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INSPECTION OF NUCLEAR FUEL TRANSPORT IN SPAIN

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La experiencia adquirida en la inspección de los transportes de combustibles realizados en España, servirá de base para fijar las normas que han de exigirse a los futuros transportes, ya que debido al programa nuclear español el transporte de combustibles nucleares se verá incrementado notablemente en España en los próximos años. Se pretende con esta comunicación poner de manifiesto la experiencia adquirida por la inspección oficial en el transporte de combustibles nucleares.

The experience acquired in inspecting nuclear fuel shipments carried out in Spain will serve as a basis for establishing the regulations which must be adhered to for future transports, as the transport of nuclear fuels in Spain will increase considerably within the next -- years as a result of the Spanish nuclear program. The purpose of this report is to describe the experience acquired in nuclear fuel transport inspection.

1. INTRODUCTION

The transport of nuclear fuels plays an important role in a nuclear power plant's operation and even in its performance, if the established transport program is altered.

The experience acquired in inspecting nuclear fuel shipments carried out in Spain will serve as a basis for establishing the regulations which must be adhered to for future transports, as the transport of nuclear fuels in Spain will increase considerably within the next years as a result of the Spanish nuclear program. We have experience in transporting non-irradiated fuel by plane, ship and highway and in transporting irradiated fuel by road, train and ship.

Figure 1 indicates the most frequently used itineraries for transporting nuclear fuels in Spain. In the "José Cabrera" plant, the non-irradiated fuel arrives by plane to Barajas Airport and continues by road to the plant; the irradiated fuel is shipped by road from the plant to the Port of Bilbao and from there by ship to the United Kingdom. In the "Santa Maria de Garoña" plant, the non-irradiated fuel arrives by ship to Bilbao and continues by road to the plant; the irradiated fuel is shipped by road to the Dancharinea Customs and from there continues by road through France and is finally shipped to the United Kingdom. In the "Vandellos" plant, the non-irradiated fuel arrives by road to La Junquera Customs and continues by road to the plant; the irradiated fuel is sent by train from the plant to the Port Bou Customs and continues by train until reaching its final destination in France.

The purpose of this report is to describe the experience acquired in nuclear fuel transport inspection and for a better understanding, we have divided the study into the following sections:

Identification of the risks in transporting nuclear fuels.

Steps to avoid or reduce risks: Regulations applicable in Spain.

Requirements prior to shipment.

Experience in transporting nuclear fuels in Spain.

Inspectors' rôle in nuclear fuel transport.

Conclusions.

2. IDENTIFICATION OF THE RISKS IN TRANSPORTING NUCLEAR FUELS

The characteristic risks in transporting nuclear fuel are irradiation, contamination and criticality, and in all the national and international Regulations, rules for avoiding or reducing these risks are given. However, depending on the means of transportation and the itinerary followed, other risks may exist, such as: conventional accidents, sabotage, terrorism and theft.

In railway transport carried out in Spain from the Vandellos nuclear power plant to the reprocessing installations in La Hague, France, due to the light weight of the train, there is a risk of accident due to sharp breaking or when traveling on an incline as the cars can bang into each other and cause derailment.

In road transport of irradiated fuel, there is an additional risk of irradiation if the transports are not well-planned. This risk exists in storage on the pier until the packages are transferred to the ship or during storage required until the packages are dispatched through the Dancharinea Customs in the case of the Santa Maria de Garoña plant.

There is a danger of accidents in transports of irradiated fuel made from the José Cabrera plant while traveling through the Barazar mountain pass and from Santa Maria de Garoña through the Velate mountain pass, due to the road's sharp incline and its limited width. In addition to the accidents we must add skidding in winter - as these areas are covered with ice and snow - and also terrorism and sabotage as during the last few years the Basque Provinces have been politically conflictive areas and terrorist acts have taken place there.

We have observed, especially in the transports made from the José Cabrera plant, exudation phenomena, which in no case surpassed the regulatory limits for transitory surface contamination.

3. METHODS FOR AVOIDING OR REDUCING RISKS : REGULATIONS APPLICABLE IN SPAIN

The steps taken to avoid or reduce irradiation, contamination and criticality risks have basically consisted of applying the transport rules established in the Regulations applicable in Spain which are as follows:

- Law 25/1964 on Nuclear Energy.
- Rules for transporting radioactive materials without risk by the I.A.E.A. (1973 Edition).
- European Agreement on international transport of dangerous merchandise by road (ADR).
- International Rules for transporting dangerous merchandise by rail (RID).
- National Rules for transporting dangerous merchandise by road.

To avoid the risk of accidents, speed limits are placed on the expeditions and in the case of railway transport, sharp braking and take-offs are prohibited and a heavy-weight car is placed at the end of the convoy to assist in braking.

If shipments are made by road in the winter, before authorizing the expedition to leave, we check the snow and road conditions along the route by calling the Public Works Offices in the Provinces through which the convoy will pass.

A series of places are established along the route, from where telephone calls are to be made to the Inspection of the JEN informing of the convoy's progress. The places chosen have automatic telephone service.

Radio-protection personnel from the nuclear power plant in question always accompany the shipment with markers, detection equipment, etc. and they are perfectly aware of the rules to follow in case of emergency.

In the cab of each vehicle, and in a place visible from the outside, emergency telephone numbers are given which include the Nuclear Power Plant in question, the Nuclear Energy Board (JEN) and the Police or other Provincial Authorities. All the expeditions are accompanied by armed guards located at the front and back of the convoy.

4. REQUIREMENTS PRIOR TO SHIPMENT

The documentation presented for requesting transport authorization is studied by the JEN which issues a report on the transport's

nuclear safety and proposes conditions for carrying out same. The Nuclear Energy Board sends these studies to the Energy Administration Board which in turn authorizes transport based on these recommendations. This complete documentation is sent to the inspection which thus is informed of all the technical characteristics of the shipment to be effected. Figure 2 shows a diagram of the steps taken in processing a request for transport authorization.

In addition and in fulfillment of the clauses stated in the Authorization, the plants must send to the inspection a series of details, which includes: number and identification of the elements to be transported, degree of burn-up, number of cooling days, U-235 content, Pu-239 content, license number of the vehicles making the transport, packing identification, itinerary and schedule which has been established. If any abnormality or deficiency is found in the information received, the plant owner is contacted so that they may correct same or delay the shipment until the necessary corrections can be made.

5. EXPERIENCE IN TRANSPORTING NUCLEAR FUELS IN SPAIN

Below is a chart listing the total number of expeditions carried out by the three plants currently existing in Spain and the number of elements transported in each shipment (until July 1977).

Nuclear Plants	Non-irradiated fuel		Irradiated fuel	
	No. Exped.	No. Elements	No. Exped.	No. Elements
Vandellos	51	91,920	13	30,717
Sta.M. de Garoña	14	868	32	191
José Cabrera	12	205	7	113

6. INSPECTORS' ROLE IN TRANSPORTS

In the case of irradiated fuel, shipments are inspected before they are transported and in the case of non-irradiated fuels, they are inspected upon arrival into the national territory or upon arrival at the Plant.

In order to facilitate inspection, a Guide to systematic checking has been prepared which includes the applicable paragraphs of the I.A.E.A. Regulations for transporting radioactive materials without risks (1973 edition) and of the European Agreement on international road transport of dangerous merchandise (ADR). This Guide is divided into the following sections: 1. Documents which must be shown; 2. Marking and labeling of the packages and the vehicles; 3. Other package checks; 4. Radiation and radioactive contamination levels; 5. Other expedition checks. (Annex 1).

Once these checks have been carried out, the Inspector issues a report which is signed by an authorized plant representative, indicating the latter's agreement or disagreement to its contents. Annex II presents a guide to issue the report.

While the transport is being effected, the Nuclear Energy Board (JEN) receives the telephone calls made from pre-established points along the route.

In the inspections carried out, no serious safety risks have been detected and the radiation levels as well as the transitory radioactive contamination readings have always been within the limits established by law. However, in some transports, we have observed the lack of documents required in the authorization conditions, incorrect labeling of packages and vehicles, lack of sealed bands on the packages and in some cases the vehicles did not carry the telephone number to call in case of emergency and in others the Nuclear Energy Board was not notified sufficiently in advance, as stated in the authorization conditions.

We have also observed that some packages were not marked in accordance with the markings established in the I.A.E.A. Regulations for transporting radioactive materials without risk (1973 Edition) and that the sender's certificate and shipping details did not comply with that specified in said Regulations.

It has been proven, in general, that the personnel handling the radioactive material in ports and airports are not prepared for this job and that the drivers of the vehicles also lack proper training. In several cases, the inspectors have observed that the drivers had not read the information which had been given to them several hours before starting the journey. Also, in some cases, vehicles which are not suitable for this type of transport and vehicles not authorized by the Spanish Authorities have been used.

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7. CONCLUSIONS

1. In order to avoid risks during transport, no expeditions should take place during the winter season, if the route goes through mountain passes and when the weather conditions hinder or prevent normal travel along these roads.
2. Also, transport should be prohibited in areas where possible disturbances or alteration of public order could occur. In addition, a strict adherence to the schedule along the route should be demanded in order to avoid prolonged waits of the convoys at points along the itinerary or at shipping docks or at Customs Houses.
3. Speed limits should be more strictly enforced in order to avoid accidents and motorways or highways where there is a lot of traffic should be avoided as there is always a danger of accidents which could force the convoy to stop and wait for a certain length of time.
4. The personnel handling the radioactive material in ports and airports must have a clear idea about the care that is necessary to avoid falls and hits.

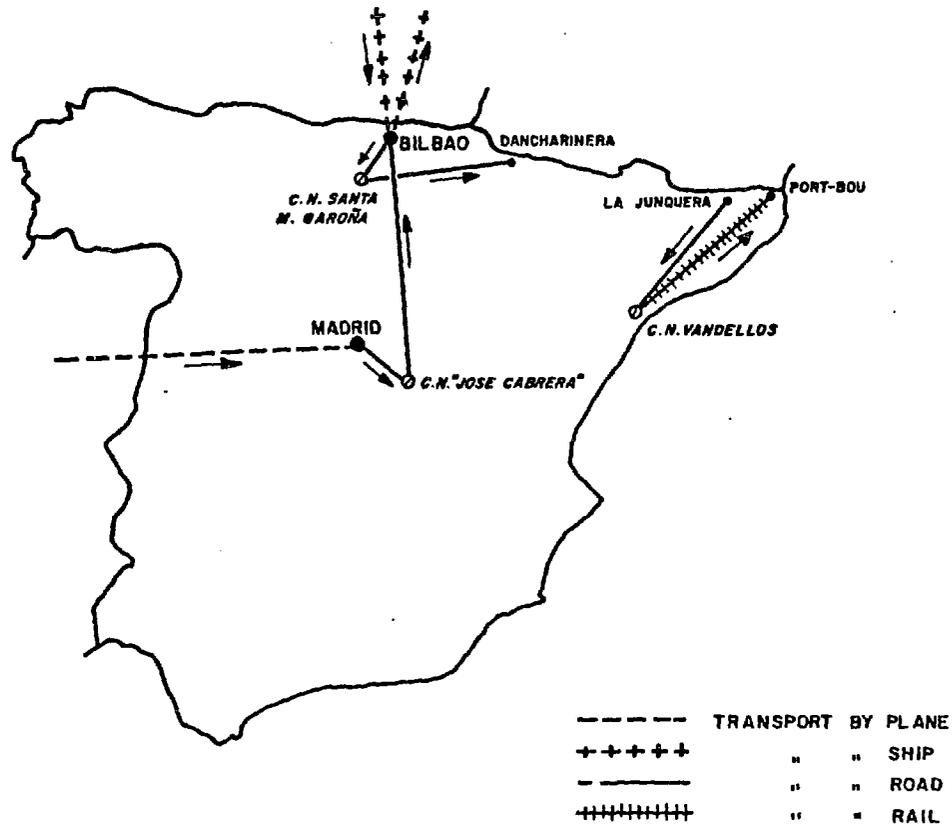


FIG.1.—DRAWING OF THE FUEL ELEMENT TRANSPORTS FOR THE SPANISH NUCLEAR POWER PLANTS.

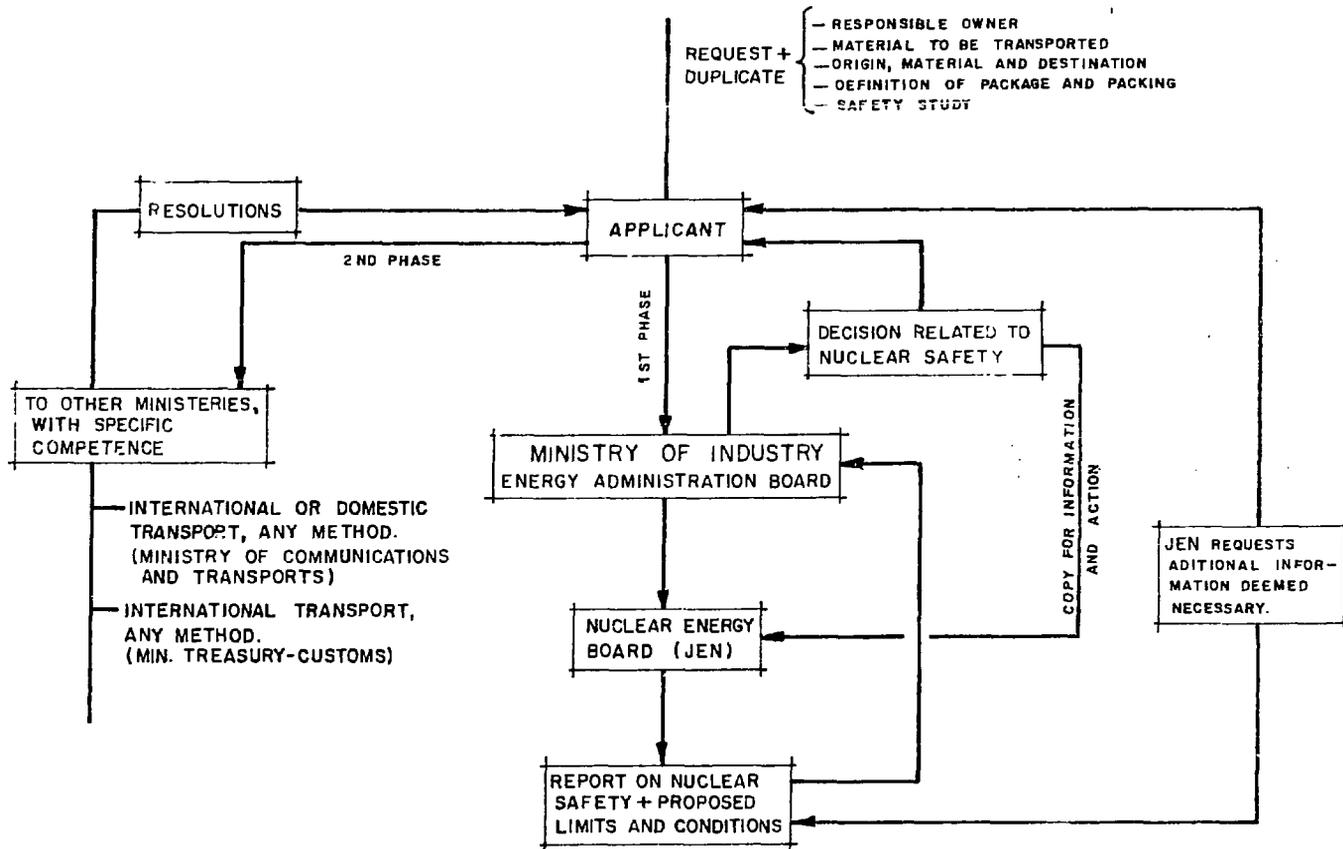


FIG. 2.—PROCESS FOR ISSUING RADIOACTIVE MATERIAL TRANSPORT AUTHORIZATION.

SYSTEMATIZED CHECKING GUIDE
FOR INSPECTING RADIOACTIVE
MATERIAL TRANSPORTS

A N N E X I

U.C. INSPECTION
FORMAT-GUIDE No. 4
REV.

TRANSPORT OF: _____

Origin: _____

Destination: _____

Starting date: _____

Inspection location _____ Date: _____

1. DOCUMENTS TO BE EXHIBITED

Transport Authorization. Ministry of Industry, date _____

Transport Authorization. Ministry of Public Works _____

Transfer Authorization (O.I.E.A. Safeguards) _____

Rules for transporting radioactive materials without risks -

(O.I.E.A. 1973 Edition) _____

Sender's certificate and expedition details (827 to 831) (photocopy attached _____

Information for transport company (832) _____

Certificate of approval of type of package (804 - 824) _____

Certificate of multilateral approval of type of package B (I) (807-824) _____

Others _____

2. MARKING AND LABELING OF PACKAGES AND VEHICLES

2.1. PACKAGES

Labels affixed on two opposite sides of the package (511) _____

Package category (510) _____

Main radioactive content _____

Content's activity (curie) _____

Transport index (137) _____

If this refers to "complete charge", this will be mentioned on each label (513)

Weight marked on the package (514) _____

Identification marks of package type (516) _____

Type B package, cloverleaf symbol printed on outer surface (517) _____

2.2. VEHICLES

Truck license number and platform number _____

Transport card number _____

Cars have signs on the sides (533) _____

Trucks have signs on the sides and rear (535) (42.500 A.D.R.) _____

Trucks carry emergency telephone numbers in visible place _____
Trucks and trailers are equipped with fire extinguisher (10.240 ADR) _____
Trucks have a battery switch in the cab (200.000 ADR) _____
Others _____

3. OTHER PACKAGE CHECKS

No visible damage _____
The sealed bands are intact: (211) _____
The inscription on the sealed bands states: _____
The temperature will not exceed 50°C in the shade (231,b) _____
In case of a complete charge, the temperature will not exceed 82°C in the shade (240) _____
The outer packing will not absorb nor retain rainwater (205) _____
Others _____

4. RADIATION AND RADIOACTIVE CONTAMINATION LEVELS

- Maximum admissible radiation intensity (534 and 537)
- In a closed vehicle, without package movement, without intermediate loading and unloading operations, on the package surface <1.000 mrems/h.
 - In any other type of circumstances, on package surface < 200 merems/h.
 - On outer side surface of vehicle < 200 mrems/h.
 - At 2 meters distance from the vehicle's side surface <10 mrems/h.
 - In places occupied by people <2 mrems/h (537).

Transitory radioactive contamination (frotis of 300 cm²) (502)

- Beta and gamma emitters <10⁻⁴ Ci/cm²
- Natural uranium <10⁻³ Ci/cm²
- Alpha emitters <10⁻⁵ Ci/cm²

The drivers carry a dosimeter _____
Others _____

5. OTHER EXPEDITION CHECKS

The armed guard protection is formed by _____
The person traveling with the expedition in his capacity as radio-protection expert is Mr. _____
Time of expedition departure _____
Transport has been notified with _____ days advance notice.
Other requisites contained in the authorizations _____

OUTLINE OF THE INSPECTION STATEMENT REGARDING TRANSPORT OF
RADIOACTIVE MATERIALS

Mr. _____, Inspector of the Nuclear Energy Board

CERTIFIES: That he was present (1) on the day, month and year (all in writing)
in (2).

That the object of the visit was to inspect a radioactive material
shipment, destined for _____, coming from _____
_____, whose transport authorization was granted by the Energy Administration
Board on the date _____ to (3).

That the Inspection Department was received by Mr. (4) _____
who confirmed his knowledge and acceptance of the inspection objectives in
that which refers to nuclear safety and radiological protection.

That the results of the tests carried out by the Inspector, as well
as the information required and supplied by the technical personnel _____
_____ are as follows:

That the shipment consisted of _____ packages, on whose identity
plate was the following _____.

That inside said packages, (5) was found stored, whose characteristics
are indicated in Annex I:

That (if applicable) during transport no (or a) nuclear accident
occurred; however the following facts or accidents did occur: (describe
with greatest exactness what has happened).

That the sender's certificate was shown, duly authorized, photocopy
of which is attached as Annex II (6).

That specification _____ of the Energy Administration Board
corresponding to this transport has not been complied with (if applicable).

That the packages were located on _____ frames, trailers, special
cars, distributed in the following manner: package _____, frame, trailer,
car _____, trailer truck license number _____. That the
trailer truck license number _____ is not listed in the authori-
zation granted by the Surface Transport Department of the Ministry of Public
Works, as a vehicle authorized for this type of transport (if applicable).

The _____'s sealed band is intact, with the following inscription _____ (or without) (?). That the packages did not show any visible signs of outer damage (or they showed damage). That the packages were duly marked with labels corresponding to yellow category _____, on which I read: package _____: (transcribe literally, do not translate).

That the vehicles, cars, _____ were duly marked. That in the vehicle cab, a list of emergency telephone numbers were visible from the outside. That the drivers were equipped with a personal dosimeter, type _____.

That the transitory external contamination readings, as well as the radiation intensity and temperatures, measured by technical personnel from _____ in different parts of the packages _____ are not appreciable, the maximum admissible dose can increase under normal transport conditions.

That a radio-protection expert from the Plant accompanied the expedition, with the necessary equipment to act in case of emergency.

That the transport convoy left at _____ hours from _____, protected by armed guards.

ACTION TO BE TAKEN IN CASE OF INDICATION OF RISK.

When the Inspector observes or has reasonable suspicions that a shipment does not fulfill the proper conditions with regard to nuclear safety and radiological protection and therefore it could constitute a nuclear risk in its surroundings, he will immediately inform the title-holder of the "Authorization of transport" or his representative and the competent authorities (Customs, Airport authorities, entrance point or border, etc.), recommending that steps be taken to correct the situation and isolating the material as much as possible. All actions taken should be reflected in the report issued "in situ" and handwritten, if necessary. In any case, as soon as possible, he will inform JEN and the Delegation of the Ministry of Industry (by telephone, telex) who will give the pertinent instructions. Until the competent authorities have been duly informed, the inspector will remain "in situ" awaiting instructions or to counsel the Authorities.

If no "risk" of a nuclear accident is observed, but if the contents of the shipment cannot be affirmed by means of the sender's certificate (in case same is missing) and/or if the transport authorization granted by the Energy Administration Board is not exhibited, the inspector will inform the authorities

so that they may decide what should be done. If the inspector is requested to give his recommendations, he should recommend that the entrance or exit to/ from the national territory of said shipment not be permitted and that it be intercepted to avoid possible risks.

CLOSING THE STATEMENT

That the airport, port, border officials, etc. have given the necessary facilities to the Inspector for fulfilling his mission (if applicable).

This Statement is issued in the place and date indicated below, in accordance with that indicated in the current Law 25/1964 and the referred Resolution.

Place and date (in writing)

INSPECTOR'S SIGNATURE

PROCESSING= In fulfillment of that provided in the present legislation, an authorized representative of _____ is invited to sign, date and indicate his agreement or disagreement to the contents of this Statement.

- 1.- If accompanied, indicate the name and title: JEN Expert, Provincial Delegation Engineer of the Ministry of Industry, etc.
- 2.- Define specifically, for example: Port of Santander, Barcelona Airport, Vandellos Nuclear Power Plant, Irun Customs (Guipuzcoa), Km. 92,300 of National Highway No. 1, etc.
3. Transnuclear Española, Union Electrica, SA., Mr. _____ title-holder of building or operating authorization of radioactive installation _____, company _____, etc.
4. Person he proved to be (National Identity Card or other document exhibited), he said to be (if same is not confirmed), or is (if the Inspector knows him).
5. The number of packages and characteristics will be specified: irradiated fuel elements, natural uranium or enriched fuel elements, encapsuled radioactive sources or non-encapsuled cobalt-60, iridium-192, iodine-125, etc.; if they are radioactive products or wastes, mention will be made if these refer to nuclear substances.
6. If the certificate is not exhibited, specific mention will be made that the Inspector has requested same but that it was not shown. This point is of great importance.
7. For shipments which enter or leave Spain, it is necessary to always check that the sealed bands are intact and especially when this refers to radioactive material subject to safeguards.

