Transport of Radioactive Materials in the Federal Republic of Germany (FRG) since 03. October 1990 - a Survey

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INTRODUCTION

This paper presents the important changes in Germany since 03. October 1990, which took place in the field of nuclear fuel cycle activities in the Federal Republic of Germany (FRG).

Due to fundamental political changes in eastern Europe, the existing border between the Federal Republic of Germany (FRG) and the German Democratic Republic (GDR) was opened on the 9th of November 1989. The political decision in the former GDR and also in the FRG led to the re-unification on the 3rd of October 1990.

Due to the political changes in Germany a new situation has grown up in the last three years in the field of the nuclear fuel cycle and the use of radioactive material in medicine, technology and scientific instrumentation.

TRANSPORT OF RADIOACTIVE MATERIAL IN THE NUCLEAR FUEL CYCLE IN GERMANY

In the following chapter an overview is given about all kinds of transports of nuclear material in the nuclear fuel cycle in Germany.

Today the transport of spent fuel elements from nuclear power plants in Germany to the reprocessing facilities in France (COGEMA) and the United Kingdom (BNFL) is a normal routine procedure.

According to Table - 1 - in 1991 only 84 transports of spent fuel elements took place, 75 between Germany and France and 7 between Germany and the United Kingdom and two others.

Transport of spent fuel elements have caused a lot of "headlines" in the press during the last three years.

In January 1991 a small amount of 26 kg of spent fuel material from the scientific material test reactor of the "Physikalisch-Technische Bundesanstalt", Braunschweig, should have been transported to Dounreay, United Kingdom, but the transport was stopped at Rotterdam harbour in the Netherlands. All

existing international requirements for the safe transport of radioactive material were fulfilled, but the trade union of harbour workers still refused to move the transport cask from the lorry to the sea-going vessel.

The German Federal Railway developed a new concept for such a type of transport. The concept was to use the existing ferry-boat link between Dunquerke, France, and Dover, United Kingdom. This ferry-boat is the only one which exists for railway freight cars between the United Kingdom and continental Europe. In September and November 1991 the ferry-boat "Nord-Pas-de-Calais" was used for the shipment of a total of 39 kg of spent fuel elements from the FRM-reactor in Braunschweig to the nuclear facility at Dounreay and was also used for further shipments of other spent fuels.

A survey about all the different materials shipped in the Nuclear Fuel Cycle in Germany is given in table - 1 -.

TRANSPORT OF RADIOACTIVE WASTE IN GERMANY

Following some irregularities which came to light at the end of 1987 in correlation with the companies in Hanau/Germany and Mol/Belgium, there was an urgent call for safety improvements to be introduced into private sector structures of the nuclear energy industry in the FRG, in cooperation with the companies concerned.

Modification of the structures of important areas of the nuclear energy industry has resulted in the following:

- the transport of radioactive material within the nuclear fuel cycle is centralized and coordinated by the Federal German Railway Company (Deutsche Bundesbahn, DB) and
- the conditioning of radioactive waste is now centralized and carried out by one company belonging to the Gesellschaft für Nuclear Service (GNS)

The primary aim of the restructuring exercise is to improve substantially national safety measures by making one company in the private sector, GNS, totally and exclusively responsible for the conditioning of radioactive waste and one company, DB, totally and solely responsible for the transport, so that each can give a comprehensive and full account of its respective area of responsibility to the approval and inspection authorities at all times.

In order to achieve its aim of maximum safety, the nuclear industry's structure must be modified as described in order to complement these regulations. Private sector structural change ensures, in a way which would not be possible with the national regulations, that the firms concerned take a direct and active interest in constantly improving the safety of the conditioning, storage and transport of radioactive material.

The Federal Government is of the opinion that the combination of the two approaches - i. e., improvements to national regulations and structural change in the nuclear industy - is a particularly appropriate way to achieve the safety objectives.

As a result the German Federal Railway shipped all radioactive waste from nuclear power plants, conditioning facilities and the existing intermediate storage facilities in Germany.

In 1991 in such a way 179 shipments of radioactive waste were carried out. (For further information see table - 2 -)

A new documentation system was developed by the electrical power companies in Germany, a special computer program for waste flow tracking and quality assurance and quality control systems. (In German language: AVK-Sytem).

In the former GDR radioactive waste was directly shipped from the nuclear power plants and other waste producers to the final repository at Morsleben - that means long distance railway transportation and a short highway connection between Magdeburg and the site of the repository at Morsleben.

In 1990 a total amount of 214 shipments between the power plants at Greifswald and the final repository site at Morsleben were done, in January and February 1991 only 20 shipments.

Due to the existing contracts between the reprocessing companies in France and the United Kingdom radioactive waste from the reprocessing facility must be brought back to the FRG in the near future.

It is planned that in 1994 vitrified high level waste should be shipped from the COGEMA reprocessing facility to the Gorleben Intermediate Storage Facility in Germany.
Two or three years later low- and medium level radioactive waste will be sent back to Germany directly to the Konrad Waste Disposal Site.

TRANSPORT OF RADIOACTIVE MATERIAL OUTSIDE THE NUCLEAR FUEL CYCLE IN GERMANY

In a contract sponsored by the Federal Ministry for Environment, Nature Protection and Nuclear Safety, BMU, the Gesellschaft für Reaktorsicherheit, GRS, finished in 1988 an actual survey about all kinds of transport of radioactive material outside the Nuclear Fuel Cycle.

The purpose of the GRS paper was to provide a technical summary of RAM transport experience in Germany it describes the German RAM transport shipment volume in 1987/88.

This most recent estimate was conducted by GRS and determined that during a period from 1987 to 1988 there were approximately 850 000 packages of RAM per year shipped in the Federal Republic of Germany this means only FRG without the former GDR.

Also a detailed investigation was carried out about air transport of RAM. As a result in 1988 approximately 19 000 shipments of RAM with 247 000 packages were done with commercial airlines.

CONCEPT AND FACILITIES FOR INTERMEDIATE STORAGE OF SPENT FUEL ELEMENTS

In 1979 the Government of the Federal Republic of Germany had decided that the storage of irradiatied fuel elements outside nuclear power stations should take place as intermediate dry storage in free-standing, air-cooled fuel storage flasks for a limited period. Since the 24th of June 1992 this is not only a concept in the FRG, intermediate dry storage is still existing at the storage facility in Ahaus near the border to the Netherlands.

In the FRG the dry storage of spent fuel elements can be considered as a proven technology. The emplacement and retrieval of irradiated fuel in dry storage facilities and the safe operation over a long

period of time have already been demonstrated. License applications were given for the away-from-reactor intermediate storage facility in Ahaus.

Transport-storage casks have been developed for further storage of Thorium-High-Temperature-Reactor (THTR) spent fuel, dry storage for spent THTR-pebble bed fuel in canisters.
The design of casks for THTR spent fuel follows the conceptual principles of the nodular cast iron casks for transport and storage of LWR fuels. The casks themselves represent the containment for the fuel and no credit is taken of the sealed canisters for the barrier concept in this case.
(see table - 3 -)

The cask of the type CASTOR - THTR will be used in the Ahaus dry storage facility after a minimum decay time of one year; the casks are to be monitored for leaktightness by means of the same equipment as used for the LWR storage casks.

NUCLEAR POWER PLANT AT GREIFSWALD AND RHEINSBERG

The BMU charged the GRS on January 1990 with performing a safety analysis of the "Greifswald WWER - 440 nuclear power plant" and , in this way, investigating whether the safety of the personnel and of the environment was guaranteed in the operation of the facilities.

For economical reasons the nuclear power plant at Greifswald was shut down at the end of 1990. It will be the task of the power company (Energiewerke Nord AG, EWN AG) to manage the intermediate storage of the existing spent fuel elements of the power plant facilities and to find the way for future decommissioning-concepts for the site.

It is important to notice that it will be impossible to export spent fuel elements to Russia (former Union of Soviet Socialist Republics) in future. The last transport of spent fuel elements from Greifswald to Russia took place in 1985.

In the near future the storage of irradiated fuel elements from the nuclear power plant at Greifswald should take place as intermediate dry storage in free-standing, air-cooled fuel storage flasks for the next years at a near-by-reactor site in Greifswald.

The nuclear power plant at Rheinsberg was shut down in 1989. The storage of these spent fuel elements from PWR Rheinsberg should take place at the Greifswald storage facility in the near future. Decommissioning of the Rheinsberg plant will start as soon as posible.

MORSLEBEN

At the Morsleben site - near to the former German-German border - the GDR had in service a waste repository which contains low- and medium radioactive wastes, whose activity is made up chiefly of Beta/Gamma-emitters.

As a rule, the content of Alpha-emitters was limited to 400 MBq per cubic meter of waste volume or less for all kinds of waste. The existing waste in the repository so far has been recorded in the safety report. In addition the former National Board of Nuclear Safety and Radiation Protection (SAAS) had regularly determined the status of waste arising for intermediate and final storage on the territory of the GDR and compiled the data in annual reports.

Waste was transported to the repository from the nuclear power plants Greifswald and Rheinsberg and also from other waste producers in the GDR in large containers holding the waste either in reusable casks or, in the case of low-level-solid waste, also in 200 litre drums. The transport regulations in force so far correspond to the IAEA Regulation for the Safe Transport of Radioactive Material.

Up to the decision of the court at the End of February 1991 the Morsleben repository was closed for an intermediate time. In June 1992 a final decision of the court opened the repository for the future. The re-opening of the Morsleben repository will start immediately the next time.

A detailed analysis of the safety of normal transports has been performed by the GRS. This report shows that the transport of radioactive waste to the repository will fulfill all kinds of transport regulations. An analysis of the accident risk is in progress, the detailed analysis will be presented at the end of this year.

GERMAN - GERMAN LEGISLATION IN 1990

During the re-unification process in Germany 1990 a group of experts had worked on the problem to re-organize the different transport and nuclear safety legislation in both countries.

As an important decision the Atomic Energy Law of the FRG was changed in detail and for a time period from 1990 to 1992.

- RID/ADR-requirements

The existing basis for international transports of RAM in the former GDR as well as in the FRG was:

"The International Regulations Concerning the Carriage of Dangerous Goods by Rail, RID" and "European Agreement Concerning the International Carriage of Dangerous Goods by Road, ADR". In the past the GDR was a member of these agreements.

For all kinds of transport requirements it was a minor problem to find a solution for both parts of the country, because the existing IAEO Requirements for the Safe Transport of RAM were the fundamental requirements for the transport of RAM in the FRG and the GDR.

- Federal Office for Radiation Protection

In the Federal Republic of Germany the Federal Office for Radiation Protection was founded on 1 November 1990.

The duties of the Federal Office for Radiation Protection in the field of transport of RAM are:

- licensing the transport of fissile material and large sources according to the Atomic Energy Law and Radiation Protection Ordinance
- approval of package designs and
- certifying for special arrangement (schedule 13)

For all kinds of railway transports of RAM in Germany the Federal Railway Company (Deutsche Bundesbahn) in the western part and the "Deutsche Reichsbahn" in the eastern part of Germany have only one office for inspection and radiation protection measurements - the Central Office in Minden (Bundesbahn-Zentralamt Minden, BZA).
The Central Office in Minden is also responsible for evaluating the radiation doses to railway workers and to members of the public due to transport of RAM in Germany.

	Domestic Transport	International Transport
RAIL		
Unirradiated Material	-	50
Irradiated Material	-	84
Waste	-	6
Sum	-	140
ROAD		
Unirradiated Material	837	331
Irradiated Material	7	27
Waste	554	6
Sum	1398	364
SEA		
Unirradiated Material	-	68
Irradiated Material	-	3
Waste	-	-
Sum	-	71
AIR		
Unirradiated Material	-	90
Irradiated Material	-	-
Waste	-	-
Sum	-	90
TOTAL	1398	665

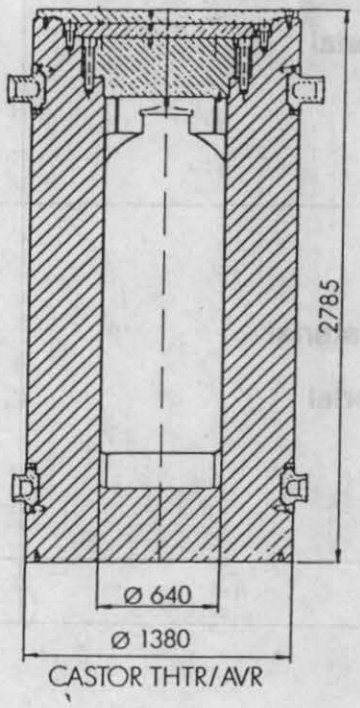
Table 1 **TRANSPORT OF NUCLEAR MATERIAL IN THE FEDERAL REPUBLIC OF GERMANY IN 1991**

Transport of Radioactive Waste in the Nuclear Fuel Cycle(*) in Germany 1991, * (Rad. Waste from Nuclear Power Plants only)	
Destination	**No. of Shipments**
Intermediate Storage facilities (Gorleben/Miterteich)	**73**
Conditioning Facilities **(Karlsruhe,Jülich, Duisburg, Krefeld)**	**69**
Morsleben Repository	**20**
Incineration	**17**
Total of Shipments	**179**

Table - 2 -

Hauptkenndaten/ Main Features	THTR-A
Beladekapazität/ Loading capacity	2100 BE-Kugeln 2100 F/A
Höhe/Height	2785 mm
Außendurchmesser/ Outer diameter	1380 mm
Schachtdurchmesser/ Cavity diameter	640 mm
Schachthöhe/ Cavity height	1965 mm
Wanddicke/ Wall thickness	370 mm
Behältergewicht, beladen/ Cask weight, loaded	25500 kg
Behältergewicht, leer/ Cask weight, empty	24350 kg

CASTOR THTR



CASTOR THTR/AVR

Table - 3 -