Transport of Nuclear Material in Germany Since the Enforcement of the First Atomic Law in 1959: Experiences, Assessments, and Tendencies

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INTRODUCTION

Following the IAEA-Regulations for the Safe Transport of Radioactive Material (IAEA 1990), the competent authority in each country is responsible for the estimation of the development in the field of the transport of radioactive material, for periodical assessments in this area and also for the compliance assurance of all relevant provisions.

Therefore, the Federal Office for Radiation Protection, as one of the competent authorities in Germany, assesses these developments periodically.

The results of the assessments are important for the

- development of transport regulations;
- decisions of competent authorities, industrie, and policy makers,and
- discussions in respect to the significantly increasing public concern.

The paper will present an extraction of such information, collected in the past 25 years, with respect to licensing matters, quantities of nuclear material transport,and other aspects.

SOME ASPECTS IN LICENSING MATTERS

Concerning the German atomic energy law (ATOM 1959), all shipments of nuclear material need shipment approval from the Competent Authority. In former times this was the PTB (Physikalisch-Technische Bundesanstalt), since 1989 the Federal Office for Radiation Protection in Braunschweig/Salzgitter (BfS) is responsible for these tasks.

Such approvals are necessary, independent from the requirements according to the IAEA Regulations for the Safe Transport of Radioactive Material and the derived regulations of the various bodies, regulating the provisions of dangerous goods transport.

In the former German Democratic Republic the National Board of Nuclear Safety and Radiation Protection in Berlin was the competent authority. Besides the provisions, coming from the IAEA, a shipment approval for the transport of all fissile material was necessary.

If Type B-packages or packages for fissile material are used, also approvals for package design are necessary. The competent authority for package approval is also the BfS (formerly the PTB). In Table 1 packages mostly used for the transport of spent fuel, of unirradiated nuclear material and of Uranium Hexafluoride are listed.

Table 1: PACKAGES mostly used for the transport of nuclear material

For spent fuel:		
to France	to United Kingdom	to other countries and within Germany
R52 NTL 8/2 TN 17/2 TN 12/1 TN 12/2 TN13/2 TN 9 TN 1	TCC1 NTL 3 NTL 11	NTL 3 TN 7/2 Castor IIb Castor S1 Castor KRB-MOX Castor THTR-AVR GTC TK-6
For unirradiated material:		
Pellet-Außenbehälter BU-D(powder, pellets) Model Nr. ANF-250 (powder) BU-J (powder, scrap) BE-Transportbehälter Typ II, III and IV (fuel elements) Framatom RCC3 SP-1, SP-2 RA-2; RA-3 Transportbehälter für Brennstäbe THTR-Transportbehälter Reststoffaß R 200		
For Uranium Hexafluoride:		
UF_6-Zylinder 48Y UF_6-Zylinder 30B (incl. Overpack)		

QUANTITIES OF NUCLEAR MATERIAL TRANSPORT

The first shipment approval for a transport of nuclear material was submitted in January 1960, after the first atomic law had come in force in the Federal Republic of Germany in 1959. And one year later, in May 1961, the first shipment approval for a spent fuel element was issued.

Therefore much data concerning the transport of spent fuel exist in the Federal Office for Radiation Protection. The number of transports of spent fuel with regard to the various items is as follows: During the past 25 years (1970 - 1994) more than 4,550 t heavy metal in 1,904 flasks by 1,562 shipments has been transported.

Figures 1a and 1b show the number of transports of spent fuel in these 25 years. It can be seen that since 1981 the number has increased. Figure 1b demonstrates, that in the seventies there were more domestic shipments to the former reprocessing plant WAK Karlsruhe in Germany, but later the number of export shipments increased.

With the amendment of the German atomic law in 1994 the possibility for a direct final disposal of spent fuel is allowed. So more shipments are carried out within Germany to the intermediate storage facilities. From 1992 to 1995, 58 shipments with 305 packages with spent THTR-pebble bed fuel have been realized to the intermediate storage facility in Ahaus.

Most of the spent fuel from the German nuclear power plants was transported to the reprocessing plants in France and in the United Kingdom. Some spent fuel was shipped also to Belgium (nine shipments in 1970), to Denmark (one shipment in 1983) and to Sweden (twelve shipments in 1977, 1987, and 1988). The transport of spent fuel from the former GDR to Russia (from the nuclear power plants Rheinsberg and Greifswald) was carried out from 1972 to 1985. They were stopped in 1985, because the intermediate storage facility in Greifswald started operation.

Figures 2a and 2b show the number of all German nuclear material transports for the past 5 years. There is a decrease in the transport number within Germany due to the fact that the production of nuclear material is also decreased. The transport of international shipments is nearly constant.

In Figures 2a, 2b and in Figures 3a, 3b, 3c, and 3d it can be seen, that especially in 1992 the transport of unirradiated nuclear material increased, because the exchange of this material between the various facilities also increased. On the other hand, in 1994 were less transports by reason of the burn up rising in some German nuclear power plants.

SOME RADIATION PROTECTION ASPECTS AND THE GENERAL ACCEPTANCE OF NUCLEAR MATERIAL TRANSPORT

In 1989 the construction of a German reprocessing plant at Wackersdorf, Bavaria, was stopped, and the construction of packages for spent fuel for shipment and intermediate storage, which was begun early in the 1980s, was intensified.

This development also has influence on the amount of radiation exposure. Concerning the IAEA transport regulations a maximum dose rate at any point on the surface of the package of 10 mSv/h (under exclusive use conditions) or of 2 mSv/h is allowed. Otherwise, the Competent Authority approvals for the intermediate storage in Ahaus and Gorleben prescribe a mean value of

0,1 mSv/h for Gamma radiation and
0,15 mSv/h for neutrons at the package surface.

Furthermore, the spent fuel is stored for longer time on-site (in the water-cooling pool) and thereby the dose rate is lower. Although the radiation exposure of the transport workers, for example, during the rail shipment of spent fuel is very low (Fasten 1994) and no incidents or accidents occurred, the antinuclear-campaigns in Germany is increasing [see also: (Alter 1992)]. So about 9,000 policemen had to protect the transport of spent fuel in one CASTOR IIa package on the way from the nuclear power plant in Philippsburg to the intermediate storage facility in Gorleben in April this year.

Independent from the fact that the individual doses and the total collective dose of the policemen were low, such an effort is in contradiction to the „as low as reasonably achievable“ principle.

REFERENCES

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Fasten, Ch., Müller, U. and Alter, U., *Twenty years of experience in spent fuel shipment from German nuclear power plants* - a view of the competent authority; RAMTRANS, Vol.5 Nos 2-4, pp 151-153 (1994)

Gesetz über die friedliche Verwendung der Kernenergie und den Schutz gegen ihre Gefahren, (Atomgesetz) vom 23. Dezember 1959 (BGBl. I.S. 814)

IAEA Regulations for the Safe Transport of Radioactive Material, Safety Series No.6, Vienna (1990)

Figure 1a

Shipment of spent fuel
national and international

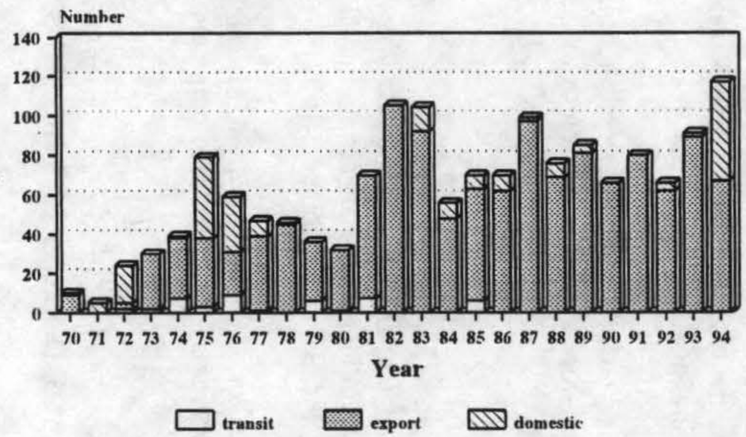

Figure 1b

Shipment of spent fuel
with respect to the Consignee

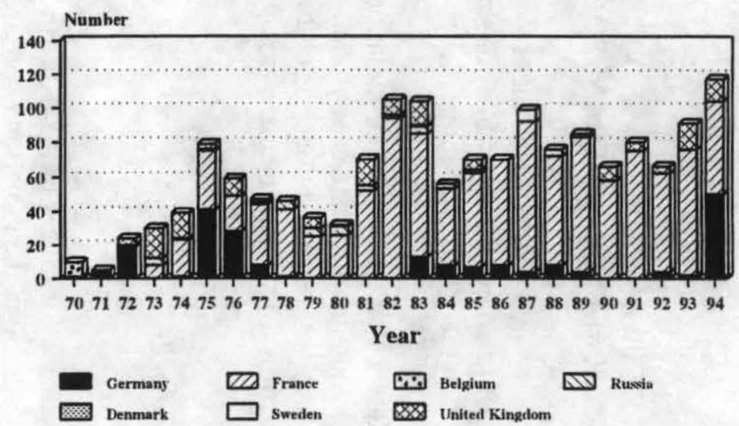

Figure 2a

Transport of nuclear material

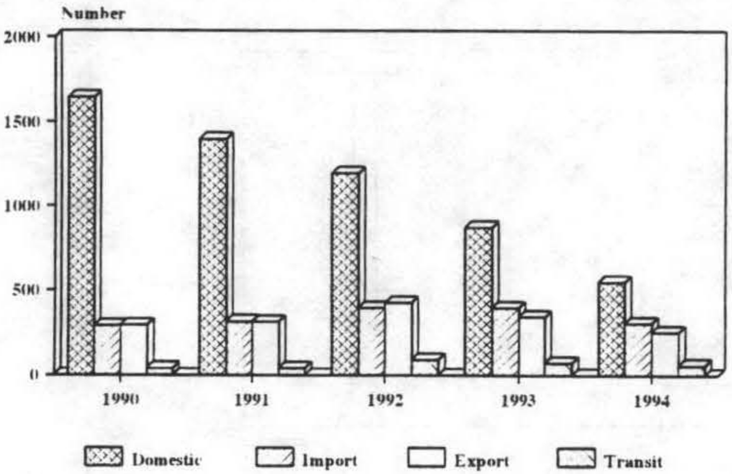

Figure 2b

Transport of nuclear material
national and international

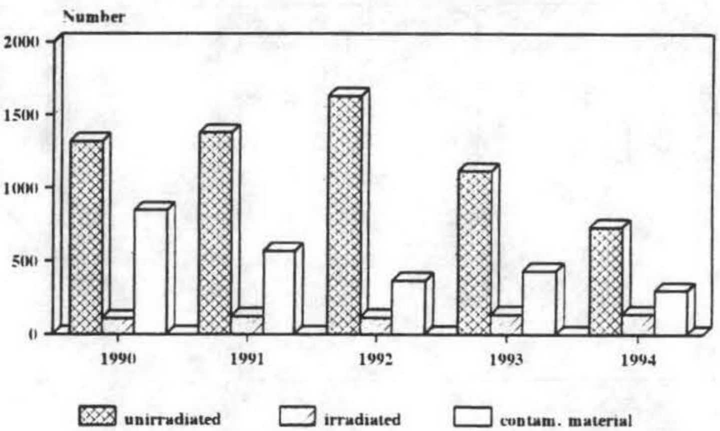

Figure 3a

Transport
of fresh fuel

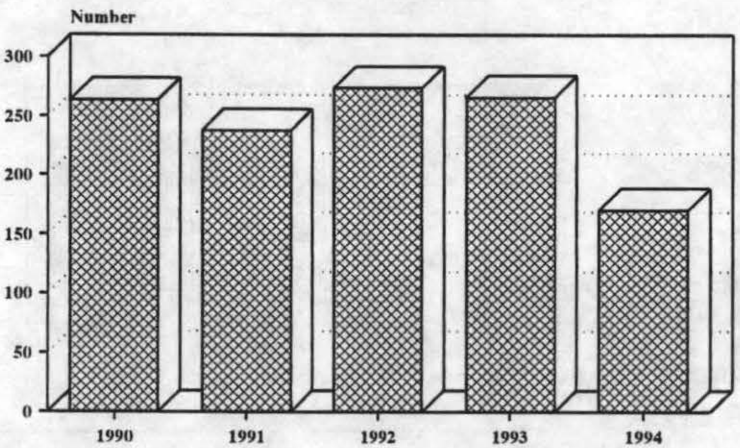

Figure 3b

Transport of UF6
enriched, nat. and 'Heels'

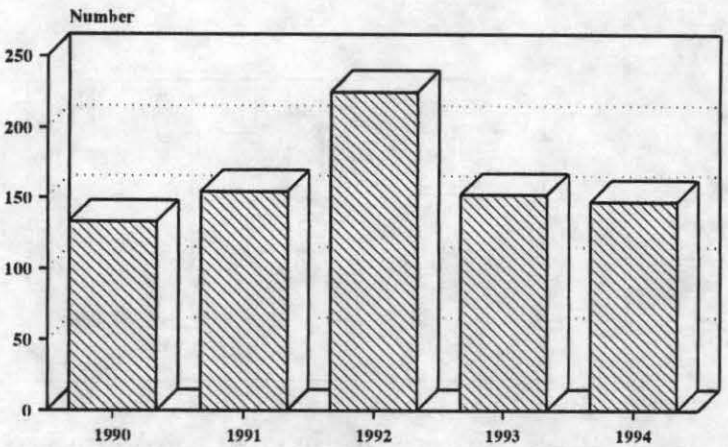

Figure 3c

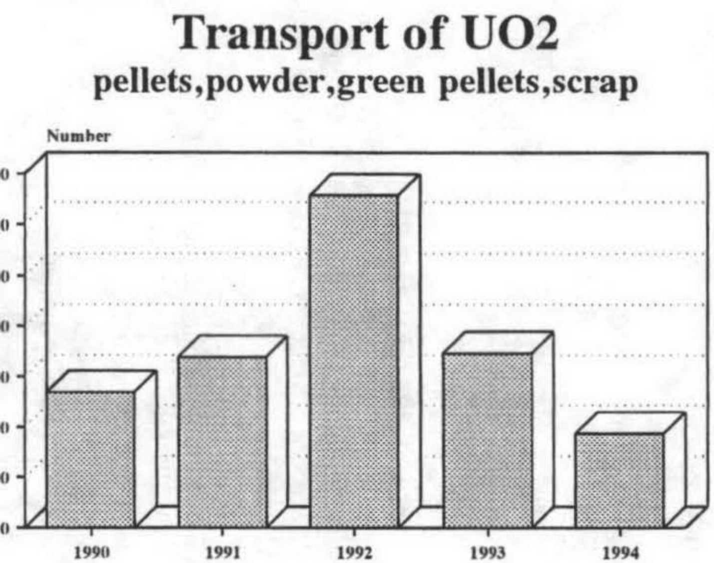

Figure 3d