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Processes and Practices Related to Occupational Dose

ID: 17

IRON CONTROL (BWRs)

Keywords: FE CONTROL; IRON; FE; FEEDWATER; REACTOR WATER; CHEMISTRY CONTROL

Description:

In order to obtain a method of injecting suitable iron ingredients for preventing the activation of coolants and leaching of nickel. The iron ingredients are added at a ratio of 1.5 to 5 molar times to the Ni ingredients in the coolants to form ferrite compounds within a range from behind the coolant desalter up to the near reactor in a BWR type nuclear power plant. In this case, conversion to ferrite is prompted by setting the dissolved oxygen density in coolants to 0-50 ppb. The coolant pH is set to 5-8. The iron ingredients contain at least one iron ion, iron hydroxides and iron oxyhydroxides. Further, Fe is injected into the coolants at two positions before and after the feedwater heaters. Further, Fe ingredients are injected by an amount automatically controlled corresponding to the detected Ni ingredients. Therefore, by controlling iron-to-nickel ratios in primary coolant, out-of-core radiation levels can be reduced thereby reducing occupational exposures.

References and Selected Abstracts:

1. Sawa, T., Adachi, T., Ito, K., Nishino, Y., and Osumi, K., "Method of Reducing the Radioactivity in Nuclear Power Plants," Patent No. JP 62-233796/A/, pp. 5, October 14, 1987 (in Japanese).

2. Nagai, H. and Ino, T., "Improved Crud Iron Removal Efficiency for Powder Resin Type Condensate Filters," (in Japanese), January 1989, pp. 58-62.

ABSTRACT: In 1984, a precoat type condensate filtration system was delivered to the Tokyo Electric Power Company, Inc. by Ebara and stable operation of the system is reported ever since. Originally, condensate filtration systems are used to remove crud iron in condensate water. However, it has become desirable to freely control the crud iron in the outlet flow of such filtration system. The main source of radioactivity in a BWR plant is cobalt 60, and it is necessary to optimally control the amount of crud iron released into the reactor to match the nickel and cobalt amounts in the reactor feed water for achieving an overall reduction of the concentration of radioactivity within the BWR plant. The method of such control, developed by the authors, is outlined in the following. By this method, the radioactive level within the overall plant is significantly decreased. Consequently, the risk of radioactive epxosure of personnel at time of periodical checkup is greatly reduced.

3. Nishino, Y.S., Sawa, T., Osumi, K., and Ito, H., "Method of Reducing RAdioactivity in Nuclear Power Plant," (in Japanese), pp. 11, March 14, 1989.

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ABSTRACT: In primary coolant circuits of a nuclear power plant, since the conversion ratio of nickel ferrite due to reaction between iron ingredient (iron hydroxide, oxide, and ion) and nickel is low, the yield of iron cruds is increased and no sufficient reduction can be attained for the radioactivity. Accordingly, the primary coolants, are recycled under heating at the presence of beryllium to form membranes mainly composed of nickel ferrite and cobalt ferrite to the surfaces of pipeways and equipments in the primary coolant circuits. That is, the iron cruds, nickel and cobalt are converted into insoluble nickel ferrite and cobalt ferrite at high conversion rate and rapidly under the catalytic effect of beryllium. Accordingly, radioactivity concentration of cobalt-58 and cobalt-60 in the reactor water is reduced, by which the surface dose of pipeways and equipments are reduced to remarkably decrease the operator's exposure dose.