
NUCLEAR MATERIAL DISCOVERY OR LOSS : THE FRENCH EXPERIENCE

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Abstract:

In a nuclear facility, when a difference between the physical inventory listing and accountancy records is discovered, the French law (Article 11 of the “Décret 81-512”) requires a declaration to the High Civil Servant for Defence of the Ministry in charge of Industry. Moreover, according to article L.1333-13 of the Defence Code, in case of a suspicion of loss, theft or diversion of nuclear material, the licensee has to declare this event to the police.

In the meantime, an investigation is carried out in the facility, and in cooperation with other facilities if necessary. These measures are aimed at :

- ✓ *Finding the lost nuclear material (if any),*
- ✓ *Understand the causes of the problem,*
- ✓ *Solve the differences by acting on the PIL or/and accountancy records,*
- ✓ *Act to prevent any other occurrence of this kind of event.*

These actions can take place in the general field of a police investigation.

After all these facts and information have been gathered, the licensee writes down a complete file which is transferred to the High Civil Servant for Defence of the Ministry in charge of Industry, in order to be analysed by his technical support body (IRSN). Thus, the IRSN is able to give its conclusion to the authority about this event, especially regarding :

- ✓ *The causes of the event,*
- ✓ *Relevance and completeness of investigations,*
- ✓ *Pertinence of the corrections,*
- ✓ *Relevance of corrective actions,*
- ✓ *Probability of another occurrence.*

This system is useful to ensure a complete follow-up of the events occurring in the various nuclear facilities in France, to have an extensive overview of the problems on a national scale. If an item is found in a facility A, numerous questions must be answered :

- ✓ *Where does it come from ?*
- ✓ *Since when is it in facility A ?*
- ✓ *How did it happen that this item has been transferred from facility B to facility A without the transfer of information ?*
- ✓ *...*

We will consider these issues through examples.

This kind of event can be potentially very rich in terms of information feedback, analysis of possible weaknesses of systems of accountability of nuclear material in facilities, and improvement of these systems.

Moreover, any loss or discovery of nuclear material in a facility can lead to an inventory of nuclear material in case of emergency.

1 INTRODUCTION

In France, there are approximately 270 facilities holding nuclear materials classified in three physical protection categories, and 55 of them hold category I nuclear materials. The majority of these facilities are part of nuclear sites, such as research centers, industrial complexes and nuclear power stations. These facilities cover the entire nuclear fuel cycle, from reconversion of uranium to storage of waste and plutonium recycling in the manufacture of mixed oxide (MOX) fuel, and including spent fuel reprocessing.

The French regulations, in particular the Code de la Défense, the decree of 12th May 1981 for its application and the order of 16th March 2004, provide for control by the authorities of all nuclear materials located on French territory. This control consists in :

- ✓ Evaluation of the measures taken by the licensees to guarantee the protection and control of nuclear materials; these measures are described in the various files requested from the licensees (mainly the authorization file), and
- ✓ Regulatory inspections carried out by sworn State-authorized officials.

The authority responsible for the application of these regulations is the Minister for the Industry, represented by the High Civil Servant for Defense who has been delegated with those powers. He is assisted by the means and skills available at the Institute for Radioprotection and Nuclear Safety (IRSN).

2 NUCLEAR MATERIAL DISCOVERY OR LOSS

The French regulations provide for numerous controls in the facilities to ensure

- ✓ Accurate knowledge, in quantity and quality, of all the nuclear material inputs or outputs in the facility
- ✓ Knowledge at any time of location, use, movement and conversion of nuclear material

These controls consist in :

- ✓ Comparison between the accounting data registered in the facility and the national accounting data (at least once a month),
- ✓ Physical inventory of the nuclear material, and comparison between the PIL and the accountancy records (at least once a year),
- ✓ Controls required for shipment or reception of nuclear material,
- ✓ Comparison between the MUF and measurement uncertainties,
- ✓ Any control required by the quality management system in the facility.

In addition, inspections are carried out in the facilities by IRSN staff to verify on-site practices set up by the operator.

All these controls can lead to a discovery of differences between the PIL and the accountancy record, or between the PIL and the articles detained.

2.1 Declaration

After a difference is discovered, the licensee has to declare this event to :

- ✓ the High Civil Servant for Defense : *“Regarding control and accountancy of nuclear material, the licensee must make the necessary arrangements to [...] detect promptly*

any anomalies concerning the control of NM, and immediately transmit the information to the Ministry of Industry” (Article #11 – Décret 81-512)

- ✓ *the police force : “Anyone, being licensed [...], or being responsible for the nuclear material [...], or looking after its management, has noticed any loss, theft, disappearance or diversion of nuclear material and has not informed the police force within 24 hours, will be sentenced to a 2 years term of imprisonment and a 37 500€ fine.” (Article # L1333-13 – Code de la Défense)*

The difficulty in these legal texts is to establish the moment when the declaration must be done, because such an event cannot be declared without a few verifications such as, for example, checking of the last movements of nuclear material in the facility.

It is now admitted that the declaration must occur as soon as a reasonable certainty is obtained that something unusual has happened.

2.2 Investigation

In the case of missing nuclear material, everything must be done to find them, an action plan is set up to organize the operations.

A special inventory is carried out in the facility. This inventory is targeted on specific aspects related to the missing nuclear material such as nature, physicochemical form, containers, location...

Interviews of staff members are performed to gather as much information as possible, especially to assess precisely the moment of the event, and to relate it to any unusual operation at that time.

All the documents that can be related to the nuclear material are examined, such as operators' records, daily reports, local accountancy books, movement and process records...

In the case of a discovery of nuclear material, the investigations aim at obtaining answers to two key questions :

- ✓ Where does it come from ?
- ✓ Since when is it in this facility ?

As there is generally a lack of record of the movement, the investigation is essentially based on interviews of staff members.

It is perfectly understandable that this inquiry can involve other facilities, as nuclear material could have been :

- ✓ Evacuated,
- ✓ Never received,
- ✓ Transferred without the proper record...

At the end of those operations, the causes of the anomaly have generally been identified.

2.3 Regularization

Once the nuclear material have been found, or all the possibilities explored without any result, or the sequence of events established, it is necessary to make corrections so that the accounting records and the PIL are in agreement with the new situation.

The local accountancy records are modified by the emission of a declaration of either :

- ✓ Accidental loss
- ✓ Inventory discrepancy (which can be positive or negative)
- ✓ Receipt / shipment

2.4 Corrective actions

The licensee has to put up means and procedures to eliminate the causes and avoid any other occurrence of this event.

They can be :

- ✓ Modification of documents : procedures, modus operandi...,
- ✓ Modification of soft wares,
- ✓ Modification in records form,
- ✓ Formation,
- ✓ Information,
- ✓ ...

2.5 Documents

Once all these steps have been carried out, the licensee writes down a complete file, which is transferred to the High Civil Servant for Defence. In this file, are gathered any information regarding :

- ✓ Investigations and action plan,
- ✓ Determination of causes
- ✓ Regularizations
- ✓ Corrective and preventive actions

This file is evaluated by the technical support body of the High Civil Servant for Defence, which is the IRSN/DEND (Nuclear Defence Expertise Division). This evaluation can be performed with the help of technical meetings with the licensee to examine documents not included in the file.

The analysis is focussed on the evaluation of several key points :

- ✓ The causes of the event,
- ✓ Relevance and completeness of investigations,
- ✓ Pertinence of the corrections,
- ✓ Relevance of corrective actions,
- ✓ Probability of another occurrence.

The evaluation is sent to the High Civil Servant for Defence, which draws conclusions on this particular event.

2.6 Conclusion

This approach is useful to ensure a complete follow-up of the events occurring in the various nuclear facilities in France, to have an extensive overview of the problems on a national scale.

These kinds of events can be potentially very rich in terms of information feedback, analysis of possible weaknesses of systems of accountability of nuclear material in facilities, and improvement of these systems.