

N233. ABB-CE Applies ALARA Principles in the Design of System 80+^(TM) PWR

ABB-CE believes that evolutionary designs of advanced LWR will dominate nuclear technology for the next few decades. Evolutionary designs are the only LWR technology that is truly proven and will provide economical electricity at minimum risk. They are also considered capable of offering a level of safety that rivals, or exceeds, that of other advanced designs, including the passive ALWR.

Accessibility And Maintenance

In the System 80+ design the time and effort needed to reach support facilities is reduced as much as possible to make maintenance more efficient and reduce dose.

- The plant is designed for maintenance.
- Access to radiation control areas is via a single point to reduce confusion as to which routes are available.
- Permanent maintenance access is provided through permanent platforms, having stairs where possible, to avoid using ladders or temporary scaffolding.
- Stairs and elevators in the "four corners" of the nuclear annex are connected to dedicated aisles and corridors.
- The system 80+ operating floor gives increased work space for refueling operations.
- Maintenance support devices such as cranes, monorails, and hoists are augmented by pull spaces, removable shield plugs, and other aids.
- Staging areas have been identified for equipment, tools, and supplies necessary for complex maintenance operations.
- Direct shielded access to pipe chases, valve rooms, and valve galleries makes maintenance easier. Reserved access aisles keep personnel and equipment pathways clear.
- A valve maintenance area makes it unnecessary to remove valves from the containment so that dedicated radiation personnel monitoring is eliminated as is waste for packing and transport material for the valves.
- Allowances are made for large equipment and one-piece steam generator removal and replacement.

Radiation Control

The application of ALARA principles in the design phase has brought substantial dose and cost savings. ALARA features include:

- Segregation of radioactive systems from non-radioactive systems,
- Minimized pipe lengths of radioactive systems,
- Shielded maintenance access and work spaces for laydown and for equipment pull areas,
- Separation of radioactive equipment into shielded compartments based on access frequency, operational characteristics, and radiation level, and
- Valve galleries are used to limit the dose from the operation of highly radioactive systems.

Control of radioactive sources is integrated in the design to maintain a clean plant and reduce exposure. Total annual personnel exposure is around 170 person-rem in current plants. The figure is expected to be reduced to less than 70 person-rem in the System 80+ design.

At least half of total dose received by personnel is from corrosion products or crud. The following measures limit crud production and accumulation:

- Selecting components and materials in contact with the reactor coolant with low cobalt impurities (<0.020% wt).

- Increasing the reactor coolant pH from 6.9 to 7.4.
- Eliminating low points in piping and stagnant pipe legs.
- Providing flushing and/or decontamination capability for primary and radwaste systems.
- Requiring all internal surfaces of piping in contact with the reactor coolant to be smooth.

Taken from: "System 80+ ^(TM) PWR Technology Takes a Major Step Up the Evolutionary Ladder," by Richard S. Turk and Regis A. Matzie. Nuclear Engineering International, November 1992, p. 15. For additional information, contact the authors at ABB Combustion Engineering Nuclear Power, 1000 Prospect Hill Road, Windsor, CT 06095.