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P3.228 Studies on helium-3 separation at Cernavoda nuclear power plant

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Helium-3 is a rare isotope of helium (1.37 ppm as fraction of total helium – natural abundance), with applications in medicine, industry, security, and science. Due to its high request, the world is experiencing nowadays a shortage of helium-3.
The most common source of helium-3 is the disintegration of tritium. Tritium is an unstable isotope of hydrogen, with a half-life of 12.3 years, and is a by-product in CANDU type nuclear reactors.
Tritium is found mostly in moderator heavy water. It is produced by the thermal neutron activation of deuterium atoms from the heavy water molecules. It can be found also in the cover gas used to control the pressure in the calandria and to provide a non-corrosive, non-radioactive atmosphere in parts of the system not filled with water.
In the first part, the paper propounds an analysis regarding the feasibility of helium-3 extraction from the cover gas used in Cernavoda Nuclear Power Plant. A theoretical calculus of the amount of helium-3 produced so far is presented. The production rate of helium-3 is related to the concentration of tritium in the moderator heavy water. The solubility of helium-3 in water is very low, therefore almost all of it will be found in the moderator cover gas.
The second part of the paper presents a technological solution for separation of helium-3 from helium gas at cryogenic temperatures.

Presenter: BULUBASA, Gheorghe (National Research and Development for Cryogenics and Isotopic Technologies - ICSI Rm. Valcea)

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