

## Transportation and accounting : linking two national databases

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### Abstract

IRSN is the French TSO in nuclear and radiation risks. Its activities cover all the related scientific and technical issues. Among these numerous activities, it carries out the centralised accountancy of nuclear materials. Within the context of the national regulation, a daily report for any inventory change has to be transmitted to the centralised accountancy by the authorized operators. The centralized accountancy processes every working day the accounting records sent by all the facilities in the country. These records include the usual accounting data. By crossing this accounting information, a computerised system verifies the validity of the data and their consistency (e. g. matching of the accounting data between shipper and receiver, availability in stocks, respect of international obligations). The data are, if necessary, corrected by the operators. Safeguards reports are produced and checked on this basis.

IRSN supports also the Authority in the management and monitoring of nuclear materials transport with a Transport Control Center (TCC). Prior to the authorization of any transport, data describing the nuclear material are requested by TCC pursuant to the national regulation. These data are recorded in a specific database dedicated to transport activities.

Discrepancies have been occasionally identified between these two separated sources. Reconciliation between the two sources, in addition, has proven tedious and time-consuming. In order to easily and systematically cross-check the two sources, a linkage between the two databases has very recently been created. It was made possible by the adding of the transport ID in the transmitted accounting data, creating a common key between the two databases. This information was made mandatory in the context of an overall new national regulation, greatly strengthening the veracity of information both for Safeguards and Security purposes. This new regulation entered into force as of 1 January 2023.

## 1. INTRODUCTION

IRSN -the French Institute for radiological protection and nuclear safety- is the French Technical Support Organization in nuclear and radiation risks. It provides technical support to all the government authorities involved in the safety and security of nuclear facilities, nuclear material, transportation and protection of the population. This technical support relies on research, in a process of synergy, on all related scientific or technical subjects. Among these many activities, IRSN carries out the centralized accountancy of nuclear materials as part of the French obligations towards national regulation on nuclear security as well as obligations towards international non-proliferation and safeguards agreements.

IRSN is also in charge, on behalf of the nuclear security Authority, of the management and monitoring in real time of nuclear materials transport with the so-called *Transport Control Center* (TCC). It performs technical controls on the means of transports (tractors and trailers) to check for compliance with regulatory requirements related to nuclear security and performs inspections during transport operations.

The purpose of this paper is to explain and demonstrate how:

- cross-checking of accounting and transportation data, at small scale, has already enhanced the reliability of Safeguards data;
- the linking of these two separated sources has very recently been operated;
- a new regulatory provision within a whole revised national security regulation has greatly facilitated this operation;
- the provision implemented for security purposes will fully benefit the accuracy and reliability of safeguards reports.

## 2. AN INITIAL ORGANIZATION BASED UPON SECURITY OBJECTIVES

### 2.1. Historical context

In the second half of the twentieth century France developed a nuclear program of great magnitude. For a long time, a public state institution known as the CEA has been the sole owner of the nuclear materials present on French soil. The transition to the industrial stage has led to the multiplication of private stakeholders in the civil nuclear fuel cycle. This has resulted in the need to create in the early eighties a national legislative and regulatory framework especially for nuclear materials, which is a part of the French Code of Defense which deals with the protection of nuclear material, nuclear facilities and the transportation of nuclear material against malicious acts. This early security regulatory framework existed in France, unlike most other countries, prior to international safeguards agreements and commitments.

On August 2, 1992, France was the last of the five nuclear-weapon States to join the NPT[1], regarding which, up to then, it had declared that it would comply with the provisions therein. The Additional Protocol was signed in 1998 [2],[3]. Member of the Euratom Treaty since its signing in 1957, France is fully committed to Regulation 302/2005 along with many others [4], [5], [6], [7], [8], [9], [10].

### 2.2. Administrative organization

The national legislative and regulatory framework has an integrated approach including physical monitoring and accountancy measures designed to track with accuracy the quantities of nuclear material present at facilities and its location, together with physical protection, management, organizational and information technologies measures. [11], [12]. Responsibility for drawing-up the regulations, assessments and inspections is assigned by the French Defense Code to the Minister for Energy Transition (MTE). The Senior Defense and Security Officer under the responsibility of MTE is the competent authority for nuclear security.

The Euratom Technical Committee (CTE), reporting directly to the Prime Minister, monitors implementation of international controls on nuclear material in France:

- by the European Commission under Chapter VII of the Euratom Treaty;
- by the IAEA under the safeguards agreement signed between France, the IAEA and Euratom.

IRSN provides technical support for both the nuclear Security Authority (HFDS/MTE) and the Safeguards Authority (CTE).

### 2.3. Specificities of the French organization

#### 2.3.1. Separation of duties

The French legislation set forth organizational requirements. The licensee has to appoint a “special representative” who formalizes and assigns responsibilities and missions and shape the staffing structure for both physical follow-up and accountancy with the following features:

- staff in charge of accounting or physical protection system cannot handle nuclear material;
- staff in charge of physical follow-up cannot perform tasks related to accounting or to physical protection;

- physical follow-up, physical protection and accounting systems do not share any equipment or procedure.

This strict separation of duties with no overlap of responsibilities between “accountancy” and “follow-up” goes far beyond AIEA’s guidance which recommends only a separation between “Physical Protection” and “Nuclear Material Accountancy and Control (NMAC)”. This provision constitutes a great specificity of the French organization.

### *2.3.2. Fine breakdown into accountancy zones*

An “accountancy zone” is a part of an installation subject to license that may contain nuclear materials and in which any operation affecting the book inventory is registered. An accountancy zone may contain one or more physical monitoring zones.

A “physical monitoring zone” is a part of an installation subject to inspection of arrivals and departures of nuclear materials.

As part of the issuance of the license, the operator has to define the most relevant breakdown of the facility in one or several accounting zones. The accounting breakdown in France is in many cases reduced to a smaller area compared to the MBA (Material Balance Area) established for international safeguards. The purpose is to make control easier and to reduce the size of the area to which an unauthorized removal or loss can be imputed.

412 accountancy zones are thus managed for Security purposes versus 186 MBA for Safeguards ones.

### *2.3.3. Daily recording and transmission to the centralized accountancy*

The efficiency of the accounting system is mainly based on:

- A daily information flow between facilities and the centralized accountancy;
- An ongoing verification of the transmitted data.

All the French authorized facilities daily transmit their variation reports to the centralized accountancy through a VPN (Virtual Private Network) connection. These variations data are recorded on the same day in the accountancy at facility level- also called local accountancy- where the transaction occurred. Transactions include receipt, shipment, enrichment, blending operation, category change, transfer to waste, etc... They include a lot of information such as accounting zones, type of nuclear material, characteristics, irradiation status, quantities, etc

The data are checked in order to verify any inconsistency (non- matching data between shippers and receivers, material stock smaller than quantity to be cleared, anomaly in enrichment, non-conservation of mass etc...) or prohibited transactions (unauthorized change in particular obligation, incorrect rebatching etc...). After possible corrections, the postings are made both at facility level and at centralized accountancy level.

Table 1 shows the annual volume of accounting data processed by the centralized accountancy during the last five years:

**TABLE I: Annual volume of processed data by the centralized accountability**

<b>Year</b>	<b>Accounting areas</b>	<b>Daily variation records</b>	<b>Lines of records</b>
2018	411	64 903	181 417
2019	413	69 835	194 377
2020	412	69 322	198 377
2021	412	86 158	247 766
2022	412	87 600	246 205

### 3. CROSSING OF TRANSPORTATION DATA WITH ACCOUNTING DATA

#### 3.1. IRSN Transport Control Center

IRSN has a special operations center for monitoring nuclear material transport, called Transport Control Center (TCC).

Under the authority of the Ministry of Energy Transition (MTE), the TCC has three main missions as part of nuclear material protection and control:

- Managing and monitoring nuclear material transport operations in real time;
- Performing technical controls on the means of transport (tractors and trailers);
- Performing inspections during transport operations.

All the different modes of transport used for transporting nuclear material are monitored (road, rail, sea and air). These activities are qualified technical support responsibilities since they are technical activities under the States's sovereign functions.

#### 3.2. Categorization of transport

Organisational and protection measures during transportation are designed to ensure a security level equivalent to that deployed in facilities. As an extension of the categorization of nuclear material table from INFIRC 225, nuclear material is divided into four categories (category I to IV) according to the nature and quantity of the material.

The most sensitive materials are classified Category I, those which are most likely to be transformed into nuclear explosive devices.

#### 3.3. Implementation Approval

Shipments, by all modes of transport, shall require an implementation approval. This provision is not, however, applicable to shipments of natural uranium, depleted uranium or thorium. Requests for implementation approvals shall be submitted, giving a minimum of fifteen days' notice.

This notice period shall be extended to one month for shipments of nuclear materials falling under categories I or II originating or bound abroad or to three months for shipments of nuclear materials falling under categories I or II comprising at least one maritime or air stage.

For shipments of nuclear materials other than those in categories I and II, silence on the part of the competent authority one clear day prior to the scheduled shipment date shall be regarded as an implementation approval [14].

The data transmitted by the shipper are recorded by IRSN, prior to the transportation, in a separated database.

**TABLE II: Number of transports monitored by the transport operation center**

Transportations	2018	2019	2020	2021	2022
Year	1 013	1 151	1 165	1 389	1 155

**TABLE III: Breaking-down of transports in 2022**

	Cat 1	Cat II	Cat II irradiated	Cat III
Cancelled files	5	0	63	93
Grouping	0	0	0	2
Carriage performed	89	1	184	881

### 3.4. Cross-Checking of accounting and transportation data

The authorized carriers are required to declare properties and specificities of each shipment to IRSN, independently of the accounting declaration of the shipper and the receiver. Subsequently, IRSN gets therefore the accounting declaration not only from the shipper but also from the receiver and the carrier.

A cross-checking of transportation and accounting data used to be carried out, until the end of last year, following each monthly accounting closure. The data were provided from the two following separated databases:

- centralised accountancy
- transportation (TCC).

Errors, irregularities or omissions could thus be identified in declarations. Any detected discrepancy was transmitted to the relevant operator and subject to an investigation.

Relevance of data stored in the two separated databases was consolidated.

## 4. LEVERAGING THESE TWO SEPARATED DATABASES

### 4.1. Constraints and limits

The cross-checking of data between the two sources was not yet automated, some long manual steps were still required both for reconciling the data and then exploiting them. It has proven tedious and time-consuming.

### 4.2. Implementation of an improved process

A specific field identifying the transport "ID" on the accounting report daily transmitted by the operator to the centralised accountancy was implemented as from 1 January 2023 in order to create a direct link to the transportation database. This results in the creation of a unique common key clearly identifying the material's shipment in the two

distinct computer databases. Reconciliation of the two hitherto separated databases is thus greatly improved.

#### **4.3. Contribution of a recent national security regulation**

This provision to include the transport “ID” on the accounting report daily transmitted by the operator to the centralised accountancy will apply as from 1 January 2024 for all transports with implementation approval. It is part of a larger national regulatory overhaul. [13]

#### **4.4. Contribution for international safeguards**

The Accountancy Unit relies on the national accounting data to produce following reports for international purposes:

- imports/exports of nuclear materials;
- passage of material under safeguards to non-safeguards and vice-versa;
- swaps;
- production of mines;
- transparency regarding stocks of plutonium and highly enriched uranium

In addition, the verification of the completeness and correctness of the Euratom reports benefits from the upstream work and cross-checked possibilities within the national centralized accountancy.

The recent systematized linking of accounting and transportation data will streamline the cross-checking process, further leverage the gathered data and enhance the reliability and accuracy of safeguards reports.

### **REFERENCES**

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- [6] Commission Regulation 302/2005
- [7] Bilateral agreement between France and Australia
- [8] Bilateral agreement between France and Canada
- [9] Bilateral agreement between France and Japan
- [10] Bilateral agreement between France and USA
- [11] Legislative parts (Articles L.1333-1 and following of the Defense Code) and the regulatory parts (Articles 1333-1 and following) relative to the protection and control of nuclear material
- [12] Defense Code Article R.1333-17
- [13] Decree 2021-173 of 3 June 2021