of another data item that contains aspects of the required information, the data item shall summarise these aspects and refer to the other data item.

* 1. Specific Content
     1. Summary Results

The HAR shall include a summary of the results of the hazard analyses, including:

**System/Element Description:** A summary description of the physical and functional characteristics of the system, subsystems or other elements to which the analysis applies. The description shall identify and describe the major elements considered during the analysis and identify the boundaries associated with the elements and to the analysis. Reference to more detailed descriptions, including specifications and design documentation, is included where such documentation is available.

**Hazard analysis methods and techniques:** A description of each method and technique used to conduct the hazard analysis, including the assumptions made, the qualitative and quantitative data used, and traceability to the source data.

**Hazard Analysis Results Summary:** A summary of the significant hazard analysis results including a conclusion about the level of risk identified and that expected to remain after the application of the identified controls and recommendations.

* + 1. Hazard Analysis Results

The data item shall contain the results from the hazard analyses applicable to the type of HAR required, as described by options 1 to 8 below, and in accordance with the Approved SSPP or Approved IMSP, as applicable.

Where a HL is required under the Contract and the HL is concurrently accessible to the Commonwealth, then the delivered HAR should minimise duplication and refer to the applicable update / data release of the HL to supplement and form part of the HAR.

* + 1. Option 1 – Preliminary Hazard Analysis Report

When the HAR is to include a Preliminary Hazard Analysis Report (PHAR), the hazard analysis results within the PHAR shall include:

the identification and description of each hazard and its associated risks;

the severity category, probability of occurrence, and initial Hazard Risk Index (HRI) assigned to each of the hazard’s associated risks; and

a description of the potential risk mitigation measures.

* + 1. Option 2 – System Hazard Analysis Report

When the HAR is to include a System Hazard Analysis Report (SHAR), the hazard analysis results within the SHAR shall, in respect of subsystems and interrelationships, include:

Verification of system compliance with the requirement to achieve Safety Outcomes;

previously unidentified hazards associated with the design and the analysis of associated risks;

recommended actions to eliminate the previously unidentified hazards and achieve Safety Outcomes;

a description of system and subsystem events and the results of associated failure analysis that could create hazards or result in increased risk;

the degradation of a subsystem or the total system;

design changes that affect subsystem hazards and associated risks;

the effects of human errors; and

the determination as to:

the contribution of system hardware and software events on potential mishaps;

whether related design requirements in the System Specification (SS) and Support System Specification (SSSPEC), as applicable, have been met; and

whether the methods for implementing design requirements and mitigating risk have introduced new hazards.

* + 1. Option 3 – Subsystem Hazard Analysis Report

When the HAR is to include a Subsystem Hazard Analysis Report (SSHAR), the hazard analysis results within the SSHAR shall include:

1. Verification of subsystem compliance with the requirement to achieve Safety Outcomes;

previously unidentified hazards and the analysis of the associated risks; and

the determination as to:

the contribution of subsystem hardware and software events on potential mishaps;

whether related design requirements in the System Specification (SS) and Support System Specification (SSSPEC), as applicable, have been met; and

whether the methods for implementing design requirements and mitigating risk have introduced new hazards; and

recommended actions to eliminate the previously unidentified hazards and achieve Safety Outcomes.

* + 1. Option 4 – Operating and Support Hazard Analysis Report

When the HAR is to include an Operating and Support Hazard Analysis Report (O&SHAR), the hazard analysis results within the O&SHAR shall include:

details of operating and support activities involving known hazards;

required changes to functional and design requirements for system hardware, software and Support Resources, needed to achieve Safety Outcomes;

required features, devices, and equipment needed to achieve Safety Outcomes;

requirements for Personal Protective Equipment (PPE), including details of its limitations with regards to minimising health and safety risks;

requirements for warnings, cautions, and special emergency procedures within Technical Data;

requirements for packaging, handling, storage, and transportation to achieve Safety Outcomes;

requirements for the packaging, handling, storage, transportation, and disposal of Hazardous Chemicals;

Training requirements associated with the reduction of risks;

the effects of non-developmental items with other system components or subsystems;

potentially hazardous system modes under operator control; and

where applicable, details of existing comparable systems that provide background information relevant to operating and support hazard analysis.

* + 1. Option 5 – Health Hazard Assessment

When the HAR is to include a Health Hazard Analysis Report (HHAR), the hazard analysis results within the HHAR shall include:

hazard identification and description, including the exposure pathway to persons (eg, inhalation, absorption) and exposure characterisation (eg, rate of exposure);

severity classification, probability of occurrence and the resulting HRI for each associated risk; and

recommended actions for achieving Safety Outcomes including, where a hazard cannot be eliminated, the risk level(s) expected to be achieved through mitigation.

In addition to the requirements of clause 6.2.7.1, if the hazard involves a Hazardous Chemical, the hazard analysis results shall include, for the Hazardous Chemical:

a cross-reference to the Safety Data Sheet (SDS), which shall be prepared in accordance with the requirements of DID-PM-HSE-SDS and delivered to the Commonwealth as supporting information to the HAR;

characteristics, including the quantity and hazard class;

a description of how it is used in each process or system component;

an estimated rate of use within each process or component for the subsystem, system, and the program-wide impact; and

the recommended disposition including, where applicable, possible substitution with less harmful alternatives.

In addition to the requirements of clause 6.2.7.1, if the hazard involves ergonomic factors, the hazard analysis results shall include:

a description, including all work performance criteria such as:

physical properties of all system components that personnel will manually handle or wear, or that will support personnel body weight;

a task analysis that lists the physical and cognitive actions that personnel will perform during typical operations and routine maintenance; and

exposures to mechanical stress encountered while performing work tasks;

characteristics in the design of the system or work processes that could degrade performance or increase the likelihood of erroneous actions that may result in mishaps; and

requirements to operate and maintain the system from the sum of the physical and cognitive demands imposed on personnel and recommended strategies to reduce these demands through equipment or job redesign when considered necessary.

In addition to the requirements of clause 6.2.7.1, if the hazard involves environmental factors, the hazard analysis results shall include:

a description of anticipated whole body movement, including whole body vibration, vehicle shock, and motions that are likely to result in musculoskeletal disorders, disorientation, or motion sickness;

a description and quantification of the potential for blast overpressure and other sudden barotrauma and the estimated pressure changes, time and rate of onset, and frequency of occurrence;

the identity and categorization of the main noise and vibration sources in the new or modified system(s);

calculated estimates for noise, blast, and vibration levels and the identification of potential alternative processes and equipment that could minimise the adverse impacts;

a description of the anticipated effect of protective equipment and engineering changes, if required, for mitigating personnel exposures to noise and vibration; and

a description of the limitations of the protective equipment and the burden imposed with regard to weight, comfort, visibility, and the range of the population that would be accommodated.

In addition to the requirements of clause 6.2.7.1, where the hazard involves ionising and/or non-ionising radiation, the hazard analysis results shall include:

the physical characteristics of radiation hazards and the physiological processes by which the hazard can affect or harm people as well as the criteria for assessing the resulting risk;

an assessment of the RF exposure to personnel against the mandatory limits set in the ARPANSA Radiation Protection Series S-1, *Standard for Limiting Exposure to Radiofrequency Fields – 100 kHz to 300 GHz (2021)*; and

where the RF device is designed to be used close to the human body, an assessment of the specific absorption rate against the criteria in ARPANSA Radiation Protection Series S-1, *Advisory Note:* *Compliance of mobile or portable transmitting equipment (100 kHz To 300 GHz)*.

* + 1. Option 6 – Functional Hazard Analysis Report

When the HAR is to include a Functional Hazard Analysis Report (FHAR), the hazard analysis results included within the FHAR shall include:

a decomposition of the system and its related subsystems to the major component level;

a functional description of each subsystem and component identified;

a functional description of interfaces between subsystems and components;

identified hazards associated with the loss of function, degraded function or a malfunction;

an assessment of the risk associated with each identified failure of a function, subsystem, or component, including severity classification, probability of occurrence and resulting HRI for each risk;

an assessment of whether the functions identified are to be implemented in the design’s hardware, software, or human control interfaces;

an assessment of software control category and the assigned software criticality index for each safety-significant software function; and

a list of requirements and constraints, to be included in the SS and/or SSSPEC, as applicable, that when successfully implemented will achieve Safety Outcomes.

* + 1. Option 7 – System-of-Systems Hazard Analysis Report

When the HAR is to include a System-of-Systems Hazard Analysis Report (SOSHAR), the hazard analysis results within the SOSHAR shall include the:

identified unique system-of-systems hazards and traceability of these hazards to architecture locations, interfaces, data, and the stakeholder(s) associated with each hazard;

risk assessment(s) for identified unique system-of-systems hazard(s), and recommend control measures for achieving Safety Outcomes; and

Verification and Validation of results for the effectiveness of recommended risk-mitigation measures.

* + 1. Option 8 – Environmental Hazard Analysis Report

When the HAR is to include an Environmental Hazard Analysis Report (EHAR), the hazard analysis results within the EHAR shall include:

hazard identification and description, as applicable to the system’s life-cycle when considering:

the use of Problematic Substances and Problematic Sources and the generation of environmental contaminants during normal system operations and support functions;

demilitarisation and disposal;

public health;

impact on sea, air and land resources and related ecosystems; and

inadvertent release of Problematic Substances or other contaminants (eg, via mishap);

severity classification, probability of occurrence and the resulting HRI for each associated risk, including any change to severity class descriptions if applicable;

reference to related documentation (eg, environmental impact statements); and

recommended actions for achieving Environmental Outcomes including, where a hazard to the Environment cannot be eliminated, the risk level(s) expected to be achieved through mitigation.

In addition to the requirements of clause 6.2.10.1, if the hazard involves a Problematic Substance, pollutant (including noise) or other contaminant, the hazard analysis results shall include, where applicable:

a cross-reference to the SDS, which shall be prepared in accordance with the requirements of DID-PM-HSE-SDS and delivered to the Commonwealth as supporting information to the HAR;

characteristics, including the relevant quantities and hazard class;

a description of how it is used or generated in each process or system component;

an estimated rate of use within each process or component for the subsystem, system, and the program-wide impact; and

the recommended disposition including, where applicable, possible substitution with less harmful alternatives.