Summary of Nuclear Material Transport in the Federal Republic of Germany (1990–1994)

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INTRODUCTION

In 1990 the Federal Office for Radiation Protection (BfS, Salzgitter) developed the Nuclear Material Transport Database to support the activities of the Federal Ministry of Nuclear Safety and other competent authorities in the FRG.

The Nuclear Material Transport Database contains information on all kinds of transport of nuclear materials within the fuel-cycle in Germany. For reasons of inspection by local authorities every transport of nuclear material in the FRG should be notified 48 hours in advance. The 48-hours-notification is the principal source for the database. No accident with release of radioactive material occurred in this time-period. As in the previous time the numbers of incidents was low.

SITUATION OF THE NUCLEAR INDUSTRY BETWEEN 1990 AND 1994

Electricity generation by nuclear power plants has an important role in the FRG. Between 29 % and a maximum of 34 % of the total amount of electricity generation is produced by nuclear powerplants. This is a positive aspect of the use and acceptance of NPPs in Germany. In contradiction to this aspect many minor difficulties have to be mentioned:

Today, no new nuclear powerplant is under construction or planned for the near future. The number of nuclear powerplants is a steady state system, 19 in use, with 21 900 MWe and an electricity generation with 151 100 GigaWatthours(GWh) per year. The situation in Germany between 1973 and 1994 is shown in Table 1.

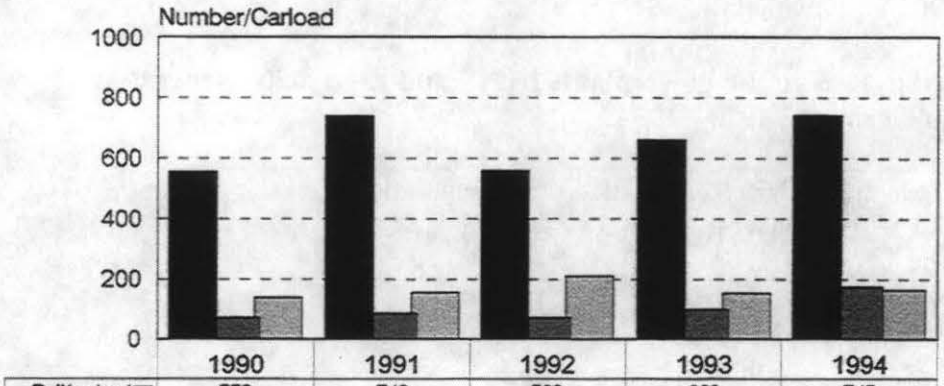
Table 1. Nuclear Powerplants (NPP) and Electricity Generation in Germany, 1973 - 1994

Year	NPP [MWe]	Electricity Generation [GWh]
1973	2,400	11,800
1980	9,100	43,000
1985	16,900	125,900
1990	23,600	146,100
1994	21,900	151,100

TRANSPORT OF NUCLEAR MATERIAL, 1990 - 1994

In the Nuclear Material Database information about different kinds of shipments of nuclear material are available. The total amount of all nuclear material shipments between 1990 and 1994 differs from a maximum of 2,267 in 1990 and a minimum of 1,165 in 1994. The German Railway Company (DB AG) itself produces every year a database on radioactive material shipments by rail (carload per year), see Table 2 .

Table 2. Rail-Transport, 1990 - 1994



	1990	1991	1992	1993	1994
Rail/carload	558	743	562	662	745
Spent fuel	72	87	71	99	173
No. shipments	137	155	210	153	164

The transport of spent fuel elements from nuclear powerplants in Germany to the existing reprocessing facilities in France and the United Kingdom is centralized by the German Railway Company (Alter et al .1992 and IAEA 1985) A brief summary on all shipments of spent fuel between 1990 and 1994 is given in Table 3 .

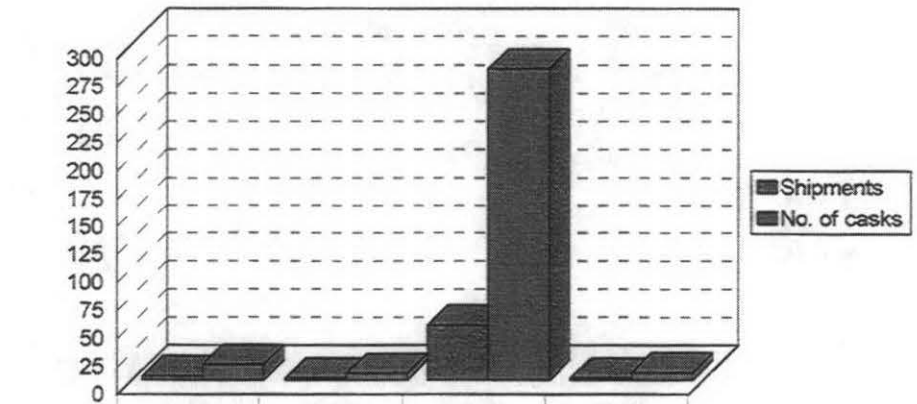
Table 3. Shipments to the reprocessing facility

NPP		Shipments	No. of casks	COGEMA	BNFL
BBA	Biblis	41	43	43	0
KKS	Stade	24	25	25	0
KKU	Unterweser	28	37	5	32
KI1	Isar	39	39	39	0
GK1	Neckarwestheim	27	27	27	0
KWW	Würgassen	21	21	21	0
KKG	Grafenrheinfeld	22	22	22	0
KP1	Philippsburg	30	30	30	0
KKK	Krümmel	23	23	23	0
KWO	Obrigheim	14	14	14	0
KKB	Brunsbüttel	20	20	20	0
KGB	Gundremmingen	29	36	16	13
KWG	Grohnde	18	19	18	0
KBR	Brokdorf	8	9	0	8
MKA	Mülheim-Kärlich	0	0	0	0
KKE	Emsland	0	0	0	0

The project of a fast-breeder-reactor (Kalkar 300 MWe) was definitely closed. Up to the end of the 1980s the Thorium High Temperature Reactor (THTR) a pebble bed reactor with 300 MWe was closed early. The spent fuel material had to be moved to the interim storage facility Ahaus. These CASTOR THTR - Shipments started in 1992, up to 1995 a total amount ot 57 shipments and 305 CASTOR THTR-casks were shipped to Ahaus; see Table 4.

Table 4. CASTOR THTR - Shipments

from 1992 - 1995

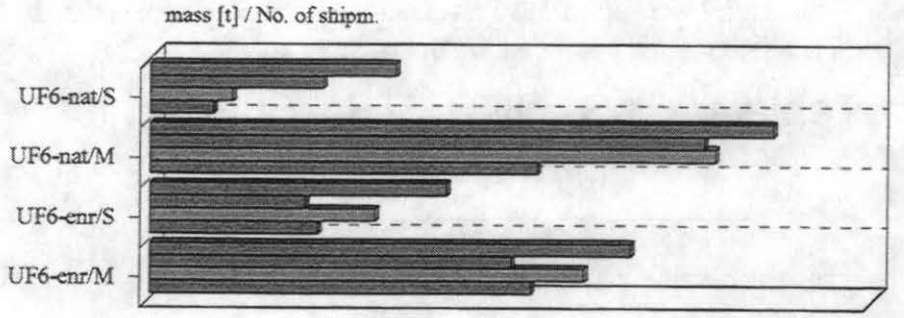


	1992	1993	1994	1995
Shipments	4	2	49	2
No. of casks	14	6	278	7

In the eastern part of Germany the WWER 440 pressure water reactor facility at Greifswald, 5 nuclear powerplants, were closed in a short time period after the unification up to the end 1990. Fresh fuel elements of the WWER 440 type have to be sent away to other nuclear powerplants of the same type in Eastern Europe. In the near future a transport of spent fuel elements from Greifswald is planned to a similar unit, Paks, in Hungary. The transport cask will be a CASTOR WWER 440/84 type for storage and transportation.

Because of a long dispute with the local governement of the Bundesland Hessen, SIEMENS Company decided to close at the end of this year the fresh uranium fuel-element fabrication plant in Hanau and the Mixed Oxide fuel fabrication plant as well. In the future a majority of fresh fuel elements must be delivered from foreign countries to nuclear powerplants in Germany. As an important head-end product of the nuclear fuel cycle shipments of Uranium-Hexafluoride (UF6, enriched and natural uranium) are of great importance, nearly 27 500 tons of natural UF6 were shipped in Germany between 1990 and 1994; see Table 5.

Table 5. UF6 - Shipments, 1990 - 1994



	UF6-nat/S	UF6-nat/M	UF6-enr/S	UF6-enr/M
total	223	27.499	424	4.499
rail	89	11.422	71	979
ship	28	13.133	172	2.496
ship/transit	22	1.358	83	1.264

Abbreviations:
UF6-nat/S and UF6-enr/S means number of shipments of natural/enriched UF6
UF6-nat/M and UF6-enr/M means mass of natural/enriched UF6

TRANSPORT TO A FINAL REPOSITORY IN GERMANY

The transport of radioactive waste is centralized and coordinated by the German Railway Company (Deutsche Bahn AG, DB) in Germany. The conditioning of radioactive waste is now centralized and carried out by the Gesellschaft für Nuklear Service (GNS). The German Railway Company, DB AG, is responsible for the transport and GNS is responsible for the conditioning of radioactive waste.

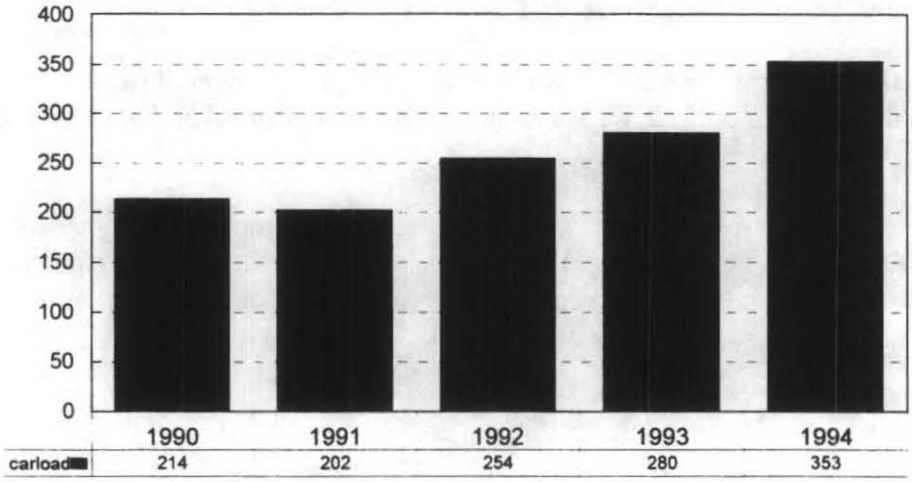
The German Railway is responsible for all shipments of radioactive waste from nuclear powerplants, conditioning facilities, and the existing intermediate storage facilities in Germany. For these shipments special transport procedures exist, different waste packages for radioactive waste with negligible heat generation are in use. For this purpose the inspection authorities in Germany use a new documentation system, a special computer program for waste flow tracking and quality assurance and compliance assurance, developed by the electrical power companies in Germany.

In the former German Democratic Republic (GDR) a disused salt-mine was chosen for the disposal of low-radioactive waste (GRS 1991) situated in Morsleben near Helmstedt at the former German-German border. The final disposal started in 1978. Low-level radioactive waste from the nuclear power plants in Greifswald and Rheinsberg, from the research and development facility in Rossendorf (Saxonia) and from different users of low radioactive material in

the former GDR were disposed in Morsleben from 1978 to 1991. Pending on a court decision the final repository was closed between 1991 and the beginning of 1994.

The Morsleben final waste disposal site was back in operation on January, 13, 1994. Low-level radioactive waste from the shut-down nuclear power reactors in Greifswald and Rheinsberg and from other NPPs in Germany are disposed in the facility now.

Table 6. Waste shipments by rail, carloads in 1990 -1994



Inspection authorities in Germany use a documentation system, that includes a computer program for waste flow tracking and quality assurance and compliance assurance data for radioactive waste shipments.

Data for waste shipments of the German Railway Company are given in Table 6. Shown are the total number of carloads per year of radioactive waste with negligible heat production. This means only shipments of conditioning radioactive waste from nuclear powerplants to waste-handling facilities or interim storage facilities. Standardized containers are in use for those waste-shipments.

MORSLEBEN TRANSPORT STUDY

A transport safety analysis study has been conducted for shipments of low- and medium-level radioative waste materials suitable for underground disposal at the Morsleben final repository (Lange et al, 1994).The objective of the study, referred to as Morsleben Transport Study, is the anaylsis of transport operations and the assessment of the radiological risks from normal transportation and po-

tential accidents. The annual volume of waste shipments assumed for the study is 865 shipping units corresponding to a waste volume of approximately 5,000 m^3.

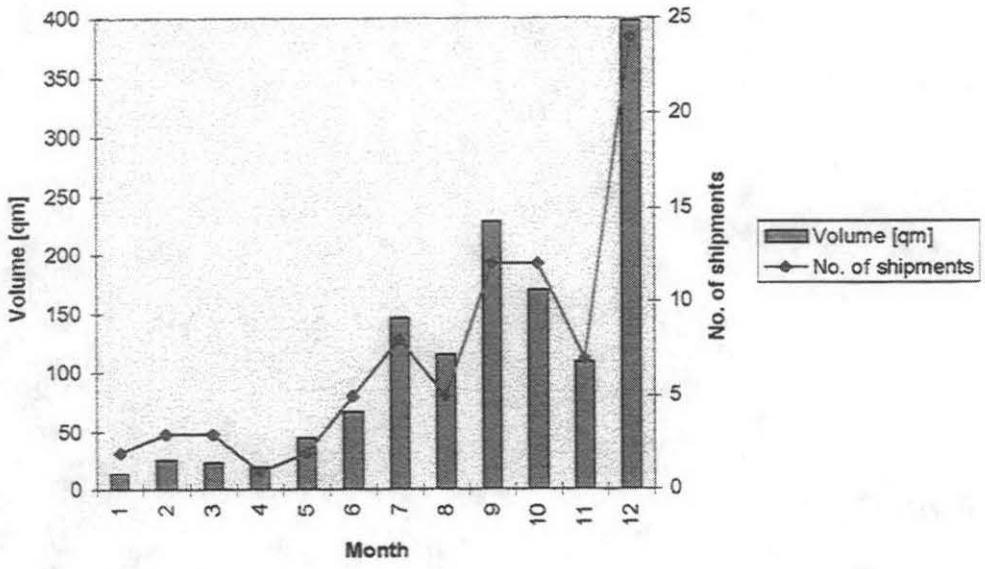
Rail transport is the preferred shipping mode nationally. But the Morsleben final repository has no rail access. This is the reason why in the repository region, 40 - 50 km around the disposal site, waste transportation has to be primarily by road from the marshalling yard Magdeburg-Sudenburg to the location of the final repository.

The accident analysis relies to a large extent on probabilistic safety assessment techniques taking into account the broad range of values of model parameters which determine the radiological consequences of transport accidents and the estimated frequency of occurrence.

From the results of the study it can be concluded that the overall transport risk from shipments of radioactive waste materials to the Morsleben final repository is very small.

In Table 7, all waste shipments to the final repository Morsleben are presented from the re-opening in January 1994 to the end of the year. With 84 shipments a total volume of 1,360 cubic metres of low-activity radioactive waste were brought to the final repository during 1994.

Table 7. Waste-shipments to MORSLEBEN 1994



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