Our Decontamination technologies for NPSs

Tadasu Yotsuyanagi

TOSHIBA Corporation

<Introduction>

In nuclear power stations, radiation exposure should be decreased. Toshiba has developed many kinds of countermeasures to reduce the radiation level. For a long time, occupational radiation exposure had decreased in Japanese BWR plants due to efforts of utilities and design-based countermeasures. Recently, increase of works during annual outages, radiation exposure slightly increased as shown in Fig. 1.

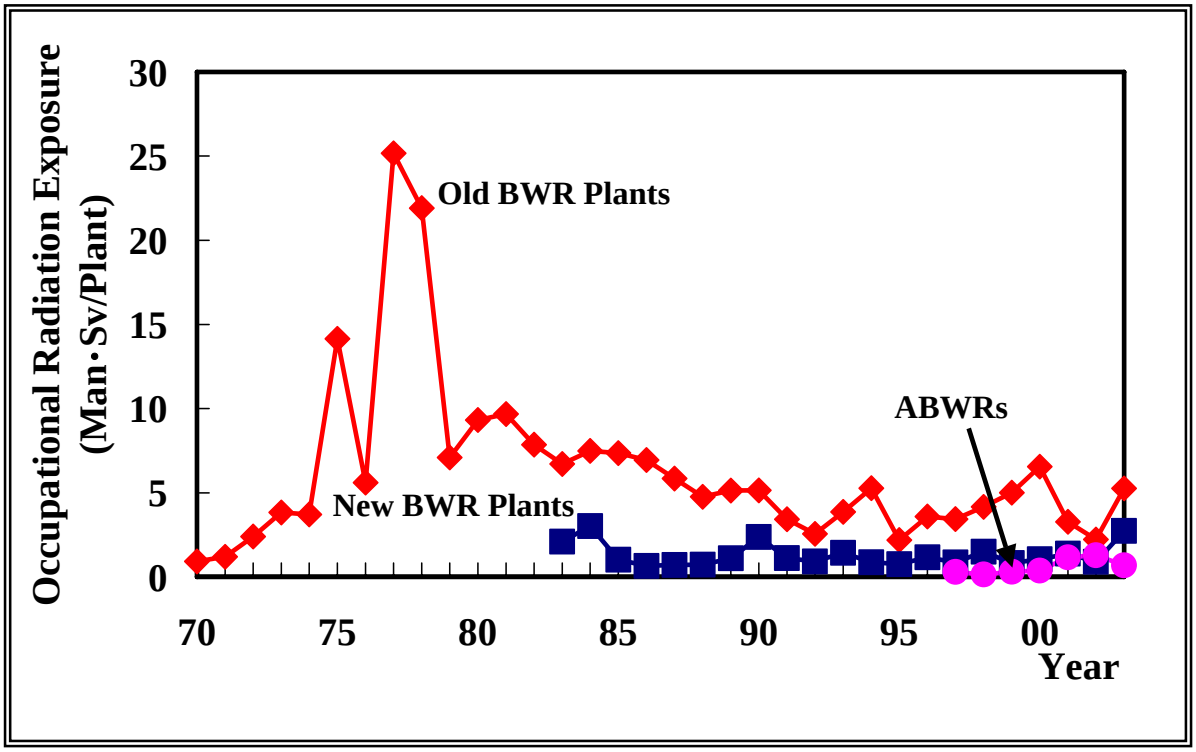

Fig. 1 Trends of Occupational Radiation Exposure in Japanese BWRs

<Decontamination technologies>

To reduce the occupational radiation exposure, various kinds of countermeasures have been applied. Decontamination technologies have been applied to remove the radiation source deposited on the inner surface of piping and equipments. Decontamination technologies are categorized into mechanical and chemical ones.

Principle of chemical decontamination is based on dissolution of metal oxides on materials. The dissolved metal such as Fe and Cr can be removed easily by ion exchanger. Superior decontamination technology can achieve high decontamination factor, minimum secondary wastes, and no adverse impacts on material integrity.

Upon these requirements, Toshiba developed T-OZON. Principle of T-OZON is shown in Fig. 2. Oxalic acid reduces ferrites to soluble Fe; Ozone oxidizes chromites to soluble Cr. After the chemical reactions, both reagents can be decomposed easily.

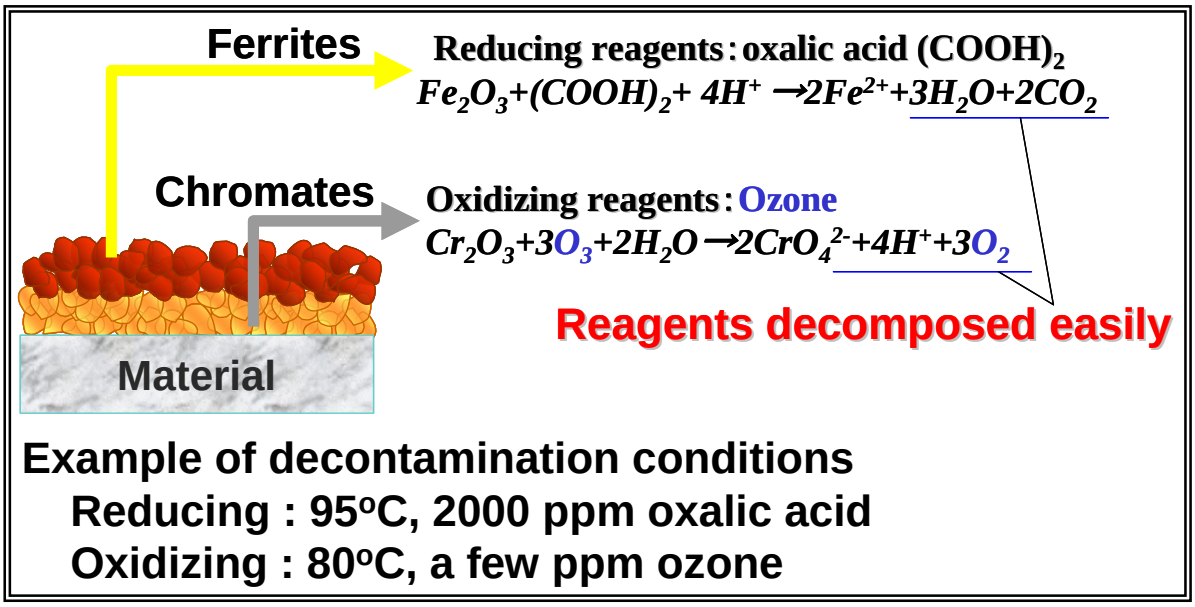

Fig. 2 Principle of T-OZON

In T-OZON process, secondary wastes of reagents are O_2, CO_2, and H_2O. Volume of secondary wastes can be decreased drastically. We have been promoting the application of T-OZON in NPPs and 13 BWRs has applied T-OZON for system decontamination.

Fig. 3. shows an example of system decontamination in a BWR. In BWR, both stainless steel and carbon steel are used as primary circuit piping. Connecting T-OZON system to the primary circuit and circulating the chemical reagents in these piping, metal oxide and deposited activated corrosion products are almost removed as shown in photos in Fig. 3. Decontamination factor (DF) obtained in T-OZON process depends on the conditions, more than 10 of DF were achieved in this case.

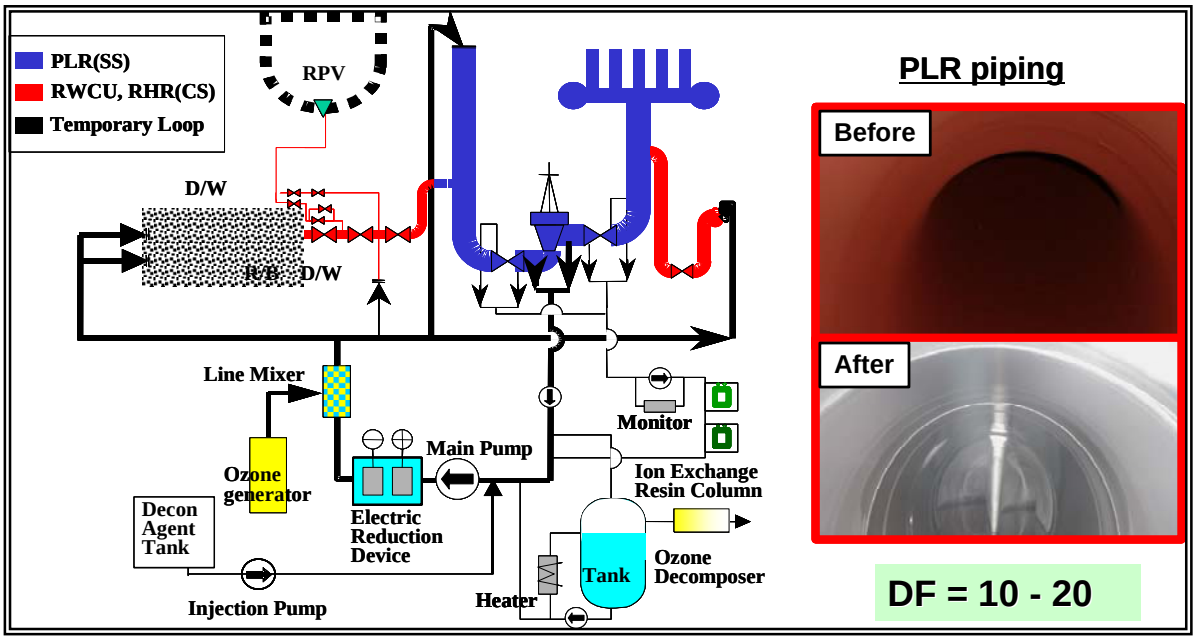

Fig. 3 Application of T-OZON to system decontamination in a BWR

We also developed and applied many kinds of mechanical decontamination technologies. Water jet cleaning is suitable for simple cleaning of piping because of relatively short period for the cleaning. Zirconia blast technology is superior in terms of abrasive repetition as shown in Fig. 4.

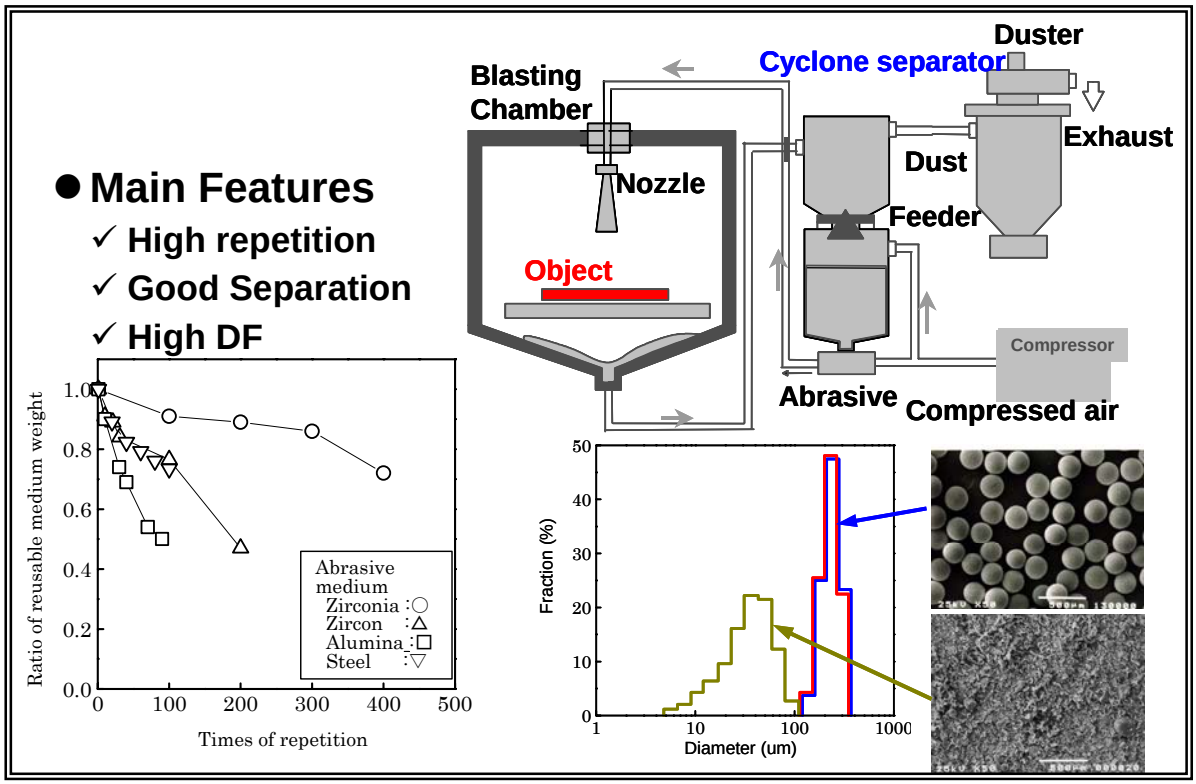

Fig. 4 Main features of Zirconia blast decontamination

<Summary>

We have line-up of decontamination technologies to reduce both radiation exposure and volume of secondary wastes in the process. T-OZON can be applied to equipments, primary circuit systems, and full system decontamination. We propose the combination of chemical and mechanical technologies for front-end facilities and backend facilities.