HLW Return from France to Germany - 15 Years of Experience in Public Acceptance and Technical Aspects - 12149

Wilhelm Graf
GNS Gesellschaft für Nuklear-Service mbH, 45127 Essen, Germany

ABSTRACT

Since in 1984 the national reprocessing concept was abandoned the reprocessing abroad was the only existing disposal route until 1994. With the amendment of the Atomic Energy Act in 2001 spent fuel management changed completely since from 1 June 2005 any delivery of spent fuel to reprocessing plants was prohibited and the direct disposal of spent fuel became mandatory. Until 2005 the total amount of spent fuel to be reprocessed abroad added up to 6080 t HM, 5309 t HM thereof in France. The waste generated from reprocessing - alternatively an equivalent amount of radioactive material - has to be returned to the country of origin according to the commercial contracts signed between the German utilities and COGEMA, now AREVA NC, in France and BNFL, now INS in UK. In addition the German and the French government exchanged notes with the obligation of both sides to enable and support the return of reprocessing residues or equivalents to Germany. The return of high active vitrified waste from La Hague to the interim storage facility at Gorleben was demanding from the technical view i. e. the cask design and the transport. Unfortunately the Gorleben area served as a target for nuclear opponents from the first transport in 1996 to the latest one in 2011. The protection against sabotage of the railway lines and mass protests needed highly improved security measures. In France and Germany special working forces and projects have been set up to cope with this extraordinary situation. A complex transport organization was established to involve all parties in line with the German and French requirements during transport. The last transport of vitrified residues from France has been completed successfully so far thus confirming the efficiency of the applied measures. Over 15 years there was and still is worldwide no comparable situation it is still unique.

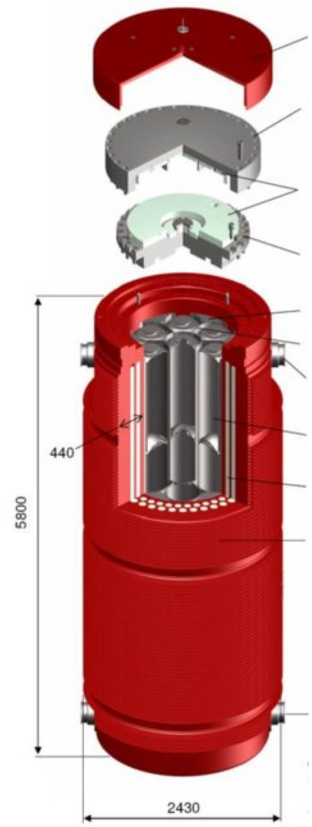
INTRODUCTION

In 1996 since the start-up of the first commercial reactor the spent fuel generated from then on was of particular public interest with profound political consequences. Until 1994 the essential objective was to recover the existing spent nuclear fuel by recycling uranium and plutonium back into fuel elements for reuse in nuclear power plants. Therefore reprocessing was the only legal way to manage German spent fuel. In 1989 the national reprocessing concept was abandoned and reprocessing abroad became the only existing disposal route. In 1994 an amendment of the Atomic Energy Act was implemented. As a consequence the option of direct disposal of spent fuel became legally equal to the reprocessing scenario. On basis of an agreement with the utilities in June 2000 the red-green federal government closed off the reprocessing disposal route by prohibiting the delivery of spent fuel elements to reprocessing plants. The legal ban of reprocessing turned out to be a part of the concept to phase out nuclear power in Germany. According to the resulting amendment of the Atomic Energy Act the direct disposal of spent fuel became mandatory from 1 July 2005 with the consequence that the total amount of spent fuel to be reprocessed abroad added up to 6080 t HM, 5309 t HM thereof in France. Since 2008 all the spent fuel delivered to France has been reprocessed. The obligation for the return of reprocessing waste or an equivalent amount of radioactive waste to the country of origin is based on long-term contracts between the German utilities (EVU) and Compagnie Générale des Matières Nucléaires (COGEMA), now AREVA NC in France and British Nuclear Fuels (BNFL), now INS in United Kingdom (UK) and to the intergovernmental agreements concluded between Germany and France or UK. Different types of reprocessing residues with different radiation levels are generated such as high-level, medium-level and low-level radioactive waste (HLW, MLW; LLW) which have to be returned to Germany. Right from the very beginning the return of reprocessing waste to Germany as part of the disposal activities of the German industry became challenging large scale projects with a volume close to 1 Billion €. The first of these return projects dealing with the return of HLW in 108 big-sized casks from France started in 1996 and was finished in November 2011. It can be regarded as the largest project of its kind carried out in Europe or even worldwide so far in terms of technical, logistic, safety, security and especially public acceptance challenges. The anti-nuclear civil disobedience started very early in the 70s. It manifested especially in the area of the interim storage facility at Gorleben as the first main destination for the storage of reprocessing waste and a possible site for a final repository. Since the start in 1996 the HLW-return was extremely politically impacted, strongly focused on by the public and abused to show the antinuclear attitude in Germany. Civil disobedience was mostly ideologically driven and people couldn´t be convinced by information or transparency which was available to everybody all the time during all activities. During the last 15 years a profound knowledge how to handle such a technically demanding and organizationally complex project could be gained in order to ensure a sucessful performance of such a large scale project.

TECHNICAL ASPECTS

The most important requirements for the transport of radioactive materials derive from the UN Model Regulations. The so called Orange Book has to be followed in accordance with the IAEA safety standards (TS-R-1). They focus on the package that encloses the radioactive content and specifies different transport scenarios, such as routine, normal and accident conditions of transportation. The quintessence is a graded approach – in general, the more dangerous the radioactive content, the higher the level of resistance in terms of retaining and shielding capacity of the package.

The purpose is to garantee a sufficient protection for humans and environment against irradiation and heat damages as well as criticality. HLW requires the highest safety level which is met by the transport accident-safe package of type B(U)F. It is a big-sized self shielding transport and storage cask. Its design consists of a cylindrical body with cooling fins on the cask surface, two trunnions at the top and bottom ends for handling purposes. It has a dual lid system comprising a primary and a secondary lid which is covered by a protective plate prior to storage to protect the lid system against mechanical damage. For the transport and storage of vitrified HLW the cask contains a basket which can be loaded with 28 steel canisters. From 1996 to 2011 in total 108 casks were shipped from the reprocessing plant in La Hague to the interim storage at Gorleben.



Dimensions:	H = 6120 mm, Ø = 2430 mm
Cask Weight loaded:	114.3 t max.
Loading:	28 canisters with vitrified HLW
Inventory:	55 GWd/MGHM - equivalent
Max. Heat Load:	56 kW
Total Activity:	1270 PBq

Fig. 1 CASTOR® HAW28M (storage configuration) [1]

In 1996 the first transport was performed as a single transport with only one cask of the type TS 28 V. Then 74 CASTOR®-casks of the type HAW 20/28 CG were shipped in 8 further transports to Gorleben. With increasing burnup of the reprocessed spent fuel also an increase of the total radioactivity of the vitrified HLW could be observed. In addition to that, the return of vitrified HLW containers after a shorter decay period was needed. As a result the heat capacity of the vitrified HLW containers increased to a maximal value of 2 kW. Based on the necessity to respond to these new conditions the present cask had to be replaced by newly developed type B(U)F casks. The developing process was very challenging because of new requirements and additional drop tests imposed by the approval/licensing authority; it finally lasted close to 10 years until the first cask could be used. The CASTOR® HAW28M-cask is a further development of the well-proven CASTOR® HAW 20/28CG-cask in consideration of the altered HLW inventory. A total maximal heat capacity of 56 kW and a total radioactivity of 1270 PBq are allowed. Protection against neutrons is achieved by two rows of polyethylene rods inserted in the wall of the iron-cast cask body, capsuled graphite columns in the interior of the cask, a polyethylene plate in the bottom area and a multi-part polyethylene plate on the primary lid sealed by a metal sealing as shown in Fig. 1 [1]. Prior to transport the cask is equipped with shock absorbers to reduce the mechanical load during the transport on public lines in consideration of hypothetical accident conditions. The legal approval as a package of type B(U)F which is necessary for the cask transport on public lines was granted by BfS in September 2009. The storage of the recent cask types in the interim storage at Gorleben required a corresponding extension of the storage licence which was granted by the BfS in January 2010.

Altogether 12 casks of the type TN85 and 21 casks of the type CASTOR®HAW28M have been manufactured and used. The transport in 2008 included 11 TN85-casks and the transport in 2010 one TN85-cask in addition to 10 CASTOR® HAW28M-casks. The last transport in 2011 has been finished by 11 casks of the type CASTOR®HAW28M. The IAEA safety standards were converted into European regulations as the Europe-wide applied law on the carriage of dangerous goods which is an important regulation for the cross-border transport of HLW from France to Germany. The smooth proceeding of the cross-border and inner-German transport of the vitrified HLW-containers from La Hague to Gorleben requires the involvement of different French and German authorities on federal as well as on local level; several reviewers and independent authorized experts resulting in a complex transport organization. Moreover, the transport operations do not only refer to the shipment from La Hague to Gorleben but also include the following steps: delivery of empty casks to La Hague, their preparation for loading, performance of cask loading, preparing the loaded casks for transport, loading of the loaded casks in a transport vehicle as well as acceptance of the cask in the interim storage at Gorleben. All respective steps of the transport cycle are settled in a so called "Masterablaufplan" (MAP) which additionally contains all necessary measures for the prevention of contamination. Based on this MAP a more detailed cask specific operation plan is created for each cask. Both have to be approved by the responsible authorities before its use. All measurement data records and inspection protocols to be created for the single sequential steps belong to the transport documentation file (TDF) which is to be carried together with the MAP with the cask during the whole shipment. The loading of casks and their further handling in La Hague is accompanied by the responsible German authorities or their reviewers thus ensuring that the transport operations are safe and compliant with the German regulatory requirements as transport approval, storage licence for the intermediate storage facility at Gorleben and the preventive measures against contamination.

PUBLIC ACCEPTANCE CHALLENGE

Since the radioactivity of HLW remains for a very long time, the safe disposal of this waste is one of the most controversial environmental subjects which is of high public interest and extremely politically impacted. When the Federal Government in the past accepted the pre-selection of the Gorleben salt dome as a potential repository Gorleben became a target for nuclear opponents. Since Gorleben is in addition the only destination for the storage of vitrified HLW in Germany prior to final disposal, the anti-nuclear protests focused on the HLW-transports to Gorleben. The Gorleben area became the preferred location for nuclear opponents to demonstrate their anti-nuclear attitude. Although the casks fully comply with the very strict regulatory criteria defined by IAEA this safety practice does not help to deter tens of thousands of Germans along the public lines from their mass protests against the HLW transports. In the beginning of the return project everybody had the hope that the civil disobedience will dissapear with time, but the decision for convoy transports once a year instead of monthly or quarterly transports could also contribute to establish a civil disobedience as it became a welcome one year event to the region. The governmental and industrial hope that the civil disobedience against the transports would decrease during such a long lasting project finally didn´t come true. Especially the on-going activities of national and regional initiatives stabilized the civil disobedience. There is always the danger of flaming up again either because of politically driven reasons e. g. in case of a transport close to an election or because of any other nuclear event with a negative image.

This became especially true in 2010; according to the organizers the transport in November 2010 triggered one of the largest anti-nuclear protests ever seen in Germany or even world-wide against nuclear transports because it was faced by approx. 25,000 to 50,000 protesters, whereas in 2006 their number reached only approx. 3,000 and increased to approx. 15,000 in 2008. In 2010 approx. 12,000 police forces in total were mobilized to deal with the protests which aimed at stopping the HLW transport by sabotaging the rail haulage by cutting the power cable and chaining people to the rails as well as hindering the road haulage by tractors and sit-down demonstrations as shown in Fig. 2 and Fig. 3. The outcome was a delay of around 32 hours in total. The civil disobedience became even violent against the police forces which were attacked with signal ammunition, bars, stones and fire works. Even special purpose vehicles were set on fire. Also in November 2011 when the last return of vitrified residues was performed the civil disobedience still continued. Even if the number of opponents was less than in 2010 the activities to delay the transport became unfortunately more violent. The experience showed that as in the years before besides some thousands of nonviolent opponents more than one hundred autonomous activists acted extreme violently against the police forces.

Fig. 2: Unscheduled stops of the HLW-transport by sabotaging the railway lines

Fig. 3: Sit-down demonstrations and violent activities

The reasons for the continuous and strong anti-nuclear movement in Germany seem to be multifaceted: The anti-nuclear movement can be regarded as a driving force for the Green party which gained their greatest political impact when they came to power in coalition with the social democratic party. The Greens pursued their major political goal -phasing out nuclear energy in Germany. The strong anti-nuclear activities during the HLW transport in 2010 can also be regarded as a response to the previous decision of the today's conservative federal government to extend the life time of German NPP. Moreover, nuclear events with a negative image increase or at least stabilize the German anti-nuclear movement. The catastrophe in Fukushima led the government to reconsider their concept of extending the life time of NPP with the consequence of a plan to phase out nuclear power in Germany. But even in view of this decision the civil disobedience continued in 2011; may be also partly driven by the catastrophe in Fukushima. Finally, in the last years the effectiveness of civil disobedience was especially supported by the progress in the information technology thus enabling an improved networking and information exchange via internet. Not knowing the exact day of the HLW-shipment the protesters have always been able to respond to short-notice demonstrations (see Fig. 4).

Fig. 4: Organisation of the opponents

Furthermore it can be shown by examples that the dissemination of information by the media could influence the public and even manipulate it because of the sensational character of the given information. Possibly the strength of the civil disobedience during transports was even nurtured by the media.

Special working forces and projects have been set up in France and Germany to cope with the anti-nuclear activities. Improved safety, security and public information measures were implemented like a common control/communication centre and flexibility on transport routes.

CONCLUSION

Summing up, the exceptional project handling challenge that resulted from the continuous anti-nuclear civil disobedience in Germany over the whole 15-year long project running time could be faced efficiently. It has to be concluded that despite of all problems the anti-nuclear activities have caused so far, all transports of vitrified HLW have always been completed successfully by adapting the commonly established safety, security and public acceptance measures to the special conditions and needs in Germany and coordinating the activities of all parties involved but at the expense of high costs for industry and government and a challenging operational complexity. Apart from an anticipatory project planning a good communication between all involved industrial parties and the French and the German government was the key to the effective management of such shipments and to minimize the radiological, economic, environmental, public and political impact. The future will show how efficiently the gained experience can be used for further return projects which are to be realized since no reprocessed waste has yet been returned from UK and neither the medium-level nor the low-level radioactive waste has been transferred from France to Germany.

REFERENCES

1. GNS mbH, Product specification sheet for the CASTOR® HAW28M (02/2011)