Ageing Management and Refurbishment of Existing Hot-Cells in Norway to Meet Future Needs

Barbara.C.Oberländer, Peter J. Bennett, & Hans J. Kleemann

IFE, Institute for Energy Technology,
POB 40, NO-2027 Kjeller
Corresponding Author: Barbara.C.Oberländer <barbara.oberlander@ife.no>

1. Abstract / Introduction

Norway is starting the process of decommissioning spent nuclear fuel (SNF) sites and two Norwegian research reactors (RR), namely the JEEP2 and the Halden reactor (HBWR). SNFs from these two RRs are mainly conventional oxide fuels with variations in composition, enrichment, burn-up and geometry. One of the challenges in characterization and further treatment of the stored SNF packages is that there are many SNF packages containing limited amounts of various types of experimental fuels e.g. remains from destructive PIE and there are SNF packages with standard, intact SNF elements.

During decommissioning of the fuel , there will be a need for hot-cells in processes, such as

- SNF canister handling, canister un-and repacking,
- SNF characterization,
- SNF sorting (with respect to waste type, enrichment, instrumentation, presence of epoxy in metallography samples, etc),
- SNF cutting operations (removal of instrumentation or epoxy),
- Packing of larger storage and transport containers.

The existing suit of three interconnected Hot-cells with 1m thick heavy concrete shielding walls coated with epoxy were used for more than 50 years in post irradiation examination and during the last 20 years in fuel re-fabrication and instrumentation for testing in the HBWR. The vital components are all original. The vital hot-cell components include

- Lead cell windows,
- Master slave manipulators for handling operations,
- Overhead Crane and power manipulator for further handling and transport of fuels, materials and equipment between the cells,
- Movable doors and ports to the cells and between the cells for loading operations,
- Filtered ventilation system provides underpressure in the cells,
- Electricity supply gives light and power to the technical equipment in the cells.
- Fire fighting equipment (water vapour)

The challenges with the suit of larger concrete shielded hot-cells are

- Aging of its vital hot-cell components - limited spare parts and poor reliability and functionality,
- Contamination of cell walls and floor
- The lack of an stainless steel liner / stainless steel cladding on the inner cell walls and floor.

The paper describes main four steps in ageing management and refurbishing of the existing hot-cells, namely cell cleanup – clearing the cells, extended service and/or renewal of components and infrastructure, cell- refurbishment for new needs, and upgrade of a Service and maintenance program for cells infrastructure and documentation.

2. Planned tasks, and time frame

The hot-cells need a serious make-over within the next 3 to 5 years. This may include the following steps

1. **Cell clean-up - Clearing the cells**
   - Handling, characterizing and packing SNF canisters with SNF and materials stored in the hot-cells and pits
   - Emptying the hot-cells and pits of canisters with SNF and materials,
   - Dismantling, packing of experimental equipment from l PIE and re-fabrication,
   - Emptying hot-cells of packages of PIE and re-fabrication equipment
   - Determination of the radiological status of the hot-cells with respect to radiation and local contamination
2. **Extended service and/or renewal of components and infrastructure**
   - Renewal of filters in the cells
   - Decontamination of cells with appropriate techniques to acceptable contamination level
   - Re-surfacing the cell floor and walls
   - The electrical wiring and installations have to be checked and eventually renewed.
   - Existing ventilation-ducts have to be inspected and cleaned
   - Under-pressure zones have to be controlled and serviced
   - The fire alarm and fire fighting system in the cells and ventilation ducts has to be inspected
   - Demolishing of the old power manipulator and installation of a new power manipulator on existing rail system
   - Extensive maintenance or replacement of existing manipulators
   - Improvement of visibility through the lead glass windows alternatives have to be checked for new windows, repair of existing windows or keeping existing windows and introduce video camera systems in the cells instead of new windows
3. **Cell refurbishment to meet new needs**
   - Installation of appropriate working benches, equipment and tools for the new tasks:
   - Fuel canister handling, canister un-and repacking, fuel characterization (visual inspection) and sorting (with respect to waste type, enrichment, instrumentation, epoxy etc),
   - Cutting operations
   - Packing of larger storage and transport containers.
4. **Upgrade of a Service and maintenance program for cells infrastructure On the following**
   - Handling (power-manipulator) and manipulation
   - Experimental equipment
   - Windows and video system
   - Ventilation and filter system
   - Fire protection system
   - Cell clean-up routines with Decontamination intervals

3. Conclusion

The IFE staff has gathered experience from ageing management and refurbishment, especially by work done to our suit of three small, lead shielded cells for “metallography” which were equipped with new windows, lights, electrical cables and experimental equipment for cutting, metallographic sample preparation and microscopy. And there is significant experiences from shielded glove boxes/ hot-cells for “radio-pharma production”. We wish a discussion on experiences gathered in other hot laboratories in managing the tasks.