Construction of the cask type dry storage facility at the Federal State Unitary Enterprise Atomflot

Norman Watts, Crown Agents, UK

Purpose of project

The main objective of the project is to build a dry storage facility for spent nuclear fuel (SNF) from nuclear icebreakers that is stored on board of the nuclear service ship Lotta moored in Murmansk fjord at the Atomflot enterprise. Since this fuel is not possible to reprocess using available technologies, it should be stored until this will be possible or when the repository is available. Current fuel storage afloat poses substantial risk of radioactive release in the populated area of Murmansk. After the storage facility is built the fuel will be transferred from the Lotta to the metal-concrete casks of TUK-120 type that are designed for transportation and long term storage of fuel.

This project allows Lotta ship to carry out her duties more efficiently and has a vital link in the decommissioning and clean-up activities in North West Russia. Since SNF storage on land is safer and secure, the project benefits to improvement of nuclear safety and security in the Murmansk Region.

History of project

Preliminary preparatory work was conducted during 2001-2003. After the United Kingdom – Russian Federation Supplementary Agreement, which regulates taxation and indemnity provisions, was signed in June 2003 the actual works contracts were developed. The first contract was signed in November 2003 in Murmansk at the occasion of the 17th CEG plenary meeting. Then in June 2004 a construction tender was launched and in July 2004 the construction contract was signed. Manufacturing of casks is done under separate contracts placed in September 2005 (for 20 casks) and in January 2006 (further 30 casks). Facility construction was completed in July 2006 and opened in September 2006. Final casks will be delivered at the end of 2007 that will be the closing date of the project. Future transfer of SNF from the Lotta ship and operation of the facility are under responsibility of the Russian side.

Figure 1. Cask TUK-120 inside the facility. Cold tests.

Figure 2. Opening of the facility by H.R.H. Prince Michael of Kent and the Governor of Murmansk Region Mr. Evdokimov. September 2006

Figure 3. Building of the cask storage facility

Current status of the project

This is the largest UK project under the framework of the G8 Global Partnership in North West Russia. Construction of the storage facility was completed within the budget and on time. The first cask was delivered in August 2006, inactive and active commissioning was carried out during the same month and licensing of the facility is now in progress. Casks are to be delivered in batches until the end of 2007, and the SNF will be removed from the Lotta ship as casks are delivered.

Stakeholders

Main stakeholders are given below:

- **Department of Trade and Industry (DTI) -** Funded the project,
- **Russian Federal Agency of Atomic Energy (Rosatom) –** Beneficiary of the funding,
- **Crown Agents (CA) -** UK Project Leader, managed the project on behalf of DTI,
- **FGUP Atomflot and OAO MSCO** – jointly project execution on behalf of Rosatom,
- **ANO Aspect-Conversion -** Design Co-ordinators and Supplier of Specialist Equipment,
- **FGUP GI VNIPIET** – Building Designer,
- **OAO Apatitstroy -** General Civil Engineering Contractor,
- **OAO KBSM -** Cask Designer,
- **OAO Escort Centre** – Physical Protection Installation,
- **IBRAE RAN -** Radiological Protection Installation,
- **FGUP PO Sevmash -** Cask Manufacturer,
- **Murmansk Oblast -** Local Administration,
- **Rostechnadzor** – Russian Regulator.

Technical specification of the facility

The building size is 66m long by 31m wide by 25m high (total volume is 52,000m^3). A cross section of the building is given in Figure 4. The building is designed to accommodate 52 TUK-120 casks (50 plus 2 spare). 20 year old Zirconium-Uranium spent fuel from nuclear icebreakers in the equivalent amount of 14 reactor cores will be located on casks for dry long-term storage.

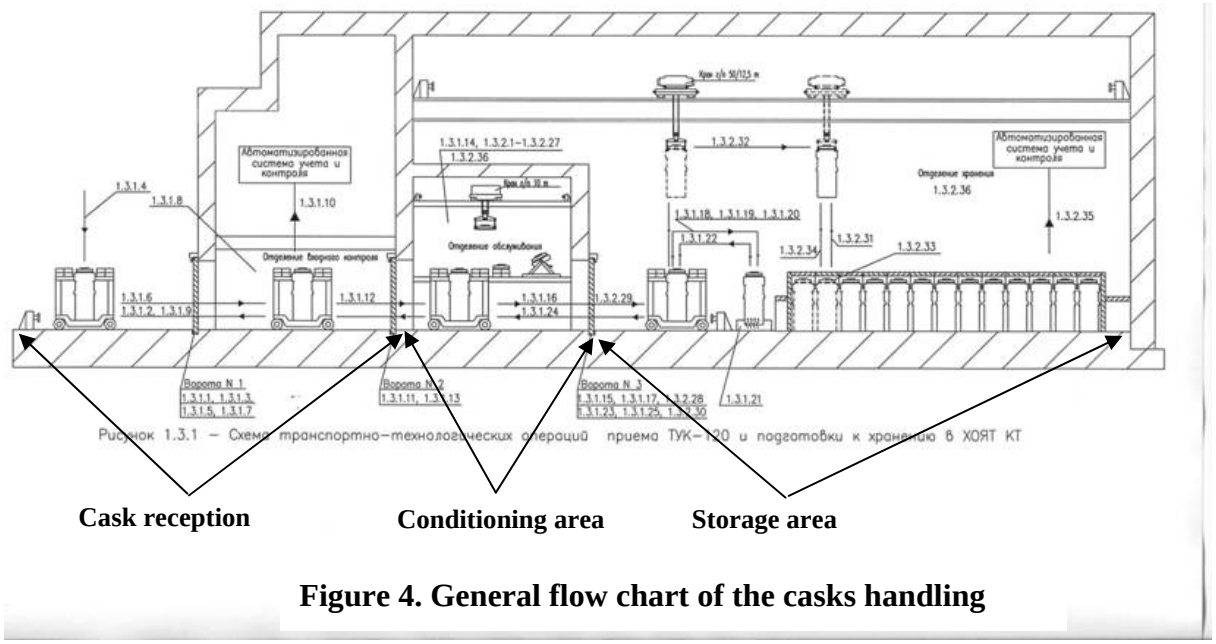

Figure 4. General flow chart of the casks handling

Design of the TUK-120 cask is based on the TUK-108 cask that has been developed under the AMEC (Arctic Military Environmental Cooperation) project for transportation of naval fuel and licensed by the military regulatory authority. Design of the TUK-120 is fully licensed by the Russian civilian regulatory authority for transportation and long-term storage of SNF. Design and testing are also compliant with the IAEA B type packaging set regulations. The cask was certified in March 2004.

In distinction from the TUK-108 cask design the cask lid has a special perforations to allow evacuation and filling with inert gas. Spent fuel assemblies (SFA) are packed in a specially designed canisters in two layers, thus the capacity of a cask is double compare to the TUK-108 design. It accommodates up to 70 SFA in 7 canisters (10 SFA per canister). Section through of the cask design is given in Figure 5.

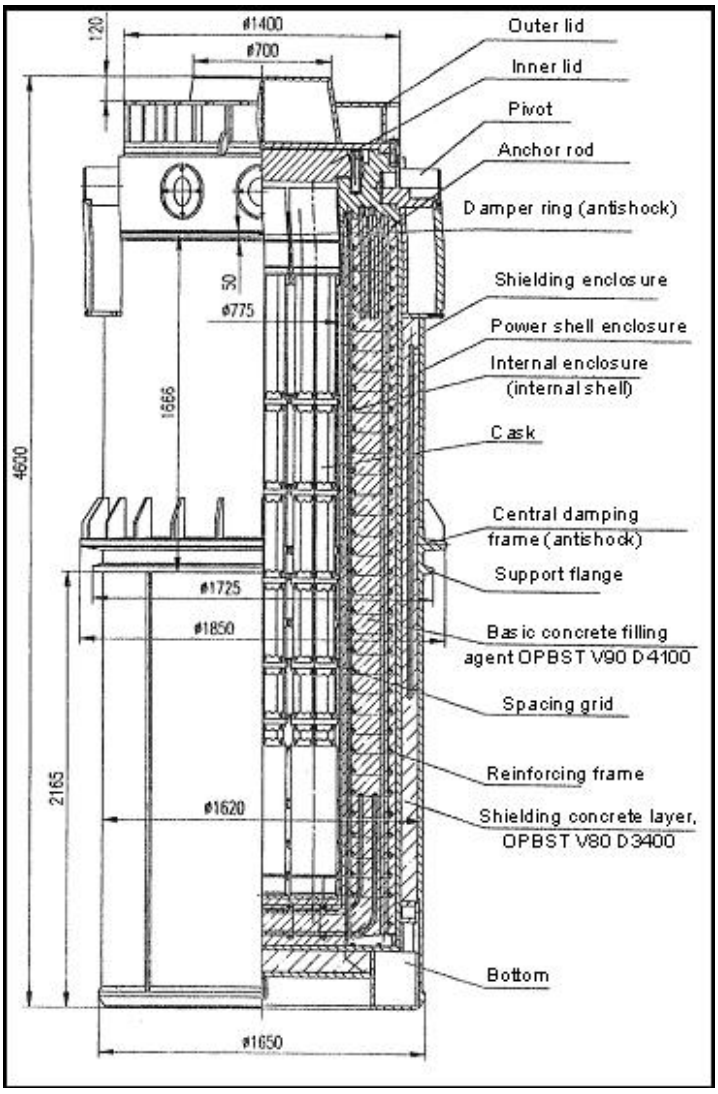

Figure 5. Section through TUK-120 cask

Cost of project

The project cost breakdown is given below.

– Management costs (7%) (Russian Beneficiary and UK consultants)	£1.5m
– Design Costs (5%)	£1.0m
– Building costs (includes cranes, generator, substation and ventilation equipment)	£8.2m
– Specialist Equipment (Includes cask handling trolley, cask conditioning equipment such as drying and gassing equipment)	£3.0m
– 50 Casks @£142k($265k)each	£7.1m
–	
– **Total budget from UK**	**£20.8m**
– **Input from the Russian side** (Includes canisters, pin cutting and design and testing of TUK 120)	£3.3m

Reasons of success

One of the reasons of the project success was selection of Crown Agents, a leading project management company as the company managing the assignment for the British Government. Crown Agents has great experience in implementation of different international projects of the similar scale, including ones in the nuclear area. Crown Agents' activities are being conducted all over the world. One of the important aspects is the Crown Agents has its well established office in Russia equipped with the qualified Russian staff, that facilitated team work.

Crown Agents established very good and trusting relationships with the Russian organisations involved, and reached a sympathetic/understanding of Russian ways of the project implementation and vice versa.

From the very beginning the approach to the project was very positive. Having understood the project specifics a very realistic programme was developed. It required some advance preparatory works and due consideration of the local conditions, including the weather and other constraints, working environment and elements of the Russian administrative system.

When possible major project elements and subcontractors were selected under the tender exercises to give fair competition and provide efficient use of the project resources. In defining the rates a comparison with other similar project rates has been done, including the comparison of rates with other countries if applicable. These measures permitted carrying out Value for Money exercises sharing the results with the project team.

The contracts were well structured with the milestones clearly defined and the deliverables identified and described. Payment was arranged only if the work under the milestone is completed to the satisfaction of Crown Agents. There were no significant delays in payments which entrusted cooperation between the parties. Certain amount of trust and flexibility in the contracts also facilitates a single team spirit. It was also important to understand the differences in the Russian and UK legal systems.

Prior to placing the contracts some preliminary work was done in order to getting to know all stakeholders (most importantly the Beneficiary) such as:

- MinAtom (now RosAtom),
- Other Ministries (Ministry of Shipping and River Transport),
- Beneficiary,
- Governor's office,
- Media – such as Bellona,
- Weather bureau, (for their environmental role)
- Potential contractors and suppliers.

Regarding the technical content of the project it was very important (and not easy) to understand the Russian design and construction processes, pricing structure and Russian methods to define the costs and Russian methods of conducting business, including the structure and relationships in Russia between client, designer and contractor. An excellent Russian designer was involved in the project. The design of facility was completed in record time and construction commenced prior to finalisation of design. An excellent local contractor was also selected, so that there were no problems and delays of the contraction

activities. It is worth to mention also that the Russian partners have a commitment to international co-operation and understanding of the need to meet not only the Russian standards, but the international requirements too.

Within the course of the contract implementation a number of visits to the site have been accomplished this ensures the required quality of the work done. Generally we did not expect major problems with access to site because:

- we have been working sympathetically with the Russian administrative system,
- we built good business relationships with the Russian authorities,
- we made advance programming and arrangements for necessary visits.

In order to ensure implementation of the project according to UK/International practice we performed a number of training sessions to the Russian staff on the following topics:

- UK/International procurement,
- Project Management methods,
- MS Project for scheduling,
- Procurement methods including tendering and contracting rules,
- Contract Management,
- Client/Contractor/Engineer relationships.

As in other UK-funded projects we applied Risk Analysis and Management (RAMP) approach, that covers most important risks, including:

- Cost increases – casks and facility,
- Cask production,
- Environmental risk,
- Risk of delays.

It was shown that the level of risks is acceptable (low enough). In particular environmental risk was not seen to be a major risk, and a risk of delays perceived to be low. We also conducted Environmental Impact Assessment (EIA) that is required by the current Russian regulations. Main EIA conclusions are:

- Impact of ‘doing nothing’ greater than ‘doing’ project,
- Atomflot site already a protected ‘nuclear’ site – has majority of infrastructure,
- Radiation and ecological monitoring already undertaken at Atomflot – confirmed in EIA,
- Atomflot is near sea but well above highest tide,
- Cask in its own right is designed to all regulatory requirements,
- Minimal wastes will be treated in Atomflot site.

In general we are very satisfied with the successful completion of the project – the lessons learned are very good. We are sure that the experience gained from this project could be used for the project on construction of the storage facility for 150 SNF casks at Mayak plant.