Recent upgrades at the Studsvik concrete hot cell laboratory and cell waste management

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Upgrades of the Studsvik hot cell laboratory over the past two years include installation of an industrial remote control of the in-cell power manipulator, a new fission gas sampling system, a 120 kN in-cell tensile testing machine, new redundant breathable air compressors supporting up to 4 simultaneous frog suits, operator ergonomics, new out-of-cell ICP-MS, ICP-OES and powder x-ray diffractometer and new Parr fuel leaching autoclaves for final repository studies. Here we report some details for the remote-control installation, the custom built tensile tester and how to get rid of bulky waste from the concrete cells.

Remote control of power manipulator

The concrete hot cell line in Studsvik was commissioned in 1960. It consists of five DxLxH 2x2x4 m and two 2.5x4x4 m cells with 1 m wall thickness. The two big cells, each with 2 windows and 2 sets of HWM-A100 master slave manipulators, are divided by a retractable wall. Removing the wall creates a cell of 8 m length. Laboratories for chemical analysis, final repository studies, electron microscopy, low and medium level waste treatment and a mechanical shop for master-slave manipulator maintenance and an automated storage room for in-cell equipment surrounds the cell line.

To move larger equipment such as fuel assemblies, transport cast insets, full-length fuel rods or bulky machinery through the big cells a PAR M3000 power manipulator (PM) can be used. Originally it was fitted with a joystick control box on wheels. The control box connects with wires to the control cabinet of the PM. The operator must move from cell window to cell window to observe the motion of the PM and rolling along with the joystick control was not easy with all cabling and the rather bulky size of the joystick control. To facilitate the surveillance the joystick control was exchanged to an industrial remote control (Åkerströms M300J), see Figure 64. Operator safety was also improved as the emergency stop function via the remote control complies with the latest standards and the risk of stumbling over wires is excluded.

In-cell 120 kN tensile tester

The Studsvik fabricated in-cell tensile testing machine see Figure 64**,** is fully mechanical and loads the specimens by means of a motor and a gear. The specimen under test is held in place by hydraulic grips. Although the load cell has a capacity of 150 kN the maximum load capacity is constraint by the grips and therefore only up to 120 kN. An Instron 8800 controller is used for load control while a Eurotherm controller is used for split-tube furnace surrounding the specimen under test. The furnace can reach operational temperatures of up to 1000 °C. The machine makes it possible to do tensile tests on reactor internal materials under typical in-reactor temperatures.

Cell waste management

Bulky cell waste, like broken fuel cutting machines or discarded PWR fuel assembly spacers, that are impossible to decontaminate needs to be handled remotely all the way to the final repository. Such wastes are packed in standard boxes dedicated for the final storage for intermediate level waste for long lived nuclides (SFL). The outer dimensions of the standard box are 1.2x1.2x1.2 m^3. The internal dimension varies depending on the shielding necessary. For hot cell waste e.g. fuel cutting machines, the box is made of concrete with a wall thickness of 1 dm and weighing about 2 tons empty. Inside the concrete box is a steel box with wall thickness of about 5 mm.

Upon getting waste out of the cells the concrete box is placed in the service area adjacent to one of the big cells. The wall between the big cell and the service area is removed (it moves on rails). The steel box is then lifted from the concrete box by the power manipulator, transferred into the big cell and the wall is closed. The cell waste is now stowed into the steel box by master slaves. When finished a lid is fastened on the box. The process is then reversed i.e. the wall is removed, the power manipulator transfers the steel box and places it inside the concrete box. A concrete lid is put on the concrete box. Depending on the dose rate on the concrete box it can be put in a lead box before transport to the interim underground storage at the Studsvik site.

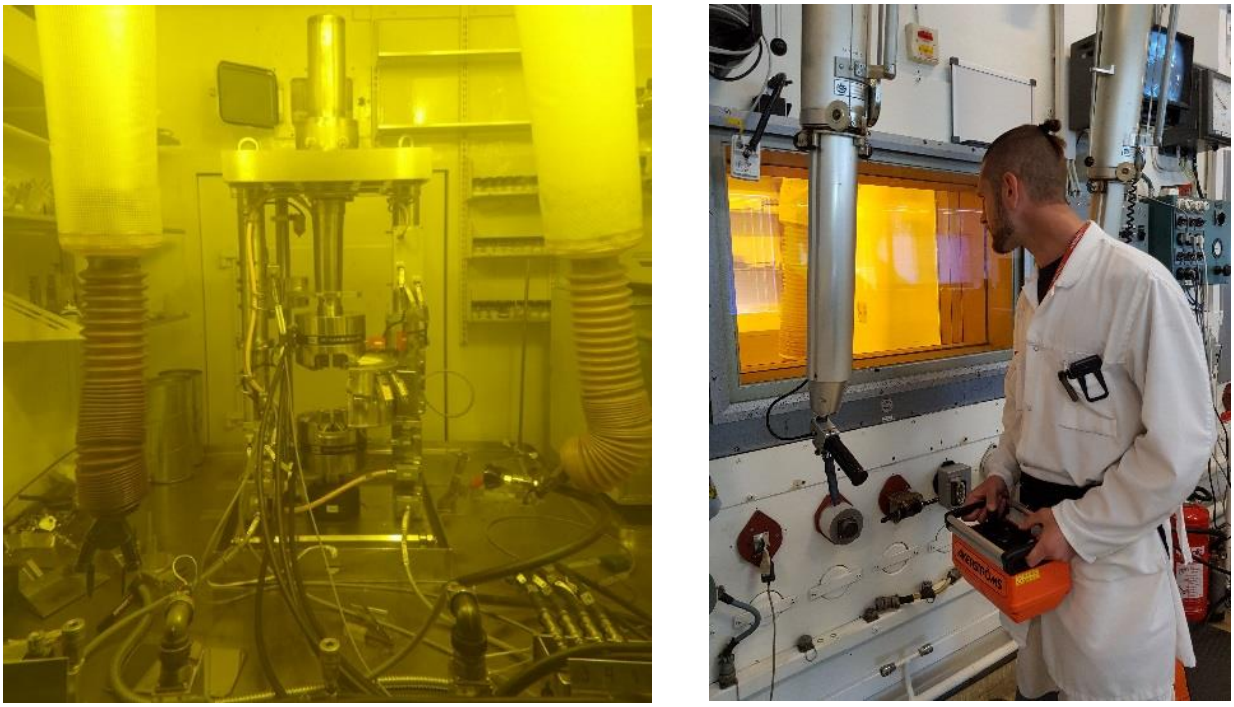

Figure 64: In cell 120 kN tensile tester (left) and industrial remote control of the power manipulator.