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Legal dispositions for transport, storage and use of special fissionable isotopes in Switzerland

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Abstract
The legal framework of handling and storing special fissionable isotopes, such as $^{239}$Pu or $^{233}$U in Switzerland is summarised.
Introduction

In the EURISOL Multi-Megawatt fission target assembly it is planned to use Th_{nat}C, U_{nat}C or U_{dep,nat}C as a fissile material target coupled to an accelerator-driven neutron spallation source. Several spent targets would be stored in the EURISOL facility after irradiation to allow radioactive decay before conditioning of the radioactive waste. Depending on the size and mass of the target and the integrated beam power, up to 75 g of $^{239}$Pu or $^{233}$U would be bred per target in one year. The inventory of the isotopes in a EURISOL facility (including storage of spent targets for radioactive decay) would be several 100 g in a form similar to that of irradiated nuclear fuel, composed of the “fuel” matrix (Th or U_{dep,nat}) in which the fission products and the fissionable materials are embedded. The isotopes $^{239}$Pu or $^{233}$U merit special attention for two reasons:

1. they are classified by international agreements as “direct-use special fissionable materials” and fall under the safeguard rules derived from the nonproliferation treaty for nuclear weapons.
2. they are among the most radiotoxic isotopes on the nuclear chart, warranting special precautions for the protection of the public.

Regulations pertaining to nuclear materials

In Switzerland, handling, transport and storage of nuclear material is regulated in the Nuclear Energy Law (Kernenergiegesetz, KEG) and the Nuclear Energy Ordinance (Kernenergieverordnung, KEV). The law and ordinance are applicable once the total amount of special fissionable isotopes, such as $^{233}$, $^{235}$U or $^{239}$Pu stored, produced or used in a facility exceeds 15 g. This mass will be exceeded even in the case of a significantly reduced size EURISOL fission target.

Transport, storage, production and use of nuclear materials are subject to an authorization from the Federal Office for Energy (KEG Art. 6). The authorization is subject to conditions (KEG Art. 7). It can be given, if the protection of man and environment is assured and all dispositions of the non-proliferation treaty for nuclear weapons are respected. In order to demonstrate the protection of the public, facilities in which nuclear materials and other isotopes with high radiotoxicity are stored or handled must meet the requirements of the radiation protection ordinance (Strahlenschutzverordnung, StSV). In particular, the operator must demonstrate with appropriate means that internal or external incidents having a probability of more than $10^{-4}$/year do not cause an exposure of the public exceeding 1 mSv (StSV Art. 94-96)\(^1\).

The prevention of proliferation requires that nuclear materials be protected against sabotage, external violence and theft with an in-depth defence concept (KEV Art. 9). Irradiated nuclear fuel is classified as material of category II and must be handled and stored in a physically protected and permanently guarded area (KEV App. 2).

\(^1\) In the case of CERN, this limit would be exceeded if minute quantities of $^{239}$Pu or $^{233}$U in the order of ten mg were released during an accident, e.g. a fire in the facility, generated for internal reasons or by external sources such as sabotage or an airplane crash. This is due to the geographical closeness of certain members of the public, the so-called critical group.
Regulations pertaining to nuclear facilities

A total mass of special fissionable isotopes exceeding 150 g must be handled and stored in a nuclear facility. Nuclear facilities encompass also installations related to the generation of nuclear energy, such as fuel production, power reactors and waste storage facilities. The Swiss nuclear facility which comes closest to a EURISOL facility is Paul Scherrer Institut, where nuclear materials are handled in specialised laboratories.

A nuclear facility is built and operated according to rules and regulations with the aims of implementing the safeguards for nuclear material, protecting the public from the consequences of accidents, and the workers from undue exposure to ionizing radiation. These goals are achieved by implementing the principles of defence in depth during construction and operation of the facility. Access to a nuclear facility is strictly regulated and limited to the minimum necessary for its operation.

All aspects of construction, operation and decommissioning are subject to authorization and are closely supervised by the competent authority, the Nuclear Inspectorate (Hauptabteilung für die Sicherheit der Kernanlagen, HSK).

The construction and operation of a nuclear facility are subject to a global authorization (Rahmenbewilligung, KEG Art. 12). A global authorization can be given by the Federal Council (the Swiss government) after a series of consultations and hearings involving experts, the cantons, neighbouring states and the public. The decision must be approved by the Federal Assembly (the two chambers of parliament). The global authorization can be contested by way of referendum.

A global authorization is not necessary, if the operator of the planned nuclear facility can demonstrate with approved means that accidents leading to an exposure of the public and a personal dose exceeding 1 mSv have a probability of less than $10^{-6}$/year (refer to footnote 1 in this context).

Specific authorizations are required for construction, operation, and decommissioning of nuclear facilities. Modifications of the operation conditions of the facility require the agreement from the supervising authority.

During normal operation, quarterly, annual and special reports, e.g. after revision (“shutdown”) on aspects pertaining to radiation protection, safety and safeguards in the facility must be submitted to the supervising authority. Incidents and accidents, with an estimation of their gravity and their consequences, must be notified immediately to the authority together with consolidation measures taken.

Detailed rules and regulations for the construction, operation, modification and commissioning of all parts of a nuclear facility are periodically edited and maintained by the HSK.