



SAFETY SERVICES ORGANISATION



Session 4.4

Electrical, RF & MHE Requirements

**IATG Foundation Course:
Ammunition Storage & Operations Module**



Lesson Objectives

By the end of this lesson, you should be able to:

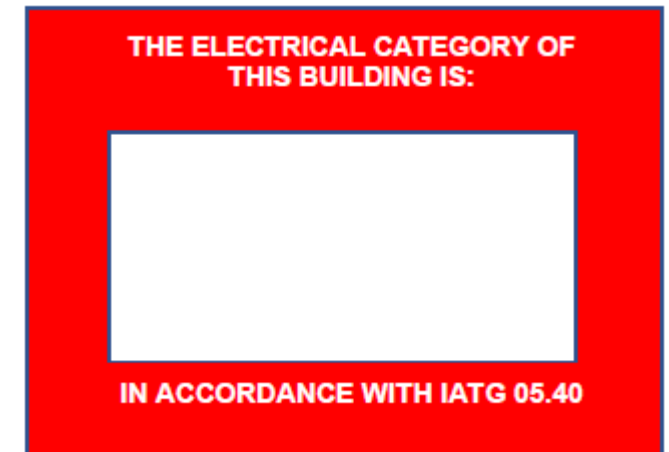
- Identify some of the main hazards that are difficult to eliminate
- Discuss the infrastructure and procedural measures that can be implemented to mitigate the risks

Introduction

- Electricity is an essential requirement in ammunition facilities, but also presents multiple hazards
- Poorly maintained electrical systems can cause fires, in addition to the direct hazards presented by electricity to ammunition and explosives
- Electrostatic, Electromagnetic (EM) and Radio-Frequency (RF) also provide stimuli that can cause explosive materials to function, leading to fire or explosion
- For these reasons, controls must be implemented to reduce the hazards from electricity and other stimuli to a tolerable level

Electrical

- The electrical supply in explosives areas must comply with higher safety standards than in domestic situations
- Within an explosives area, some buildings and facilities require higher electrical standards than others
- Meeting these standards is expensive, so it is important to match the electrical category to the intended purpose of the PES



Electrical

- **Electrical standards for explosives facilities are divided into four categories:**
 - Category A – for PES in which explosive gas or vapour may be present
 - Category B – for PES in which an explosive dust atmosphere may be present
 - Category C – for PES which contain explosives, but are unlikely to give rise to explosive gas, vapour or dust in the atmosphere
 - Category D – this category is only applicable for facilities which may contain small quantities of explosives, excluding HD 1.1



Category A

- **Explosives buildings in which gases and vapours may be present.**

Category A Zones	Definition
Category A Zone 0	An area in which an explosive gas/vapour atmosphere is continuously present or is present for long periods.
Category A Zone 1	An area in which a flammable atmosphere is likely to occur during normal operation.
Category A Zone 2	An area in which a flammable atmosphere is not likely to occur in normal operation but, if one does occur, it will exist for a short time only.



Category B

- Processing and handling of explosives gives rise to an explosives dust atmosphere and/or hazard created by accumulation or settling

Category B Zones	Definition	Dust Tightness to EN 60528
Category B Zone 20	An area in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods, or frequently.	IP6X
Category B Zone 21	An area in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.	IP6X
Category B Zone 22	An area in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, it will persist for a short time only.	IP5X



Combination of Categories A and B

- An area with flammable vapour/gas and dust atmosphere must meet the requirements for both Category A and Category B

Category C

- **Explosives buildings in which explosives do not give rise to flammable vapour or explosive dust at normal storage temperature**

Category D

- **Buildings where authorised quantities of explosives are stored.**
- **Explosives are not exposed and should not give rise to flammable vapour or explosive dust.**

Fixed Electrical Equipment

- **Heating, Ventilation and Air Conditioning (HVAC)**
- **Light fittings**
- **CCTV, communications equipment and alarm systems**
- **Heat sealing equipment**

Portable Electrical Equipment

- **Items which emit RF radiation**
- **Mains-powered portable equipment**
- **Equipment containing batteries**
- **Environmental monitoring equipment**
- **Equipment for testing EEDs**
- **Personal medical equipment**



Computing equipment

- **Cathode Ray Tube (CRT) displays**
- **Printers, display screens and other peripherals**
- **Asset tracking devices**

Electrical

- Electrical systems must be inspected at regular intervals by a qualified and authorised person
- The results of the inspection must be recorded and any certificates retained
- If the electrical system fails any safety aspect, repairs must be carried out before any explosives are stored or processed in that PES
- Buildings should be certified as free from explosives before any major repair work is conducted

Electrostatic Discharge and Lightning

- **Static electricity to ammunition and explosives presents a particularly dangerous hazard while working with ammunition**
- **Electrostatic can be generated by friction in people's clothing, or by any other rubbing of surfaces together**
- **Where necessary, precautions should be included in normal work procedures, including:**
 - Wearing appropriate anti-static PPE
 - Checking individual static levels
 - Earthing of people (workers) and equipment



Electrostatic Discharge and Lightning

- **PES, in particular those used for processing ammunition, should have:**
 - Anti-static surfaces and floors
 - Anti-static bonding systems in place to reduce the likelihood of electrostatic discharge
- **For some tasks a higher level of protection is required and conducting surfaces and systems are needed**

Electrostatic Discharge and Lightning

- Lightning is an extreme form of electrostatic discharge
- Whilst statistically rare, a lightning strike on a building containing ammunition or explosives may be catastrophic
- Initiation of ammunition or explosives may be caused by fire and/or massive electrostatic discharge



Electrostatic Discharge and Lightning

- **An effective Lightning Protection System (LPS) requires:**
 - An external element to draw lightning away from the PES
 - Internal bonding systems and procedural precautions intended to prevent electrostatic sparks from “flashing across” from the PES structure to any ammunition contained within
- **LPS are to be inspected at intervals of 11 months by qualified and authorised personnel and the results of the tests and any certificates are to be recorded and retained for audit purposes**



Electrostatic Discharge and Lightning

- **In the event of lightning all personnel are to:**
 - Stop work
 - Promptly evacuate the explosives area
 - Prior to doing so, only essential, basic safety precautions are to be implemented if time allows. These include:
 - Returning any ammunition to its packaging and closing the package
 - Ensure there is 500mm gap between the ammunition and the walls
 - Close windows
 - Doors and vents
 - Switch off the electricity outside the building
 - Evacuate to a safe location



EM and RF Discharge

- **Many items of ammunition are themselves or contain within them, electrically initiated devices (EID)**
- **Although safety mechanisms are often used, accidental initiation may still occur if the required stimulus is received from an EM discharge or RF signal**
- **The main ammunition types susceptible to EM/RF, include:**
 - Electric detonators
 - Electronic fuzes
 - Firing circuits in guided weapons



EF and RF Discharge

- Communications systems widely utilize the RF spectrum and therefore radios and mobile/cell phones are classified as contraband
- The likelihood of an accidental RF discharge causing an item to function is reduced as distance between is increased

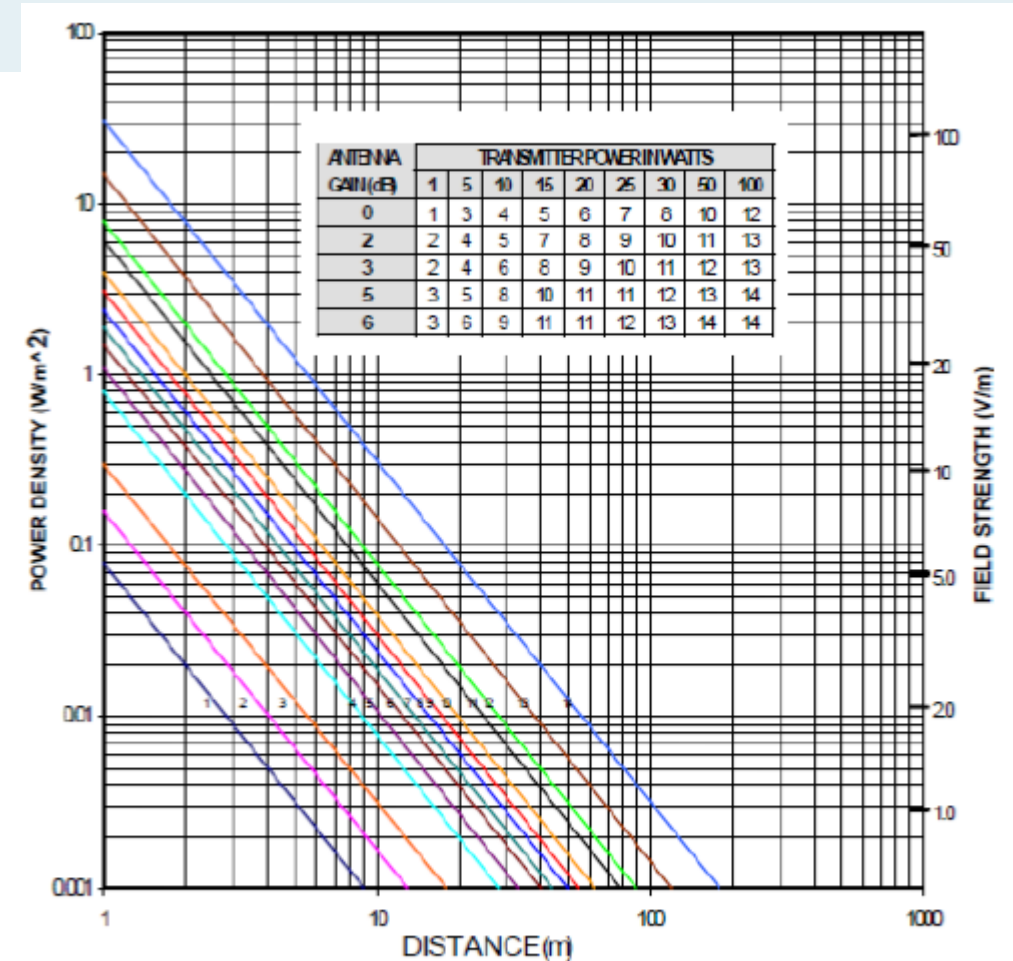


Figure C.2: RF power density hazard graph for frequencies from 60 to 500MHz



EM and RF Discharge

- **Historically all RF transmitters have been banned from explosives areas**
- **However, the national technical authority may permit their use subject to strict limitations**
- **Transmitters shall not be permitted in any building where an EID may be removed from its packaging and:**
 - Should not in any circumstances be used within 4m of any ammunition
 - Nor be allowed to touch any ammunition or its packaging



Vehicles and MHE

- **The types of vehicle that may be used in an explosives facility:**
 - MHE
 - Intra-dept transport
 - Cranes
 - Personnel transport
 - Logistics vehicles
- **Internal-combustion engines in an explosives facility present additional hazards within explosives facilities**



Vehicles and MHE

- Not all vehicles are permitted in all parts of an explosives area.
- Some are not permitted inside any PES
- While others may be permitted in an ESH, but not an APB
- Checks on whether or not the vehicle is authorised or not must be made by all levels of user and supervisor



Vehicles and MHE

- **As a general rule:**

- Electrically operated vehicles and MHE are preferred from a safety point of view
- Diesel powered vehicles may be used inside the explosives area, but not inside all PES
- Petrol vehicles are prohibited from all PES



Vehicles and MHE

- All vehicles used in a PES must be serviceable and well maintained
- Any vehicles that emit sparks shall immediately be switched off and any explosives removed from it
- Vehicles and MHE are to be refuelled at authorised points only, outside the explosives area
- They should not be filled to greater than the specified capacity
- No spare fuel is to be carried

Vehicles and MHE

- The batteries of electrically powered vehicles and MHE shall be maintained and charged only at authorised locations
- The maintenance and charging of some types of batteries can produce hydrogen gas, which is explosive, and therefore the process shall be viewed as dangerous
- After battery charging, the MHE should stand for a minimum period of 1 hour before entering an explosives area



Questions?

Lesson Objectives

You should now be able to:

- Describe the main stimuli that present hazards to ammunition and explosives
- Understand the principal requirements of a system to minimise the hazard caused by electricity
- Understand the electrostatic hazards, including lightning, and how these may be mitigated
- Understand the EM and RF hazards and how these may be mitigated
- Understand the hazards presented by vehicles and MHE and how these may be mitigated



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