PLASMA MATERIAL INTERACTION GROUP
University of Illinois at Urbana-Champaign

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Pros and Cons Associated with Nuclear Energy

Nuclear energy has proven itself to be both reliable and relatively safe. The benefits of using nuclear energy over conventional sources, especially in the production of electricity, should be noted. Nuclear power plants need to be refueled only once per year. This is obviously much better than coal power plants, which require a trainload of coal per day in order to operate. The reason for this is that the energy which can be obtained from one pound of uranium is equal to the amount of energy in approximately 3 million pounds of coal. This is very hard to picture, but it is true. As if it is not bad enough that an entire trainload of coal is needed to operate a coal plant, the train often has to come from the western part of the U.S. when transporting coal to the east. This is because western coal has less sulfur and thus produces less pollution than eastern coal. Thus numerous towns are inconvenienced by long trains traveling through. These problems obviously do not exist when nuclear power is utilized.

As was mentioned above, coal power plants produce air pollution. The use of different coals merely varies the level of air pollution produced. The most common pollutants from fossil power plants (specifically coal) are nitrogen oxides, sulfates, and carbon dioxide. The nitrogen oxides and sulfates are responsible for acid rain, while the carbon dioxide contributes to the Greenhouse Effect, which is responsible for global warming. The combustion of fossil fuels also inevitably leads to the production of hydrocarbons, some of which are carcinogenic. Nuclear power plants produce none of the the aforementioned pollutants into the air. Thus, in a sense, they are a much cleaner source of energy which should not be ignored.

Nuclear energy is also very abundant, and will not run out as soon

as petroleum or natural gas. Although coal reserves are very large, perhaps even larger than uranium reserves, it is a dirty form of energy. Plus, it too will eventually be depleted. By this time, however, nuclear energy has the potential to still be abundant, assuming that fusion reactors become a reality. Since fusion reactors use hydrogen, which is very abundant on Earth, fuel reserves will be essentially infinite. Since fossil fuels and nuclear energy are the two main sources for producing electricity, and fossil fuels will run out, nuclear energy will be the only other option for producing electricity at any geographic location at a time when the demand for electricity will be much greater than it already is. This is both a benefit of nuclear energy and a reason for increased research funding.

Despite the numerous positive aspects of nuclear energy, there are also several problems with it. It is not the perfect source of energy which some people believe it to be. There are several major problems which plague the nuclear industry. Among them are: 1) waste disposal, 2) possible reactor meltdown, and 3) thermal pollution.

Nuclear wastes have long presented a problem for nuclear power plants. There are two types of reactor waste: high and low level. High level waste consists of the fission products, and they are contained in fuel rods. Low level wastes are materials which have been activated by the neutrons produced by the fission process. Both types of waste are radioactive and thus dangerous for people to be exposed to, but they are treated differently since high level wastes emit more radiation. High level wastes are typically kept at the plant and are under high security. This is because spent fuel rods often contain unused uranium, which could be reprocessed, a practice not currently employed in the U.S. However, if the wastes were to fall into the hands of the wrong groups (i.e. terrorists) serious repercussions could follow since the material could be used to make bombs. Low level wastes are not treated nearly as seriously as high level wastes since they can not be reprocessed to create bombs. They are typically compacted and shipped to a burial ground. Eventually high level wastes will be buried in deep geological structures, but these sights have not been made yet.

Another potential problem with nuclear reactors is the possibility of a nuclear meltdown. This is typically the result of both mechanical and operational failure. Rarely is one at fault. Nuclear meltdowns occur when there is a loss of coolant in the core. Without coolant, the core physically melts and this allows the radiation from the highly radioactive fuel to escape to the environment. This poses a severe threat to any life forms in the immediate vicinity of the reactor. The two most famous nuclear meltdowns occurred at Three Mile Island (TMI), located in

Pennsylvania, and at Chernobyl, in Russia.

The accident at TMI was a result of component failure and mistakes on the part of the operators which prevented the safety systems to act as designed. Surprisingly, the amount of radiation emitted at TMI was relatively low and it caused no physical harm, but its psychological damage was far reaching. It caused a severe lack of trust in nuclear power to develop in the populace. This is very unfortunate because nuclear power plants in the U.S. are highly regulated by the Nuclear Regulatory Commission (NRC). The staff also are rigorously trained. The strict regulation has lead to U.S. reactors being the safest in the world, but this still can not alleviate the lack of trust instilled in the population by the accident at TMI.

The accident at Chernobyl also is partially responsible for the general hesitance in using nuclear energy. However, before proceeding, it must be noted that the reactor at Chernobyl was completely different than those in the U.S. Its design was not nearly as safe since the core was not even contained. This is why the accident at Chernobyl released massive amounts of radiation, which was the direct cause of 31 deaths in the vicinity. Regardless, this accident made people fear nuclear power more than ever.

Lately, there is the problem of thermal pollution caused by nuclear power plants. Thermal pollution occurs when hot effluents are put into a lake or reservoir. The hot effluents are obviously a product of the power plant. These effluents raise the temperature of the cold reservoir slightly (perhaps only by a few degrees), but this is enough to change the entire ecosystem since it makes the conditions more favorable to species which are not already there. Some fish have low temperature tolerances and would die. However, it is possible to solve this problem by cooling the effluents before dumping them. This would cost some extra money, but it would nonetheless provide a solution.

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