RELEASE ASSESSMENT OF TRITIUM IN LIQUID EFFLUENTS OF BUSHEHR NUCLEAR POWER PLANT (BNPP) IN 2013

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Tritium is a radioisotope produced as a by-product in various nuclear reactor systems. Owing to its natural specifications, it is necessary to control the production and release of tritium in nuclear facilities. The amount of tritium in released waste waters generated by the nuclear industry varies as a function of parameters such as reactor type and the plant operation [1]. In order to prevent or minimize the destructive effects of radiation exposure and intake of radioactive materials on workers, public and the environment, it is necessary to use several control systems. BBNPP which is a WWER-1000 reactor type located 17 kilometers southeast the city of Bushehr, beside the Persian Gulf and it is operating from 2011. The Persian Gulf water is being used in condenser coolant system and it is being released into the Persian Gulf (1200 meters away from the Bushehr shoreline) through undersea ZN34 channel. Before release, whole waste waters from reactor building and the auxiliary building passes through an anionic and cationic filter and then is gathered in a reservoir. Release of tritium is done according to the requirements of Iranian Nuclear Regulatory Authority (INRA) which guaranties that the release of tritium, in any form like gaseous or liquid, not to exceed the national standards levels.

Waste water from reactor building and auxiliary buildings, after passing through the treatment system; have been decanted to ZN2 channel which is being mixed with condenser water of turbine and finally will be released to Persian Gulf through ZN34 channel. In this channel volume activity of water is being measured online. Before releasing of gathered water in the tank, a one-liter- sample of the water is being sent to the laboratory. At first, samples are being poured in special geometry glasses. In order to determine the volume activity of gamma emitter radionuclides in samples, it is being put in a gamma spectrometer (HPGe Type) instrument in a determined time, so the activity is being measured. Tritium is a weak beta emitter, so we used a Liquid Scintillation Counter (LSC) in order to counting tritium activity in samples, according to verified procedures. The final spectrum of each sample will be analyzed by spectroscopy expert. If the results of spectroscopy could fulfill the specific requirements, then the whole water of the tank will be released into the environment, otherwise, purification processes will be carried out. During the first and second quarter of 2013, totally 418 and 616 samples have been analyzed and reported, respectively [2].

The annual discharges limit for tritium and other radionuclides including Cr-51, Mn-54, Ci-58, Co-60, Zn-65, Sr-89, Sr-90, Ru-106, Cs-134, Cs-137, Ce-144 in liquid and gaseous effluents from nuclear power plants, mainly pressurized water reactor (PWR) plants, specified by the national regulatory and IAEA standard series is equivalent to 1.5×10^{14}Bq (4.0×10^{3}Ci) and 7.5×10^{11}Bq (2.0×10^{1}Ci), respectively[3]. The results of analyzes shows that total release of tritium in the first half of 2013 is equivalent to 6.24×10^{11}Bq. By assuming that the amount of tritium activity released from Bushehr nuclear power plant in first and second half of 2013 year is equal, total release in one year is equivalent to 1.248×10^{12}Bq. Comparison between this result and the annual limits of tritium discharges shows that the ratio of released tritium to the annual limit is less than 0.01. So, it is clear that the tritium release from Bushehr Nuclear Power Plant waste water is under the specified standard limits. However, it is possible to optimize the results through amendment procedures.

1. Technical Report Series (TRS-421) No. 421, Management of waste containing Tritium and carbon-14, International Atomic Energy Agency (IAEA), Vienna, 2004.
2. Radiation analyzes of BNPP, identification code: 51.BU.10.00.AB.WI.ATEX.016. BNPP, Bushehr, 2012.
3. Technical specification of safe operation of nuclear power plants and the Standards of Radiation Safety, NRB-96, Russia, 1996.