Energy production from nuclear wastes

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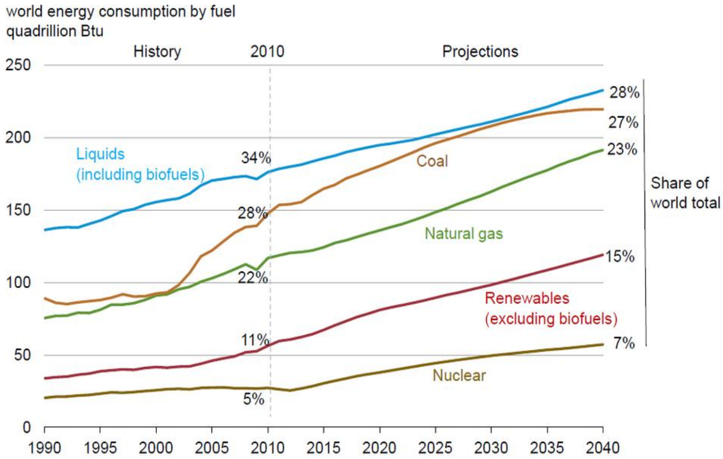
***Abstract*—The continuation of nuclear power optio around the world require and eventual resolution for nuclear waste disposal.The country like US only has now 70000 tones of high level nuclear waste,the ocean waste dumping waste is now completely unacceptable.They were dumped only 300 m beneath the surface.These waste emit highly penetrating gamma radiation .The structure properties of recent predicted thermally fissle neutron rich Uranium and Thorium are studied using the relativistic mean field formalism.The new phenomena of multifigration fission is analysed.The possible use of nuclear fuel in an accelarater based discussed which may be the substation of $^{233, 235}$U and ^{239}PU for nuclear fuel in near future.plan for small nuclear reacters.**

I. INTRODUCTION

Nuclear power is the use of nuclear reactor to release nuclear energy, and thereby generate electricity. The term includes nuclear fission, nuclear decay and nuclear fusion. Presently, the nuclear fission of elements in the actinide series of the periodic table produce the vast majority of nuclear energy in the direct service of humankind, with nuclear decay processes, primarily in the form of geothermal energy, and radioisotope thermoelectric generators, in niche uses making up the rest. Nuclear (fission) power station , excluding the contribution from naval nuclear fission reactors, provided 13% of the world's electricity in 2012. The share of the world's primary energysupply, which refers to the heat production without the conversion efficiency of about 33 %, was about 5.7%.[2] Its share of the global final energy consumption (actually useful energy, i electric power) is below 2.5 %.There is an ongoing debate about nuclear power.[Proponents, such as the World Nuclear Association, the IAEA andEnvironmentalists for Nuclear Energy contend that nuclear power is a safe, sustainable energysource that reduces carbon emissions.[14]Opponents, such as Greenpeace International and NIRS, contend that nuclear power poses



Nuclear waste

Nuclear waste is the material that nuclear fuel becomes after it is used in a reactor. It looks exactly like the fuel that was loaded into the reactor -- assemblies of metal rods enclosing stacked-up ceramic pellets. But since nuclear reactions have occurred, the contents are't quite the same. Before producing power, the fuel was mostly Uranium (or Thorium), oxygen, and steel. Afterwards, many Uranium atoms have split into various isotopes of almost all of the transition metals on your periodic table of the elements.The waste, sometimes called spent fuel, is dangerously radioactive, and remains so for thousands of years. When it first comes out of the reactor, it is so toxic that if you stood within a few meters of it while it was unshielded, you would receive a lethal radioactive dose within a few seconds and would die of acute radiation sickness]within a few days. Hence all the worry about it.In practice, the spent fuel is never unshielded. It is kept underwater (water is an excellent shield) for a few years until the radiation decays to levels that can be shielded by concrete in large storage casks. The final disposal of this spent fuel is a hot topic, and is often an argument against the use of nuclear reactors. Options include deep geologic storage and recycling. The sun would consume it nicely if we could get into space, but since rockets are so unreliable, we can't afford to risk atmospheric dispersal on lift-off.

II . COMPOSITION OF NUCLEAR WASTE

Spent nuclear fuel composition varies depending on what was put into the reactor, how long the reactor operated, and how long the waste has been sitting out of the reactor. A typical US reactor's waste composition is laid out in **table**. Notice that most of the Uranium is still in the fuel when it leaves the reactor, even though its enrichment has fallen significantly. This Uranium can be used in advanced fast reactors as fuel and is a valuable energy source. The **minor actinides**, which include Neptunium, Americium, and Curium, are very long-lived nuclides that cause serious concern when it comes to storing them for more than 100,000 years. Fortunately, these are fissionable in fast reactors and can thus be used as fuel! This still would leave us with the **fission products**. The decay of each nuclide vs. time is shown in Figure

1) How much nuclear waste does nuclear energy create?

If all the electricity use of the USA was distributed evenly among its population, and all of it came from nuclear power, then the amount of nuclear waste each person would generate per year would be **39.5 grams**. That's the weight of 7 U. S. quarters of waste, per year! A detailed description of this result can be found here. If we got all our electricity from coal and natural gas, expect to have over 10,000 kilograms of CO_2/yr attributed to each person, not to mention other poisonous emissions directly to the biosphere (based on EIA emissions data).If you want raw numbers: in 2002, there were 47,023.40 metric tonnes of high-level waste in the USA. 105,793 GW-days of thermal energy has been produced by nuclear power plants throughout the years to create that waste. Also in 2002, operating reactors added 2,407.20 metric tonnes [1] (1 metric tonne = 1000 kg).

ChargeDischargeUranium100%93.4%Enrichment4.20%0.71 %Plutonium0.00%1.27%Minor Actinides0.00%0.14%Fission products0.00%5.15%

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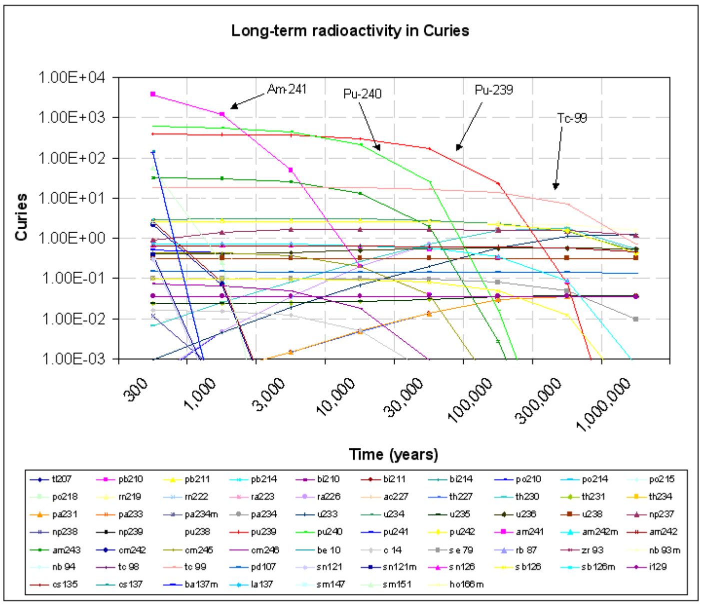

2) Recycling nuclear waste

As mentioned previously, nuclear waste is over 90% uranium. Thus, the spent fuel (waste) still contains 90% usable fuel! It can be chemically processed and placed in advanced fast reactors (which have not been deployed on any major scale yet) to *close the fuel cycle*. A closed fuel cycle means much less nuclear waste and much more energy extracted from the raw ore.France and Japan currently recycle spent fuel, although they only recycle one time before disposal. The US had a recycling program that was shut down because it created Plutonium, which is arguably the easiest material with which to make a nuclear weapon. Were some plutonium diverted in the recycling process, a non-nuclear entity could be one step close to building a bomb. However, under programs such as the (now stalled) proliferation-free waste recycling can exist.The longest living nuclides in nuclear waste are the ones that can be used as fuel: plutonium and the minor actinides. If these materials are burnt in fuel through recycling, nuclear waste would only remain radioactive for a few hundred years, as opposed to a few hundred thousand. This significantly reduces concerns with long-term storage

3)Help from Thorium Fuel

We could switch from Uranium/Plutonium based fuel to Thorium/Uranium-based fuel. This would allow for recycling and breeding without creating any plutonium or minor actinides whatsoever. Fission products are still created, of course, and some of them are quite long-lived, but reducing the minor actinides is a benefit of Thorium.

Small modular reactors (**SMRs**)

are part of a new generation of nuclear power plant designs being developed in several countries. The objective of these SMRs is to provide a flexible, cost-effective energy alternative.Small reactors are defined by the International Atomic Energy Agencyas those with an electricity output of less than 300 MWe, although general opinion is that anything with an output of less than 500 MWe counts as a small reactor.Modular reactors are manufactured at a plant and brought to the site fully constructed. They allow for less on-site construction, increased containment efficiency, and heightened nuclear materials security.

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