Cool solution to waste disposal

July 31 2006

As the Committee on Radioactive Waste Management (CoRWM) prepares to issue advice to government on nuclear waste, a group of physicists claims to have discovered a technique that could make nuclear waste much easier to deal with. The new technique, reported in the August edition of *Physics World*, would render nuclear waste harmless on timescales of just a few tens of years, instead of thousands.

Professor Claus Rolfs, leader of the group at Ruhr University in Bochum, Germany, said “The method we are proposing means that nuclear waste could probably be dealt with entirely within the lifetimes of the people that produce it. We would not have to put it underground and let our great-great-grandchildren pay the price for our high standard of living.”

The technique involves embedding the nuclear waste in a metal and cooling it to ultra-low temperatures. This speeds up the rate of decay of the radioactive materials potentially cutting their half lives by a factor of 100 or more.

Professor Rolfs added “We are currently investigating radium-226, a hazardous component of spent nuclear fuel with a half-life of 1600 years. I calculate that using this technique could reduce the half-life to 100 years. At best, I have calculated that it could be reduced to as little as two years. This would avoid the need to bury nuclear waste in deep repositories - a hugely expensive and difficult process.”

Rolfs developed the technique after trying to recreate experimentally the

way in which atomic nuclei react in the centre of stars. Whilst using a particle collider to carry out his studies, he noticed that more nuclear fusion reactions happened in the collider if the atomic nuclei were encased in metal and cooled. Fusion involves light nuclei coalescing to form heavier nuclei, releasing energy in the process. Radioactive decay is the opposite: a particle is released from a nucleus. Rolfs believes that if cooling nuclei in metal enhances fusion, it could enhance the opposite reaction, namely speeding up the rate at which radioactive particles decay.

According to Rolfs, the lower temperature of the metal means that free electrons can get closer to the radioactive nuclei. These electrons accelerate positively charged particles towards the nuclei, thereby increasing the probability of fusion reactions, or in the opposite case, accelerate particles that are being ejected from the nucleus.

“We are working on testing the hypothesis with a number of radioactive nuclei at the moment and early results are promising”, he said. “It is early days, and much engineering research will need to be done to put this idea into practise, but I don’t think there will be any insurmountable technical barriers.”

Source: Institute of Physics