**Reply to EPS President letter regarding the opportunity of an EPS PP on energy**

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**The Position Paper of the European Physical Society, ENERGY FOR THE FUTURE – The Nuclear Option, represents an excellent synthesis of the scientific arguments in order to demonstrate that the nuclear option represents the main component of the future energy supply.**

**Romanian Physical Society agrees with the conclusion of the Position Paper *with emphasis on, "No one source will be able to fill the need of future generations for energy. The nuclear option, incorporating recent major advances in technology and safety, should serve as one of the main components of future energy supply".***

**Bellow are included some comments.**

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The following paragraph should be restated: *"Afterwards, the spent fuel is either reprocessed so that uranium and plutonium are chemically removed and reused as reactor fuel, or, in the once-through cycle, packaged (mainly by vitrification) for future long-term storage in deep underground repositories".*

We suggest the following content: *"Afterwards, the spent fuel is either reprocessed so that uranium and plutonium are chemically removed and reused as reactor fuel, or, in the once-through cycle, stored for future disposal in deep underground repositories".*

Comment:

When the fuel is removed from the reactor it is labeled spent nuclear fuel (SNF). The SNF is highly radioactive from the decay of the fission products, is still generating heat, and contain some plutonium and unconsumed uranium. If the SNF is reprocessed, the fission product waste stream (vitrified) is labeled HLW (high level waste) in all country. Most countries do not count SNF as high-level waste (HLW). The distinction is maintained because of the uranium and plutonium in SNF, which can be used for further energy production or for nuclear weapons. The HLW, when SNF is not included, does not contain much plutonium and uranium and is therefore not a proliferation concern, and is in the sense not a security threat.

The current operations for management of spent fuel are: discharge of fuel from the reactor, sending for storage in the Spent Fuel Bay, and transfer to the storage facilities on or near the earth's surface. Spent fuel may be stored in either a wet or dry environment. In addition, it may be stored either at the reactor where it was used or away from the reactor at another site. The current storage techniques are the wet (pool) and the dry storages.

Both pool storage and dry storage are safe methods, but there are significant differences. Pool storage requires a greater and more consistent operational vigilance on the part of utilities or other licensees and the satisfactory performance of many mechanical systems using pumps, piping and instrumentation.

Dry storage, which is almost completely passive, is simpler, uses fewer support systems and offers fewer opportunities for things to go wrong through human or mechanical error. Dry storage is not suitable for fuel until the fuel has been out of the reactor for a few years and the amount of heat generated by radioactive decay has been reduced.

*The presently feasible options for SNF& HLW management are monitored storage on or near the earth's surface, or geological disposition in a mined repository that can became the site for geological disposal, if a decision is taken that the repository be filed, closed, and sealed [http://www.nap.edu/openbook].*

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Paragraph: *"The long-term exclusion of water is the main problem to be dealt with in deep underground repositories. Possible sites for such repositories have been identified in several countries and their long-term geological safety has been investigated in detail".*

We consider important to mention:

*On June 3, 2008, the U.S. Department of Energy (DOE) submitted a license application to the U.S. Nuclear Regulatory Commission (NRC), seeking authorization to construct a deep geologic repository for disposal of high-level radioactive waste at Yucca Mountain, Nevada. The NRC's review of that application will require evaluation of a wide range of technical and scientific issues. The NRC will issue a construction authorization only if DOE can demonstrate that it can safely construct and operate the repository in compliance with the NRC's regulations.*

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Paragraph: "*Nuclear warheads are built by the nuclear powers from highly enriched uranium (HEU) or from weapons grade plutonium; the latter is not produced in reactors of nuclear power plants but in special purpose reactors, that are tailored to yield mainly Pu-239 [38]".*

Comment:
However, plutonium of virtually any isotopic composition can be used to make nuclear weapons. The difference in proliferation risk posed by separated weapons-grade plutonium and separated reactor-grade plutonium is small in comparison to the difference between separated plutonium of any grade and no separated material in spent fuel. However, SNF poses proliferation risk that are initially far lower, but increase with time as the intense radioactivity that provides the most important barrier to recovery of this material decays.

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**Chapter**: *Future perspectives for the handling of spent fuel*

Comment:

Partitioning and transmutation (P&T) should be considered a supplement to, but not a substitute for, continued surface storage or geological disposal. Any intense source of neutrons (thermal reactor, fast reactor or ADS) can accomplish transmutation of long-lived radionuclides. Partitioning is essentially the same as reprocessing SNF to recover plutonium and uranium, except that the goal includes separating long-lived fission products (I-129 and Tc-99) as well as plutonium and other actinides. This step, which can lead to separated plutonium, is one reason for opposition to P&T.

Very high separation factors are required if the residue from partitioning is to be low enough in radioactivity to avoid being classified as long-lived waste requiring the same isolation as HLW&SNF. *To achieve these very high separation factors, much more advanced and sophisticated reprocessing technologies than those available today are required. The reasons offered to support P&T are to make geological disposal safer and easier by reducing the volume of HLW, especially the long-lived radioactive constituents; to address plutonium management and to extract valuable materials.*

The removal of actinides might allow four to five times as much waste to be emplaced in a given area of a repository and the removing the cesium and strontium could increase repository capacity by a factor of 10 to 40.

In 1999, the U. S. Congress directed the Department of Energy (DOE) to develop a “road map” for the accelerator transmutation of the waste. The DOE report concludes that “ *ADS, if successful, could reduce potential long-term radiation doses from repository wastes by a factor 10; however, a repository is still required (for the US) due to presence of defense wastes (which are not readily treatable by accelerator transmutation of wastes) and the long-lived radioactivity generated by accelerator operations. The inventory of fissionable materials from commercial spent fuel in the repository could be reduced by a factor of 1,000.*

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**The conclusion**: “The possibility of extending the life-time of existing reactors also should be studied”.

The specification “should be studied” is very important. From the point of view of the nuclear energy producer, the extension of Nuclear Power Plant life-time is a normal option which reduces the price of electricity. The scientist point of view is different: the extension of the life-time of existing reactors should be studied using nuclear safety and economic arguments. The following example is significantly [Dave Martin, Nuclear Power in Canada — An Overview, Sierra Club of Canada National Office, June 2003]:

*There are 22 CANDU power reactors in Canada, of which 20 are in Ontario, one in Quebec and one in New Brunswick. As these CANDU reactors have aged, they have experienced increasing technical problems and dramatically poorer performance. Although it was assumed that reactors would last for forty years, they are typically experiencing serious operational problems much earlier.*

*The case of the four Pickering A reactors provides an instructive lesson as why nuclear refurbishment is ill-advised. In August 1983 a disastrous pressure tube rupture occurred in Pickering Reactor 2, and all four reactors at the Pickering A station were shut down. The pressure tubes of each reactor were replaced in succession over a ten year period. The retubing of the four reactors cost about $1 billion (dollars of the year) — more than their original capital cost. As noted above, despite this enormous investment, the reactors were shut down just a few years later at the end of 1997 because of technical and performance problems.*