SUMMARY OF RAIL SHIPMENTS IN THE FEDERAL REPUBLIC OF GERMANY (1972 - 1997) - 25 YEARS OF EXPERIENCE

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Summary

The Federal Railway Office (Eisenbahn-Bundesamt, Bonn) is responsible for the supervision of all railway-shipments of radioactive material within the Federal Republic of Germany. Up to this responsibility the Federal Railway Office has a database dealing with all shipments and all incidents and accidents during the transport of radioactive material by rail and the total amount of all railway-shipments during the time-periode from 1972 to 1996. During this time period the safety record was excellent, no severe rail-accident during transport of radioactive materials occured. A brief description of the situation of the Federal Railway Office, the number of shipments during the 25-years time-period and the supervision-situation on the main transport-routes will be described in the paper.

Introduction

Since 1972 the Federal Railway Office (Eisenbahn-Bundesamt, Bonn) former central agency for the Federal Railway Company (Bundesbahnzentralamt, Minden) is responsible for the supervision of all railway-shipments of radioactive material within the Federal Republic of Germany. Up to this responsibility the Federal Railway Office has a database dealing with all shipments and all incidents and accidents during the transport of radioactive material by rail and the total amount of all railway-shipments during the time-period from 1972 to 1996.

In this position the Federal Railway Office is able to support the activities of the Federal Ministry of Nuclear Safety, Federal Ministry of Transportation and other competent authorities in Germany. In the 25 years time-period rail-shipments of all kinds of radioactive material especially nuclear materials such as spent fuel elements and vitrified high-active glass canisters, uranium-ore, low active waste (LAW), Uraniumhexafluoride (UF6) and other kinds of radioactive material were carried out by the German. Railway Company (Deutsche Bahn AG), see Table 1.

The safety record is excellent, no suitable accicent forced release of radioactive material, a number of less than 20 incidents and accidents during 25 years of rail-shipments. It should be mentioned that during this 25-years time-periode no accident-induced radiation exposure occured to the railway transport personnel or to member of the public railway-traffic. Up to 1600 rail-shipments of spent fuel elements from nuclear power-plants in the Federal Republic of Germany to different locations of reprocessing facilities in Germany, France, United Kingdom and other countries were done without any severe accident and without the accident-forced release of radioactive material.

Rail transport is the preferred shipping mode for all kinds of radioactive waste nationally. The transport of radioactive waste is centralized and coordinated by the German Railway Company (Deutsche Bank AG) in Germany. The German Railway transports all radioactive waste from nuclear power plants, conditioning facilities, the existing final repository Morsleben and the existing intermediate storage facilities in Germany. For reasons of inspection by local authorities every transport of nuclear material in the FRG should be notified 48 hours in advance.

	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986
Enriched UF6	14	16	23	53	31	55	56	30	83	46	64
UF6-, UNH-nat	0	3	22	66	59	26	26	49	26	7	5
Fresh Fuel	3	3	0	6	16	2	3	6	9	16	6
Irradiated Fuel	99	73	173	99	71	87	72	84	75	100	65
Uranium-ore	24	24	37	0	21	236	74	318	177	175	216
Depleted UF6	7	10	13	12	0	10	8	87	40	15	19
Low Active Waste	519	444	353	280	254	202	214	146	66	32	33
Empty Casks	97	69	75	94	67	87	70	82	70	102	68
Total Amount	763	642	696	610	519	705	523	802	546	493	476

	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975
Enriched UF6	36	66	89	108	23	22	50	37	34	26	60
UF6-, UNH-nat	0	0	8	29	0	0	0	0	1	0	0
Fresh Fuel	5	4	25	5	4	5	4	8	4	10	5
Irradiated Fuel	67	47	89	72	60	31	19	8	11	16	4
Uranium-ore	281	291	436	304	244	283	84	382	132	207	306
Depleted UF6	19	35	36	22	97	85	94	0	0	0	0
Low Active Waste	32	11	56	35	17	13	8	471	308	300	315
Empty Casks	64	38	82	72	60	31	*	*	*	*	*
Total Amount	504	492	821	647	505	470	259	906	490	559	690

Table -1- Rail-shipments in Germany from 1975 to 1996

National Policy

Distinct regulations have been established for the transport of spent fuel and radioactive waste within the Federal Republic of Germany and for transport across borders. The general policy for transporting spent fuel is shipment by rail. Exceptions are made for a small amount of nuclear power plants which have no rail connection. In all those cases transport of spent fuel is carried out by combined truck and rail shipment.

Radioactive waste being produced at various sites in the Federal Republic of Germany should be preferably transported by rail, too. Due to the fact that a small number of these sites are not connected to the railway network, transport of radioactive waste must also be carried out by combined truck and rail shipment.

The general policy for transporting spent fuel and radioactive waste is aiming at a minimization of shipments.

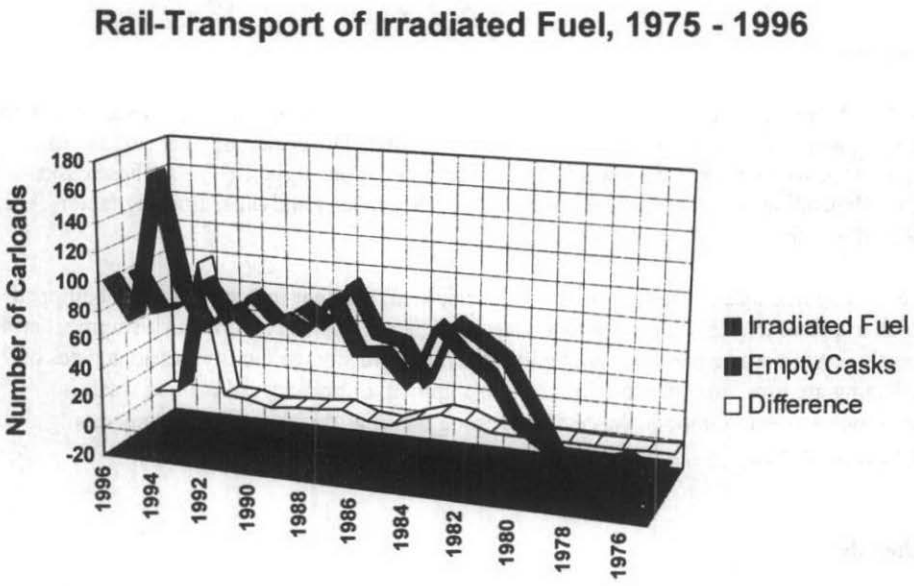

Figure -1- Rail-transport of spent fuel in Germany from 1975 to 1996

Requirements

All requirements for transporting spent fuel and radioactive waste are in complete conformity with the existing international transport regulations. As far as the traffic law regulations are concerned, the national regulations correspond to the recommendations of the International

Atomic Energy Agency (IAEA, Regulations for the Safe Transport of Radioactive Materials, Safety Standards, ST-1) as well as to RID and ADR. Nevertheless transport licences may specify special provisions of the Atomgesetz (Atomic Energy Act) and partly the Strahlenschutzverordnung (Radiation Protection Ordinance) are also applicable, these presupposing, among other things, that the regulations of the traffic law are complied with.

The Atomic Energy Act and the related ordinances, comprise regulations which refer on the one hand to traffic law regulations and which on the other hand define additional prescriptions and prerequisites, in particular of the administrative type. A survey and comparison of the regulations issued under traffic law and atomic law show that the two series of laws supplement each other without being contradictory. The regulations as a whole regulate the following aspects:

- safety during transport,
- liability in the case of accidents, and
- physical protection of radioactive substances.

Description

For the shipment of spent fuel thick-walled transport casks are utilized (dry casks, steel body, large capacity, standard sizes and ancillary equipments). The design of such casks is in compliance with the existing international recommendations (type B(U) F). These casks allow, depending on the nuclear power plant's crane capacity and other limiting factors, useful loads of less than 20 PWR fuel elements.

The railway carriages which are used for the shipment of spent fuel are normally equipped which a special enclosure. Radioactive waste is delivered by rail and/or truck shipment either directly or via a waste conditioning facility to an interim storage facility. Various types of packaging are used. In order to minimize the shipment of primary radioactive waste, preference is given to mobile waste conditioning facilities which enable the processing and packaging on-site.

Schedule

At present, spent fuel elements from German nuclear power plants are shipped to the reprocessing companies COGEMA in France and BNFL in Great Britain. Scheduls for transporting spent fuel are agreed upon between the utilities and the reprocessing companies, e. g. according to the respective operational necessities of a nuclear power plant.

Future transport of spent fuel, according to present plannings, will be carried out to the facilities of the reprocessing companies COGEMA in La Hague/France and BNFL in Sellafield/Great Britain according to present contractual negotiations; the interim storage facilities in Gorleben and Ahaus as well as to the interim storage facility in Greifswald/Rubenow which is now finished. Transporting spent fuel and radioactive waste is considered as a normal industrial activity. The costs for shipments are borne by the waste generators.

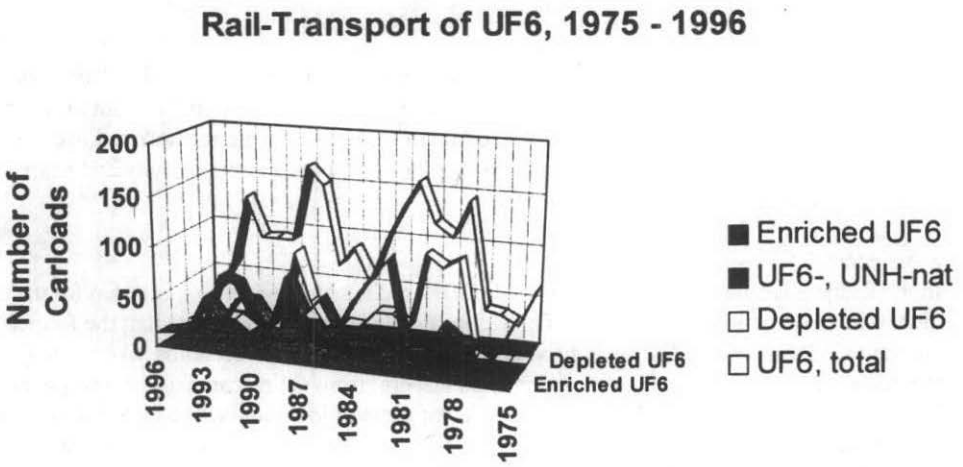

Figure 2-, Rail-transport of Uraniumhexafluoride (UF6) in Germany from 1975 to 1996

Experience/status

Spent fuel and radioactive waste have been shipped in the Federal Republic of Germany since the sixties, i. e. for more than 30 years. In addition, spent fuel and radioactive waste have been shipped abroad, e. g.

spent fuel from nuclear power plants to reprocessing plants in Germany (WAK, Karlsruhe), France and Great Britain.

Transport of radioactive waste

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 fhr Nuklear Service (GNS). The German Railway Company, DB AG, is totally and exclusively resposible for the transport. The German Railway transports all radioactive waste from nuclear power plants, conditioning facilities and the existing intermediate storage facilities in Germany. Many different types of packagings have been utilized for shipment, e. g. type IP, type A and type B packaging according to the IAEA recommendations. The most common packagings comprise 200 litre and 400 litre drums, cylindrical concrete packagings, cylindrical cast iron packagings and box-shaped containers made of sheet steel, reinforced normal and heavy concrete and cast iron for radioactive waste as well as transport casks made of nodular cast iron for spent fuel.

Transport to a final repository in Germany

Asse:
The first final radioactive waste repository in Germany was the former salt mine "Asse" near Braunschweig/Wolfenbhttel. Disposal of radioactive waste was started in 1967 but only for 11 years up to 1978. During this time nearly 120 000 m^3 of low- and intermediate-radioactive waste were disposed with an activity content of 1 250 TBq beta/gamma-activity and nearly 88 TBq alpha-activity.

Morsleben:
In the former German Democratic Republic (GDR) a disused salt-mine was chosen for the disposal of low-radioactive waste /1/ situated in Morsleben near to 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. The Morsleben final waste disposal is back in operation since 13. January 1994. Low level radioactive waste are disposed in the facility now. After the German reunification the resposibility for the operation of ERAM was transferred to the BfS. Now it is planned to dispose of 40 000 m3 of radioactive wastes until the expiration of the current licence on June 30, 2000.

Konrad:
In the western part of Germany the disused iron ore mine Konrad near Braunschweig/Salzgitter is planned to be the final disposal for radioactive waste with negligible heat generation. The capacity is scheduled to be up to 600 000 m^3 of radioactive waste with a maximal beta/gamma-activity of nearly 5 000 000 TBq and an alpha-activity of maximal 150 000 TBq.

The total amount of all rail-shipments of low- and medium activity wastes and Uranium-ore is shown in Table 3.

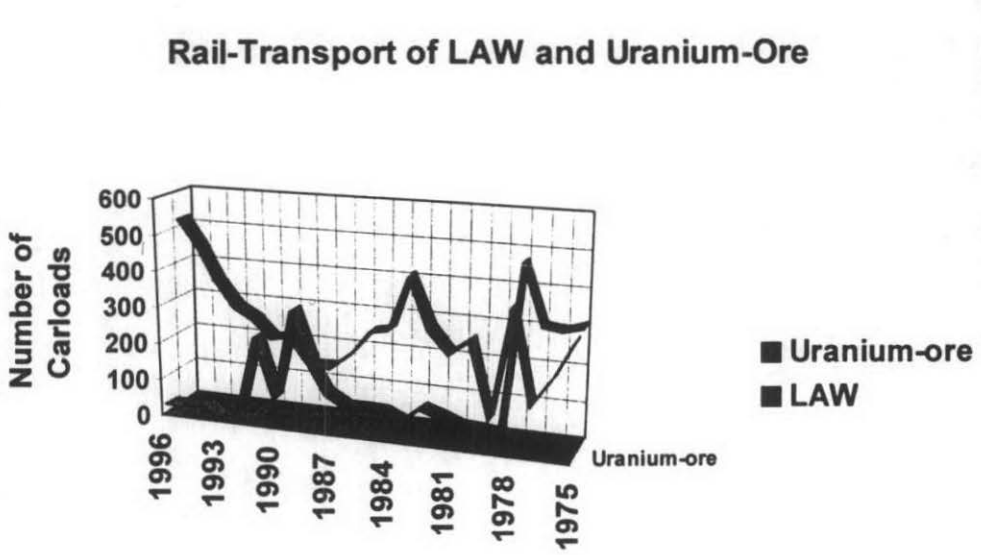

Figure -3- Rail-transport of LAW and ore in Germany from 1975 to 1996

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SESSION 12.2

Sea Transport