Hazards of Uranium Mining and Milling.

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In recent years, there has been an interest in Armenia's uranium deposits, as displayed by outside entities, such as the government of Russia, which, just a few days ago, signed an agreement with the RA government to explore, mine and perhaps also mill uranium in Armenia. Although it is not clear to the public how much uranium exists in Armenia (Soviet geologists had estimated deposits to be low, compared to Central Asian deposits), nevertheless, there seems to be an active interest in mining uranium in Armenia. The Greens Union of Armenia are opposed to mining of uranium in Armenia. Given Armenia's small size and its aging Nuclear Power Station, the carcinogenic and mutagenic risks and other radiation hazards involved with uranium mining and milling overwhelm the benefits.

Hazards of Uranium Mining

Waste rock is produced during open pit mining when overburden is removed, and also during underground mining when driving tunnels through non-ore zones. Piles of so-called waste rock often contain elevated concentrations of radioisotopes compared to normal rock. Other waste piles consist of ore with too low a grade for processing. All these piles threaten people and the environment due to their release of radon gas and seepage water containing radioactive and toxic materials. In addition, to keep water out of the mine during operation, large amounts of contaminated water are pumped out and released to rivers and lakes. When the pumps are shut down after closure of the mine, there is a risk of groundwater contamination from the rising water level.

Miners are exposed to mine dust and mine radon gas via 3 main pathways:

- Inhalation/swallowing of radium (an alpha-emitter with a half life of 1,600 years, a decay product of uranium), also inhalation of radon gas and of radon progeny.
- External radiation (gamma radiation from uranium ore, alpha radiation from radon gas, etc.).
- Inhalation of uranium ore dust
  For example, Radium is absorbed by the intestine and is carried to the bone, where it can cause leukemia or bone cancer. Also, uranium itself is acutely radioactive and toxic.

Past and current health records of uranium miners and of populations living near the mines and mills show that the radiation in the mines and from the mill tailings produces an epidemic of cancer both for the miners and for the population living near the mines and mill tailings - in particular - throat, lung, liver and bone cancers, as well as leukemia.

For example: `Cancer cases among Aboriginal people living near Australia's biggest uranium mine appear to be almost double the expected rate, a study by the Federal Government's leading indigenous research body shows' (Sydney Morning Herald, 23 November, 2006). Another example: `Of the 1,500 Navajo men recruited in the 1940s through the 1960s from a simple farming life to mine uranium at Cove and Red Valley, Arizona, 1,112 miners or their families have filed for

government compensation related to lung cancer and other radiation induced diseases' (Nuclear Madness, by Helen Caldicott). Also, note that mines have frequent spills, leaks and breaches of regulations, so that miners can end-up drinking uranium-contaminated water, such as in the Jabiluka mine, Australia. And finally, consider the legacy of uranium mining: `Over a decade after uranium mining ended in Tajikistan, the country is finally facing up to its nuclear legacy. Specialists estimate that almost 55 million tonnes of uranium waste lie buried across the north of the country, posing a major ecological threat. The waste could remain harmful for hundreds of years. Making it safe would require the kind of technology Tajikistan just does not possess.' (International War & Peace Reporting (IWPR, London), Reporting Central Asia Bulletin No.394, July 2005).

Hazards of Uranium Mill Tailings

Ore mined in open pit or underground mines is crushed and leached in a uranium mill. A uranium mill is a chemical plant designed to extract uranium from ore. In most cases, sulfuric acid is used as the leaching agent, but alkaline leaching is also used. The leaching agent not only extracts uranium from the ore, but also several other constituents like molybdenum, vanadium, selenium, iron, lead and arsenic, thus, the uranium must be separated out of the leaching solution. The final product produced from the mill, commonly referred to as "yellow cake" (U3O8 with impurities), is packed and shipped in casks. In the end, large amounts of radioactively contaminated scrap, that is tailings, are produced, which have to be disposed of. Uranium mill tailings are normally disposed of (dumped) as a sludge in special ponds or piles, where they are abandoned. The amount of sludge produced is nearly the same as that of the ore milled. At a typical grade of 0.1% uranium, 99.9% of the material is left over as scrap/tailings.

Apart from the portion of the uranium removed, the sludge contains all the constituents of the ore. Because long lived decay products such as thorium-230 (gamma emitter with a half-life of 80,000 years) and radium-226 are not removed, the sludge contains 85% of the initial radioactivity of the ore. Radionuclides contained in uranium tailings emit 20 to 100 times as much gamma-radiation as natural background levels on deposit surfaces. The radium-226 in tailings continuously decays to the radioactive gas radon-222, the decay products of which can cause lung cancer upon inhalation. Some of this radon escapes from the interior of the pile. Radon releases are a major hazard that continues after uranium mines are shut down. Since radon spreads quickly with the wind, many people receive small additional radiation doses. Also, uranium mill tailings disposed of as sludge in piles or ponds are anything but safe. For example, `Killer landslides could spread radioactive pollution across much of southern Kyrgyzstan. Environmental officials in Kyrgyzstan are warning that a spate of landslides threatens to contaminate large parts of the Fergana valley with radioactive waste. Landslides caused by rains occur annually. But the downpours have been unusually heavy this year, and the mudslides they create are made worse by the deforestation of mountain slopes that has taken place over the last decade. Analysts now fear that toxic waste dumped 30 years ago at a disused uranium mine near the town of Mayluu-Suu could be washed away in a torrent of mud.' (International War & Peace Reporting (IWPR), 05 May 2003).

Due to technical limitations, all of the uranium present in the ore cannot be extracted. Therefore, the sludge also contains 5% to 10% of the uranium initially present in the ore.
In addition, the sludge contains heavy metals and other contaminants

such as arsenic, as well as chemical reagents used during the milling process. Moreover, the constituents inside the tailings pile are in a geochemical dis-equilibrium that results in various reactions causing additional hazards to the environment. For example, in dry areas, salts containing contaminants can migrate to the surface of the pile, where they are subject to erosion. If the ore contains the mineral pyrite (FeS2), then sulfuric acid forms inside the deposit when accessed by precipitation and oxygen. This acid causes a continuous automatic leaching of contaminants, including the radioisotopes. After hundreds of thousands of years, the radioactivity of the tailings and thus its radon emanation will have decreased so that it is only limited by the residual uranium contents.

Conclusion

The issue of uranium mining and milling should be discussed in the National Assembly. The people must be given the opportunity to decide for themselves whether to mine or not to mine uranium, since it is the inhabitants of the mining region, Syunik particularly, and not the Ministers of the RA government, who will be paying the high cost of mining. It is the inhabitants of the mining region who will be deprived of a healthy living space and a sustainable livelihood from agricultural activity, which will be destroyed as a result of mining. Thus, the will of the people must be considered in the decision making process.

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