THE CONTROL OF THE TRANSPORT OF RADIOACTIVE MATERIAL BY AIR IN FRANCE

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ABSTRACT

300,000 packages of radioactive material are carried each year in France. About 50, 000 of these packages are consigned by air. Most of this traffic concerns small-size packages containing limited or very limited quantities of radioactive material (type A or excepted packages) for medical use. Some shipments of high activity sources for medical use, or fissile material for research reactors, are also listed. The Nuclear installations safety directorate (DSIN) has been responsible since June 12, 1997 for the control of the safe transport of radioactive material for civil use. In this context, DSIN has frequent contacts with the government department dealing with civil aviation (General Directorate for civil aviation – DGAC). An agreement was cosigned between the DSIN and DGAC which defines the responsibilities of both departments. Schematically, in this new organization, the DSIN became responsible for all aspects concerning the safety of the package, while DGAC remained in charge of all technical controls with the airplane and airline operator. As of 1996, during the adoption process of the new IAEA TS-R-1 (ST-1 revised) regulations, France already supported additional provisions aimed at facilitating package recovery in the case of the transport of high activity material involved in airplane accidents. Anticipating the date the modal regulation became mandatory in July 2001, deviations to the technical instructions of the International civil aviation organization (ICAO) were issued by France in 1999. Inspections where carried on the most important airport terminals, in connection with the civil aviation authority, aiming at the supervision of the application of the regulation. These inspections allowed the Nuclear safety authority to discover a very complex traffic path where many intermediate players are involved besides the carrier. Each year handling incidents occurring at airports are reported to DSIN. Most of them are concerning the deterioration of type A or excepted packages, generally without radiological impact. More recently, loss of packages during transport focuses the attention of the authorities. With a view to remedying the situation observed, DSIN and DGAC have organized training sessions for their inspectors and information meetings with airline operators and their technical assistance companies.

INTRODUCTION

Many packages of radioactive material for medical use or for research are consigned each year by air from France. The Nuclear installations safety directorate (DSIN) is the competent authority in charge of the control of the transport safety of radioactive or fissile material for civil use. As part of this responsibility, DSIN participates to the elaboration of the regulation and controls its application by inspections. DSIN also set up an organization for the response in case of transport incidents or accidents, and provides information to the public. This paper presents how these missions are performed

in the particular case of the transport by air of radioactive material.

GENERAL DATA ON AIR TRANSPORT OF RADIOACTIVE MATERIAL

It is estimated that about 50,000 packages are consigned each year by air, from or to France. In most of the cases, it concerns small size packages for radiopharmaceutical use, containing limited or very limited quantities of radioactive material (excepted or type A packages). These packages contains often short-life radioisotopes, which needs to be carried as soon as possible to patients in medical centers located in the whole world. They are usually carried in the cargo bay of passenger aircraft. Table 1 lists radioactive periods of some typical radioisotopes frequently carried by air.

Radioisotopes	Ga-67	I-123	I-131	Mo-99	Sa-153	Tl-201	Xe-133	Y-90
Period in day (d) or hour (h)	3.26 d	13.2 h	8.02 d	66 h	46.7 h	3.04 d	5.243 d	64 h

Table 1: Radioactive periods of some radioisotopes frequently carried by air

A few consignments of high activity sources or fissile material for research reactors are also taking place. They represent only about a few tens of transports each year, onboard cargo aircrafts. Few data are available concerning transport flow from abroad to France, in transit, or overflying the French territory.

Airports of Orly and Roissy-Charles-de-Gaulle located near Paris concentrates most of the traffic for the transport of radioactive material by air. Rhône-Alpes area, where fuel manufacturers are located, is concerned by some transports of fissile material for research reactors.

The transport logistic involves at the consignment, a consignor directly or represented by a shipping agent, a forwarding agent at the airport, and an airline, which may be assisted by several handling companies. After the flight, a symmetrical organization exists. Booking of the flight is generally performed by the forwarding agent at the airport; he is also responsible for all customs issues. The package is delivered at the airline office, or at the warehouse of one of its handling companies. Several handling agents may successively intervene for package acceptance controls, palletisation, taxiway transport, loading (unloading) on the aircraft… These operations may be performed directly by the airline's own employees, or still under the control of another subcontractant.

REGULATION

Organization

DSIN is in charge since June 12, 1997, of the elaboration of the transport safety regulation concerning radioactive or fissile material for civil use, for all transport modes. On June 4, 1999, an agreement with the general directorate for civil aviation (DGAC) was signed to clarify the responsibilities between the two directorates, concerning the control of the transport by air of radioactive material. Schematically, following to this agreement, DSIN became competent for all issues related with the safety of the packages, while DGAC remained responsible for the security of the aircraft, and contacts with airline operators.

Elaboration of the regulation at international level

At an international level, DSIN is taking part to the elaboration of the International atomic energy agency (IAEA) transport regulations [1]. It is associated to the transposition process of this regulation into the technical instructions of the International civil aviation organization (ICAO)[2].

As of 1996, during the adoption process of the new IAEA TS-R-1 (ST-1 revised) regulations, France already supported additional provisions aimed at facilitating package recovery in the case of the transport of high activity materials involved in airplane accident [3]. The following objectives were proposed as modification to the IAEA 1985 (as amended 1990) transport regulation standards:

- Protection of the public: dose equivalent to less than 50 mSv at 500 meters of the accident scene, resulting from dispersion of contamination or emission of the failed package. For this criterion, spread of contamination is considered to have a much more severe impact than those resulting from a criticality accident.

- Protection of the environment: implementation of simple countermeasures would be sufficient outside a 1 km^2 area, where decontamination could be easily managed. In this case, a criticality accident will result in contamination compatible with this objective. Here also, priority is given to limitation of dispersion of radioactive material.

- Protection of surviving persons: experts have considered that there would be no surviving persons after an aircraft accident having such an impact, that it will lead to the failure of a type B package or a package containing fissile material. Therefore, an upgrading of the radiological safety function was not considered as necessary.

The use of the above-defined safety objectives in the case of transport of plutonium in an aircraft (plutonium was chosen to cover the case of other less radiotoxic radionuclides), lead experts to consider that the containment system of any package containing more than 3,000 A_2, should be upgraded from the mechanical and thermal point of view.

These requirements are at the source of the new type C package design, defined into the regulation mandatory since July 1, 2001 for the transport by air of high activity radioactive or fissile material.

Elaboration of the national regulation

ICAO Technical instructions are transposed into the ministerial order from May 12, 1997 (modified), concerning the technical operating conditions of aircrafts by a public airline company [4]. Anticipating the date the modal regulation became mandatory in July 2001, deviations to the technical instructions of the International civil aviation organization (ICAO) were issued by France in 1999. In this transitory period, overflight of the French territory were submitted to prior agreement for radioactive contents exceeding 3,000 A_2. This requirement was formalized by the French deviation to the technical instruction FR 4.

However so far, the Competent Authority of France received no official request for an agreement according to FR4 deviation. Moreover, eventhough preliminary studies were performed in France concerning the design of a type C package, no application for an approval, nor validation of an approval certificate has been submitted until now.

Approval certificates of type B or fissile package designs issued in France before July 1, 2001, are no longer valid for the transport by air of high activity or fissile radioactive material. According to § 680 of [1] and grandfathering rules, applications for the revision of approval certificates concerning the transport by air of fissile material were received. They are currently under expertise.

According to the ICAO Technical instructions, France authorizes transport of radioactive material by post for very limited quantities of radioactive material, not exceeding one tenth of activity limits for excepted packages. These requirements were transposed into the ministerial order from March 22, 2001, concerning the consignment by post of radioactive material [5]. This regulation authorizes only domestic transports and imposes a prior approval of consignors.

INSPECTION

Inspections provided for in the annual program, some of them without prior announcement, or after a transport incident, were organized in the major airports in coordination with DGAC and technical inspectors of the civil aviation directorate (DAC) to check the implementation of the regulation. These inspections revealed a very complex traffic path, where many intermediate players are involved besides the carrier, all of them having to perform operations in a very limited period of time. Up to now, the supervision concerned airports near Paris and in Rhône-Alpes area. Inspectors checked the organization of airline authorized by DGAC to carry dangerous goods and radioactive material. Small-size and big national airlines, as well as foreign airlines were inspected. Investigations were also done in direction of their handling and assistance companies. Inspectors took part to consignments or reception of packages and visited warehouse, and storage in transit. For airlines, the main controls concerned packages acceptance, training of the employees involved in transport operations, experience feedback after incident, storage conditions in transit, handling and stowage onboard aircrafts, segregation and supervision of their subcontractors. Inspections concerning handling companies focuses on training of the employees, their knowledge of hazards associated to the transport of radioactive packages, conditions concerning the transmission of instructions or informations provided by the airline, and handling of packages. The results of near ten inspections since 1999 showed that:

- Emergency arrangements are not always available for all intervening party,
- Experience feedback after incident is insufficient,
- Some airlines and their handling companies ignored basic radioprotection rules,
- Deviation were found concerning labelling of package or overpacks,
- Some handling companies were not well informed about the characteristics of package to handle, about the right choice of lifting device, and about general risks associated with the transport of radioactive material,
- Some handling companies operates only on a very exceptional basis in the transport of radioactive material, without being well prepared for that.

INCIDENTS

Some tens of air transport incidents are reported each year in France. These incidents concern damages at ground to package or loss of packages. Up to now, these incidents did not present any radiological consequences. Bad or lack of stowage, inadequate handling device, and absence of sensibilization of employees regarding radiological hazards, are the main cause of incidents. Similar incidents were reported in the United Kingdom [6].

A typical example of an incident resulting in the damage of a package at ground occurred on an airport in the south of Paris at the beginning of this year, when a captain refused the loading of a radiopharmaceutical consignment. The packages were sent back to the warehouse since segregation with the passenger's compartment was insufficient. Probably because it was badly stowed on the trailer, a type A package containing iodine 131 fall from the load to the taxiway near the aircraft and was ran over by a truck. The incident occurred at the end of the day at nightfall, and nobody noticed the disappearance of the package. An employee of the airport found the damaged package more than one hour after the aircraft's departure ; he took the package and put it back to an employee of the airline having its office cloth to the taxiway. This man was very busy; he didn't alert anybody, just stored the damaged package in his office. On the next day morning, another employee of the airline found the damaged package and handled it without protective gloves before remarking that the matter in hand was a radioactive material package. Finally, very anxious, he decided to call the airport rescue team. Fortunately, the controls made on the package didn't reveal any loss of the radioactive content. Only the outer part of the package was damaged. A few hours after, the consignor sent its intervention team for the control and recuperation of the package. All in all, at least three employees of the airline and airport handled the damaged package without any particular precaution, before alert and first radiological controls. This incident was rated at level 0 of the INES scale applied in France to transport events [7].

More recently, loss of radiopharmaceutical packages during transport focuses the attention of the authorities. Generally, lost packages are rapidly found again in warehouses of the companies after a few days, or it is found that they were consigned to a wrong destination. However, some definitive cases of loss were reported. As soon such an incident is declared to DSIN, a notification is sent to IAEA, and the competent authority of the consignor's country is informed. Definitive loss of package incidents happening until now were rated at level 1 of the INES scale applied in France to transport events.

IMPROVEMENT DIRECTIONS TO ENHANCE THE SAFETY OF THE TRANSPORT OF RADIOACTIVE MATERIAL BY AIR

DSIN publishes regularly on inspections performed or incidents happening, so that the experience feedback can be shared and profit among all the player (« Control » bimonthly information bulletin, www.asn.gouv.fr Internet website, Annual report on nuclear safety in France[8]). Good practices should be encouraged. For instance, the use of standard containers or frames for the handling of small packages to prevent their fall and damage should be developed.

With a view to remedying the situation observed, DSIN and DGAC have organized training sessions for their inspectors and information meetings with airline operators and their technical assistance and handling companies. A symposium dedicated to the transport of dangerous goods and radioactive material by air was organized jointly by the two authorities at the end of year 2000 [9]. During this meeting, representatives of the airline assistance and handling companies recognized that they must improve together their practices, in order to enhance the safety of operations involving dangerous goods in airports. The creation of a working group was announced with the aim of finding improvement directions.

CONCLUSION

The objective of this paper was to present control actions performed by the competent authority of France in the field of transport of radioactive material by air. Each year, several tens of thousands of packages are consigned; the major flow comes from radiopharmaceutical products containing limited or very limited quantity of radioactive material, and some transport of high activity, or fissile radioactive material for research reactors. DSIN participates to the elaboration of the regulation at national and international level. As of 1996, during adoption of the IAEA TS-R-1 (ST-1 revised) regulation, France supported additional measures to facilitate intervention in case of an accident and recuperation operation of a damaged package. These proposals are at the source of the type C package design defined in the regulation mandatory since July 1, 2001. The result of near ten inspections performed since 1999 in coordination with DGAC showed deviations in the field of radioprotection, handling, and more generally a lack of sensibilization of some airline and their assistance and handling companies, regarding the hazards presented by radioactive material. Much more than for inland transports, in the transport by air, time constraints is very heavy for the operators and transshipments occur very often. As a consequence, about one tens of incidents are reported each year in France, concerning damaged or loss of packages. So far, these incidents did not present any radiological consequence. Finally, improvement directions to enhance the safety of transport by air of radioactive material were identified in the field of handling, radioprotection, training of employees and transmission of informations among the multiple players involved in transport operations.

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