

Background

Since 1956 radioactive effluents are discharged in the Molse Nete river through a 10 km pipeline. Nowadays, the radioactive effluents are coming mainly from the test reactor BR2 and the radioactive laboratories of SCK·CEN and the waste treatment operations of Belgoprocess. The recent yearly discharges in the Molse Nete were about 2200 GBq tritium and 1.4 GBq for the other β emitters.

Objectives

The purpose of this radiological impact study was to evaluate the current situation i.e. discharge of radioactive effluents via a pipeline into the Molse Nete and to compare it with other options.

Five options have to be considered:

- option 1: the current situation (reference option)
- option 2: discharge in another river
- option 3: discharge into the Molse Nete after transport with a tanker
- option 4: evaporation of the effluents with atmospheric discharge of iodide-131 and tritium and concentration of the other radionuclides in the solid phase
- option 5: detritiation of the tritium containing effluents coming from BR2 (contains more than 99% of the tritium) with storage of tritium and discharge of the other radionuclides in the Molse Nete

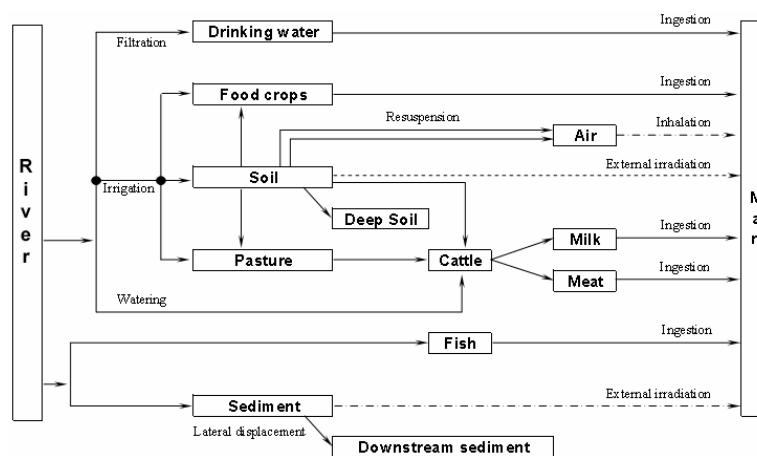
Principal results

The doses to an adult person staying in the surroundings of the discharges are calculated for the year 2002 and 2052. It is assumed that the mean discharges of the years 1998 -2002 are continued until 2052.

Also potential exposures for accident scenarios with low probability are considered for the five options. For the discharge via a pipeline, a crack in the pipeline was considered and for transport with a tanker to the river, a traffic accident is considered resulting in leakage of the radioactive effluents.

In the figure, the exposure pathways for the discharges in a river are given. It is assumed that the river is used for fishing, drinking water and irrigation of kitchen garden and pasture leading to a contamination of food crops (potatoes, root crops, leafy vegetables, pods), milk and meat. It is also assumed that sediment of the river was put on the river banks. The doses to man due to ingestion of food products, due to external irradiation of the irrigated soil and the river banks and due to inhalation of contaminated dust are calculated for an adult living in the surroundings of the river.

The accidental scenario is a leakage from the pipeline which might result in a contamination of the kitchen garden, leading to an ingestion dose for the food crops mentioned above. Conservatively, it is assumed that the ground water in the kitchen garden is replaced by radioactive effluents.



Exposure pathways from a river

For option 3, a tanker instead of a pipeline is used to transport the radioactive effluents to the river. This will result in an additional exposure pathway compared to the first two options, i.e. an external dose for the driver during the transport. In case of an accident, spectators might be exposed to external irradiation if the effluents leak out of the tank.

For option 4, tritium and I-131 will spread via air and eventually will be deposited on the soil. Possible exposure pathways are the inhalation of contaminated air, external irradiation and ingestion of food crops by people living within the area covered by the plume. For option 6, the exposure pathways are the same as for the first two options.

The total doses are given in the table. It is shown that the doses of the non-accidental options remain under the exemption level of 10 μSv per year and therefore all these options are acceptable from radiological point of view. The comparison also shows that the alternative options are not really better than the current situation and consequently implies that it is not reasonable to invest in these options. The potential exposure due to an accidental scenario, i.e. leakage from pipeline, might lead to a much larger dose due to the conservative approach that was used. However, because of its low probability, the radiological risk of this option will be much lower than that of the non-accidental option.

Calculated effective doses to an adult in the year 2052.

Option	Non-accidental exposure ($\mu\text{Sv}/\text{year}$)	Accidental exposure (mSv)
Discharge into Molse Nete	5.0	0.66
Discharge into Witte Nete: Witte Nete	5.8	0.66
Discharge into Molse Nete: Molse Nete	0.14 (a)	
Discharge via tanker into Molse Nete: Molse Nete	5.0	
Driver of tanker	0.5	$< 1\text{E}^{-05}$
Atmospheric release of H-3 and I-131: Molse Nete	5.6	
	0.14 (a)	
Detritiation Molse Nete	4.3	0.64

(a) residual doses for people living in surroundings of Molse Nete due to past discharges

Future work

In this study, only the radiological aspects were considered. In order to determine the best option also economical and social factors need to be included.

Main contact person

Lieve Sweeck, lieve.sweeck@sckcen.be

Main reference

Sweeck L., Zeevaert Th., Vanmarcke H., Loos M., Sohier A. and Vermeersch F. *Impactstudie van de effluenten van Belgoproces: huidige situatie en alternatieven. Studie uitgevoerd in opdracht van NIRAS. R-3921* (Juni 2004).