Security Guidance for Radioactive Material at Medical, Industrial, and Research Facilities

Introduction

- Possible scenarios for a terrorist attack are the dispersion of radioactive material, by an explosive device or other means, or the use of radioactive sealed sources to expose people to large doses.

- The dispersion of radioactive material poses the risks of external exposure to persons, if the material emits penetrating radiation such as gamma rays, and internal exposure if the material is inhaled, ingested, or absorbed through the skin. The dispersion of radioactive material may cause fear and even panic in some people and is likely to complicate the efforts to respond to and recover from a terrorist incident. The dispersion of radioactive material may cause significant economic loss, from the cost to decontaminate buildings or other areas, or from the cost of abandonment, if decontamination is not feasible.

- Therefore, every reasonable effort should be devoted to preventing terrorists from obtaining suitable radioactive material.

- On the other hand, radioactive materials are important tools in medicine, industry, and research. Unnecessarily strict security precautions for radioactive material could cause a significant loss of benefits to mankind. For example, overly strict security measures could significantly increase the cost of health care, reduce the safety of foods and structures, and greatly hinder research.

US Nuclear Regulatory Commission Requirements

- The US Nuclear Regulatory Commission imposes strict security requirements on commercial nuclear power reactors, research reactors, and nuclear fuel facilities. These have been enhanced since September 11, 2001.

- On June 6, 2003, the US Nuclear Regulatory Commission issued an order imposing additional security requirements on large panoramic irradiators.

- The US Nuclear Regulatory Commission has announced it will soon issue orders for the security of other large activities of some radioactive material at medical, industrial, and research facilities, including self-shielded irradiators, panoramic irradiators, teletherapy devices, gamma knives, and some remote-afterloading brachytherapy devices.

Security Recommendations for Medical, Industrial, and Research Facilities

Basic Philosophy

- Implement security measures that are commensurate with risk, i.e., higher-risk material should be protected by more stringent security measures than lower-risk material.

- Implementing security measures that are commensurate with risk will limit the cost of the security measures, reduce the hindrance to important uses of low-risk radioactive material, and produce the greatest actual improvement in security.

Threat and Vulnerability Assessment

- Assess the threat. Until recently, security measures for radioactive material were usually designed to defend against accidental loss of radioactive material and theft for economic gain, which caused the incidents in Juarez, Mexico, and Goiania, Brazil. Now, security measures must take into account the threat of terrorism. The events of September 11, 2001, demonstrate the adversary can be a small team, with technically skilled members, that is armed and willing to kill to achieve its goals. The threat assessment should take into consideration the possibility of collusion by an insider, e.g., an employee or student.

- Assess the radioactive material possessed from a risk perspective. The risk assessment should consider (1) the activity of the material, (2) its half-life, (3) its exposure rate constant, (4) its annual limit on intake (ALI), (5) the ease of removal and portability, and (6) the dispersibility of the material. The risk assessment should consider all radioactive material at each location within the institution *in toto*. For example, the net risk of all the radioactive material stored in a specific source storage room should be assessed. IAEA TECDOC-1344 provides a method for risk assessment. In particular, high-risk material includes multicurie sealed sources of Cs-137, Co-60, Ir-192, Am-241, Sr-90, and isotopes of plutonium. Devices containing high-risk material include panoramic irradiators, self-shielded irradiators, teletherapy devices, gamma knives, and some remote-afterloading brachytherapy devices.

- Assess the security measures employed to protect the radioactive material. Whereas radiation safety professionals are experts in radioactive material safety, few are security experts. The radiation safety staff and a senior member of the police or security organization should jointly assess security measures.

Physical Protection Measures

- Implement additional security measures as necessary. Physical security measures include measures to (1) deter an adversary, (2) detect an intrusion by an adversary, (3) delay an adversary from accessing or removing the protected material, and (4) respond to an intrusion. IAEA TECDOC-1355 provides useful guidance on protective measures. Detection measures include monitored alarm systems, monitored video surveillance systems, and staff in the area, if the staff is trained to detect and report an intrusion. Delay measures include walls, doors with locks, fences, and safes. A device containing a radioactive source can be a delay measure if the device is not portable and if significant time is required to remove the source from the device.

- For high-risk material, measures should be implemented to detect an intrusion, delay the intruder, and respond to the intrusion. The delay measures should cause sufficient delay after the intrusion is detected to allow time for response.

- For high-risk material, these measures should take into account the possible terrorist adversary described above, i.e., a small team, with technically skilled members, that is armed and willing to kill to achieve its goals. For high risk material, the response should be by an armed police or security force capable of preventing the adversary from accessing or removing the protected material.

- For low-risk material, such as that used in most nuclear medicine and biomedical research laboratories, standard security measures of locked doors or direct surveillance are likely sufficient.

Disused Radioactive Material

- Identify and dispose of high-risk radioactive material that is unlikely to be used again.

Information Security

- Do not provide information regarding the location, device construction, security precautions, and any security vulnerabilities of high-risk material to a person unless that person has a legitimate **need to know** the information. A key principle of information security is “need to know.”

- Freely-available information, including that on websites and in widely distributed radiation safety manuals, should be reviewed to ensure that it does not compromise security. In some cases, it may be useful to remove warning signs that are not required by regulations.

Shipping, Receiving, and Transfer of Radioactive Material

- Higher risk radioactive material that is being received or shipped is particularly vulnerable because it is packaged to be transportable and must be taken outside of secure areas.

- Arrange to immediately take packages of higher risk material to a secure storage location upon receipt.

- Keep sources to be shipped in a secure location until the arrival of the transport vehicle. The identity of the person or persons accepting the sources should be verified before transfer, and the sources should be guarded until they are loaded into the transport vehicle.

- Restrict information regarding the expected date and time of delivery or shipment and the delivery or transfer location to persons who have a legitimate need to know.

- For high risk material, verify that the material was received by the consignee.

Personnel Security

- Limit the number of persons who are permitted unescorted access to high-risk radioactive material.

- Keys and lock combinations should be limited to persons who actually need access. Keys and lock combinations should be changed periodically and after personnel turnover. Proximity card keys are particularly useful because they can be inactivated if lost or if an employee resign. Keys and card keys must not be marked with the room number or other information identifying the protected location.

- Perform background or employment history checks of persons before granting access to high-risk material.

- Train users and ancillary workers in security measures for radioactive material. They should receive security training prior to assuming duties and periodically thereafter. The training should include security precautions to follow; not sharing information on the device, location, radioactive material, and security precautions; and reporting suspicious circumstances and suspected intrusions.

- Train security and police staff. They should receive security training regarding radioactive material prior to assuming duties and periodically thereafter. They should be aware of the locations and significance of high-risk radioactive material. They should also be aware that, in responding to a suspected intrusion where high-risk material is located, they could possibly encounter a team of terrorists armed with weapons.

Other Issues

- Implement measures to ensure that the loss of high-risk material is promptly discovered. It is possible that material could be removed, perhaps by an insider, with little or no evidence of the removal. More frequent inventories are one measure that can be taken. The measures should verify that the radioactive material is actually present. Presence of the device or container housing a sealed source should not be taken as evidence that a source is still present.

- Audit the security program periodically, perhaps annually. These audits should be performed jointly by radiation safety and police or security professionals.

References

International Atomic Energy Agency. IAEA-TECDOC-1344, *Categorization of radioactive sources,* July 2003.

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