Threats to radioactive sources in industrial radiography and well-logging applications and consequences of a malicious act involving them

GOBIERNO DE MÉXICO | SENER SECRETARÍA DE ENERGÍA | CNSNS COMISIÓN NACIONAL DE SEGURIDAD NUCLEAR Y SALVAGUARDIAS

National Commission for Nuclear Safety and Safeguards (CNSNS)

The National Commission for Nuclear Safety and Safeguards (CNSNS) is a deconcentrated body of the Ministry of Energy, with functions assigned by the Article 27 of Political Constitution of Mexican United States on Nuclear Matters, that creates it, in addition to responding to international commitments and requirements in the areas: Radiological and Nuclear Safety, Nuclear Security and Safeguards

CNSNS

Some attributions of the CNSNS*

- ✓ Establish and monitor the application of regulations and norms on nuclear safety, radiological safety, nuclear security and safeguards, including the use, handling, transportation and possession of nuclear and other radioactive material
- ✓ Licensing of Nuclear and Radioactive Facilities
- ✓ Issuance of licenses and permits for import, use, transport and storage of radioactive materials
- ✓ Perform audits, supervisions, technical visits, inspections and verifications to nuclear and radioactive facilities

CNSNS

Some attributions of the CNSNS*

- ✓ Establish the requirements that must be met by technical training programs on aspects related to nuclear safety, radiological safety, nuclear security and safeguards, and advise on them
- ✓ Intervene in the conclusion of cooperation agreements or agreements made by the Ministry of Energy with other national entities in the field of nuclear, radiological and physical safety, and safeguards

* Established in Chapter VI. The National Commission for Nuclear Safety and Safeguards of the "Regulatory Law of Constitutional Article 27 on nuclear matters"

Regulatory Framework

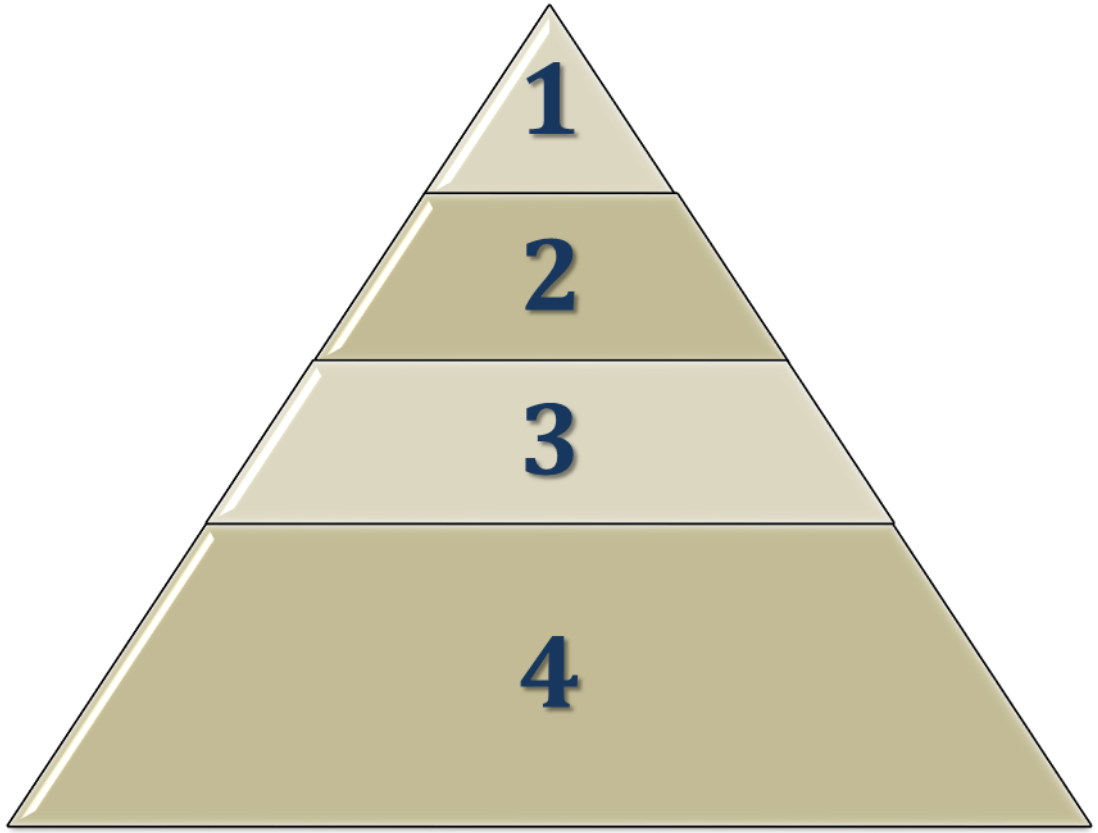
Legal framework in Mexico on Nuclear Security

Constitution and International Treaties and Agreements

Federal, General and Regulatory Laws

Regulations

Mexican Official Standards



Regulatory Framework

1

- ✓ **Article 27 of the Constitution**
- ✓ **Convention on the Physical Protection of Nuclear Materials and Nuclear Facilities (CPPNM)** *(Entry into force in Mexico in may 16, 1988)*
- ✓ **Amendment of the Convention on the Physical Protection of Nuclear Materials and Nuclear Facilities** *(Ratified by Mexico in may 17, 2012 and its promulgation decree july 27, 2016)*

Regulatory Framework

2

- ✓ **Reglamentary Law of Article 27 Constitutional on Nuclear Matter** (Entry into force January 27, 1979)

Another relative laws:

- ✓ **Civil Liability Law for Nuclear Damage**
- ✓ **Federal Law on Metrology and Standardization**

Regulatory Framework

3

- ✓ **General Regulation of Radiological Safety (RGSR).** It establishes in general that radioactive facilities must have nuclear security systems
- ✓ **Regulations for the Safe Transport of Radioactive Material.** (published in the Official Gazette of the Federation on April 10, 2017)

Regulatory Framework

Draft regulations:

- ✓ Preliminary draft of **the General Nuclear Security Regulation**, its scope applies throughout the national territory in order to establish the requirements, measures and actions of nuclear physical security to avoid acts that cause damage or alterations to public health or safety.

- ✓ Draft Mexican Official Standard PROY-NOM-042-NUCL-2019, "**Categorization of fissile materials and other radioactive materials and requirements for nuclear security for its transportation**"

- ✓ Draft Mexican Official Standard PROY-NOM-***-NUCL-2019, "**Information to be contained in the nuclear security plan for the transportation of fissile materials and other radioactive materials**"

Definition of Threat

Threat is defined as "a person or group of persons with motivation, intention, and capability to commit a malicious act"*

The threat describes:

- ✓ Who would want to commit a malicious act involving a radioactive source
- ✓ Their **motivation, intent, and capability**

The threat is generally described with reference to a particular country (or location within a country) and a particular type of target

**Nuclear Security Recommendations on Radioactive Material and Associated Facilities,* IAEA Nuclear Security Series No. 14, 2011

Motivation

Motivation refers to why the persons or group of persons would want to commit a malicious act.

The most typical motivations include:

- ✓ **Protest**: to make a political statement
- ✓ **Criminal**: to illegally acquire a radioactive source for personal use or sale to a third party
- ✓ **Terrorist**: to inflict harm that produces fear and panic

Threat

Intent

Intent refers to what the person or group of persons plans to do, sometimes referred to as the adversaries' **objective**. In the case of radioactive sources, adversaries typically intend:

- ✓ **Theft** of the radioactive source
- ✓ **Sabotage** of the source or its associated facility

Capability

Capability refers to the resources that adversaries possess, including:

- The number of adversaries
- Skills and training
- Knowledge of the target facility and its security system
- Willingness to accept harm to themselves
- Weapons and explosives
- Tools
- Transport
- Financial backing
- Insider assistance

External and Insider Threat

- ✓ The threat may include external or insider adversaries, or a combination
- ✓ External adversaries have no direct relationship with the target facility or radioactive source
- ✓ Insiders do have such a relationship, for example as an employee or contractor of the target facility
- ✓ Insiders are particularly dangerous because of their knowledge of the facility and its security measures. They may exploit this knowledge either to act alone or to assist external adversaries. Insiders may have protest, criminal, or terrorist motives or may be good people coerced into assisting external adversaries

Threat Assessment

Characterizing the threat is essential; this is accomplished through the process of Threat Assessment, which is defined as:

"an evaluation of the threats — based on available intelligence, law enforcement, and open source information — that describes the motivation, intentions, and capabilities of these threats"*

A threat assessment is performed by various agencies of the national government

*_Nuclear Security Recommendations on Radioactive Material and Associated Facilities,_ IAEA Nuclear Security Series No. 14, 2011

Malicious use

Malicious use of radioactive sources

- ✓ Protest
- ✓ Revenge
- ✓ Terrorism
- ✓ Financial gain

Malicious use

Most Likely Malicious use

Theft or **sabotage** of a source for the purpose of deliberately exposing people and the environment to radiation

- ✓ **Radiological Dispersion Device** (RDD) spreads radioactive material over an area
- ✓ **Radiological Exposure Device** (RED) exposes individuals to radiation without their knowledge

Mobile sources are susceptible to theft and could be used anywhere

Fixed sources are more susceptible than mobile sources to being sabotaged in place

Malicious use

Radiological Dispersion Device (RDD)

- ✓Radioactive material coupled with explosive to cause dispersal of radioactivity (called “dirty bomb”)
- ✓Dispersion could be to water and/or air depending upon the adversarial scenario
- ✓Potentially, significant economic and social impact
- ✓Sabotage of a shipment of radioactive material during transport

Malicious use

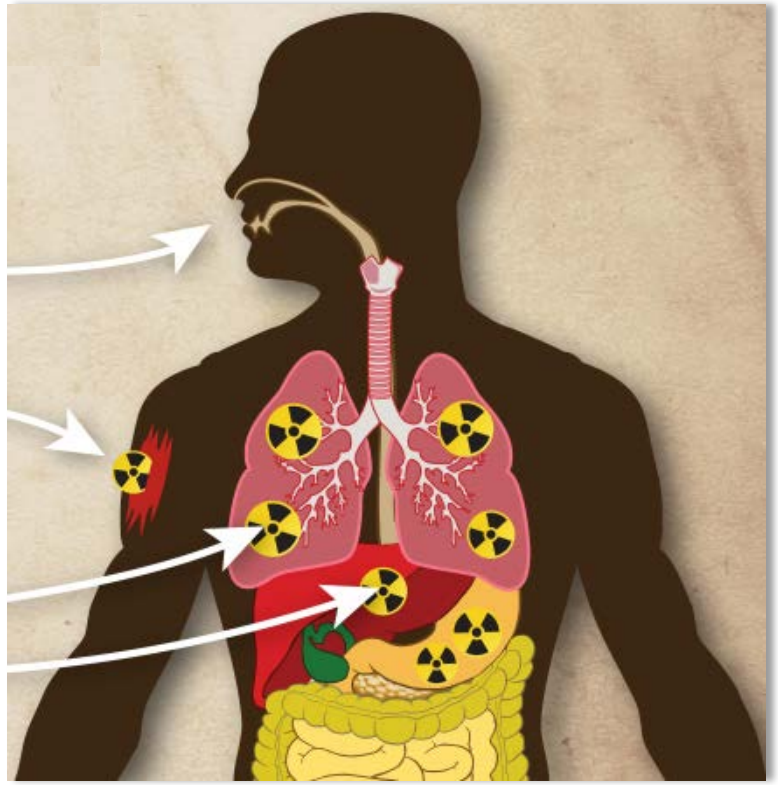
Radiological Exposure Device (RED)

- ✓ Limited health impact
- ✓ Potentially significant economic and social impact

Malicious use

Potential Consequences of Malicious Use

- ✓ Acute radiation sickness or fatality
- ✓ Radiation dose to the public and emergency workers with subsequent increase in likelihood of latent cancer
- ✓ Contamination
- ✓ Attention to radiological emergencies with specialized medical personnel
- ✓ Loss of function of an area
- ✓ Economic and social disruption
- ✓ Psychological effects



Theft of radioactive materials

Source Attractiveness to Adversaries

Some radioactive materials are more “attractive” than others from the adversary's point of view. These materials are attractive because of considerations like:

- ✓Their physical form because they are easy to disperse with the potential to inflict greater harm
- ✓The portability of the packages (e.g. **industrial gamma radiographic** devices or **density/moisture gauges**)

Certain additional security measures may be required because of the attractiveness of these materials

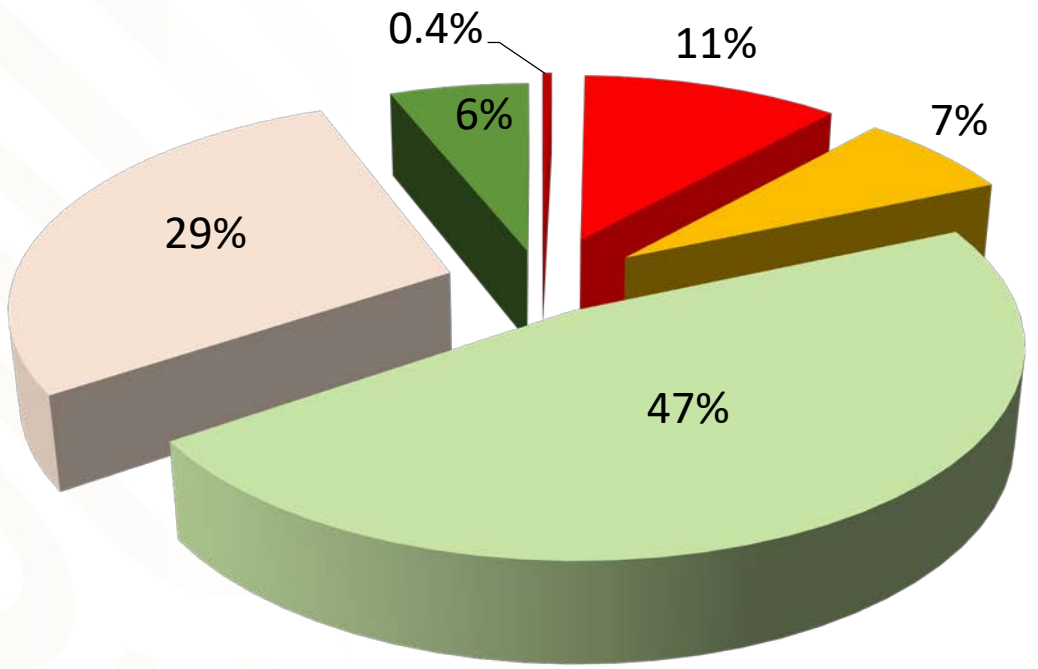
State may require the application of additional security measures if the threat level changes

Theft of radioactive materials

Source Attractiveness to Adversaries

Theft of radioactive materials

Transport-Related Theft Incidents by RS-G-1.9 Category (1993-2016)



Source: IAEA - Incident and Trafficking Database (ITDB)

Theft of radioactive materials

Theft Incidents in Mexico

SENER
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RELACIÓN DE EMERGENCIAS RADIOLÓGICAS

CNSNS
COMISIÓN NACIONAL DE SEGURIDAD NUCLEAR Y SALVAGUARDIAS

2010 – 2018						
Fecha	Material Nuclear o Fuente Radiactiva Involucrada	Lugar del Evento	Robo o Extravío	Cantidad Involucrada	Denuncia ante CNSNS/MP/PGR	Destino Final del Material
12 de enero de 2010	Americio-241/Berilio-Cesio-137	Campeche	Extravío	1	CNSNS	No recuperado, material confinado en el pozo
24 de marzo de 2011	Americio-241/Berilio	Pozo de Villahermosa, Tabasco	Extravío	1	CNSNS	No recuperado, material confinado en el pozo
24 de marzo de 2011	Cesio-137	Pozo de Villahermosa, Tabasco	Extravío	1	CNSNS	No recuperado, material confinado en el pozo
14 de julio de 2011	Cesio-137	Papantla, Veracruz	Robo	1	CNSNS	Recuperado y devuelto al propietario
14 de julio de 2011	Americio-241/Berilio	Papantla, Veracruz	Robo	1	CNSNS	Recuperado y devuelto al propietario
02 de mayo de 2012	Iridio-192	Hermosillo, Sonora	Robo	1	CNSNS	Recuperado y devuelto al propietario
06 de noviembre de 2013	Cesio-137/Americio-241/Berilio	Pozo Yoka, Ciudad del Carmen, Campeche	Extravío	1	CNSNS	No recuperado, material confinado en el pozo
02 de diciembre de 2013	Cobalto-60	Tepojaco, Hidalgo	Robo	1	CNSNS/MP/PGR	Recuperado y confinado
07 de enero de 2014	Tritio (H3)	Pozo KU	Extravío	1	CNSNS	No recuperado, material confinado en el pozo

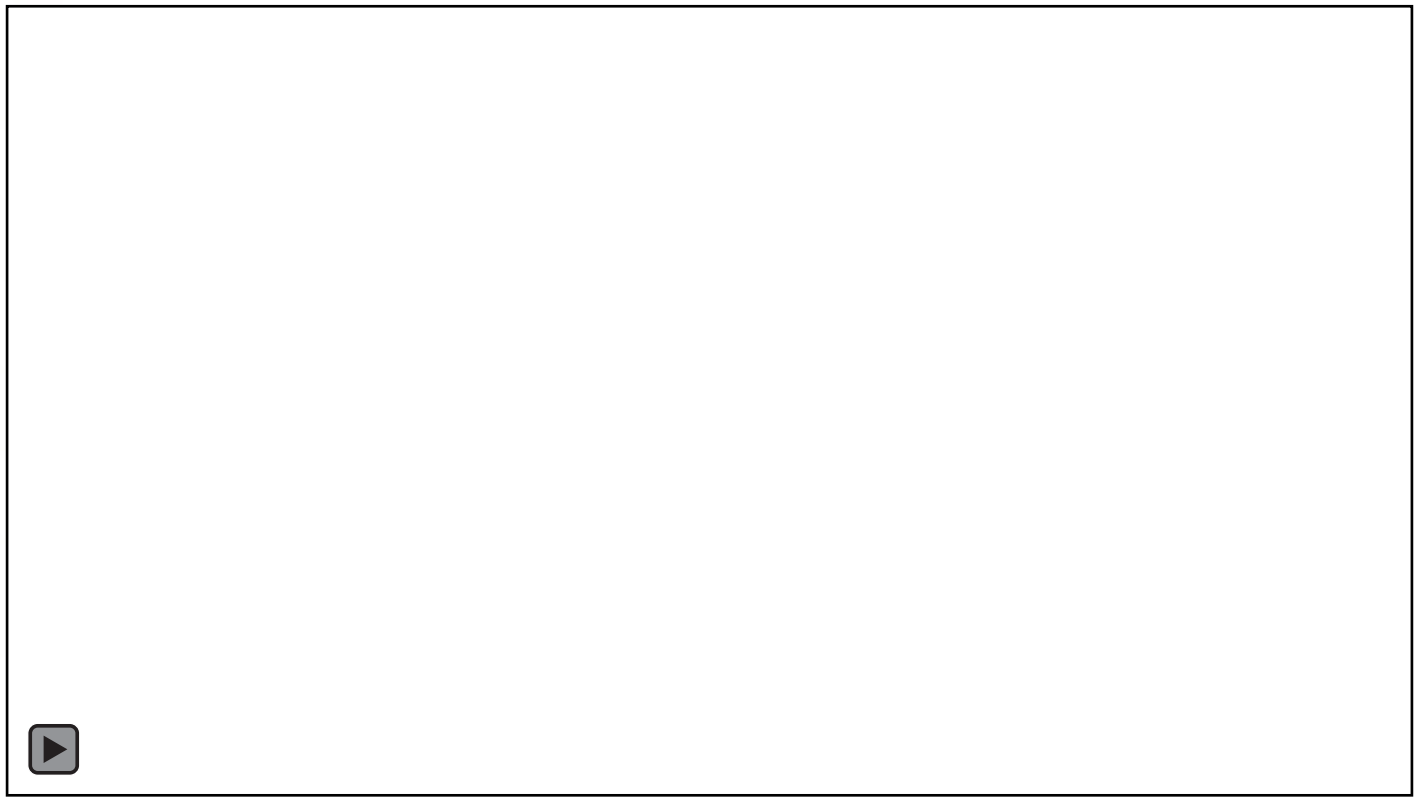
https://www.gob.mx/cnsns/es/articulos/relacion-de-emergencias-radiologicas?idiom=es

Theft of radioactive materials

Place: San Juan del Río, Querétaro
December, 2015.

The CNSNS receives the report of theft of a vehicle that was transporting a industrial radiography equipment with radioactive material, with a source of Ir-192 and an activity of Approx. 3.63 TBq.

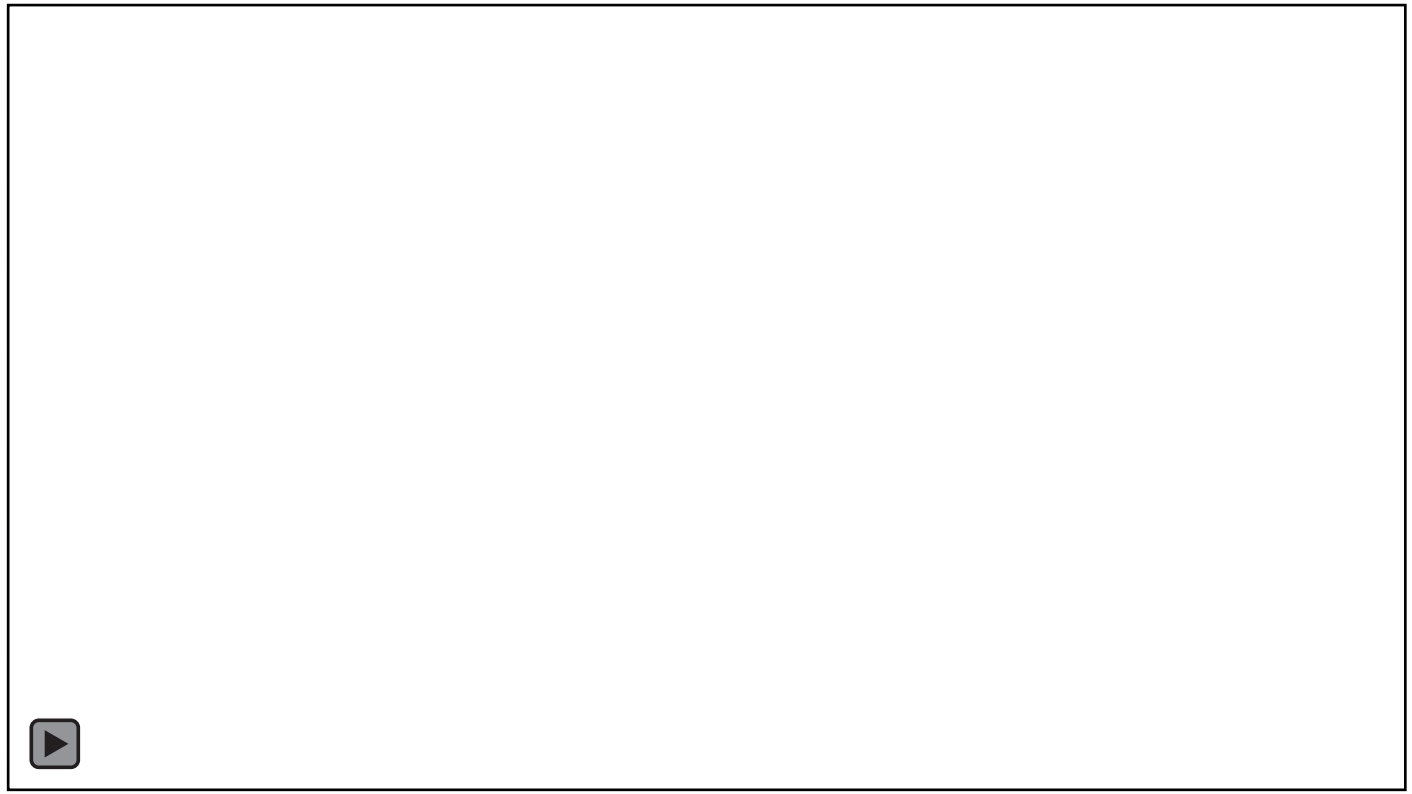
The industrial radiography equipment was recovered in Ixtlahuaca, Edo. Mexico.



Theft of radioactive materials

Place: San Nicolás de los Garza, Nuevo León.
August, 2017

Civil Protection of Nuevo León issued an alert for the theft of a nuclear densimeter with a source of cesium-137 and one of americium-241. It was recovered two days later.



Questions or comments?

Thank you

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