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**Presentation Title:**

Radiation, Nuclear, Chemical Emergency Preparedness in Aviation

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# Outline

- Why Aviation is vulnerable
- Radiation/Nuclear emergencies in Aviation
- Radiation Inspection checklist
- Chemical Emergencies
- Key regulatory and coordination bodies
- Typical Emergency response steps
- Measures for Airports
- Staff Training Essentials
- Devices used

# Why Aviation is vulnerable

- **Baggage/cargo screening –** personnel operating and managing screening of passengers and cargo
- **Screening devices?**
- **Speed and altitude** – an aircraft can quickly move a radioactive cloud over large distances
- **Passenger density** – a single flight can exposure hundreds of people to radiation
- **Limited decontamination options** – in-flight cleaning is impractical, most mitigation relies on ground-based response

# Radiation/Nuclear Emergencies in Aviation

**Radiation can't be seen, heard or smelled, but exposure can be measured.**

Nuclear emergencies require establishment of functional mechanisms for detecting and responding to radiological and nuclear emergencies

- Radioactive sources e.g. x-ray scanners or gamma sealed sources, a medical isotope container when its damaged or leaks
- Nuclear weapon or dirty bomb threats – ( an aircraft is used to carry a nuclear weapon, a radiological dispersal device or a weapon is detonated on board (very rare but high impact)
- Transport accident involving radioactive material (e.g., isotope shipments)
- Nuclear propulsion incidents – experimental or military aircraft powered by nuclear reactors could suffer a reactor failure or release of coolant
- Fallout from a ground based nuclear event – an aircraft flying through the plum of a nuclear explosion or a nuclear accident (e.g. a reactor melting) could be contaminated
- Natural events (floods, earthquakes) that disturb sealed sources

# Radiation Inspection checklist

- **Documentation and Authorization** – current license, emergency response plan
- Source integrity is verified (no visible damage, no leaks)
- **Personnel and training** – x-ray/gamma safety training and not outdated, dosimeters are worn and readings reviewed, pregnant workers have written low dose work plan
- **Area control and signage** – clearly marked, alarms system when the source is energized
- Calibration certificates readily accessible, portable detectors have current stickers
- X-ray tube housing inspected for cracks or wear
- SOPs for cargo screening are posted and followed
- **Emergency preparedness** – emergency kit, de-contamination shower inspected and functional, drills have been contacted
- Contact numbers for Radiation Protection Authority, airport security and facility's radiation safety officer posted
- **Record keeping** - all inspection, calibration, training and incident reports filed chronologically
- Personnel dose records retained for period stipulated by national regulations

# Chemical Emergencies

**The goal is to verify that the spill or exposure is safely contained, that personnel are protected, and that regulatory requirements are met**

**Initial Safety & Access Control**

- Emergency response plan for chemical emergencies
- Mechanisms established and functioning for detecting and responding to chemical events
- Confirm that emergency responders have been notified and are on-site or en-route.

# Chemical Emergencies…

**Competent Personnel**

- Environmental monitoring - air monitoring equipment is operating and readings are within safe limits, Surface wipes tests are performed where appropriate to verify contamination levels, Documentation of any environmental sampling (soil, water) is initiated
- Documentation and reporting
- Review of procedures

**Tips for Effective Inspections**

- - Keep the checklist on a waterproof clipboard or in a digital format that can be accessed on-site.
- - Review the safety data sheet (SDS) before entering the spill area to confirm PPE requirements.
- - If the chemical is unknown or highly hazardous, wait for specialist advice before proceeding.

# Key regulatory and coordination bodies

- While a large-scale nuclear accident is unlikely, smaller incidents do occur and require a coordinated response.
- **International Civil Aviation Organization (ICAO)** – Annex 6 (Operations) and Annex 13 (Aircraft Accident Investigation), contain provisions for radiological incidents
- **ICAO annex 17**
- **Doc 8973 (***restricted document***)**
- **International Atomic Energy Agency (IAEA)** – publishes the guidelines for nuclear emergency preparedness and response which are referenced by many civil aviation authorities
- International Air Transport Association (IATA) – issues the radiation Safety Manual for airlines
- Civil Aviation of Zimbabwe works with the Radiation Protection Authority (RPA) and the Department of Civil Protection
- National: Radiation Protection Authority (RPA) regulations, Health Act, Disaster Management Act
- **Key obligations**: licensing, reporting, emergency planning, training

# Measures for Airports

- Develop and maintain SOPs
- Detection equipment strategy
- **(nuclear security committee, disaster risk management committee)**
- Trained personnel on radiation safety and security

- Speaker notes: Walk through each step quickly, using a real-world example (e.g., a spilled radioactive source) to illustrate the flow.

- Conduct a radiation risk assessment annually
- Develop a site-specific emergency plan (including floor plans, evacuation routes)
- Install radiation detection alarms and signage
- Maintain and provide dosimeters or proper personal protective equipment (PPE)
- Provide regular training (initial + refresher every 12 months)

# Staff Training Essentials

- Encourage participants to check that their own workplaces have these elements in place.
- Understanding of radiation/nuclear and chemical events basics
- Use of detection equipment (dosimeters, survey meters)
- Emergency drill participation (at least one per year)
- Reporting procedures and documentation

# Practical checklist for airline operators

- **Pre flight** – verify that radioactive cargo is properly packaged and documented, ensure crew are trained on radiation alerts
- **During flight** – follow the radiation incident SOP: alert the captain, reduce the exposure (increase altitude if safe) and prepare for an emergency landing if needed
- **Post flight** – isolate the aircraft, conduct a radiological survey and notify the ground radiation safety team

# Typical Emergency response steps

- **Compliance is mandatory. Preparedness is a shared responsibility**

1.**Detection & Alarm** – radiation monitors on the aircraft or at airports trigger an alarm

2. **Notification** – internal chain, RPA, local emergency services, the crew notifies the flight deck and ground control

3. **Containment** – isolate area, prevent spread, aircraft is isolated on the ground

4. **Evacuation & Sheltering** – passenger/staff are directed to safe zone, if necessary, they are placed in a controlled area for radiological assessment

5. **Medical Assessment** – crew and passengers receive dose estimation and if warranted , medical follow-up

6. **Decontamination** – the aircraft is surveyed, cleaned and cleared by a qualified radiation protection officer before returning to service

7. **Investigation and reporting -** a joint investigation involving aviation, health and nuclear authorities is launched; findings are reported to ICAO and IAEA as required

# Devices used

- The device used to measure radiation emitted by a source is generally called a radiation detector. Depending on the type of radiation and the information you need, the detector may be:-
- Geiger-Müller (GM) tube – counts ionizing events and gives a dose-rate reading
- Ionization chamber – measures exposure or dose rate with high accuracy
- Scintillation detector – converts radiation into light pulses that are counted,- or a spectrometer (e.g., a gamma-ray spectrometer) – identifies the energy of the emitted photons as well as the intensity.

In everyday language, people often refer to any of those simply as a “radiation meter” or “radiation monitor.”

# Q&A

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THANK YOU