N44. CURRENT THINKING ON RELATIVE IMPORTANCE OF COBALT REDUCTION AND WATER CHEMISTRY FOR PWRS

Several KWU plants in Germany have operated with maximum lithium (Li) of 2.2 ppm and a pH of 7.4, giving a gradual increase in pH from 6.9 to 7.4 in the first part of the cycle. A comparison of radiation fields near the piping at these plants with similar plants operating at a constant pH of 6.9 and with those that have implemented cobalt reduction programs, shows that the newer KWU plants have benefited from an aggressive cobalt reduction program (particularly in-core cobalt). One can therefore conclude that cobalt elimination has a major impact on fields and chemistry effects are secondary. However, a comparison of plants with similar cobalt content shows that the plants operating at elevated pH have fields that are 40-60% lower. Six plants in France have operated with a pH of 7.2, while retaining the 2.2 ppm lithium limit. Results are available for only one cycle with this chemistry, but fields are 20-30% less than anticipated with the pH 6.9 regime. The Ginna plant in the United States used a constant pH of 7.2 (maximum Li of about 3 ppm) for several cycles, commencing one cycle after a chemical decontamination of the steam generators. Channel heads re-contaminated to about 50% of the pre-decontamination value in the first cycle, then remained constant for the next three cycles in the pH 7.2 regime.
Based on results to date, elevated pH reduces radiation field buildup when applied early in plant life, but with a few exceptions, the benefits are less noticeable later in life. The first results of raising pH in older plants is to shift activity from the core to out-of-core surfaces, which tends to negate the effect of reducing in-core deposition of more corrosion products for a cycle or two. So far it has not been possible to distinguish between pHs of 7.2 and 7.4, but both are superior to 6.9. Another aspect clearly apparent from many plant evaluations is the importance of avoiding sudden drops in pH, which seems to cause crud releases from the core.

For more, see Wood, C., "Approaching Consensus on the Optimum pH for PWRs," Nuclear Engineering International, p. 28, August 1990.