



APPROACH FOR SAFE TRANSPORT OF SAMPLES INCLUDING NUCLEAR MATERIAL

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ABSTRACT

Most samples including nuclear material, i.e. U, Pu and Th, is transported as Excepted Packages or Type A Packages with non-fissile material.

For these types of shipments, the packages must conform to technical requirements of the transport regulations. However, since licensing or approval from the Competent Authorities is not necessary for this transport, the shipper must check its conformity to the technical requirements of transport regulations. Once verified, the package can be shipped. The checking of conformity to the technical requirements of transport regulations before shipment is very important.

Therefore, the package, to be used for this transport, must also be checked for technical conformity to transport regulations, before the sample is packed into the package. The entire package is then checked for conformity by a radiation level survey, a verification of the label, markings, etc.

In this paper, through our experience of sample transport, the procedure and method of checking will be introduced, and improvements for the safe transport of the sample will be discussed.

INTRODUCTION

The transport of nuclear materials is classified according to transport regulations and technical requirements. In this paper, the suitable mode of transport from foreign countries to Japan will be examined, taking into account the type of package. It will also compare the advantages of Excepted and Type A Packages, based on our experience in Japan.

Considering technical requirements and the requirement of the Japanese Competent Authorities for Excepted and Type A Packages, this paper will discuss the verification of conformity to technical requirements and to requirements of the Japanese Competent Authorities.

Finally, the improvement of sample shipments (for example package modifications) as well as its advantages will be considered.



THE TYPE OF PACKAGE

Basically, the type of package will be classified either as an Excepted, a Type A or a Type B package. Fissile material or non-fissile material must also be taken into account.

In our experience of the transport of Excepted and Type A packages with non-fissile material, no special applications are required. Type B packages, however, require application such as design approval, package approval, etc.. The comparison of applications relative to the types of package is shown in Table 1.

Excepted and Type A package shipments can be performed with a shorter lead time than Type B package shipments.

The samples that we usually transport contain very small quantities of material with low activity. Therefore, it is more appropriate they are transported as Excepted and Type A packages. However, the transport of a large number samples is not suitable for these types of packages.

With regards to fissile material, special applications are necessary: for example, physical protection must be considered.

As a result, the type of package is chosen considering the characteristics of the material, type of package and mode of transport.

Table 1 Comparison of applications relative to type of package

Item	Excepted Package	Type A Package	Type B Package
Technical requirement	Yes	Yes	Yes
Test of Normal condition of transport	No	Yes	Yes
Test of Accidental condition of transport	No	No	Yes
Design approval of Competent Authority	No	No	Yes
Validation of design approval	No	No	Yes
Package approval of Competent Authority	No	No	Yes
Approval of shipment	No	No	Yes
Import License	Yes	Yes	Yes
Export License	Yes	Yes	Yes



MODE OF TRANSPORT

When considering multilateral shipments, the only transport modes are air transport or sea, because Japan is an island. The transport mode is selected according to number of samples and the cost of transport.

Thus, the characteristic of each transport mode and an explanation of the advantages and disadvantages of Excepted and Type A packages is discussed below.

1) Air transport

For the Excepted and Type A packages, a small number of samples is suitable for air transport because the cost of transport is not expensive and the transport time is short. However, when many samples are shipped it is necessary to divide the shipment because of the Japanese regulations prohibiting transport of fissile material by air. Therefore, many shipments are made dividing the number of samples to obtain non-fissile shipments. As a result, the cost in this case is expensive and the possibility of human error multiplies. Thus, large numbers of samples are not suitable for air transport.

2) Sea transport

In the case of sea transport of Excepted and Type A Packages, we carefully the transport route and cost must be carefully considered because most shipping companies will not accept small packages with nuclear material. Samples containing Pu are refused by shipping companies, therefore a special ship must be chartered. The canal to be used must also be taken into account. As a result, the cost of sea transport for small numbers of samples is expensive and not suitable for sea transport.

When shipping numerous samples, it is probable that the concentrations will be recognized as fissile material, thus the type of package must be changed. If this package is to transport fissile material, additional application for fissile material must be satisfied.

Most users do not request large number of samples. Therefore, air transport is usually chosen.

CHECKING FOR CONFORMITY

Samples including nuclear material require verification for technical conformity by executing transport a radiation level survey, checking the label, markings.

In accordance Japanese regulations, conformity is verified when the mode of transport is changed, because Japanese regulation are categorized by modes of transport. To satisfy all Japanese regulations the exact schedule of shipment must be confirmed.

Thus, the conformity is checked at each phase according to the type of conformity (see Table 2).

**Table 2 Phases and main categories for conformity verification
(Case of Import from foreign country to Japan)**

No.	Phase	Main categories
1	At the start of the job	Confirmation of transport regulation related samples
2	During the preparation of the package	Confirmation of materials (i.e. Characteristics of materials)
3	Before the shipment from consignor	Confirmation of materials (i.e. A2 value calculation)
4	At the moment of departure from consignor	Confirmation of package (i.e. Labeling, Sealing, etc.)
5	Departure from NRT airport	Confirmation of package (i.e. Labeling, Sealing, etc.)
6	During inland transport in Japan	Condition of package (i.e. Lashing)
7	Arrival at consignee	Confirmation of package (i.e. Labeling, Sealing, etc.)

By checking the conformity at each phase, it is possible to confirm that the shipment satisfies related Japanese regulations. As a result, a stable service to our customer is always provided thanks to this method.

As each package must be verified, as the number of packages increases the cost increases as well.

A simplified, more effective method need to be studied to reduce cost even more.

IMPROVEMENT OF TRANSPORT

Improvement is based on packaging design and transport method. However, it is difficult to modify the transport method due to the current regulations.

1) The package design

The package design is determined according to package type.

a) Excepted and Type A Packages

The design must satisfy transportation regulations.

b) Type B packages

Type B package design is specific to the type of content packed. If the content is changed a new approval is needed.

2) Improvement of packaging for Excepted and Type A packages (TNB 169 package)

TNB 169 packages is generally used to transport samples and is certified to satisfy transport regulations for Type A package, including the requirements for solids, liquids and gases. The appearance of TNB 169 packages is shown in Figure 1, the inner contents of TNB 169 packages is shown in Figure 2, the drawing of TNB169 packages is shown in Figure 3.



Figure 1 Appearance of TNB 169 packages



Figure 2 Inner contents of TNB 169 packages

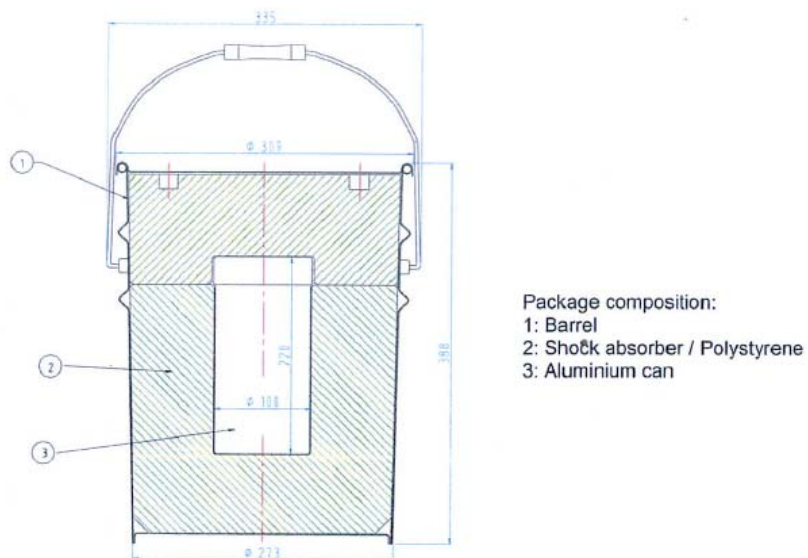


Figure 3 Drawing of TNB 169 packages¹

In the current design of this package, the space for the samples is limited, according to the type of samples. A maximum of 10 samples can be packed. If 100 units of this sample are requested, 10 TNB 169 packages must be prepared. Thus, each of the 10 packages must be verified for conformity to transport regulations by a radiation level survey, checking the label, markings, etc.



To avoid this repetition a study is underway to enlarge the packing capacity of Inner Al cans and PE bottles. The target of this study is to enlarge the packing capacity to twice the volume of the conventional design.

Once the packing capacity is enlarged, the number of shipments will be decreased by half, decreasing the cost and human error as well.

Enlarging the Inner Al cans and PE bottles will result in the reduction of the shock absorber. Therefore, the technical requirement for Type A packages must be carefully considered.

CONCLUSIONS

Most of the samples including nuclear material, i.e. U, Pu and Th, is transported as Excepted or Type A packages with non-fissile material, and must satisfy the In Japanese regulations as well as other related regulations. The most appropriate transport mode must consider the number of samples, characteristics, etc. Although, the verification procedure is already well established, the reduction of human error and unexpected accident can be further avoided.

We have introduced the improvement of packages as a countermeasure for accidents.

In the future, we will have to study a more effective and low cost solution for these shipments.

REFERENCES

- 1) Certificate of approval of the packaging TNB 169 Transport of radioactive materials –Type“A”- (Issued by TNB, TNB reference No : 10.126/0142)