

## Dumping nuclear waste in the molten lava on the flanks of an active volcano

Nuclear wastes are already there, and piling up further. Many possible avenues for disposing these wastes are currently under investigation all over the world. The discovery (by French scientists) of a natural reactor having existed more than a billion years ago in Africa and the resulting fission products having been incorporated and stored in the rock till today has led to some new developments. For example, the incorporation of high level nuclear waste in synthetic glass and its storage in a cooled place is being actively investigated and pursued.

From time to time, I have opined that the feasibility of disposal of wastes in molten lava on the *flanks* of active volcanoes or in hydrogeologically isolated craters of *extinct* volcanoes may be explored. It may be cheap and safe. But the resemblance of the smoke cloud in volcanic eruption with that in a nuclear explosion has kept the workers away from taking even a casual look at the possibility.

The recent eruption of Barren Island volcano (an uninhabited tiny island, about 4 km × 3 km, in Andaman-Nicobar chain: 12° 17' N, 93° 51' E) has prompted me to put forth the suggestion once again, for possible investigation.

The volume of lava flowing out during an eruption can be enormous. We can afford to dilute the waste (with granular material like sand) to low level and then dump it in the molten lava on the flanks (outside the crater and away from vents) using a suitable aerial platform. The wastes can be expected to get incorporated in the rock formed from cooled lava. This procedure, though attractive, is however not practical in Barren Island. The supply of

molten lava is not regular enough. The duration of eruption is short and uncertain (10–20 years) and the period between two consecutive eruptions may exceed 100 years. This is not a dependable proposition. However, every few years there occurs an eruption somewhere or the other in the world, involving outpourings of large amount of lava which can entomb large amounts of nuclear waste. The waste, of course, would need to be transported to the site. There may be some merit even in transporting and disposing the radioactive synthetic glass whenever opportunity arises rather than arranging for its storage for thousands of years. One expects weathering and erosion of the newly created surface rocks at normal rates, thus realising radioactive products at rates not far above the natural radioactivity. But this has to be ascertained by small-scale experiments.

My intention in writing this note is not to suggest that the above proposition is a practical method for nuclear waste disposal. I merely wish to point out that the feasibility may be examined, and not dismissed out of hand for psychological reasons. It may well turn out that there is one (or several) scientific/technical/economic reason(s) for rejecting the idea, but only, after an honest appraisal has been made.

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### Comments:

In view of long-term environmental concerns in dealing with nuclear wastes,

a number of ideas have been floated in the past, viz. space disposal, disposal in permanent snow zones at high altitude, deep terrestrial geological disposal, seabed disposal, disposal in earth's subduction zone, etc. I take it that nuclear waste dumping in molten lava could be one more such idea. At present, disposal of nuclear wastes in geological formations is the alternative most widely studied world over and considerable experimental data have been generated which support the practicality and economic viability of this alternative. In fact the concept of storing intensely radioactive high level wastes after incorporating in a solid matrix like glass of special composition, suitably conditioned for withstanding environmental impact, in deep geological repositories is being actively pursued in many countries.

While dealing with molten lava, in view of the very high temperatures involved, even the glass matrix could melt and the activity could get dispersed creating environmental activity problems. Normally, radioactive wastes are not safe to be transported in liquid form and the idea of diluting the waste to low level and then dumping it in molten lava is an unacceptable proposition. Also, disposal of radioactive waste in hydro-geologically isolated craters of extinct volcano cannot be considered due to uncertainty of period of dormancy. The uncertainty in the location, size, type of volcano and the amount of flow of molten lava and its spread will make the proposition impractical.

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