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## Specialized Transportation of Highly Sensitive RAM

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### Abstract

DAHER NUCLEAR TECHNOLOGIES GmbH (DAHER NT) is licensed for the transport of highly sensitive radioactive material since decades. With its experienced and trained staff and own specialized equipment DAHER NT is capable to plan and perform any transportation in this field.

DAHER NT carries out regularly transports of spent MTR fuel from European Research Reactors to the USA. About two years ago the University of Basel/Switzerland was looking for possibilities to bring the last irradiated 13 HEU fuel elements having still been stored at Basel to Savannah River Site, USA. DAHER NT was able to convince the University of Basel that the optimal way to dispose this spent fuel was to use DAHER NT's packaging and transport means and to join a scheduled transport from the German Research Reactor HZB.

The presentation will give an overview about this combined transport of spent MTR fuel from two different countries. It will give an overview about planning, necessary permits, charter vessel, loading at the two sites and performance of the transport.

### Introduction

DAHER NT is licensed for the transport of highly sensitive radioactive material since decades. Among others following transports were carried out by DAHER NT:

- Fresh MOX fuel assemblies from Belgium and UK to Germany
- Fresh fast breeder fuel from UK to Germany and from Germany to France
- Fresh MTR fuel elements with high and low enrichment from France to Germany
- Irradiated MTR fuel elements worldwide to the US
- Unirradiated Plutonium from Germany to the US

For planning and performance of such kind of transports DAHER NT has

- Experienced personnel for planning and licensing
- Trained drivers and security personnel for the performance of the transports
- Trucks for different security levels up to high security vehicles
- Escort vehicles for the highest security level

The paper will give an overview about planning, preparation and performance of the transport of highly sensitive material. However, details must be excluded whenever the information is classified.

## **Planning and preparation of transport**

### Background information

DAHER NT carries out regularly every 2-3 years transports of spent MTR fuel from the German Research Reactor HZB in Berlin to the USA. About two years ago the University of Basel/Switzerland was investigating possibilities to bring the last irradiated 13 HEU MTR fuel elements having still been stored at Basel to Savannah River Site, USA. DAHER NT was able to convince the University that the optimal way to accomplish this task was to use DAHER NT's packaging GNS16 and DAHER NT's transport means and to join a scheduled transport from the German Research Reactor.

### Clarification of feasibility

77 weeks before transport
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The first step was the detailed analysis and clarification of the feasibility of this project. A feasibility study was started on the transport of irradiated MTR fuel elements from university Basel to the US DOE Savannah River Site with following main topics:

- Collection of all fuel data relevant for the transport planning and licensing
- Calculation of radioactivity, thermal power and source terms for shielding analysis
- Description of the foreseen packaging for transport
- Compliance matrix for content and certificate of package approval
- Handling study for loading at the university of Basel including radiological assessment
- Import/export issues
- Harbor transshipment in Germany and USA and sea transport
- List of necessary permits
- Project schedule

58 weeks before transport

The feasibility study was completed and submitted to the customer and the Swiss authorities for review.

52 weeks before transport

The feasibility study was revised taking into account the review of the customer and the Swiss authorities. The main results of the study were:

- The transport is feasible
- The fuel has to be classified as category II according to [1]; hence special measures with respect to physical protection are required
- The burn-up of the fuel element is very low; hence radioactivity, thermal power and gamma source terms are rather low
- Despite the low burn-up the fuel elements must be classified as irradiated in the sense of the transport regulations but non-irradiated in the sense of physical protection
- Due to the limited space at University of Basel a special manual loading procedure had to be developed
- Special measures with respect to physical protection must be set up for the transfer from road to vessel
- Regular measures used for category II transports apply for the road transport
- A specific handling step plan had to be established
- A vessel authorized for such kind of material must be used.

### Planning and necessary permits

49 weeks before transport

The feasibility study listed following necessary permits:

- Germany
  - Certificate of package approval valid throughout the whole transport period
  - Transport license
  - Import-/export licenses
- Switzerland
  - Validation of the certificate of package approval
  - Transport license

- Export license
- Working permit for loading team
- US
  - Validation of the certificate of package approval
  - Transport license
  - Import license

A project plan containing the individual tasks to be carried out, the deadlines for milestones and the required resources was set up. The project team was compiled and regular meetings of the project team scheduled. The first task was to confirm the findings of the feasibility study with respect to the critical path of the project and to define appropriate measures to solve the related issues.

For the transport project three critical paths were identified:

1. The certificate of package approval expired before the transport date and had to be prolonged; furthermore the new revision of the certificate had to be validated in Switzerland and the US. Fortunately, the application for prolongation had been filed by DAHER NT well before the start of the project. The licensing department of DAHER NT was assigned the task to monitor the progress closely. Furthermore, the packagings and handling equipment had to be inspected by DAHER NT and the German competent authority before transport.
2. The HEU fuel elements had to be classified as category II material with respect to INFCIRC 225 [1]. Hence for the transport enhanced physical protection measures must be developed and defined by DAHER NT and submitted to the German Competent Authority for approval. The specification of these measures is part of the transport license. The staff unit security and the licensing department of DAHER NT were assigned the task to develop the measures and to follow up the licensing process with the German competent authority.
3. For the shipment from Europe to the US only special vessels could be used (INF-2). The availability of such vessels is limited. The task to secure the vessel for the planned transport window was assigned to operations and transport department.

Certificate of package approval and preparation of the packagings for transport

129 weeks before transport

The prolongation of the certificate of package approval was applied for with the German competent authority.

46 weeks before transport

The certificate of package approval was issued by the German competent authority.

40 weeks before transport

The validation of the certificate of package approval was issued by US DOT.

30 weeks before transport

The validation of the certificate of package approval was issued by the Swiss competent authority.

9 weeks before transport

The packaging and handling equipment have been inspected by DAHER NT and the German competent authority and were ready for use.

### Transport license

47 weeks before transport

The German transport license was applied for with the German competent authority, the Swiss and the US authorities.

6 weeks before transport

The transport and export license was issued by the Swiss authorities.

4 weeks before transport

The US transport license was issued by the US authorities.

2 weeks before transport

The German transport license was issued by the German competent authority.

### Chartering of the vessel for the sea transport

30 weeks before transport

The decision was made to use a vessel of the UK Nuclear Decommissioning Authority (NDA) operated by International Nuclear Services (INS) for the transport from a German port to an US port. A first draft contract was exchanged between the parties.

8 weeks before transport

The contract between DAHER NT and NDA was signed.

## Transportation

For the transports a detailed schedule was established taking into account following boundary conditions:

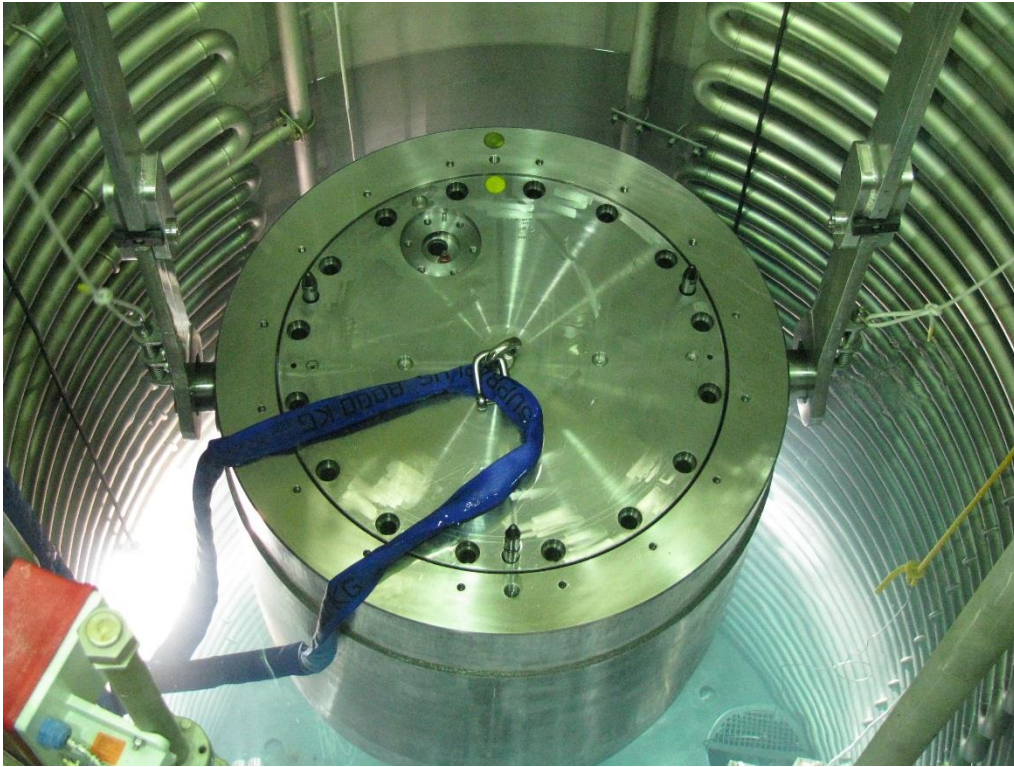
- The transports from University of Basel and of the Research Reactor HZB in Berlin must arrive at the German port at the same time to minimize the docking time of the vessel for security reasons.
- One packaging GNS16 had to be loaded at the University Basel by using a special manual and dry transfer process for individual fuel assemblies from the building to the packaging and prepared for transport.
- The second packaging GNS16 had to be loaded in the pool of the Research Reactor HZB and prepared for transport.

Figure 1 shows the fuel elements of University of Basel inside the compartments of the basket of the packaging GNS16. The dose rate of the fuel elements was even without any shielding very low so that only distance from the source was necessary for meeting the dose rate limits for the loading operators. Figure 2 shows the packaging GNS16 after loading in the pool with the lid put in place. Figure 3 shows the seal placed on the loaded packaging.

Figure 4 shows the package GNS16 as presented for transport and Figure 5 the transport leaving the University of Basel.



**Figure 1: View of the basket of the packaging GNS16 loaded with fuel elements**



**Figure 2: View of the packaging GNS16 in the pool after completed loading**



**Figure 3: Package seal**





**Figure 4: Package GNS16 as presented for transport**





**Figure 5: Transport leaving University of Basel**

## **Conclusions**

By combination of the transport of fuel elements from the University of Basel with an already foreseen fuel transport from the Research Reactor HZB in Berlin DAHER NT was able to provide in all aspects an attractive solution to the University of Basel for the removal of the remaining fuel elements. DAHER NT was capable to provide all necessary resources for this transport: experienced staff for planning, licensing, loading of the packagings and performance of the transport and all required qualified equipment from approved packagings to high security trucks and escort vehicles. Last but not least, sharing of the costs for the ocean vessel was a very beneficial solution for both customers of DAHER NUCLEAR TECHNOLOGIES GmbH.

## **References**

[1] INFCIRC/225: Nuclear Security – Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities