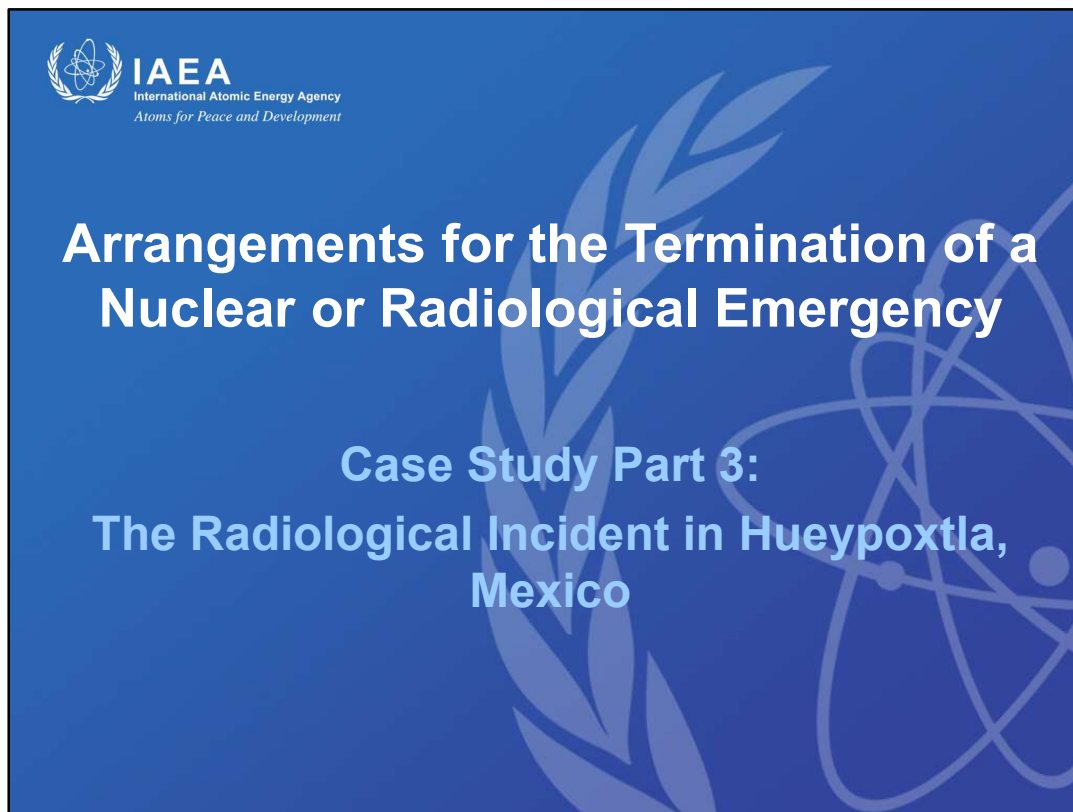


# Arrangements for the Termination of a Nuclear or Radiological Emergency



**Case Study:** Part 3. The Radiological Incident in Hueypoxtle, Mexico in 2013

## **Purpose of the Presentation:**

- To present and discuss the emergency response to the radiological incident in Mexico in 2013
- To analyse the radiological incident in the context of the guidance given in IAEA Safety Standards Series No. GSG-11 for the transition to a planned exposure situation

## **Learning Objectives:**

- To analyse the emergency response to this radiological incident against the guidance given in IAEA Safety Standards Series No. GSG-11
- To identify the different stages of response to the radiological incident
- To analyse when the prerequisites for transition to a planned exposure situation were fulfilled and when the emergency could have been terminated

**Duration:** 60 min

**References:**

1. International Atomic Energy Agency, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018).

## Purpose



- To present and discuss the emergency response to the radiological incident in Mexico in 2013.
- To analyse the radiological incident in the context of the guidance given in IAEA Safety Standards Series No. GSG-11 for the transition to a planned exposure situation.

*The Case Study is **not** an assessment of the emergency response to this radiological incident but an opportunity to illustrate fulfillment of the prerequisites given in the IAEA Safety Standards Series No. GSG-11 for transition to a planned exposure situation.*

## Learning objectives



- To analyse the emergency response to this radiological incident against the guidance given in IAEA Safety Standards Series No. GSG-11.
- To identify different stages of response to the radiological incident.
- To analyse when the prerequisites for transition to a planned exposure situation were fulfilled and when the emergency could have been terminated.

## Contents



- Overview of the emergency response to the radiological incident in Hueypoxthla, Mexico, in 2013
- Discussion and feedback session

# Expectations from participants



- Following the presentation, participants are expected to discuss the emergency response to this incident within their Working Group and to answer the questions provided in *Case Study Part 2 and Part 3: Analysis of the Fukushima Daiichi NPP accident and the radiological incident in Hueypoxtla, Mexico.*

Case Study Part 2 and Part 3:  
Analysis of the Fukushima Daiichi NPP accident and the radiological incident in Hueypoxtla, Mexico

QUESTIONS	Fukushima Daiichi NPP accident	Radiological incident in Hueypoxtla, Mexico
1. What urgent protective actions were implemented and when their implementation was completed?		
2. What early protective actions were implemented and when their implementation was completed?		
3. What activities were implemented to characterize the situation and to support resumption of normal social and economic activity and when preparations for this resumption were completed?		
4. When conditions were ensured that allow for the emergency to be terminated?		

## Lecture notes:

The participants should be guided to review the print out distributed to them with the questions and to get familiar with the questions before the Case Study is presented (for about 2-3 min).

## 2 December 2013

### Background of the event



On 28 November 2013, a truck left the city of Tijuana (Baja California State) carrying a teletherapy unit head (about 3000 Ci or 100 TBq  $^{60}\text{Co}$ ) from the Hospital General Regional 20 (Instituto Mexicano del Seguro Social - IMSS).



#### Lecture notes:

The event has its start on 28 November 2013, when an old teletherapy unit was decommissioned in a hospital (Hospital General Regional 20) in Tijuana (Baja California), and the head with its cobalt-60 source had to be transported by road to a waste storage facility close to Mexico City. The residual activity of the source was estimated at about 100 TBq.

**2 December 2013**

## **Background of the event (cont'd)**



Its final destination was a radioactive waste storage facility (Centro de Almacenamiento de Desechos Radiactivos - CADER), located near the town of Santa María Maquixco (Mexico State), a trip of 2800 km.



*Image courtesy of CNSNS*



### **Lecture notes:**

The truck with the radioactive parts had to cross some 2800 km to reach the waste storage facility near Santa Maria Maquixco.

*FIG.: Vehicle transporting the teletherapy unit with Co-60, International Atomic Energy Agency, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018)*

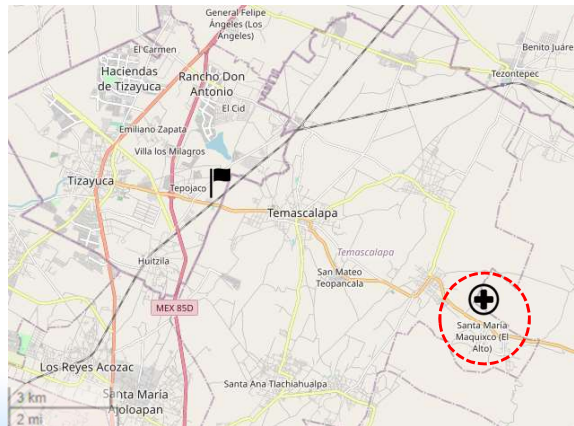


**2 December 2013**

## **Background of the event (cont'd)**



During the night of 1 December 2013, the driver of the vehicle stopped at a rest stop within the site of a gas station near the city of Tepojaco (Hidalgo State), some 20 km from the final destination.



*Image reproduced from @OpenStreetMap contributors CC BY-SA*

### **Lecture notes:**

20 km before its final destination, the driver decided to take a rest in the city of Tepojaco and to spend the night in his truck at a gas station.

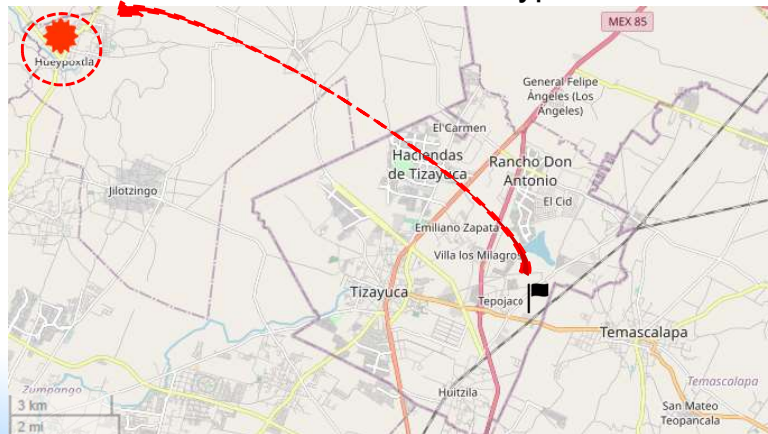
*FIG: @OpenStreetMap contributors CC BY-SA*

## 2 December 2013

### The event sequence



- At about 02:00 on 2 December 2013, a group of armed individuals stole the vehicle, together with the radioactive source.
- The thieves drove to the town of Hueypoxtlá.



*Image reproduced from @OpenStreetMap contributors CC BY-SA*

#### Lecture notes:

During the night, the truck and the driver were hijacked by people with weapons who stole the vehicle with its radioactive cargo. They drove the truck to the city of Hueypoxtlá.

*FIG: @OpenStreetMap contributors CC BY-SA*

## 2 December 2013

### The event sequence (cont'd)



- The thieves were apparently only interested in the vehicle.
- Still, the teletherapy head was dismantled and the  $^{60}\text{Co}$  source was removed from its shielding.



Image courtesy of CNSNS

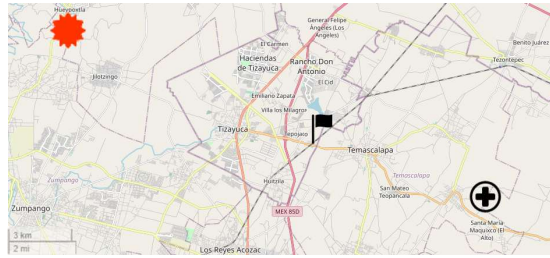


Image reproduced from @OpenStreetMap contributors CC BY-SA

#### Lecture notes:

Apparently the thieves were interested in the vehicle and did not know about the cargo.

However, it appeared later that the teletherapy head had been dismantled, and the Co -60 source removed from its shielding.

*FIG. on the right: @OpenStreetMap contributors CC BY-SA*

*FIG. on the left: Courtesy of CNSNS*

## 2 December 2013

### Notification of the event



At 08:13 on 2 December 2013, the National Commission for Nuclear Safety and Safeguards (CNSNS) was notified by an employee of the transport company.

- The CNSNS searched for information about the serial number and activity of the stolen source and the identification of the shielding;
- The CNSNS prepared an information bulletin for the Civil Protection Agency with details of the incident, potential risks of handling the radioactive source, recommendations for actions and protection of the public and contact numbers for distribution.

#### Lecture notes:

The authorities, namely the National Commission for Nuclear Safety and Safeguards, or CNSNS in Mexico, were notified in the morning of the hijacking by an employee of the transport company. Their first reaction was to make sure about the exact nature of the cargo and especially about the dangers of the source. With this information, they prepared a note explaining the risk and providing recommendations for the protection of the respondents and the public.

## 2 December 2013

### Distribution of information



At 13:00 on 2 December 2013, the CNSNS distributed an information bulletin to the State Governments of Hidalgo, Veracruz, Puebla, Tlaxcala, Mexico, Querétaro and San Luis Potosí, as well as to Mexico City and to the federal authorities.

The IAEA was notified through USIE.



#### Lecture notes:

This information was distributed in the beginning of the afternoon to several state governments where the truck could have been transported.

The CNSNS also notified the IAEA.

## 2 December 2013

### The search



- In the afternoon of 2 December 2013, the army located the stolen truck in the neighbourhood of Hueypoxtla.
- The federal police sent out officers to confirm the information and search the area for the radioactive source.
- The truck had been abandoned, but the source had disappeared.

#### Lecture notes:

In the afternoon of 2 December, the army located the stolen truck in the neighbourhood of Hueypoxtla, and the federal police sent out officers to confirm the information and search the area for the radioactive source.

The truck had been abandoned and the source had disappeared.

## 4 December 2013

### The search (cont'd)



- The Federal Police located the teletherapy head in a local backyard and reported it to the CNSNS. The shielding casing was empty.
  - A local resident had brought the device home thinking that it was a water pump. He could not read English and therefore was not aware of a potential radiation hazard.



Images courtesy of CNSNS

#### Lecture notes:

Two days later, the police located the teletherapy head in the backyard of a local resident and reported the discovery to the CNSNS. The shielding was empty. Apparently, this person had brought the device home thinking that it was a water pump. In fact, he could not read English and did not understand the indications painted on the shielding and therefore was ignorant of a potential radiation threat.

*FIG. on the right: The empty shielding of the radioactive source (courtesy of the CNSNS), International Atomic Energy Agency, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018)*

*FIG. on the left: Courtesy of CNSNS*

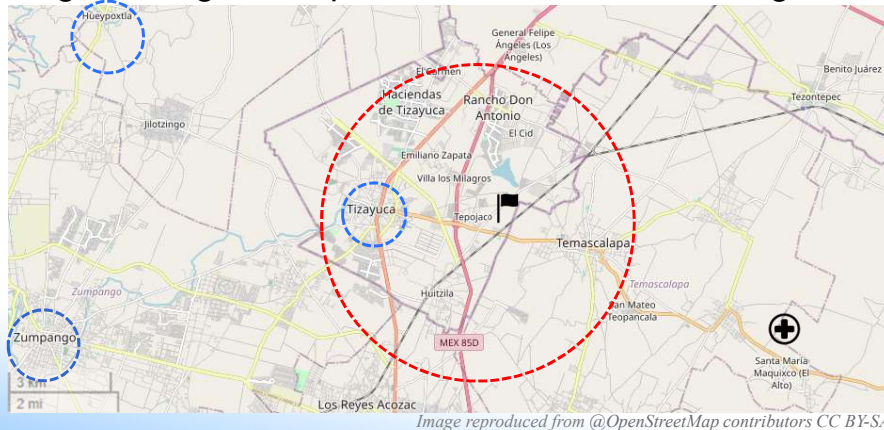


## 4 December 2013

### The search (cont'd)



- The CNSNS dispatched two teams with mobile equipment to search for the radioactive source. They focussed on 10 km radius area around the location of the robbery.
- The Federal Police continued their investigation in neighbouring municipalities and their surrounding areas.



#### Lecture notes:

On 4 December 2013, the CNSNS dispatched two teams with mobile equipment to search for the radioactive source. They focussed on a 10 km radius area around the location of the robbery, while the Federal Police continued their investigation in neighbouring municipalities and their surroundings.

*FIG: @OpenStreetMap contributors CC BY-SA*



## 4 December 2013

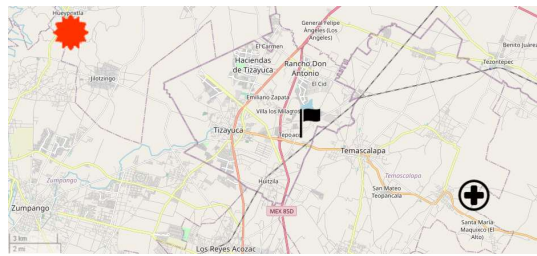
### Locating the source



- The federal police identified an area in the vicinity of Hueypoxtla, where the radiation level exceeded the normal background.
- In the evening, together with a specialized team from the CNSNS, the police located the source; it was lying among the crops in a field. A 500 m radius zone was cordoned off to prevent access.



*Image courtesy of CNSNS*



*Image reproduced from @OpenStreetMap contributors CC BY-SA*

#### Lecture notes:

Finally, the police identified an area in the vicinity of Hueypoxtla, where the radiation level exceeded the normal background.

Together with a specialized team of the CNSNS, they located the source, which was lying among the crops in a field. They cordoned off a 500 m radius zone to prevent access to the spot. Because of the absence of lighting, they could not continue to work.

*FIG. on the right: @OpenStreetMap contributors CC BY-SA*

*FIG. on the left: Courtesy of CNSNS*

**5 December 2013**

## **Preparing for recovery of the source**



- The activities to delineate the area and more accurately locate the position of the radioactive source continued.



*Images courtesy of CNSNS*

- The CNSNS also requested experts from the Laguna Verde NPP and the Ministry of the Navy to assist in planning for the recovery of the source.

### **Lecture notes:**

On the next day, they more closely delineated the area and located the cobalt source.

For planning the recovery of the source, the CNSNS asked for help from the Laguna Verde NPP and the Ministry of the Navy.

*FIG.: Courtesy of CNSNS*

**6 December 2013**

**Preparing for recovery of the source (cont'd)**



- Experts from the Laguna Verde NPP entered the area previously delineated by CNSNS and determined the exact location of the source.
- A transport container was requested from the National Institute of Nuclear Research (ININ) for recovering the radioactive source. The container had to be adapted for the intended purpose.



*Image courtesy of CNSNS*

**Lecture notes:**

The experts from the Laguna Verde NPP determined the precise location of the source within the area previously delineated by the CNSNS .

For recovering the radioactive source, the CNSNS requested the National Institute of Nuclear Research to provide a transport container. However, this container had to be adapted for the intended purpose.

*FIG. : Courtesy of CNSNS*

**7 December 2013**

**Preparing for recovery of the source (cont'd)**



- Experts from the CNSNS, Laguna Verde NPP, Navy and Federal Police started planning the clearing of the area around the location of the source in order to facilitate the recovery operations.
- Clearing operations continued until 9 December.



*Image courtesy of Federal Commission for Electricity of Mexico*

**Lecture notes:**

In the meantime, the area around the source location was cleaned in order to facilitate the recovery operations.

*FIG.: Exposed radioactive source (courtesy of Federal Commission for Electricity of Mexico), International Atomic Energy Agency, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018)*

## 8 – 9 December 2013

### Medical follow-up



- The CNSNS requested the help of the Ministry of Health of Veracruz State and the federal Ministry of Health for support in examining individuals who may have been in contact with the radioactive source.
- A joint team visited the Hospital de Pachuca to examine individuals who might have been exposed.
- The team also went to Hueypoxtla to examine individuals thought to have been in contact with the source.
  - One individual had symptoms of radiation exposure on the left shoulder and right leg and was sent to the Hospital de Nutrición in Mexico City for treatment and follow-up.
  - Another individual showed no signs of radiation exposure (having been in contact with the source in its shielded state).

#### Lecture notes:

To help in identifying potential victims, the CNSNS requested the help of the Ministry of Health of Veracruz State and the federal Ministry of Health.

## 10 December 2013

### Medical follow-up (cont'd)



- People who were present at the site on the day the source was found were questioned about their behaviour.
- Out of 59 persons who were presumed to have been exposed:
  - 22 persons were identified for more detailed dose reconstruction;
  - Of these, 10 individuals were selected for a biological dosimetry.
- The biological dosimetry later revealed that only the person who had handled the source after it had been taken out of the shielding received a dose in excess of 500 mSv.

#### Lecture notes:

On the site, an enquiry was conducted to identify people who were present and could have been exposed. A group of 59 persons was retained as potentially exposed. A deeper reconstruction isolated a smaller group of 10 individuals for whom a biological dosimetry was ordered.

In the end, it was shown that only one person had received a dose in excess of 500 mSv, the yearly dose limit stated by the Mexican authorities to avoid deterministic effects for occupationally exposed workers. This was the individual who had manipulated the cobalt source out of its shielding.

## 10 December 2013 Recovery of the source



- The source was successfully recovered with the help of a robot, placed in a transport container and transported to the waste storage facility.



*Images courtesy CNSNS*

### Lecture notes:

On 10 December, the source was successfully recovered with the help of a robot, placed in a transport container and transported to the waste storage facility.

*FIG.: Courtesy of CNSNS*



## Epilogue



- There was no indication that the source had been damaged or broken up and no sign of contamination to the area.
- Hospitals had been alerted to watch for symptoms indicating high radiation exposure resulting from close proximity to the source, which might include sickness and burns.
- One member of the public, the farmer of the cornfield where the source was found, presented himself with skin damage indicating overexposure after carrying the source on one shoulder. He was hospitalized for medical assessment in Mexico City.

### Lecture notes:

There was no indication that the source had been damaged or broken up and no sign of contamination to the area.

Hospitals had been alerted to watch for symptoms indicating high radiation exposure resulting from close proximity to the source, which may include sickness and burns.

One member of the public, the farmer of the cornfield where the source was found, presented himself with skin damage indicating overexposure after carrying the source on one shoulder. He was hospitalized for medical assessment in Mexico City.

End of the story.



## Discussion



- Based on this information, please discuss and answer the questions distributed for this Case Study (*Case Study Part 2 and Part 3: Analysis of the Fukushima Daiichi NPP accident and the radiological incident in Hueypoxtla, Mexico*) within your working group.

– Time allocated: **15 mins**

### Lecture notes:

Allow participants to discuss and answer the questions within the Working Groups for about 15 mins.

## Let's discuss:

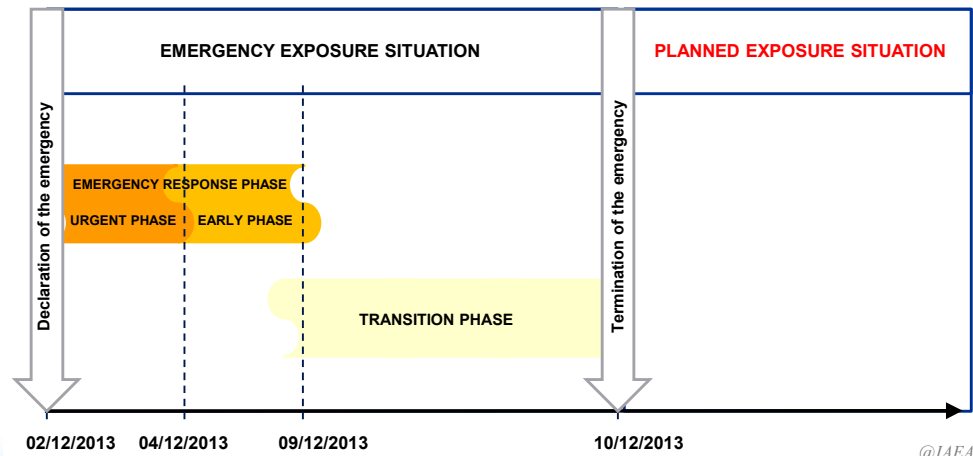


- What urgent protective actions were implemented and when was their implementation completed?
- What early protective actions were implemented and when was their implementation completed?
- What activities were implemented to characterize the situation and to support resumption of normal social and economic activity and when were preparations for this resumption completed?
- When were conditions ensured that allowed for the emergency to be terminated?
  - Time allocated: **15 mins**

### Lecture notes:

After the time for discussion and answering questions has passed, pose each question and allow participants from different Working Groups to answer it and to provide the bases for their answers (for about 15 mins). Only after all questions and answers have been covered, move on and present the next slides.

## Retrospective sequencing and milestones of the radiological incident in Hueypoxtlá



### Lecture notes:

If we put the key milestones of the event on the general timeline of an emergency response, the declaration of the emergency occurred on 2 December 2013 with the notification to the CNSNS. The urgent phase lasted until 4 December, after the source had been located and the area was cordoned off to control access. The transition phase started on 9 December, after the integrity of the source had been confirmed. The emergency came to an end with the recovery of the source on 10 December.

*FIG.: Courtesy of International Atomic Energy Agency*

## Basis for the milestones



- The emergency started on 2 December 2013, when the vehicle transporting a dangerous source was stolen (**urgent response phase**).
- Until 4 December 2013, the emergency response focused on locating the source and issuing warnings and information. On 4 December 2013, the source was located and the area cordoned off and secured (**early response phase**).
- Until 9 December 2013, emergency response focused on identifying the exact location of the source among the crops. On 9 December 2013, the source was isolated and its integrity confirmed (**end of emergency response phase**).
- Plans for recovery progressed in parallel, allowing the rapid recovery of the source on 10 December, by which time monitoring around the site had been completed and all exposed individuals had been identified for assessment and medical follow-up (**transition phase**).

## Case studies



- Detailed in Annex I of IAEA Safety Standards Series No. GSG-11 for further information

*Thank you!*

**Lecture notes:**

Thank you!