SAFETY SERVICES ORGANISATION

HAZ ID AND HAZ OP

HAZARD IDENTIFICATION – AN INTRODUCTION

SAM CHURCHYARD – SENIOR CONSULTANT – SSO PE – JUNE 2023

CONTENTS

- Relevant definitions
- Useful documentation and resources
- When should Haz ID occur?
- Preliminary vs “Full” Haz ID
- Scoping the Haz ID
- OME- MTDS
- Conducting Haz ID – key points
- Analysis
- Next steps

[1,2]

RELEVANT DEFINITIONS

As defined in Def Stan 00-56:

- **Harm**: "Adverse impact on people, including fatality, physical or physiological injury, or short- or long-term damage to health."
- **Hazard**: "Potential to cause harm, e.g. A physical situation or state of a system, often following from some initiating event that may lead to an accident."
- **Hazard Identification (Haz ID)**: "The process of identifying and listing the hazards and accidents associated with a system."

Finally:

- **Hazard and Operability Study (Haz Op)**: Is one of several techniques that can used to identify hazards.

[1,2,23]

RELEVANT DEFINITIONS

Hazards can generally be split into one of two groups:

- **Physical Hazards (sometimes referred to as Inherent Hazards)**: Hazards based on *"what the system is"*

- **Functional Hazards**: Hazards based on *"what the system does"*

It is important to identify all the credible physical and functional hazards of a system.

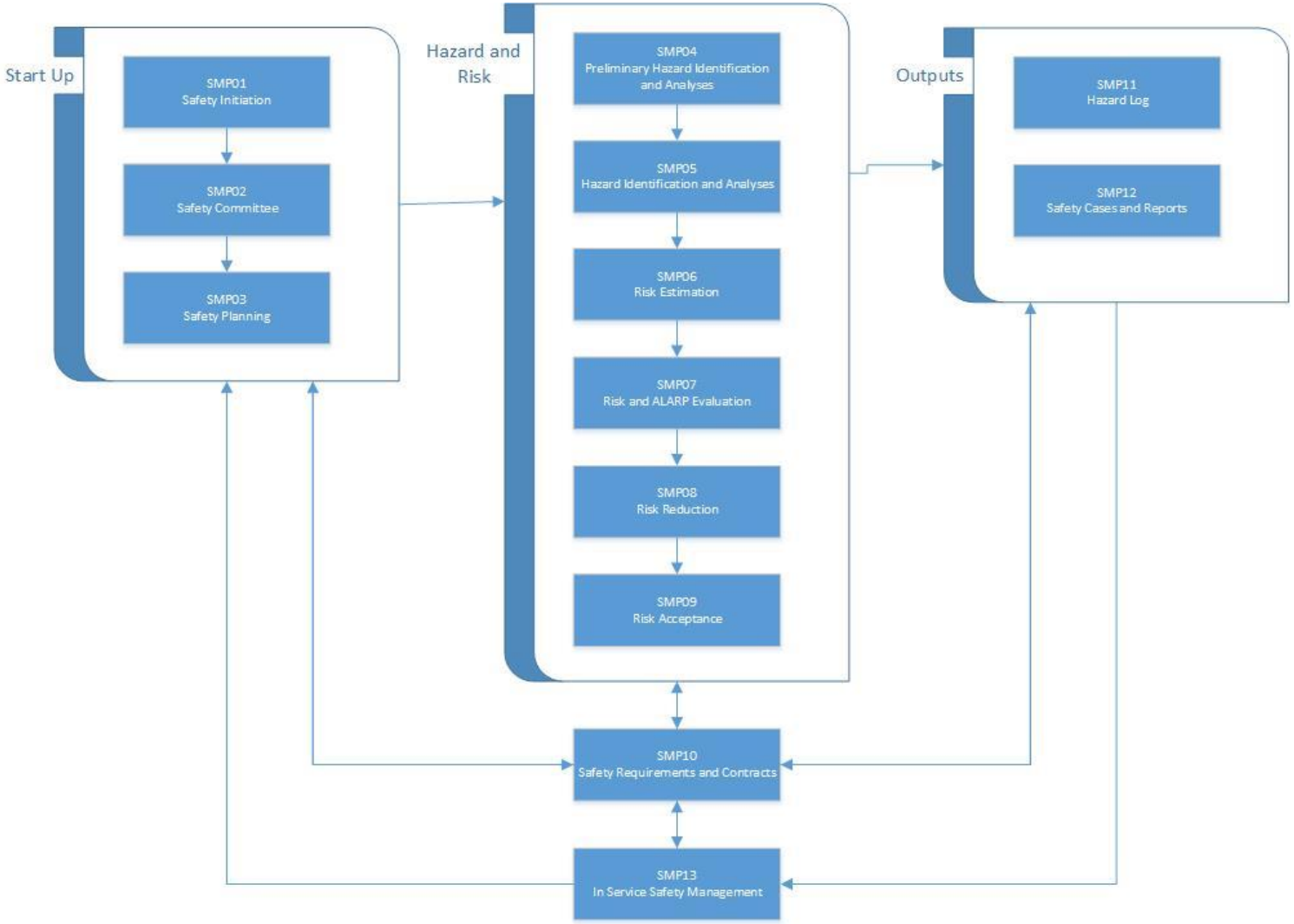
[1,2,24]

USEFUL DOCUMENTS & RESOURCES

Useful documentation and resources:

- **ASEMS**: The MOD's Acquisition Safety and Environmental Management System (ASEMS). A useful resource that details the policy and contains guidance on all stages of the Project Oriented Safety Management System (POSMS).
  - Access: search "ASEMS Online".
- **MOD Safety White Booklet**: An Introduction to System Safety Management in the MOD, Issue 4 Parts 1 and 2.
  - Access: search "An introduction to system safety management in the MOD (White booklet)" on www.gov.uk
- **Def Stan 00-56**: The standard for "Safety Management Requirements for Defence Systems".
  - Access: via StanMIS (search "stanmis" and create an account).
- **AOP-15**: AOP-15 Ed3 (STANAG 4297) "Guidance on the Assessment of the Safety and Suitability for Service of Non-Nuclear Munitions for NATO Armed Forces".
  - Access: via StanMIS.
- **Def Stan 00-35:** Environmental Handbook for Defence Materials. In particular Part 4 – Natural Environments and Part 5 – Induced Mechanical Environments.
  - Access: Via StanMIS.

WHEN SHOULD HAZ ID OCCUR?



WHEN SHOULD HAZ ID OCCUR?

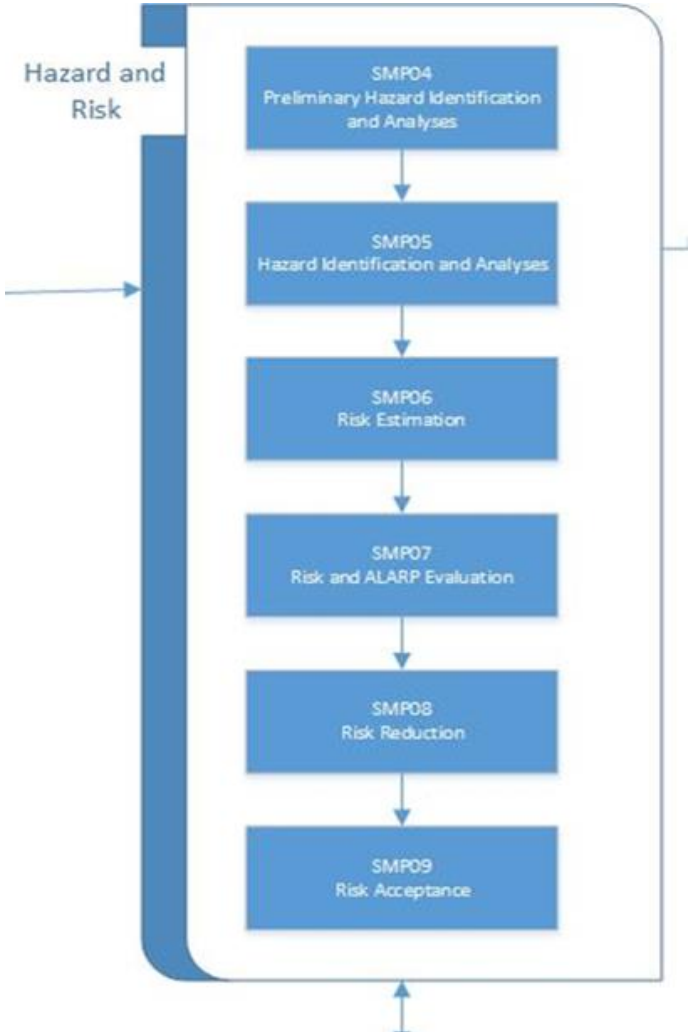
As you would expect the project will typically begin with the safety initiation.

Once this has been done the next logical step is the Preliminary Hazard Identification Phase.

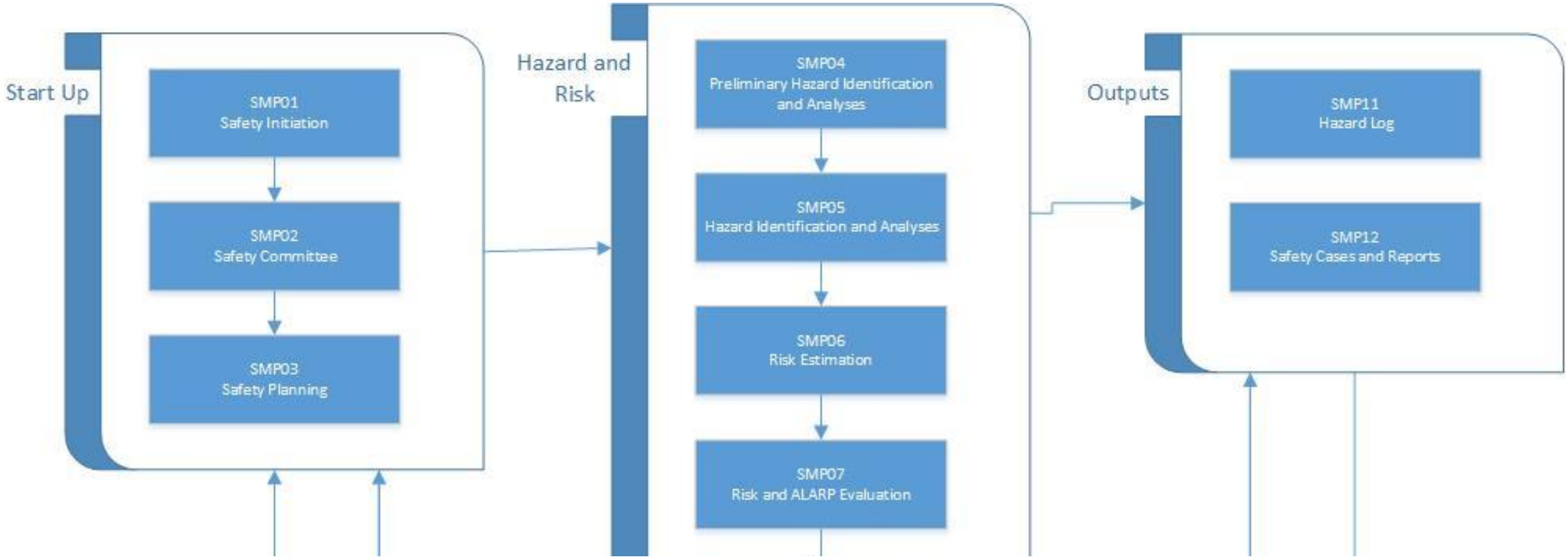
Following this, a more detailed and fuller Hazard Identification can be completed.

Utilizing the Haz ID, the Risk Assessment phase can be conducted next.

All this information is then gathered to produce the key outputs: Safety Case, Safety Case Report and the Hazard Log.



WHEN SHOULD HAZ ID OCCUR?



PRELIMINARY VS "FULL" HAZ ID

Looking more closely at the Preliminary and "Full" Hazard Identification Stages:

- **Preliminary Hazard Identification (PHI)**: The objective of the PHI is to identify, as early as possible, the main hazards and accidents that may arise during the life of the system.

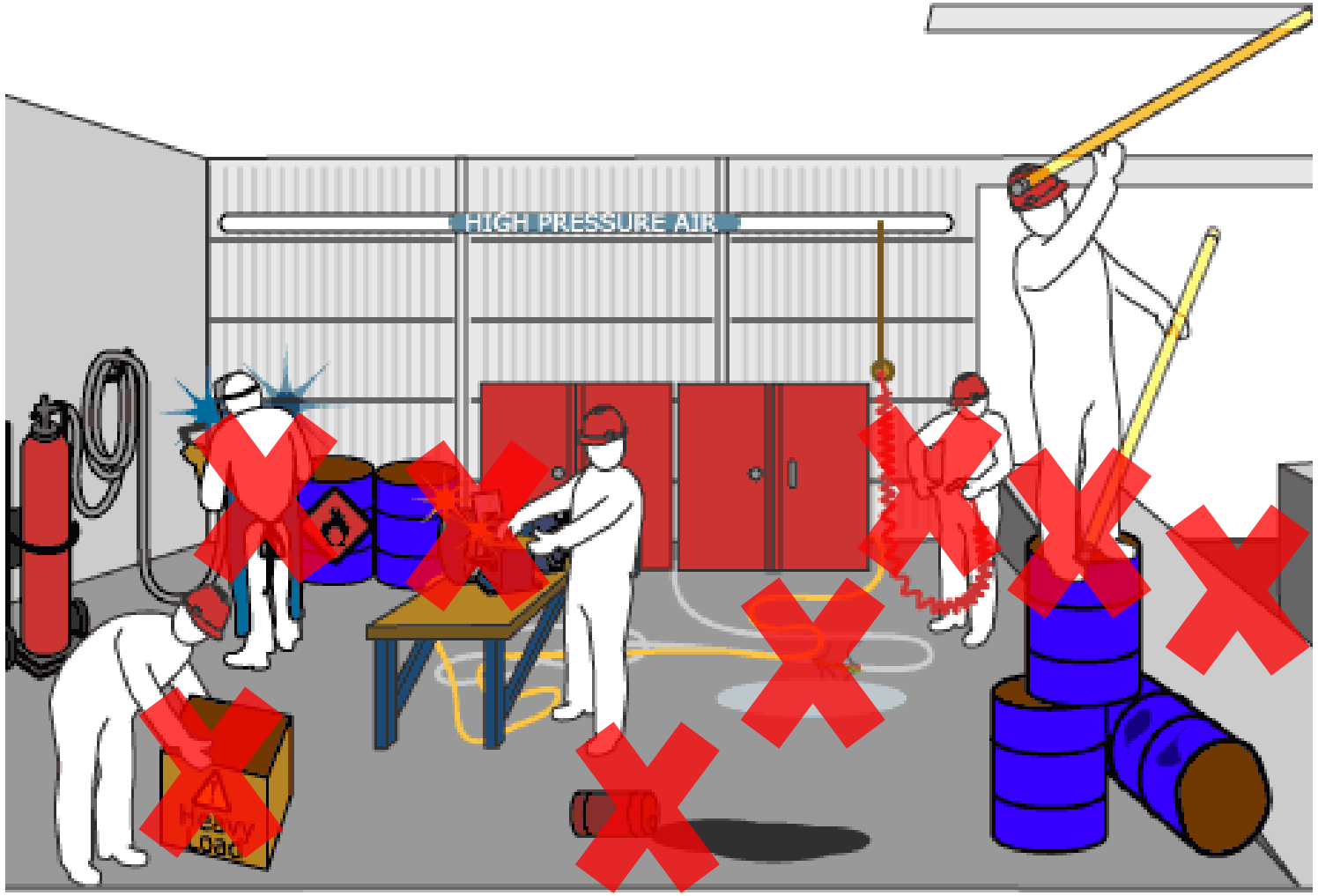
- **Hazard Identification (Haz ID)**: The objective of Haz ID is to identify in detail all credible hazards and accidents that may arise during the life of the system so that the associated risks can be managed.

As you would expect PHI is conducted earlier in the project and is less detailed.

In terms of techniques, the two are similar.

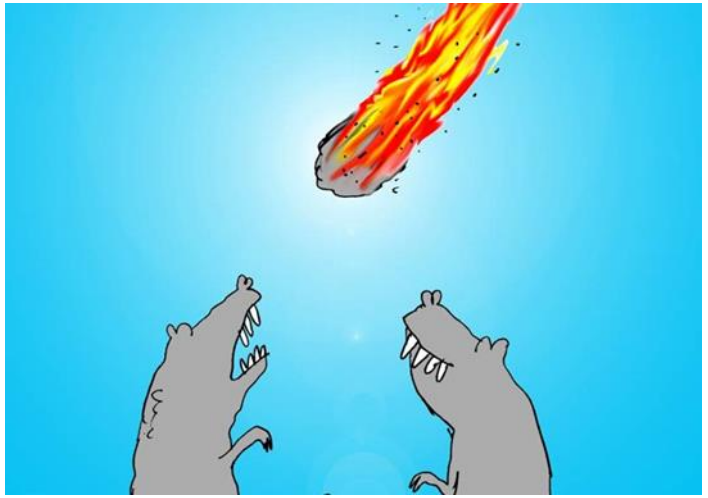
HAZ ID EXERCISE – 10 MINS

HAZ ID EXERCISE – 10 MINS



SCOPING THE HAZ ID

It is crucial to ensure the Haz ID covers all ‘credible’ hazards and so it is important to scope the Haz ID properly.



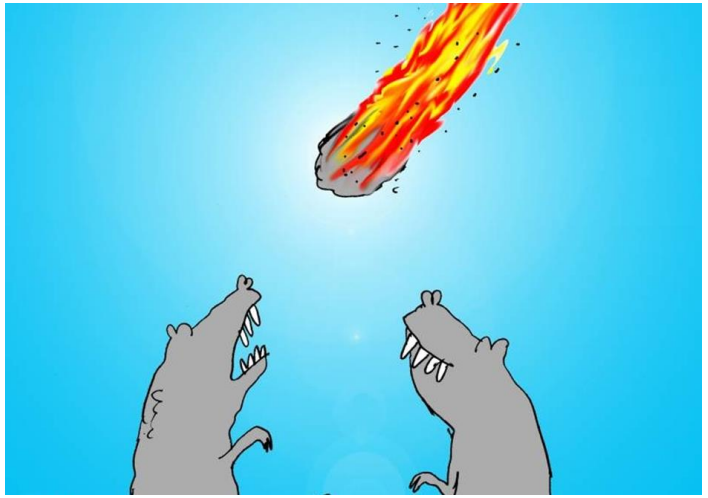
- You do not need cover every possible worst eventuality; but it is vital that all credible hazards are identified, and none are missed.
- If there is any doubt however; always include the hazard.
- Proper scoping is essential.

[5,6]

SCOPING THE HAZ ID

Points to consider when scoping:

- Exactly what equipment or system is being covered.
- Other stakeholder Haz IDs.
- Sphere of influence.
- The Concept of Use (CONUSE) and/or the Concept of Operation (CONOP).
- Predicted Service Life (PSL) of the equipment or system – particularly if OME.
- Who will be using the equipment or system, how can they be subjected to or even cause hazards?



[3,5,6]

OME - MTDS

MTDS = Manufacture to Target or Disposal Sequence.

It aims to describe the item's entire life from cradle to grave and is often represented pictorially as a flow chart.

A good place to start is with the "QUESTIONNAIRE TO IDENTIFY THE ENVIRONMENT LIFE CYCLE PROFILE OF A MUNITION IN SERVICE" within AOP-15

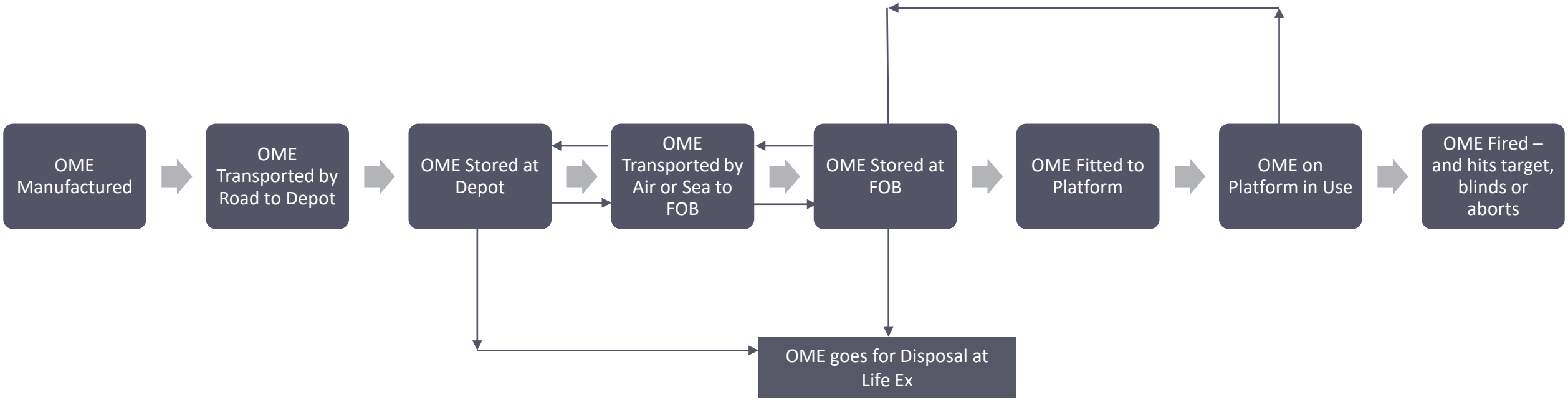
[7,8,9]

OME - MTDS

Section 2 - Applicable to all Stores

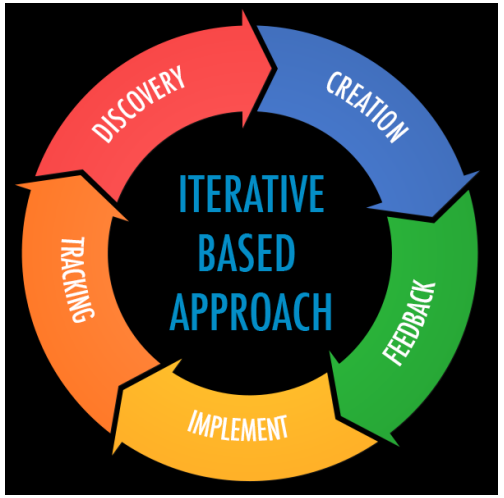
No.	Question	Answer	Source Reference (e.g. Staff Requirement, Design Spec., etc. as appropriate)
(a)	(b)	(c)	(d)
2.1	**Application** Which of the Services are likely to use this munition? State from which type of weapon platform (land, sea, or air) the weapon will be operated.		
2.2	If the munition is to have detachable explosive components, are these to be stored separately? Give details. (If answer is "yes", questions 2.4-2.16 should be answered for each item.) When and where will these components be assembled to constitute the complete store?		
2.3	Is there to be a practice version which contains explosives? Is the practice version to be stored separately? (If the answer is "yes", questions 2.4-2.16 should also be answered for the practice version.)		
2.4	**Life Information** What is the minimum acceptable service life of the munition? The required operational and storage lives should be given where specified. What is the ultimate planned life for this store? (intended phase-out date)		
2.5	Can the minimum acceptable service life be achieved by replacing short-lived components? In order to achieve the minimum acceptable service life of the munition, must components having an inadequate shelf-life be replaced?		
2.6	Will the shelf-lives of all replaceable components either be approximately the same or be multiples of the shorter shelf-life?		
2.7	If there is likely to be a requirement to extend the life beyond the minimum value given in 2.4, is it acceptable to do it by using additional protection either to the package or the store itself?		
2.8	At what stage in the life of the munition will it be necessary to know whether its life can be extended?		
2.9	What will be done with munitions that exceed their service life?		
2.10	What is the proposed maintenance cycle for the munition in service?		
2.11	**Climatic and Storage Conditions** In which climatic categories (defined in STANAG 4370) or geographical areas will the munition be: a. Transported? b. Stored? c. Maintained? d. Operated?		

OME - MTDS


OME Manufactured
OME Transported by Road to Depot
OME Stored at Depot
OME Transported by Air or Sea to FOB
OME Stored at FOB
OME Fitted to Platform
OME on Platform in Use
OME Fired – and hits target, blinds or aborts
OME goes for Disposal at Life Ex

CONDUCTING HAZ ID – GENERAL POINTS

- The ID must be structured and documented.
- "Different approaches and techniques are more suited to different systems and no single approach is likely to be sufficient on its own." – ASEMS Online
- Most effective when done in diverse groups including experts, users and maintainers. Competence of the team is key.
- Will usually need to be revisited to ensure it remains current. Ideally it should be an iterative process.



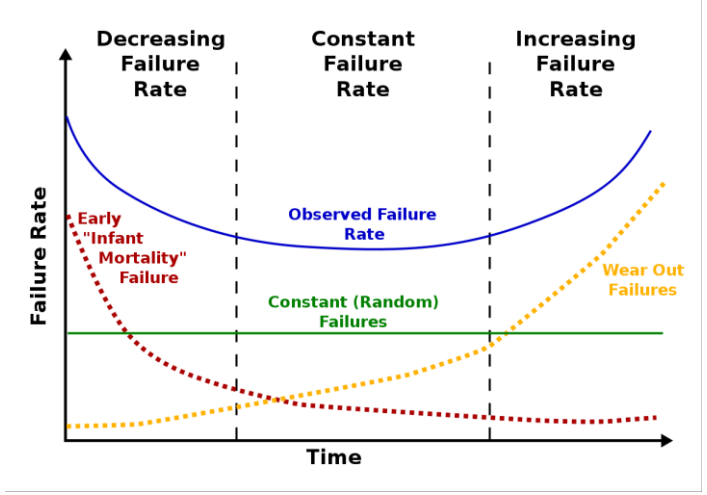
You can never be sure you have identified all hazards, however you must be highly confident that they you done all you can.

[3,10,11]

CONDUCTING HAZ ID – GENERAL POINTS

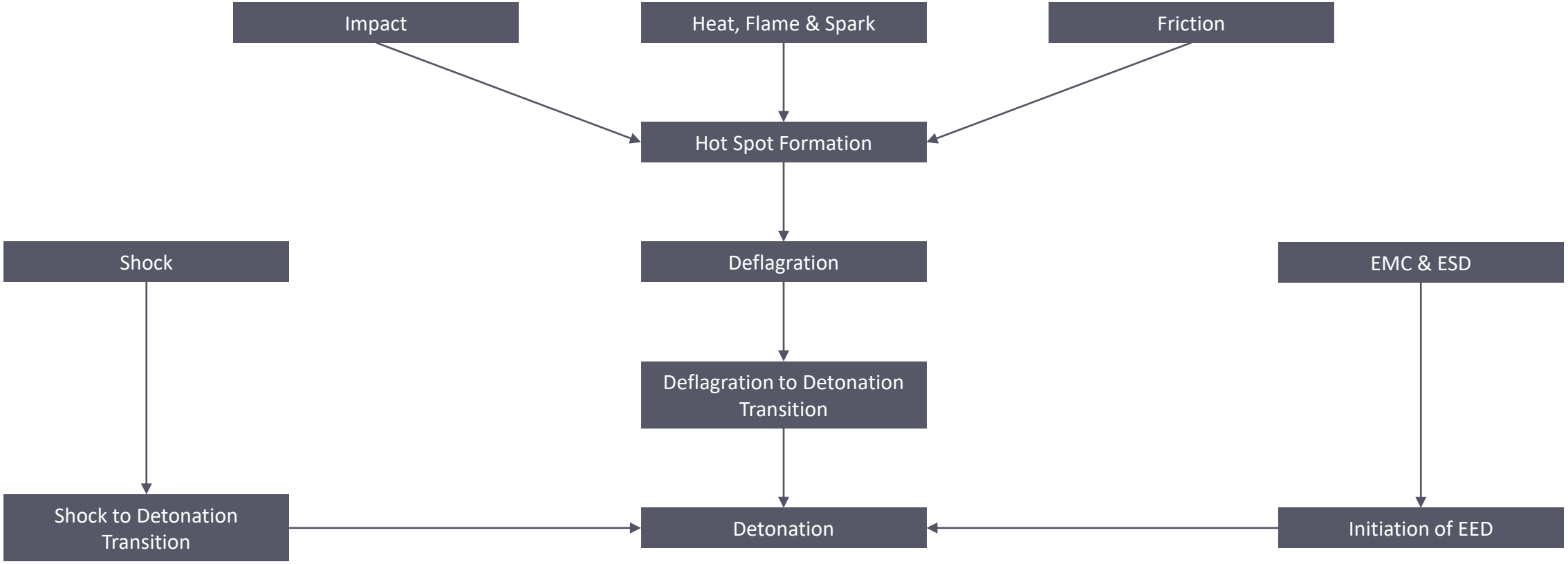
It is not enough to consider hazards that arise from 'normal' use. The following also need to be considered:

- Systematic and random failures
- Credible failures arising from normal and abnormal use in all operational scenarios
- Human error
- Procedural, managerial and cultural activities
- Common cause and common mode failures
- Interactions between systems, sub-systems or components
- The defined operating environment
- Storage, transportation, disposal and other such activities



[3,12,13]

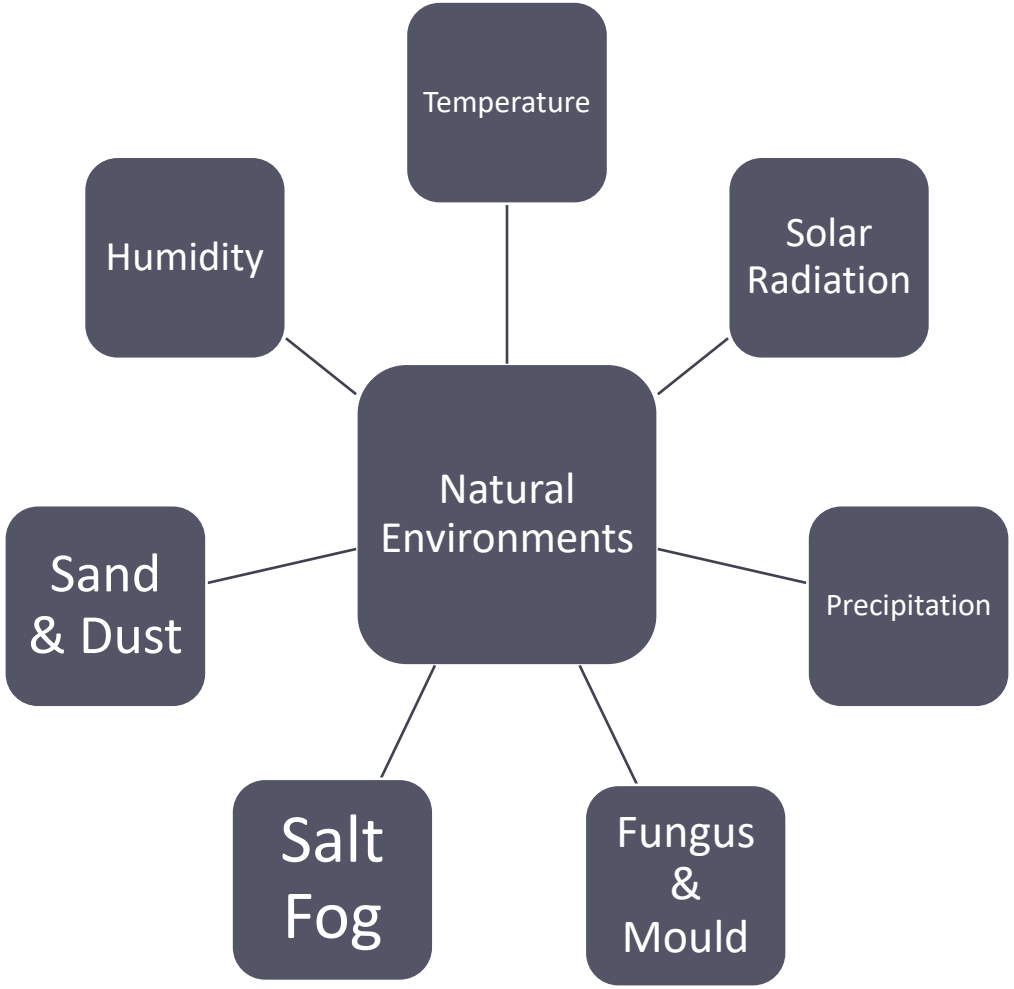
ANALYSIS – DIRECT IGNITION



ANALYSIS - NATURAL

Consider:

- Packaged or unpackaged?
- What areas of the world is the equipment required to operate in?
- What is the desired shelf life of the item?
- What can the effect of each of these be on the particular munition?
  - E.g. high temperatures can increase ageing rate and can lead to autoignition in NC
- How will the munition be stored and transported?

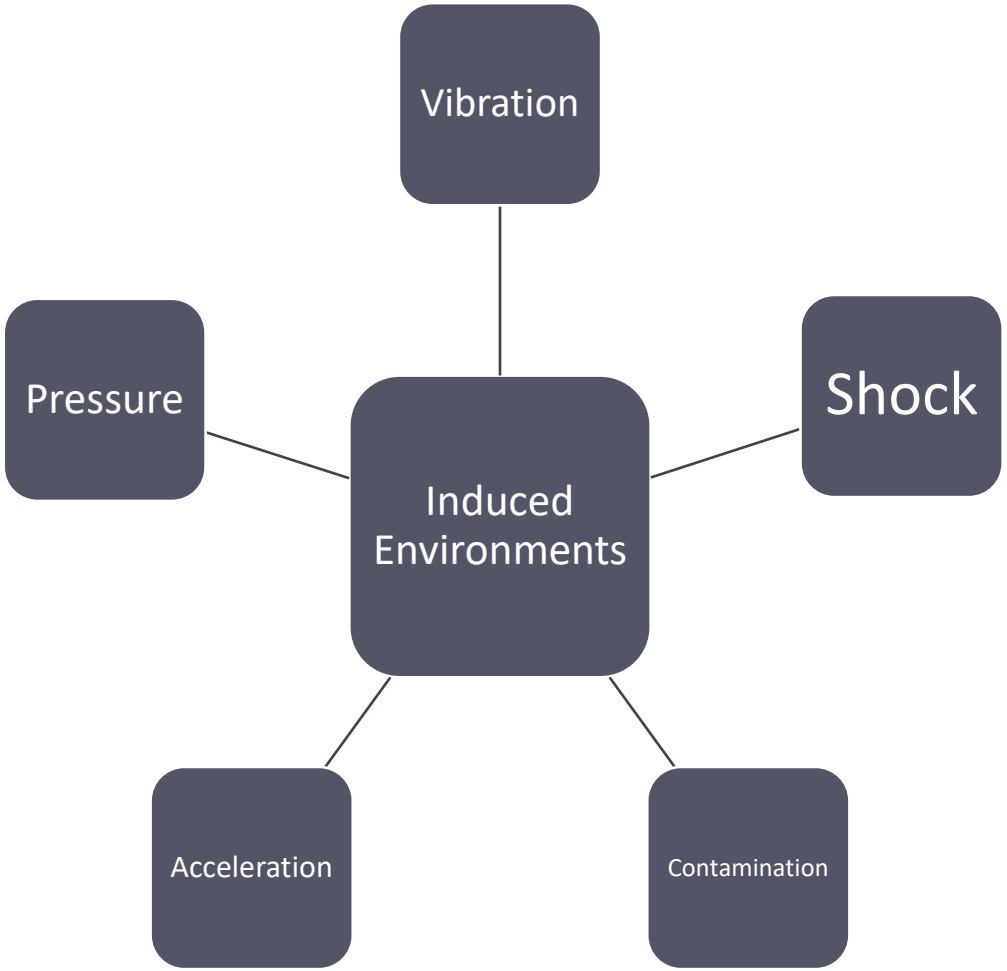


[7,14]

ANALYSIS - INDUCED

Consider:

- Packaged or unpackaged?
- What effect will each of these have on the particular munition?
    - E.g. shock can detonate the OME directly, or can cause rocket motors to burn more violently when ignited.
- How will the munition be stored and transported? Land, Air or Sea?
- What is the firing platform – Land, Air or Sea?

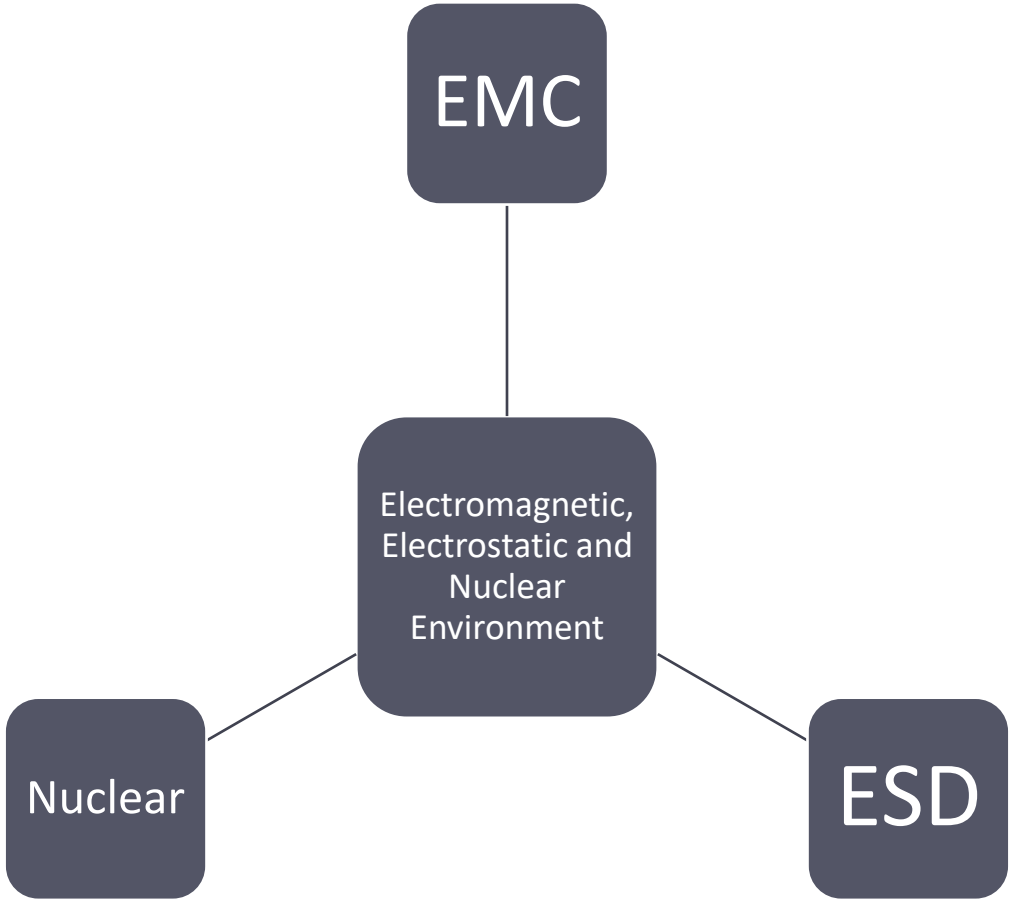


[7,15,16,17]

ANALYSIS - ELECTRONIC

Consider:

- Packaged or unpackaged?
- Is it fitted with shorts/shunts?
- What can affect of each of these be on the particular munition? Usually concerned with EEDs.
- What is the No Fire Threshold?
- How will the munition be stored, transported and fired? Land, Air or Sea? Some may be more EMC harsh than others.
- How controlled is the environment? Usually can control ESD to an extent in storehouses.



[7,18]

ANALYSIS – IM THREATS

Stimuli / Responses		Fast Heating	Slow Heating	Bullet Impact	Fragment Impact	Sympathetic Reaction	Shaped Charge Attack
None	-						-
Burning	V	O	O	X*	X*	X*	-
Deflagration	IV			X			-
Explosion	III	X	X			O*	-
Partial Detonation	II						-
Detonation	I			O	X O	X O	-

X = Rocket Motor, O = Warhead

= the pass criteria

*Denotes test was conducted on the weapon within its logistics container

ANALYSIS – LARGER SYSTEM

As well as considering the hazards specific to the munition or explosive, you also need to consider wider system hazards. For examples the following hazards are considered for Turreted Armoured Vehicles:

- Uncommanded firing caused by the fire control systems
- Uncommanded turret movement
- Self Damage; either by firing or barrel movement
- Misdirected firing
- Noise of firing
- Loss of situational awareness and vision systems

[20,21]

NEXT STEPS…

In the next lecture we will go on to discuss various techniques that can be used to undertake Haz ID. We will discuss how they work and the pros and cons of each.

The final lecture will focus specifically on Hazard and Operability Studies, one particular technique. We will go through this in more detail.

REFERENCES

1. https://www.kpcmhealthandsafetysigns.com/international-hazard-warning-symbol
2. https://www.repubblica.it/economia/2017/04/07/news/la_ue_cambia_i_simbol_sulle_etichette_rischio_discarica_per_molti_prodotti-162336907/
3. ASEMS Online POSMS - https://www.asems.mod.uk/guidance/posms
4. https://www.rooferscoffeeshop.com/post/workplace-inspections-safety-talk
5. https://www.cartoonstock.com/directory/m/meteorite.asp
6. https://www.localseoguide.com/geotargeting-location-by-ip-address-seo-death/
7. AOP-15 Ed3 (STANAG 4297) "Guidance on the Assessment of the Safety and Suitability for Service of Non-Nuclear Munitions for NATO Armed Forces"
8. https://www.thetruthaboutguns.com/gun-dealer-discounts-disappearing-rationing-begins/
9. https://medium.com/homeland-security/ied-awareness-the-blast-zone-be8efd4c837c
10. https://www.derbyshirelmc.org.uk/lmcmeetings
11. https://blog.doist.com/analysis-paralysis-productivity/
12. https://en.wikipedia.org/wiki/Bathtub_curve#/media/File:Bathtub_curve.svg
13. https://uxdesign.cc/human-error-an-important-ingredient-in-great-designs-5cd1c278ba7f?gi=f70bd2328920
14. http://s730279079.websitehome.co.uk/environmental-analysis/
15. https://commons.wikimedia.org/wiki/File:Military_trucks_laden_with_ammunition_convoy.jpg
16. https://www.ainonline.com/aviation-news/defense/2017-06-20/typhoon-gears-brimstone-firing
17. https://www.adsadvance.co.uk/formidable-shield-2017-successfully-concluded.html
18. https://military.wikia.org/wiki/SAMPSON
19. Improving the safety of the HeavenFire Missile: A Technical Guidance Document - Sam Churchyard Cranfield University
20. https://www.gov.uk/government/news/ajax-vehicle-brings-merthyr-tydfil-factory-back-to-life
21. https://worldofjaymz.fandom.com/wiki/Challenger_II_MBT
22. http://little-bitsofjoy.blogspot.com/2012/08/next-steps-towards-kimberlie.html
23. Def Stan 00-56: The standard for "Safety Management Requirements for Defence Systems".
24. MOD Safety White Booklet: An Introduction to System Safety Management in the MOD Issue 4 Parts 1 and 2.

THANK YOU FOR LISTENING

ANY QUESTIONS?

SAFETY SERVICES ORGANISATION