On Site Inspection: New approach to contamination control in the Field and at Base of operation.

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INTRODUCTION AND MAIN RESULTS

During OSI trainings or small exercises focused on specific techniques decontamination control procedures were typically the subject of discussion between IT leadership due to the fictitious scenario, human resources, equipment deployed and limited time.

The goal of this presentation is to show and discuss a new approach to establishing decontamination line, standardizing the decontamination line configuration that we could use depending on the complexity of the scenario and it is focus in fill the gap between trainings, exercises and real scenarios.

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Radioactive Contamination

Radioactive contamination occurs when radioactive material is deposited on or in something where it shouldn't be, such as on surfaces, objects, or within living organisms.

This contamination can be external (on the surface) or internal (inside a body). It is considered undesirable because the presence of radioactive substances can be harmful to people, equipment, or the environment.

Radioactive contamination refers to the presence of radioactive substances in places where they are not wanted or intended.

Contamination can result from accidents, releases of radioactive materials, or improper handling of radioactive substances.

Radioactive contamination can affect air, water, soil, structures, objects, and living organisms (people, animals, plants).

Potential harm:

Radioactive contamination can cause harm through radiation exposure, which can lead to various health effects, including acute radiation sickness, long-term health problems like cancer, and damage to the environment.

Difference between radioactive contamination and radiation exposure

It's important to differentiate between contamination and radiation exposure.
Contamination means radioactive material is physically present on or inside something. Irradiation means something is exposed to radiation but doesn't become radioactive itself. For example, handling radioactive material can cause contamination, while being near a radioactive source without touching it causes radiation exposure.

Characteristics of radioactive contamination

- It cannot be neutralized or destroyed
- Even a small amount has great contamination capacity
- Decay

Internal Radioactive Contamination:

Internal contamination by radioactive materials can occur through:

- inhalation of radioactive dust,

- ingestion of contaminated food or water,

- Contact with the skin through open wounds that allow radioactive material to enter the body.

The three fundamental principles of radiation protection

1. Justification:

This principle establishes that any practice involving radiation exposure must be justified by a positive net benefit. In other words, radiation exposure should only occur if the benefit it provides outweighs the risks it entails.

2. Optimization:

Also known as the ALARA principle (As Low As Reasonably Achievable), this principle seeks to keep radiation doses as low as reasonably achievable, considering social and economic factors. This involves taking measures to reduce radiation exposure, even if it is already within permissible limits.

3. Dose Limitation:

This principle establishes maximum radiation dose limits that workers and the general public can receive. These limits are designed to prevent deterministic radiation effects (those that occur only above a certain threshold) and reduce the risk of stochastic effects (those that can occur at any level of exposure).

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Contamination control in the field

- Approaching the search zone

Mission planning begins with a radiological risk assessment, using data from the initial overflight (IOF) and vehicle monitoring. This allows for the preparation of resources, equipment, PPE, and the approach strategy for the site.

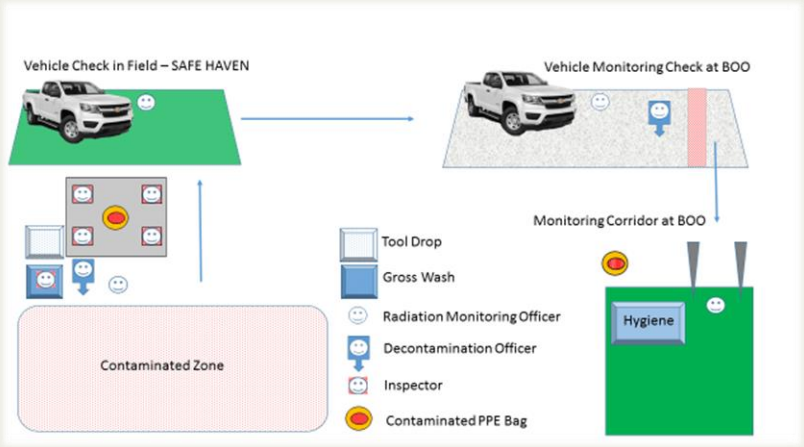
Upon arrival at the site, the H&S team monitors the dose rate using handheld equipment to determine a "safe haven" where personnel can take shelter, unload equipment, and don PPE.

Dose rate information obtained on-site is critical for determining personnel exposure time, adhering to radiological safety limits, and mitigating other mission environmental hazards.

- Leaving the search zone

Before the inspection team members leave the search zone, the Health and Safety (HSS) team will establish a monitoring line and a decontamination station. This will ensure that no inspector, tool or equipment leaves contaminated and enters the vehicle.

Returning procedure from a contaminated area

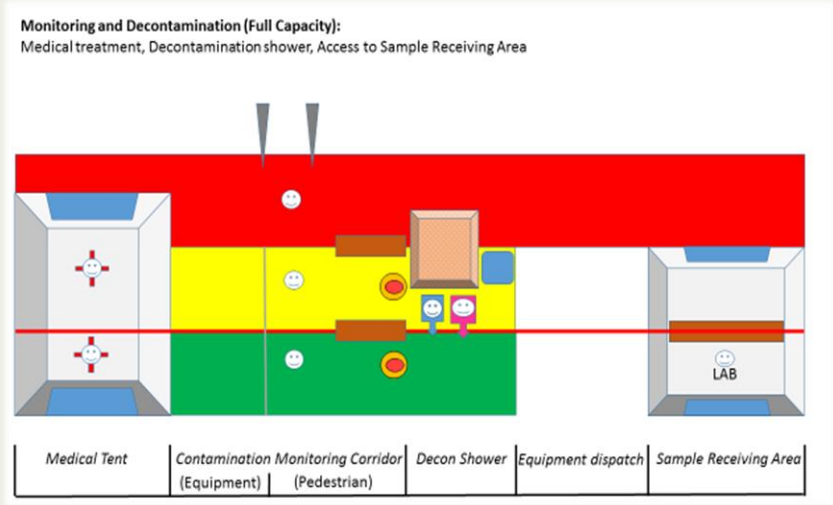


The HSS monitoring officer will perform the monitoring of the inspectors, the decontamination officer, equipped with a portable jet washer, will perform the decontamination of the suit, boots, and tools if it is necessary. Inspectors will remove PPE following the doffing procedure mirroring with a colleague so they can help each other.
Contaminated trash produced during the mission will be ISP responsibility after an agreement.
Upon returning to the BoO the vehicle is check for contamination by using a portal or handheld equipment.
Wheels, mudguards and air filters must be checked before access to BoO premises is granted.

Contamination control at the Base of Operation (BoO)

The monitoring and decontamination line, the COMMS, and the medical tent are considered top priorities. This is essential for inspectors to begin their missions.

To manage the decontamination line, adequate space, the corresponding resources, equipment, and a team of 4 to 7 people are needed. This team should be composed by dedicated and trained personnel. Monitoring and Decon officers, logistician and medical doctor.



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Characterization of Scenario Contamination Levels

Depending on the search zone location, dose info recorded, type of mission, and the interaction between inspector and the environment, we could distinguish between three possible scenarios.

No contamination:

Dose Reading: The radiation dose recorded in the field is equal to the background dose level at the Base of Operations (BoO), with a measurement of less than 0.6 µSv/hr. This indicates no significant radiological hazard.

Environmental Interaction: There is very little interaction with the surrounding environment, reducing the chance of contamination.

Weather and Ground Conditions: The absence of wind, dust, mud, or snow means there are fewer vectors for contaminants to be transported and adhere to clothing or equipment.

Hazard and Visual Cues: Personnel are exposed to low-level hazards, and there are no visible signs of contamination on their protective clothing.

Low level scenario:

Dose Reading: The radiation dose recorded in the field is between 0.6 µSv/hr < Dose < 10 µSv/hr
This indicates a low radiological hazard unless the time of exposure is exceeded.

Environmental Interaction: There is moderate interaction with the surrounding environment, the chance of contamination will depend on the activity performed and time of exposure.

Weather and Ground Conditions: Certain climatic conditions can significantly aid in the spread of contaminated materials. Eg: Wind, presence of dust

Hazard and Visual Cues: Exposure to low level hazards, Visible signs of low-level hazard contamination on protective clothing.

High level scenario:

Dose Reading: The radiation dose recorded in the field is between 10 µSv/hr and 100 µSv/hr. This indicates a moderate to high radiological hazard. Shielding and PPE are fundamental

Environmental Interaction: There is heavy interaction with environment. Time and exposure needs to be reassessed during activities

Weather and Ground Conditions: presence of wind, dust, precipitation, humidity, mud or snow can significantly aid the spreading on contamination

Hazard and Visual Cues: Exposure to high level hazards Visible signs of contamination on protective clothing.

Additional: Catastrophic Level Scenario

Dose Reading: 100 µSv/hr or higher.
Only life saving activities!!!.

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Introducing a new concept: The Decon Triage

Given the improvement in procedures and training for inspectors in field monitoring and decontamination, it is unlikely to find high levels of contamination at the entrance of the BoO.

Therefore, the implementation of a Decon Triage system at the entrance of the monitoring line could significantly improve the speed with which inspectors access the base and optimize the use of dedicated human resources and time.

For moderate to high-risk missions, it is crucial to reassess and replan the mission if initial or expected conditions change. This includes reducing the number of inspectors working in a contaminated area, decreasing exposure time, or even ordering a full fallback.

Decon Procedure in field:

A contamination monitoring line will be stablished by HSS team and a Decon facility according to the complexity of the scenario.

Dry Decon: the most common procedure, does not use water. This could involve wiping surfaces, using vacuums, or other methods to remove contaminants without creating liquid waste.

Decon shower: require the use of water and this water must be handled as hazardous or radioactive waste, requiring special treatment and disposal.

Decon Procedure at Base of Operations:

Vehicle monitoring portal

All vehicles and heavy machinery like Geoprobe returning from the field must pass through a radiation monitoring portal.

Equipment Decon Station: a second portal for tools and equipment, two inspectors must carry them with a trolley or palletizer through this portal to a designated area and potential decontamination of equipment.

Pedestrian Monitoring Line: A separate line for monitoring all personnel on foot.

The Decon Triage:

The assigned mission's contamination level dictates the required decontamination protocol. Field teams will be assessed upon return and categorized as follows:

No Contamination: This category includes all team members and equipment that did not enter a designated contaminated area and was confirmed to be clean through monitoring.
These team members and equipment can be returned to Base without further action.

Low Contamination: Team members in this category was exposed to a contaminated environment but has only minor, superficial contamination. These team members and equipment can be decontaminated using standard 'Dry Decon' or 'Low-level Decon' procedures, such as wiping or brushing.

High Contamination: This classification is reserved for team members and equipment that has been heavily contaminated, either through direct contact with a high-contamination source or prolonged exposure.

These inspectors will require a rigorous 'Wet Decon' process, record keeping and medical follow up.

Equipment may need to be handled as hazardous or radioactive waste, depending on the nature of the contaminant.

If internal contamination is confirmed or suspected, inspectors will be evacuated from the field or from the BoO and transported to the nearest hospital with radiation treatment for whole-body counting and, if necessary, receive medical treatment.

THANKS FOR YOUR TIME!

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