

Radioactive Technetium-99 Discharges from Sellafield

1. Tc-99 is formed by the fission of uranium and plutonium when uranium is used as fuel in nuclear power stations; it does not occur in nature. Tc-99 has a half-life (i.e. the time taken for half of its activity to radioactively decay) of 213,000 years. The annual arisings of Tc-99 from the reprocessing of spent Magnox fuel in the Magnox reprocessing plant and the reprocessing of spent oxide fuel in the Thermal Oxide Reprocessing Plant ("THORP") that are currently destined for discharge to sea are around 30 - 40 TBq (Terabecquerels) and less than 1 TBq respectively. [To put this in perspective the total liquid discharge from Sellafield in 2000, excluding tritium and uranium, was around 84TBq]
2. Tc-99 discharges from Sellafield have been controversial, particularly in Ireland and Norway, since around 1994. Both governments have been pressurising the UK to drastically cut the discharges, since levels of the radioactive isotope found on their coastlines began to increase. Levels of Tc-99 in lobsters found off the coast of Sellafield were as high as 3,300 Bq/kg in 2001, compared with the Community Food Intervention Level (the level at which action should be taken after a nuclear accident) of 1,250 Bq/kg. The level in seaweed near Sellafield reached 17,000 Bq/kg in 2001, and was also up to 4,400 Bq/kg on the coast of south-west Scotland¹.
3. Magnox reprocessing produces a concentrated liquid mixture. Tc-99 is one constituent of that mixture, along with other, more radiotoxic chemicals. This mixture is called medium active concentrate ("MAC"). Newly produced MAC is stored on site, in tanks, for 3 to 5 years to allow short-lived radionuclides to decay and reduce or lose their radiotoxicity. Prior to 1981, MAC was discharged directly to sea following this period of "decay storage".
4. However, between 1981 and 1994, all MAC was held in storage pending the construction of a new abatement plant, the Enhanced Actinide Removal Plant ("EARP"). Consequently there is a large backlog of MAC stored on the Sellafield site waiting to be processed through EARP. EARP was designed to remove the most radiotoxic components of the MAC mixture, but it was not designed to remove Tc-99. Tc-99, therefore, passes through EARP, and is discharged to sea.
5. To accommodate the EARP coming into service in 1994, the discharge limit for Tc-99 was increased from the 10 TBq/year that had applied during the period that MAC was held in store, to 200 TBq/year.
6. In November 1999 the Tc-99 discharge limit was reduced to 90 TBq/year.
7. At the OSPAR Convention for the Protection of the Marine Environment of the north-east Atlantic Ministerial Meeting, held in Sintra, Portugal, in 1998, Deputy Prime Minister, John Prescott agreed to a "Strategy with Regard to Radioactive Substances". The Objective of the Strategy is:

"...to prevent pollution of the maritime area from ionising radiation through progressive and substantial reductions of discharges, emissions and losses of radioactive substances, with the ultimate aim of concentrations in the environment near background values for naturally occurring radioactive substances and close to zero for artificial radioactive substances".

The same meeting also noted "*concerns expressed by a number of Contracting Parties about recent increases in technetium discharges ... UK Ministers have indicated that such concerns will be addressed in their forthcoming decisions ...*"

8. So in November 1999, UK Ministers asked the Environment Agency to carry out a full-scale review of all radioactive discharges from the Sellafield site. Ministers also asked the Agency to consider the discharge of Tc-99 from the site on a "fast-track" basis and report back 6 months in advance of the main Sellafield review.
9. In September 2001, the Environment Agency published its "Proposed Decision on the Future Regulation of Technetium-99 Discharges". The Agency's proposal was basically, to allow BNFL to continue discharging up to 90TBq per year until the end of 2006.
10. The Agency also proposed to require BNFL to divert new arisings of MAC to the high-level waste tanks for subsequent conversion into glass blocks – a process known as vitrification – by 31st March 2003.
11. Unfortunately, this diversion of MAC would not be able to deal with the backlog of material. Under the proposals, BNFL would also be required to carry out research into the use of a chemical known as TPP, which is capable of precipitating out the Tc-99 from the liquids coming out of EARP.
12. However, in the absence of a successful Tc-99 removal process with TPP, the Agency expected the actual discharges of Tc 99 to rise to around the 87-88 TBq level until 2003/4; reduce slightly to 80TBq in 2004/5, and then fall to 45TBq in 2005/6, whilst BNFL was dealing with the backlog of MAC. This would allow them to meet the new legal limit of 10TBq in 2006/7 and onwards. Although the current legal limit for Tc-99 discharges from Sellafield has been 90TBq per year since 1999, actual discharges between 1998 and 2000 were around 40 to 50TBq.
13. There is evidence, however, that BNFL has been dragging its feet on the development of the TPP process. The way the backlog of MAC is dealt with is by running a series of 'campaigns' throughout the year. BNFL normally has around two or possibly three of these 'campaigns' every year. BNFL treating around 240 m³ of MAC in September/October this year. This resulted in the discharge of about 30 TBq of Tc-99 to sea. Another 377 m³ was processed in February-April 2002. There will be another of about 380 m³ to be treated in January/February 2003.
14. BNFL applied to the regulators (the Health and Safety Executive and the Environment Agency) to carry out a trial using TPP before the September/October MAC campaign. The regulators (HSE and the Agency) reviewed the submission and considered that a TPP trial in at that time would be premature. TPP is an organophosphate, so the resulting solid waste has the potential to cause substantial waste management challenges in the future. The process would also involve some discharges of TPP into the sea, yet there is a lack of knowledge about its toxicity.
15. In a briefing about the September/October Campaign, the Environment Agency complained that "BNFL has not provided any new information that would persuade the regulators" to allow the trial to go-ahead. Basically BNFL has not provided the regulators with any more information than was available a year ago.

16. Once the results of BNFL's research on TPP are available, hopefully by around the end of 2002, then the position concerning agreement to commencing the TPP trial will be reviewed.
17. The UK Government's decision on 11th December was to accept the Environment Agency's proposals, but also to consult on whether it would be possible to impose a moratorium on the discharge of Tc-99 from the Sellafield site whilst research on abatement technology is carried out. Greenpeace's view is that the Government should have imposed its moratorium now, rather than waiting for yet more consultation. BNFL has had plenty of time to investigate abatement technology, but it has clearly been dragging its feet. The Government's decision gives BNFL the opportunity to continue dragging its feet.
18. The real solution to end Sellafield's radioactive discharges is to end reprocessing. This polluting process is completely pointless. And yet this Government decision postpones, yet again, any review of reprocessing and the justification for continuing with it. The Decision Document says "... *it would be more appropriate to consider the need for a review of the practice of reprocessing of spent Magnox fuel in the context of the larger, more holistic, review...*" of Sellafield's other discharges, which Ministers are considering at the moment.
19. The bulk of the Tc-99 discharges come from the Magnox reprocessing plant on the Sellafield site. In fact this plant is responsible for up to 80% of Sellafield's radioactive pollution. This plant is scheduled for closure at the end of 2012, once it has reprocessed all of the spent fuel from Britain's loss-making Magnox reactors – the last of which is scheduled to close in 2010. The quickest way to reduce Sellafield's discharges would be to shut BNFL's ageing and loss-making Magnox reactors now, with the reprocessing plant following close behind.
20. Magnox reactors are losing money, yet every time there is an opportunity to review their operation, the Government and the Environment Agency have failed to bite the bullet.
21. A paper produced for Greenpeace in 2001 by Dr Ian Fairlie and Dr David Sumner estimated that the doses to the world population from Tc-99 could be as much as 1,000 times more than official estimates. (Available on Request)

ⁱ "Radioactivity in Food and the Environment, 2001" (RIFE-7), Food Standards Agency and Scottish Environment Protection Agency, 2002.