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**THE FRENCH TOUCH OF THE 3S CONCEPT:  
REINFORCING BILATERAL SYNERGIES**

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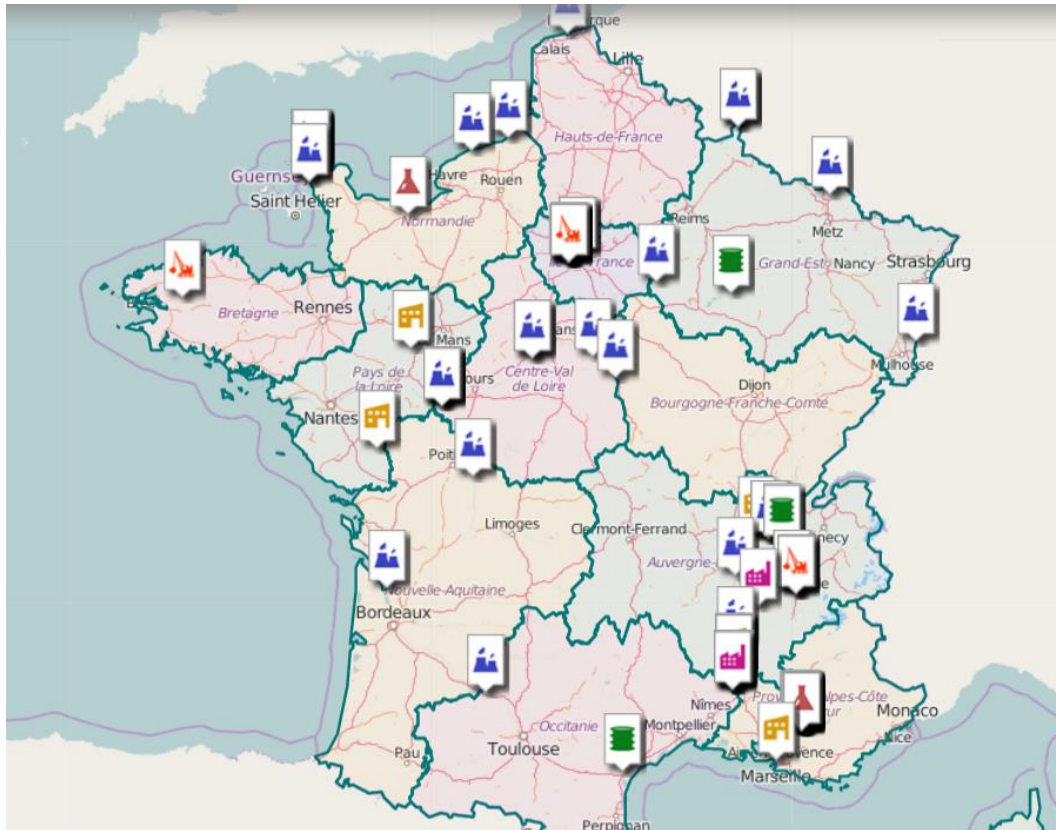
**ABSTRACT**

The development of the civil nuclear energy was accompanied by the independent development of international legal provisions on, chronologically, nuclear Safeguards, nuclear Safety and nuclear Security. Later, with the maturity of these regimes came a reflexion on the welcomed (and necessary?) synergies and interfaces between them, leading to what is called “the 3S Approach”. As a major Nuclear State with a large number of civilian nuclear facilities licensed from the 1950's in almost every step of the nuclear fuel cycle, France has built 3 different regulations addressing these topics, based on different concepts, and a clear administrative organization with 3 corresponding different and independent regulatory bodies. Nevertheless, the international debate on the 3S Approach, as well as of course the implementation of the international legal instruments ratified by France in these fields, gave food for thought to the national Authorities. An important reflection work was done to clarify the fundamental principles governing the legal provisions, focusing on the aims and not only on the means. Clear national positions were also established or reaffirmed: France considers that the principles behind each “S” are different and shall remain so; nuclear Security is the exclusive competence of each State; the management of interactions between Safety, Security and Safeguards is the sole responsibility of each State, indeed free to decide how to organize itself. However, at the same time, it should be noted that the domestic regulations addressing each “S” were amended to take into account identified interfaces between Safety and Security and between Security and Safeguards. The involved regulatory bodies have also built new procedures to consult and work together; national coordination, whenever needed, takes place under the responsibility and authority of the Prime Minister, thus ensuring the overall consistency of the State action. This paper will present the French organization and legal framework addressing each “S”, before giving examples of the interfaces and synergies between independent regulations and regulatory bodies. To synthetize the French approach, we will demonstrate that “3S = 2 x 2S”.

**INTRODUCTION**

France is an important “nuclear country”, as proves the current French nuclear panorama:

- 182 Material Balance Areas (MBA) in 2020 on 45 sites all over the territory and even overseas (see Figure 1, without the overseas French Territories);
- All the steps of the nuclear fuel cycle except mining;
- 4 main operators known worldwide: Orano (conversion, enrichment and reprocessing); Framatome (fuel fabrication); EDF (electricity production); CEA (research);
- 56 Nuclear Power Plants (NPPs) in operation;
- A unique public company, Andra, for the long-term radioactive waste management.



**Figure 1 – Location of the main French nuclear installations @ASN website**

In France, the important development of the nuclear facilities in the 1960's and 1970's is the result of the lack of national energy resources (gas, oil or coal) to produce electricity in a context of economic growth, and of the strong desire and need to be energetically independent, in the context of the world oil crisis. The political choices to go on with the nuclear electricity production were accompanied by the adoption and implementation of a robust domestic legal framework: signature of the Euratom Treaty in 1957; creation of the “basic nuclear installations” (BNI) regime in 1963 based on a 1961 Act as a starting point for the safety regulatory provisions; nuclear civil liability regime in a 1968 Act; Act of 1980 on the protection and control of nuclear material, etc. The topics were addressed one by one, with an administration in charge for each one.

Soon, international texts supplemented these national laws and regulations. An international legal and historical approach clearly illustrates that nuclear safety, security and safeguards developed independently until recently, and chronologically in the following order: nuclear safeguards, nuclear safety and nuclear security. But in the early 2000s, learning among others from the nuclear accidents of Three Mile Island and Chernobyl and from the discovery of unexpected nuclear weapons programs, the concept of the nuclear “3S” (for Safety, Security and Safeguards, in whatever order) was brought to the forefront in a number of IAEA documents. These documents pushed the idea that, in order to be truly effective, nuclear safety, security and safeguards needed to fully address their complementary and competing aims.

The current French organization is based on national historical construction and choices: each “S” (safety, security, safeguards) has its competent authority, its own set of regulations and its inspection system. It has proved to be robust and adaptive, with important changes in 2006 and 2021 for instance. Of course, this new 3S Approach is to take under consideration and helps to

improve the existing. But rather than wipe out the past, the choice was made to build links, bridges, between the existing different systems... when useful and meaningful.

## **1. 3S, 3 INDEPENDENT SYSTEMS**

In France, nuclear safety, nuclear security and nuclear safeguards developed independently. As this organization is well known from the nuclear operators and successfully working, it is still in place. The names of the administrations may have changed all over the years, as well as the references of the laws, but the principles remain and are still valid.

### 1.1 Nuclear safety

#### Legislative and regulatory framework

The main legal instruments on nuclear safety are the Act n° 2006-686 of 13 June 2006 on Transparency and Security in the Nuclear Field (the “TSN Act”), and implementing decrees, in particular Decrees n° 2007-830 of 11 May 2007 (the “BNI- Nomenclature” Decree) and n° 2007-1557 of 2 November 2007 (the “BNI Procedures” Decree). These provisions were codified and are now in the Environment Code, mainly under Articles L. 591-1 and followings (for the legal provisions) and Articles R. 591-1 and followings (for the Decree provisions). The Ministerial Order of 7 February 2012 laying down the general rules applicable to BNI completes the regulatory texts applicable to the biggest nuclear facilities in France, with regulatory decisions taken by the ASN.

Transparency is the key word of these texts: from the first reflexions of a company about a new nuclear project until the decommissioning and delicensing of BNI via the management of radioactive emergencies, the information, rules and assessments must be public.

#### Competent authority

The competent regulatory authority for nuclear safety is the Nuclear Safety Authority (ASN), created as an Independent Administrative Authority by the 2006 Act.

Managed by a college of five commissioners, including the ASN Chairman, ASN has in 2020 529 agents located in the Headquarters in Paris and in 11 territorial divisions, to be closer to the inspected facilities.

Its main roles are:

- **Regulating:** ASN contributes to drafting regulations by submitting its opinion to the Government on draft decrees and ministerial orders, or by issuing technical regulations. It ensures that the regulations are clear, accessible and proportionate to the safety issues;
- **Licensing:** it examines all individual license applications for nuclear facilities, small-scale nuclear activities and radioactive substances transport operations. It can grant licenses, except for major steps of the BNIs (for the creation and decommissioning, a decree is necessary);
- **Informing:** ASN reports on its activities to Parliament. It informs the public and the stakeholders about its activities and the state of nuclear safety and radiation protection in France. It enables all members of the public to take part in the drafting of its decisions with an impact on the environment and supports the actions of the Local Information Committees of the BNI.

#### Inspections

With 320 safety inspectors, ASN is responsible for ensuring compliance with the rules and requirements applicable to the nuclear facilities and activities within its field of competence. The inspections concern any nuclear activity, big or small: NPPS, radioactive waste

management, fabrication and reprocessing of nuclear fuel, radioactive material packages, medical facilities, research laboratories, universities, industrial activities, etc. More than 1,800 inspections are carried out every year in the fields of nuclear safety and radiation protection. ASN has a range of enforcement and penalty powers (formal notice, administrative fines, daily penalty payments, ability to carry out seizure, take samples or require payment of a deposit, etc.). The administrative fine is the competence of the Sanctions Committee within the ASN, which complies with the principle of the separation of the examination and sentencing functions.

## 1.2 Nuclear security

### Legislative and regulatory framework

The most important provisions on nuclear security are in the Defence Code, under Articles L. 1333-1 and followings (for the legal provisions) and R. 1333-1 and followings (for the regulatory provisions). The most important Act on the protection and control of nuclear material was adopted in 1980, with several implementing Decrees over the years.

The regulatory provisions of the Defence Code applicable today mainly come from the Decree n° 2009-1120 of 17 September 2009 on the protection and control of the nuclear material, their facilities and their transport. But very recently, the Decree n° 2021-713 of 3 June 2021 was adopted to update the regulatory framework applicable to nuclear security, with a clarification of this concept and a control strengthening. These new provisions, codified in the Defence Code, will enter into force in 2023.

To complete the 2009 Decree, 10 Ministerial Orders were adopted, mostly in 2011. These Orders will also be profoundly renewed in the coming year 2022, to complete the 2021 Decree.

Focused on nuclear materials that can be stolen or diverted for malevolent acts, confidentiality is an important component all the involved actors, industrials as administrations, have to deal with. The nuclear security policy is based on 3 complementary attitudes: anticipation, protection, definition of intervention mechanism if necessary.

### Competent authority

The High Official for Defence and Security (HFDS) of the Ministry of Energy (today called “Ministry of Ecological Transition”) defines and implements the national defense and security policy applicable to nuclear activities. It is responsible for the application of the Defense Code provisions on nuclear security via its Nuclear Security Department (DSN).

The DSN draws up the nuclear security regulations and authorises, for security purposes, the holding of these materials in nuclear installations and the transport of nuclear materials.

The main roles of the DSN are:

- To assure a permanent watch and vigilance on potential threats in order to anticipate all the risks that industrials have to face;
- To regulate while ensuring the highest standards of nuclear security in accordance with international commitments. The challenge is to strengthen the capacity of actors to deal with malicious acts in a pragmatic and effective manner;
- To license nuclear activities as listed by the Defence Code. The import and export, possession and transport of nuclear materials are subject to a prior license issued on the basis of the analysis of a security demonstration established by each of the responsible for a so-called nuclear activity;
- To raise awareness and to ensure the development of the nuclear security culture by running networks, seminars and training courses for the involved stakeholders.

## Inspections

The DSN is responsible for monitoring the implementation of security measures in nuclear facilities and transport, in particular through inspections, announced or not. To this end, it relies on the technical support of the Radioprotection and Nuclear Safety Institute (IRSN). Each year, approximately 150 security inspections are performed in the nuclear facilities, using different methods adapted to the issues at stake. Inspections are focused on efficiency and therefore on actions that produce the greatest benefits in terms of protection.

National exercises are also organized in order to test as well the national organisation and collaboration between Departments, with an annual rhythm of 4 exercises and various scenarii. At last, like the ASN, the Ministry of Energy has a large range of enforcement and penalty powers, as the Defence Code set administrative (financial fines for past deviations up to 10 millions € per day of non compliance for example) and criminal penalties (up to 10 years imprisonment and 7,5 M€ for theft of nuclear material for example).

### 1.3 Nuclear safeguards

#### Legislative and regulatory framework

Safeguards are not addressed the same way than nuclear safety or security. Instead of specific provisions in a Code, the legal and regulatory texts related to safeguards are mostly the consequence of the national enforcement of the French international commitments:

- With the IAEA: mainly Voluntary Offer Agreement (VOA) of 20 and 27 July 1978 (INFCIRC/290); Additional Protocol (AP) of 22 September 1998 (INFCIRC/290/Add1); Safeguards Agreement for the Caribbean of 21 mars 2000 + modifications on the Small Quantities Protocol of 17 September 2017;
- With Euratom: mainly the Euratom Treaty and its chapter VII “Safeguards”; regulation n° 302-2005 of 8 February 2005 on the application of Euratom safeguards;
- With third countries: bilateral Euratom cooperation agreements and French cooperation agreements in the field of pacific use of nuclear energy (see Figures 2 and 3).

Pays <sup>α</sup>	Date initiale d'entrée en vigueur <sup>α</sup>	Référence législative <sup>α</sup>
	1959 <sup>α</sup>	JO -59/1165 du 24 novembre 1959 (accord) <sup>¶</sup> JO-L-65/16 du 8 mars 1978 (amendement) <sup>¶</sup> JO-L-27/25 du 4 février 1982 (amendement) <sup>¶</sup> JO-C-191/6 du 31 juillet 1985 (amendement) <sup>¶</sup> Nouvel accord en cours de négociation <sup>α</sup>
	1996 <sup>α</sup>	JO -17/309 du 19 mars 1959 <sup>¶</sup> JO-L-120/1 du 20 mai 1996 <sup>α</sup>
	2006 <sup>α</sup>	JO-L-32/65 du 6 février 2007 <sup>α</sup>
	2006 <sup>α</sup>	JO-L-261/27 du 22 septembre 2006 <sup>α</sup>
	2008 <sup>α</sup>	JO-L-10/16 du 15 janvier 2009 <sup>α</sup>
	2008 <sup>α</sup>	JO-L-269/9 du 21 octobre 2003 <sup>α</sup>
	2012 <sup>α</sup>	JO-L-29/4 du 1er février 2012 <sup>α</sup>
	2013 <sup>¶</sup> (signé) <sup>α</sup>	JO-L-204/3 du 31 juillet 2013 <sup>α</sup>
	2021 <sup>α</sup>	JO-L-445/5 du 31 décembre 2020 <sup>α</sup>

Figure 2 Euratom bilateral nuclear Agreements

Pays <sup>α</sup>	Date initiale d'entrée en vigueur <sup>α</sup>	Pays <sup>α</sup>	Date initiale d'entrée en vigueur <sup>α</sup>
	1972 <sup>α</sup>		2008 <sup>α</sup>
	1975 <sup>α</sup>		2009 <sup>α</sup>
	1981 <sup>α</sup>		2009 <sup>α</sup>
	1981 <sup>α</sup>		2010 <sup>α</sup>
	1981 <sup>α</sup>		2010 <sup>α</sup>
	1990 <sup>α</sup>		2010 <sup>α</sup>
	1996 <sup>α</sup>		2011 <sup>α</sup>
	1997 <sup>α</sup>		2011 <sup>α</sup>
	1998 <sup>α</sup>		2012 <sup>α</sup>
	2000 <sup>α</sup>		2013 <sup>α</sup>
	2002 <sup>α</sup>		2013 <sup>α</sup>
	2008 <sup>α</sup>		2015 <sup>α</sup>

Figure 3 French bilateral nuclear Agreements

The 1998 AP asking for information coming from any person who has or intends to have an activity linked to nuclear material and/or the nuclear fuel cycle, the Act n° 2016-113 of 5 February 2016 implemented in the French legal framework the obligations coming from the

AP. It was completed by the Decree n° 2018-885 of 12 October 2018 and a Ministerial Order of 13 March 2020.

### Competent authority

According to the Decree n° 2011-607 of 30 May 2011, the Euratom Technical Committee (CTE) is the French Safeguards Authority. It is a Prime Minister's technical entity in charge of ensuring the implementation of the Chapter 7 of the Euratom Treaty and of the IAEA VOA and AP (declarations, inspections), as well as of monitoring the implementation of France's international commitments in the nuclear field (see Figures 2 and 3), in cooperation with other ministries (Foreign Affairs, etc.). As such, it follows up the implementation of international safeguards in the French facilities and for the civil nuclear material. In these fields, CTE has a direct contact with the IAEA and the European Commission, as well as with any French nuclear operator to help him understand and implement the international requirements.

To help in its missions on safeguards, CTE relies on the technical support of a dedicated Bureau of the IRSN.

Otherwise, according to the Article R. 1333-20 of the Defence Code, CTE is also licensing the transfers of nuclear material to or from a civil activity from or to a defence activity, to ensure that these transfers are made in accordance with France's international commitments, in particular the Euratom Treaty.

### Inspections

Euratom and the IAEA are both implementing inspections for safeguards purposes. In 2019, they performed 334 inspections, with an effort of 1 527 person.day in the French facilities (2020 being no significant because of the Covid-19 pandemic and the subsequent difficulties to travel). CTE and its technical support IRSN are organized to accompany IAEA inspections and complementary accesses, as well as some Euratom inspections in France, with an average of 50 accompanied inspections per year.

The international safeguards inspections being numerous and very comprehensive and because there is no proper set of national requirements, there are no additional national safeguards inspections. CTE agents are thus not inspectors.

## **2. TOWARDS BILATERAL SYNERGIES**

Having 3 self-sufficient and independent national organizations to deal with nuclear safety, security and safeguards is of course not an impediment for initiating a fundamental and objective reflection on the 3S Approach. The objective of this international concept being to think synergies and interfaces between them, the French public Authorities took the idea and made progressive improvements to facilitate the dialogue and co-working on cross-cutting issues. Here are some examples.

### 2.1 Strong links between safety and security

The strong links between nuclear security and safety are obvious and easy to see: a nuclear material, subject to security protection, must be handled and stored in facilities, therefore concerned by safety considerations.

A first link was introduced in the safety corpus by the 2007 "BNI Procedures" Decree, now codified in the Environment Code. When an operator wants to create a BNI, he submits to the Minister of Energy an application for license according to the Environment Code, with a preliminary safety report setting out, in particular, the hazards that the BNI might present in the event of an accident, whether or not of a radiological nature and describing accidents that might

occur, whether their cause is internal or external, including the nature and extent of the consequences of accidents studied in application of the provisions of the Defence Code on the protection of nuclear material. Here, safety meets security and the ASN, while and for analyzing the preliminary safety report, needs the expertise and data of the DSN (confidentiality being secured by legal provisions).

On the other hand, taking into account the feedback of the previous procedure, the recent changes in the nuclear security regulatory framework (Defence Code) better took into account cases in which a nuclear operator wants to handle new nuclear material because he is also asking for a safety license to build a new BNI. And the DSN, while drafting the 2021 Decree, consulted the ASN to be sure that the interactions between the 2 licenses an operator can apply for (security in the Defence Code and safety in the Environment Code) are correctly addressed.

These close relations between ASN and DSN are also planned by exchange of information in their respective monitoring of the nuclear activities : *“When they may be of interest to nuclear security, the findings made by nuclear safety inspectors or radiation protection inspectors in the course of their inspections shall be communicated to the departments of the Minister responsible for energy”*, e.g. the DSN (new Article R. 1333-73 of the Defence Code).

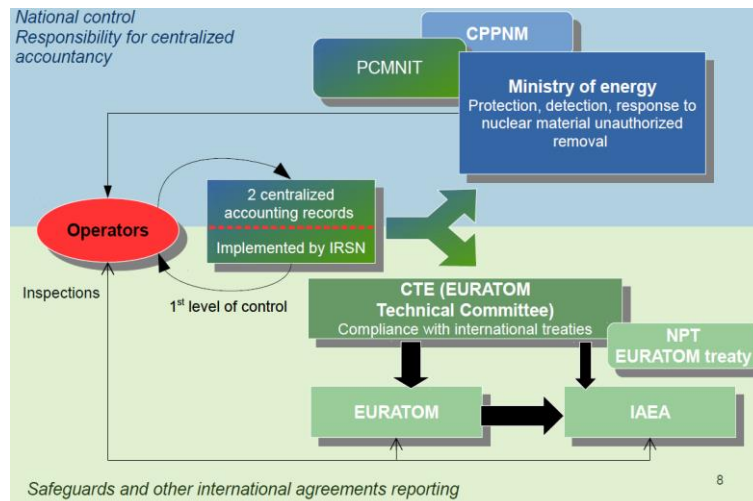
## 2.2 Complementarity of security and safeguards

In these 2 fields also, the complementarity is obvious as security and safeguards are using the same “tools” but for different purposes: accountancy and physical monitoring of the nuclear material and articles containing them. In France, they are even sharing the same technical support, IRSN, and the tools IRSN developed for both Authorities.

This complementarity is particularly explicit in the 2021 Decree on the protection of nuclear material : from its entry into force in 2023, the new provisions of the Defence Code will indicate that their purpose is to protect nuclear materials and associated activities against any malicious act or loss of nuclear materials, with the aim of avoiding nuclear proliferation and preventing any risk or inconvenience to public health, safety, security and the environment that may result, as well as to control these materials and activities, but they will also aim to respect France's international commitments relating to nuclear materials, in particular by contributing to the fulfilment of the missions of the CTE.

In the 2021 new Decree Section on *“Centralized accountancy and accounting declarations”*, it is stated that the Ministry of Energy is responsible for the centralized accountancy of all civil nuclear materials, in particular to know at any time their qualities, quantities, location and use, with the technical support of IRSN. Novelty in the regulatory text: the Decree adds that the centralized accountancy made by IRSN also contributes to the fulfilment of the missions of the CTE (new Article R. 1333-11 of the Defence Code).

Indeed, the centralized accountancy is a key tool for preparing the periodic declarations France has to send to the IAEA according to its VOA, AP and other voluntary information it accepted to give to the Agency (as INFCIRC/207, 415 or 549). It is also necessary to prepare the annual reports CTE has to send to its foreign partners when a French bilateral cooperation agreement provides for it (see Figure 4).



**Figure 4 – Synthesis on the use of the centralized accountancy both for security and safeguards purposes**

On this aspect, more information can be found in IRSN Article on “Digital Tools for Safeguards: The French TSO's Point Of View” of INMM & ESARDA Joint Virtual Annual Meeting of 2021.

Being explicitly mentioned in the Defence Code provisions dedicated to nuclear security, DSN consulted the CTE while drafting the 2021 Decree. More, it asked CTE experts on safeguards to participate to working groups it constituted for the revision of the Ministerial Orders. This solicitation clearly demonstrates the good and trustworthy relationships between DSN and the CTE.

### 2.3 Safety / safeguards: the missing and unnecessary bridge?

When a country has one and single Authority for nuclear activities, thus covering nuclear safety, security and safeguards and maybe other topics like exports controls, the interactions can appear evident and natural. But when you have 3 independent organizations and wonder about links you could build to improve your national systems and legal provisions, the relevance of common interests and interfaces between safety and safeguards is at least less clear.

An opportunity could be to take advantage of the safety application of license and add in this application information about how the operator intends to deal with the safeguards issues. But France has no national specific requirement on safeguards other than respecting its international commitments. Furthermore, the VOA and the Euratom regulation already ask for design information for safeguards purposes with specific format. Then it doesn't seem useful, from a safeguards point of view, to ask for unnecessary information in an already heavy application in which CTE has neither access nor interest. Including safeguards concerns in the safety application would also imply important regulatory changes, in the composition of the application but also in the Authorities analyzing it.

Moreover, doing so indirectly implies that the safeguards issues are submitted to a national licence, which would be an important change and need a confirmation by an Act. As already mentioned, as long as the international regulations ask for documents CTE is the first Authority to see and analyze, asking for a national safeguards licence seems unnecessary and not proportionate to the issues at stake.



## CONCLUSIONS

As summarized in Table 1 below, France historically built up its administrative organization and nuclear legal framework on the independence of nuclear safety, security and safeguards. This independence still makes sense today, the different topics obeying to different, even contradictory, philosophies and principles: safety of the nuclear facilities is ruled by transparency to increase public confidence; nuclear security on nuclear materials implies discretion and confidentiality to prevent the dissemination of information and any malicious act; safeguards on nuclear materials are focused on the French international commitments.

**Table 1- The French organization for each of the nuclear 3S**

	<b>Laws</b>	<b>Authority</b>	<b>Inspections</b>
<b>Safety</b>	Environment Code	Nuclear Safety Authority (ASN)	Safety inspections by ASN
<b>Security</b>	Defence Code	Ministry of Energy / Nuclear Security Department (DSN)	Security inspections by DSN
<b>Safeguards</b>	Euratom Treaty + IAEA commitments + international agreements	Euratom Technical Committee (CTE)	Safeguards inspections by Euratom and the IAEA

The international rise of the concept of 3S, as well as of course the implementation of the international legal instruments ratified by France in these fields, gave food for thought to the national Authorities. An important reflection work was carried out to clarify the fundamental principles governing the legal provisions, focusing on the aims and not only on the means. Clear national positions were established or reaffirmed: France considers that the principles behind each “S” are different and shall remain so: nuclear security is the exclusive competence of each State; the management of interactions between safety, security and safeguards is the sole responsibility of each State, indeed free to decide how to organize itself. However, at the same time, it should be noted that the domestic regulations addressing each “S” were amended to take into account identified interfaces between safety and security and between security and safeguards. The involved regulatory bodies have also built new procedures to consult and work together, to regulate but also to monitor. One interface is missing, which interest is not clearly obvious for the author, between safety and safeguards. This observation leads to the following synthesized formula: in France, “3S = 2 x 2S”.

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