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Editorial

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Nuclear Fuel Cycle

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Introduction

The fuel cycle, also called fuel chain, is that the progression of fuel through a series of differing stages. It consists of steps within the front, which are the preparation of the fuel, steps within the service period during which the fuel is employed during reactor operation, and steps within the rear , which are necessary to securely manage, contain, and either reprocess or eliminate spent fuel . If spent fuel isn't reprocessed, the fuel cycle is mentioned as an open fuel cycle if the spent fuel is reprocessed, it's mentioned as a closed fuel cycle.

Nuclear power relies on fissionable material which will sustain a sequence reaction with neutrons. samples of such materials include uranium and plutonium. Most nuclear reactors use a moderator to lower the K.E. of the neutrons and increase the probability that fission will occur. this enables reactors to use material with far lower concentration of fissile isotopes than are needed for nuclear weapons. Graphite and deuterium oxide are the foremost effective moderators, because they slow the neutrons through collisions without absorbing them. Reactors using deuterium oxide or graphite because the moderator can operate using natural uranium.

A light water reactor (LWR) uses water within the form that happens in nature, and requires fuel enriched to higher concentrations of fissile isotopes. Typically, LWRs use uranium enriched to 3–5% U-235, the sole fissile isotope that's found in significant quantity in nature. One alternative to the present low-enriched uranium (LEU) fuel is mixed oxide (MOX) fuel produced by blending plutonium with natural or depleted uranium, and these fuels provide an avenue to utilize surplus weapons-grade plutonium. Another sort of MOX fuel involves mixing LEU with thorium, which generates the fissile isotope U-233. Both plutonium and U-233 are produced from the absorption of neutrons by irradiating fertile materials during a reactor, especially the common uranium isotope U-238 and thorium, respectively, and may be separated from spent uranium and thorium fuels in reprocessing plants.

Some reactors don't use moderators to slow the neutrons. Like nuclear weapons, which also use unmoderated or "fast" neutrons, these fast-neutron reactors require much higher concentrations of fissile isotopes so as to sustain a sequence reaction. they're also capable of breeding fissile isotopes from fertile materials; a nuclear reactor is one that generates more fissile material during this way than it consumes.

During the natural process inside a reactor, the fissile isotopes in fuel are consumed, producing more and more fission products, most of which are considered radioactive material . The buildup of fission products and consumption of fissile isotopes eventually stop the natural process , causing the fuel to become a spent fuel . When 3% enriched LEU fuel is employed , the spent fuel typically consists of roughly 1% U-235, 95% U-238, 1% plutonium and three fission products. Spent fuel and other high-level radioactive material is extremely hazardous, although nuclear reactors produce orders of magnitude smaller volumes of waste compared to other power plants due to the high energy density of fuel . Safe management of those byproducts of atomic power , including their storage and disposal, may be a difficult problem for any country using atomic power uranium ore are often extracted through conventional mining in open pit and underground methods almost like those used for mining other metals. In-situ leach mining methods are also wont to mine uranium within the us . during this technology, uranium is leached from the in-place ore through an array of regularly spaced wells and is then recovered from the leach solution at a surface plant. Uranium ores within the us typically range from about 0.05 to 0.3% uranium oxide (U_3O_8). Some uranium deposits developed in other countries are of upper grade and also are larger than deposits mined within the us.

Uranium is additionally present in very low-grade amounts (50 to 200 parts per million) in some domestic phosphate-bearing deposits of marine origin. Because very large quantities of phosphate-bearing rock are mined for the assembly of wet-process orthophosphoric acid utilized in high analysis fertilizers and other phosphate chemicals, at some phosphate processing plants the uranium, although present in very low concentrations, are often economically recovered from the method stream.

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