Decommissioning and dismantling of the nuclear power plant Stade:

When it comes to dismantling nuclear power plants cost efficient and environmentally friendly approaches are in the foreground. The expert team of NIS GmbH has been rising to this challenge at the nuclear power plant Stade since February: The disassembling, packing, waste removal and interim storage respectively of the reactor pressure vessels and peripheral equipment are on the program.

The team has gained a lot of experience from a similar long-term project – the dismantling of the multi-purpose research reactor in Karlsruhe, Germany. Since 1997 the experts of NIS GmbH have been disassembling a pressurized water reactor which successfully operated in Karlsruhe for 18 years. Period of dismantling: 1997–2008.

The experience gained from the Karlsruhe project has been used in Lower Saxony, Germany, since the beginning of the year. The nuclear power plant Stade started operation on January 8, 1972 and started commercial power operation in May of the same year. After more than 30 years of operation Stade was the first nuclear power plant taken off the grid on November 14, 2003 as a result of the decision of the Federal German Government to phase out nuclear power. Since then Stade has been phased down – mainly for economic reasons because the pressurized water reactor generating 630 MW of electrical power (1892 MW thermal power) supplied only half as much power as other German nuclear power plants. The operating expense, however, was comparably higher. In the course of the German anti-nuclear consensus it was determined that the remaining quantity of electricity for the nuclear power plant Stade in the amount of 1.49 TWh would still be transferable.

Dismantling phase III: Dismantling of the reactor pressure vessel

The decommissioning phase at the nuclear power plant Stade was followed by a post-closure phase during which the irradiated spent fuel elements were disposed of. Since

Removed part of the moderator vessel held by the hydraulic gripper arm

View of the partly dismantled moderator vessel
September 2005 the plant is slowly phasing out. Currently, the dismantling phases I and II are in progress. In the previous dismantling phases the logistics system as well as many other systems that are no longer needed, such as the floodwater containers, accumulator tanks, and steam generators, were dismantled.

The third dismantling phase includes the disassembly of the strongest contaminated components: the reactor pressure vessel and the concrete shielding. The consortium NIS-EAS together with NIS Ingenieurgesellschaft mbH as the project leader received, in February 2008, the order for the dismantling, disassembling, packing, as well as the disposal and the interim storage of the reactor pressure vessel and all its peripheral internals.

Adhering to the protection targets is essential for a responsible execution of the order. These include: activity retention, minimal radiation exposure of the personnel, waste minimization, employee safety, occupational safety as well as plant safety.

The radiologic situation and the space conditions put additional high demands on the very complex dismantling and disassembling procedures of reactor pressure vessels. Because of the high activation of the pressure vessel and its peripheral internals the disassembly works have to be carried out by remote control. For this

Separation tubes are waiting for their dismantling with a hydraulic cutter

Dismantling of a baffle plate by plasma arc cutting

Plasma torch moves towards stubs of separation tubes
purpose NIS developed systems that are specifically tailored to the job specifications of this order. For example, high-performance robot systems are used to guide autogenous flame cutters which can cut material with a thickness up to 500 mm. The engineers of NIS have incorporated the experiences from previous dismantling projects in the development of these systems.

Customer advantage: Complete project handling from one source

The main advantage that NIS GmbH offers customers is a complete project handling from one source. Currently the project team is carrying out the planning, construction and production phase. The assembly of the facilities is scheduled for June 2009; the dismantling of the pressure vessel is scheduled to start in April 2010.

Let us take a look at the exciting process: In the beginning of the dismantling, the reactor pressure vessel resides in the mounting position inside the reactor pool. For its disassembly including all peripheral internals a broad spectrum of new equipment technology has to be installed and operated. NIS GmbH designs this equipment, monitors its production and will carry out the equipment installation inside the control area of the nuclear power plant followed by the dismantling and disassembly of the vessel.

The equipment and machines that were specifically designed and developed for this process by NIS GmbH are installed inside the reactor pool and the former spent fuel element pool. Proven dismantling and disassembly techniques based on simple tools and tool carrier systems will be used. An essential novelty is a 200 t lifting device.

Dryer unit

Bottom part of reactor pressure vessel is dismantled on a band saw

Left: View of a plasma torch with Ar/H2 nozzle

Right: View of the underwater robot end effector
This device will lift the water-filled reactor pressure vessel. A manipulator mast system and a disassembly robot with mast system which will guide the high-performance flame cutting systems are also innovations. Furthermore, the scope of supply includes a crane for the remote-controlled loading and unloading of the MOSAIK® and Konrad containers and a dismantling table for supporting of the reactor pressure vessel.

The complex disassembling of the reactor pressure vessel with its peripheral internals requires substantial preliminary work. After cutting and removing the ring compensator between the pressure vessel and the polygon ring the specialists will disassemble the supporting structure of the shielding chambers. The remaining main cooling pipes on the pressure vessels, the insulation of measurement and backup systems as well as piping in the annular space around the flange zone are removed. After loosening the bolting for the support brackets the NIS team removes possible interfering edges on the bottom and dome sections of the reactor pressure vessel (e.g., insulation and drainpipes).

After all preliminary works have been completed the reactor pressure vessel is lifted via a lifting device and the flange ring is removed from the cylindrical part with an autogenous flame cutter. The flange ring is hooked to a crane inside the reactor building and is thermally dismantled on a dismantling table inside the spent fuel element pool. Afterwards it is packed up.

Then, the pressure vessel with flood container and insulation is dismantled via remote control equipment and after that packed up.

The disassembly of the bottom and dome sections of the pressure vessel and the discharge of the last Konrad and MOSAIK® containers are followed by the next step. All systems used for the dismantling and disassembly as well as safety and transport equipment are removed and packed up in their transport containers – provided they are no longer needed for any remaining dismantling and disassembly tasks.