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Processes and Practices Related to Occupational Dose

ID: 62

IRON/NICKEL CONTROL

Keywords: FERRITE COMPOUNDS; IRON HYDROXIDE; IRON OXYHYDROXIDE; CHEMISTRY; OPERATIONAL AND CHEMISTRY CONTROL; NICKEL; COBALT REDUCTION; FE; NI; IRON

Description:

This project describes a method of injecting suitable iron ingredients for preventing the activation of coolants and leaching of nickel. The iron ingredients were 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 nuclear reactor in a BWR type nuclear power plant. In this case, conversion to ferrite is promoted 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 ions, 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.

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, 14 October 1987 (in Japanese).

2. Kobayashi, M., Osumi, K., Shindo, T., Ito, H., and Uchida, S., "Nuclear Power Plant," Patent No. JP 61-175,595/A/, pp. 8, August 7, 1986 (in Japanese).

ABSTRACT: To restrain the rise of radiation dose on reactor equipment and pipes. Constitution: In the period of high Ni concentration in the feedwater in the initial period of reactor start-up, Fe concentration in the feedwater is increased by lowering the concentration of dissolved oxygen in the feedwater to at least 10 ppb or less, or by adding iron ions or iron oxides to the feedwater during this period, thereby enabling the adhesion of Fe crud on the surface of fuel rods and the effective adsorption and retention of Ni ions brought in over the Fe crud.

Subsequently, after the decrease of the Ni concentration in the feedwater, the concentration of the dissolved oxygen in the feedwater is increased over 20 ppb to decrease the Fe concentration in the feedwater, thereby decreasing the amount of Fe crud holding on the surface of the fuel rods and effectively retaining these corrosion products on the surface of the fuel rods by preventing this decreased quantity of crud from reaching the limit value at which crud fall occurs.

3. Izumitani, M., Kawakami, T., Minato, A. and Osumi, K., "Nuclear Reactor Feedwater Equipment,"

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Patent No. JP 61-186, 897/A/, pp. 4, August 20, 1986 (in Japanese).

ABSTRACT: To reduce the radiation dose of radiactive nuclide to component members by decreasing the concentration of Co-60 and Co-58 in the primary coolants.

Constitution: Pipes, pump and valves used in the primary system are made of stainless steel and stenite. These metals are liable to corrosion during use, liquate into the cooling water, and are brought into the nuclear reactor, resulting in an increased radiation dose of the component material surface. According to this invention, cobalt and nickel concentration in the primary coolants is decreased by injecting ferous iron ions into the primary coolants. Namely, the ferrous iron ions are injected to the upstream side of a low-pressure feedwater heater by the use of an injection pump from a tank. Concentration can be automatically detected and the quantity of the ferrous iron ions to be injected can also be controlled. Thus, cobalt and nickel in the feedwater can be changed into ferrite oxides and its solubility is restrained, thereby reducing the concentration of Co-60 and Co-58 dissolving into the reactor water.