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ASSESSMENT AND APPROVAL OF REINFORCED PROTECTION OF VEHICLES USED FOR THE SHIPMENT OF SENSITIVE NUCLEAR MATERIAL

O. Loiseau, D. Larrignon, B. Autrusson

Institut de Radioprotection et de Sûreté Nucléaire (IRSN)
31 avenue de la Division Leclerc,
92260 Fontenay-Aux-Roses cedex,
France

ABSTRACT

Most sensitive nuclear materials are usually shipped in specific vehicles with a reinforced protection; such vehicles are generally escorted, tracked and watched over from a distant control centre. Among the various publications made by the IAEA in relation with the CPPNM, the INFCIRC/225 introduces major recommendations for physical protection of nuclear materials in general and particularly during transport. For instance, the text recommends — for the terrestrial shipment of most sensitive material — the use of vehicles specially designed to resist attack and equipped with a vehicle disabling device.

Applying such a recommendation at a state level requires the intervention of a competent authority; the competent authority defines the framework of a validation process starting with the design of the vehicle and ending with the vehicle protection approval. The validation process needs articulating responsibilities between the three major actors who are: the operator in charge of the design, a technical support body in charge of technical evaluation, and the competent authority who is responsible for the final approval of the protection. This paper focuses on the approval process of reinforced protection vehicles in France; it aims at showing how such a process may contribute to the security of nuclear material shipments. The paper notably focuses on the responsibilities of the operators, the competent authority and the technical support organization.

This approval process of the protection of a vehicle allows the authority to ensure that the protection setup is effective and operational in order to protect the cargo from a malicious threat. In such a process, the authority defines the threat and the objectives of protection; the authority may choose, in certain case, to recommend protection devices or solutions; the need for recommendation versus objective definition mostly depends on the environment of the vehicle and the constraints induced. The authority may appeal to a technical support organization for evaluating technical solutions and their implementation. In the French

security framework the role played by the technical support body is emphasized by the fact that IRSN houses the national control centre used for tracking of sensitive nuclear shipments. Due to that position, IRSN is acting in the definition of the technical solutions for tracking and securing the material during shipment.

Among all the conditions of approval of a vehicle protection, the paper presents the provisions to be taken by families depending on the sensitivity of the cargo. These provisions take the form of technical specifications to be observed such as embarked systems. The paper also describes the process starting from the vehicle protection design, including the appliance for approval, the technical instruction until the final approval. The paper also shows the approach followed to control the vehicles protection efficiency all along the period of their use.

INTRODUCTION

In France, sensitive nuclear materials are only shipped in specific vehicles with a reinforced protection; the vehicles are escorted, tracked and watched over from a distant control centre. At a state level, the application of this requires the intervention of a competent authority; the competent authority defines the framework of a validation process starting with the design of the vehicle and ending with the vehicle protection approval. The validation process needs articulating responsibilities between the three major actors who are: the operator in charge of the design, a technical support body in charge of technical evaluation, and the competent authority who is responsible for the final approval of the protection.

The approval process of the protection of a vehicle allows the authority to ensure that the protection setup is effective and operational in order to protect the cargo from a malicious threat. In such a process, the authority defines the threat and the objectives of protection; the authority may choose, in certain case, to recommend protection devices or solutions; the need for recommendation versus objective definition mostly depends on the environment of the vehicle and the constraints induced. The authority may address a technical support organization for evaluating technical solutions and their implementation.

In the following, after a short reminder of major guidance aspects or French domestic regulations for sensitive nuclear materials, the role repartition between the competent authority and the technical support operator IRSN is developed and illustrated on the vehicle physical protection specification and assessment subject. It is developed through an extensive description of the vehicle approval process followed in France, and tends to show how keeping technical aspects under control in a close cooperation between the operator, the authority and its technical support helps in ensuring the best protection for nuclear sensitive material shipments.

GUIDANCES, REGULATIONS AND DEFINITIONS

Sensitive material definitions

As sensitive materials, should be considered in this paper both category I and II materials, as defined by international regulations such as the INFCIRC/225 rev. 4 [1] at article 5.2.1. Sensitive materials are mostly constituted by plutonium, enriched uranium as well as irradiated nuclear material.

It has to be noticed that international recommendations may be over passed by State-level regulations, as it is in France: one the one hand, the French regulations defined in the "Code de la defense" [2] considers the category I nuclear material exactly as it is recommended in INFCIRC/225 rev.4; on the other hand, it enlarges the category II as it comprises lower quantities for plutonium or enriched uranium, as well as it includes any irradiated nuclear material. Precise figures illustrating this fact are given in table 1 below. These slight differences may have a significant influence on transports, as it naturally increases the number of sensitive-classed transports.

Table 1. Sensitive material definitions compared between international recommendations and French regulations.

Material	**Category I**		**Category II**	
	INFCIRC 225 /rev.4	French regulations (Sep. 2009)	INFCIRC 225 /rev.4	French regulations (Sep. 2009)
Plutonium/Uranium-233	≥ 2kg		≥ 500g	≥ 400g
Uranium-235 U enrichment ≥20%	≥ 5kg		> 1kg	
Uranium-235 20%>U enrichment ≥ 10%			≥ 10kg	≥ 5kg
Irradiated			Nuclear fuel with radiation level ≥ 1Gy/h at 1 m unshielded	

In the following, most information on security measures and the approach associated is relevant with non irradiated material shipments.

Security guidance

Among many security recommendations relying on the shipper, INFCIRC/225 rev. 4 introduces four items for securing category I material transports that not only imply the competent authority but also might induce a need for technical support:

- *Article 8.2.2. Advance authorization.* Advance authorization by the competent authority is required, which means security survey and evaluation of the measures prior to a shipment.
- *Article 8.2.3. Mode and route approval from the competent authority.*
- *Article 8.2.8. Communication, notably with a transport control centre.* For shipments by road, rail or sea, there should be a transport control centre keeping track of the current position of the shipment, keeping track of the security status of the shipment, alerting response forces in case of attack and maintaining continuous two-way communication. The transport control centre should be hardened to resist to aggression and staffed by qualified shipper or State's designees, whose trustworthiness has been predetermined.
- *Article 8.3.2. (Road) Designated load vehicles specially designed to resist attack.*

In the French regulations the above mentioned requirements are not only mandatory for category I but also for category II nuclear material shipments.

In addition, the regulation designates the "Institut de radioprotection et de sûreté nucléaire (IRSN)" as reference technical support operator for transport security.

Role played by IRSN as a Technical Support Operator of the Competent Authority

In the field of security of nuclear material transport, IRSN is in charge of the National transport control centre also named EOT. The EOT has to track, follow and monitor every category I and II nuclear material shipment on the national territory and report to the competent authority. Within this framework, IRSN is responsible for housing, manning, securing and maintaining the centre.

IRSN is also used to provide support in the review of transport route and advance notification approval. The support is mainly oriented on physical protection measures assessment. It has to be underlined that currently about 1,800 notifications for transport need to be addressed in a year, among which about 300 are category I or category II shipments.

The competent authority refers to IRSN for the technical expertise of particular vehicle reinforcement measures. It includes physical protection of the vehicle and cargo, as well as communication means, sensors and monitoring systems.

CONDITIONS OF APPROVAL

The conditions of approval for a designated load vehicle (truck, semi trailer, container, ship, etc.) specially designed to resist attack and to carry sensitive nuclear material are defined by national requirements. These requirements aim at protecting the shipment from theft, removal or even sabotage, and thus rely on the design basis threat established for transports. They take into account the fact that the vehicle is escorted by guards, but are expressed independently from the escort definition. These requirements are considered as sensitive information and the regulation in which they are referenced is classified.

As stated in IAEA's guidance for the security of nuclear material transports [3], vehicles are equipped with devices which contribute to deter, detect, delay and respond to theft, sabotage or other malicious acts affecting the conveyance or its cargo.

Relating to the state-of-the-art of vehicle protection, five major aspects are considered:

- Protection of the vehicle. The vehicle is hardened in such a way that the driver may pursue its route in most critical situations, based on the principle that the more the driver and security crew keep control of the vehicle, the more secure the material;
- Protection of the driver and of the security guard in the cabin. The truck cabin is reinforced, armored and secured in order to guarantee the protection of its occupants against the threat.
- Anti removal. Vehicle is equipped with one or various systems that allow the security crew or the driver to immobilize the vehicle in case of threat; the vehicle is immobilized in such a way that moving it again would take a time such that it cannot be achieved before the response forces interfere. In addition, the container where the nuclear material is placed as well as its locking system, both offer significant resistance to intrusion.
- Tracking devices. Tracking methods or devices are used to monitor the movement of conveyances containing radioactive material. Automated and real time tracking methods or devices are required, to permit the transport control centre to monitor remotely the movement of radioactive material conveyances and packages and the status of the vehicle. The tracking system, in conjunction with a communication system and response procedures, will allow the operator and the competent authority to react in a timely manner to a malicious act, including theft of radioactive material.
- Communications. Secured, redundant and hardened communications are available between the vehicle and the control centre, and also between the vehicle and the escort.

APPROVAL PROCESS; ROLE ATTRIBUTIONS

Prior to having a vehicle approved for carrying sensitive nuclear material, a carrier needs first to obtain a license as a category I or category II authorized shipper. This license is delivered upon fulfilling certain requirements; among these, trustworthiness determination of the personnel and of the enterprise as a whole is required.

The authorized shipper is communicated the confidential technical specification of vehicle physical protection provisions by the Competent authority. Based on these specifications, the shipper is responsible for the design of the vehicle and for implementing all security measures. At the end of the design process, and before the actual fabrication of the reinforced vehicle starts, a file presenting all the design of the vehicle as well as every solution adopted for physical protection is submitted to the competent authority.

In a general manner, this file is submitted for technical verification to the technical support organization (IRSN), which provides the competent authority with a technical advice on the design. This process may iterate in the case where the physical protection design is judged unsatisfactory by the competent authority. In the end of the process, the competent authority validates the design and authorizes fabrication of the vehicle and implementation of the physical protection devices.

Because integrated solutions are sometimes used in the field of physical protection, a control of conformity of these solutions is only possible while they are implemented but not afterwards. Thus several control points may be defined in accordance with the technical support and the competent authority so that vehicle fabrication can be stopped in case of non conformity of the implemented solution. As a consequence, validation is an integrated process during all along fabrication and based on technical points controlled and verified on the manufacturer’s site of production. In the end of the implementation, a final reception visit is organized to allow the competent authority to check the final conformity of the vehicle with the design specification.

After the final reception is accepted, the manufacturer constitutes a file summing up all the characteristics of the vehicle with its actual security equipment, including the fabrication quality controls, references and certificates. This file is assessed by IRSN. Based on that assessment, the Competent authority may approve the vehicle. In case of approval, the vehicle is added in the list of approved vehicles of the carrier referenced in its authorization license (see Figure 1 below).

CONTROL AND INSPECTION

Once a vehicle is approved for sensitive nuclear material shipment, the transporter is responsible for maintaining the vehicle and its physical protection, and for leaving the vehicle in a protected area when it is not used. It is requested that all the communication, monitoring and positioning systems are tested just before a shipment starts.

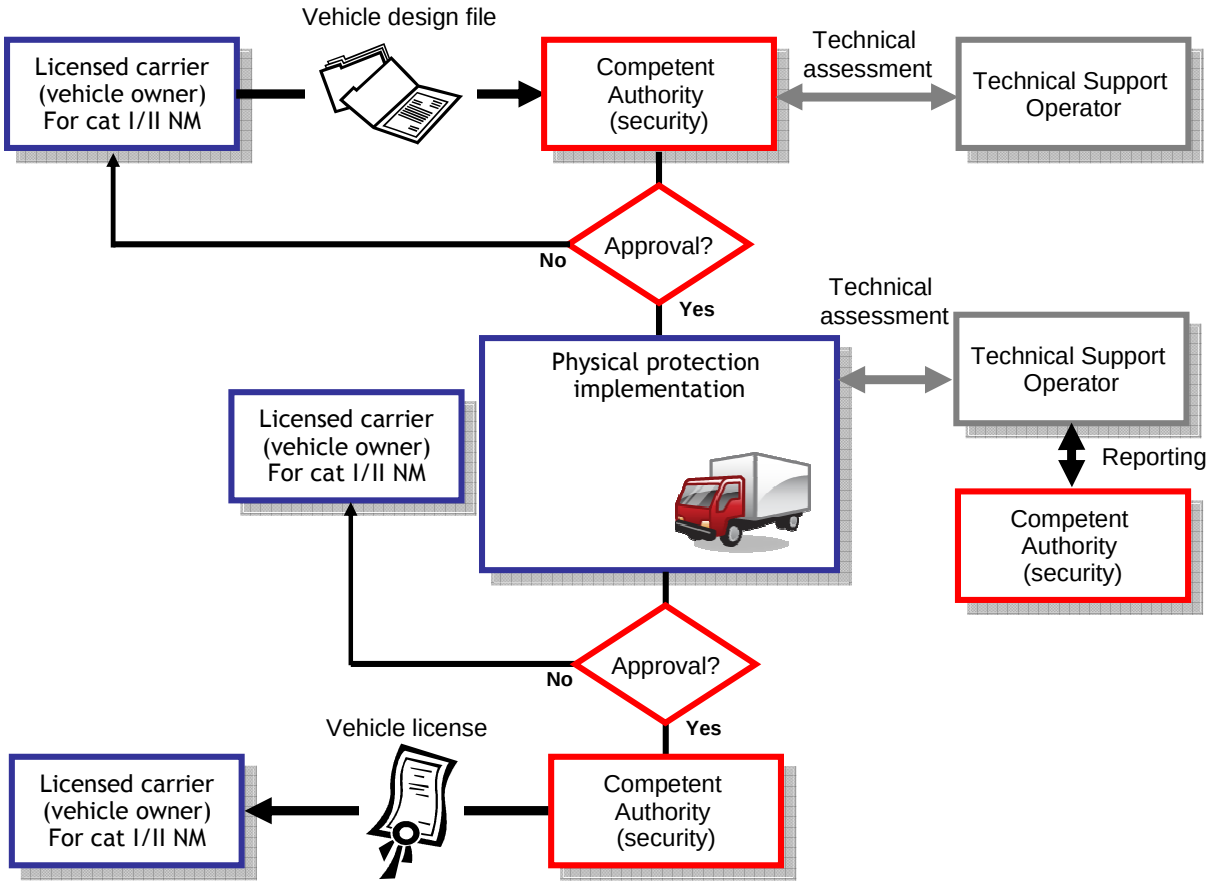

Figure 1. Approval process and role attribution summarized.

In addition, the competent authority performs inspections in order to check the vehicle physical protection status and efficiency. On most sensitive vehicles, these inspections are performed on a yearly time basis. These inspections are always performed with reference to the content of the final file being approved by the authority at the end of vehicle fabrication. The objective of inspections is to guarantee that the performance of the physical protection is maintained in time.

During an inspection, every physical protection component is systematically tested. To this end, IRSN -- which supports the technical aspects of inspections -- has developed several test apparatus dedicated to the test of physical protection devices implemented on vehicles. If major dysfunctions are observed during the inspections on important physical protection systems, the Competent Authority may suspend the license of the concerned vehicle.

If the vehicle owner has to modify or improve the vehicle with consequence to the physical protection, the competent authority needs to be informed. In case of major modifications, the same process of approval as for full vehicle fabrication may be followed.

CONCLUSIONS

In this paper are summarized the major provisions that need to be taken for physical protection on vehicles dedicated to carrying sensitive nuclear material in France. These provisions take the form of technical specifications to be observed such as embarked systems. The process starting from the vehicle protection design, including the appliance for approval, the technical instruction until the final approval has been presented. It has been shown how technical assessment from the technical support and formal approval by the competent authority contribute together to a quality evaluation. In addition, the approach followed to control the vehicles protection efficiency all along the period of their use has also been presented.

The process described in this paper illustrates how shipment protection and more especially vehicle reinforcement contributes to nuclear material protection. The evaluation process for vehicles is both technical and administrative. The approach presented in the paper intends to demonstrate how a close cooperation between the vehicle owner and manufacturers, a technical support operator such as IRSN and the competent authority tends to improve the security and the confidence in the systems which contribute to security.

REFERENCES

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