Rev. sci. tech. Off. int. Epiz., 1988, 7 (1), 105-113.

Netherlands *

Summary: Radioactivity from the Chernobyl accident reached the Netherlands in May 1986, the principal isotopes being Cs-137 and I-131. The national network for radiological monitoring was reinforced, paying special attention to milk and grass. Grazing by cows was prohibited for a brief period. The highest radioactivity recorded in milk was 170 Bq/l for I-131 and 20 Bq/l for Cs-137, and the highest radioactivity in beef averaged 30 Bq/kg for I-131 and 20 Bq/kg for Cs-137. High concentrations of both isotopes were present in mutton, and thyroid glands from cattle and sheep contained high concentrations of I-131. Human exposure to radiation remained well below the recommended limit.

KEYWORDS: Cattle - Contamination - Environment - Meat - Milk - Netherlands - Public health - Radioactivity - Sheep - Surveillance.

INTRODUCTION

On 26 April 1986 at 1:23 a.m. an accident occurred at the fourth unit of the Chernobyl Nuclear Power Plant which resulted in the destruction of the reactor core and part of the building in which it was housed.

In Sweden, the fallout from the Soviet reactor was first detected on 28 April. In the Netherlands, a central coordinator and an Inter-departmental Coordinating Committee were appointed on 29 April, together with a Technical Working Group. The Departments of Environmental Care, Health, Agriculture and Fisheries, Economic Affairs and several others participated in this Coordinating Committee. The existing programme for continuous monitoring of radioactivity in the environment was intensified.

On Friday 2 May the radioactive cloud reached the Netherlands. On 3 and 4 May substantial amounts of radionuclides were deposited, particularly by rain (Fig. 1), causing an increase of radiation up to 20 μ R/h. The total average deposition has been 1,800 Bq/m^2 for Cs-137 and 11,000 Bq/m^2 for I-131. Furthermore, substantial amounts of Cs-134, Ru-106, Ru-103, Ba-140 and Te-132 have been deposited. In this short period the deposition of Cs-137 in the Netherlands (Fig. 2) was about 40% of the total deposition during the 1950's and 60's when deposition was caused by the test programmes of nuclear weapons in the Arctic Circle. The deposition of Sr-90 and plutonium was relatively small, with an increase of 1% and 0.003% respectively on the values measured before Chernobyl. The deposition of Sr-90 (a major radionuclide in fallout from nuclear weapons tests) was only 18 Bq/m^2.

Compared to the rest of Europe, the Netherlands experienced relatively low amounts of radioactive contamination.

---

* Based on the contributions of W.G. de Ruig, State Institute for Quality of Agriculture Products, Wageningen, the Netherlands; and the Coordinating Committee for the Monitoring of Radioactive and Xenobiotic Substances (CCRX-report October 1986).

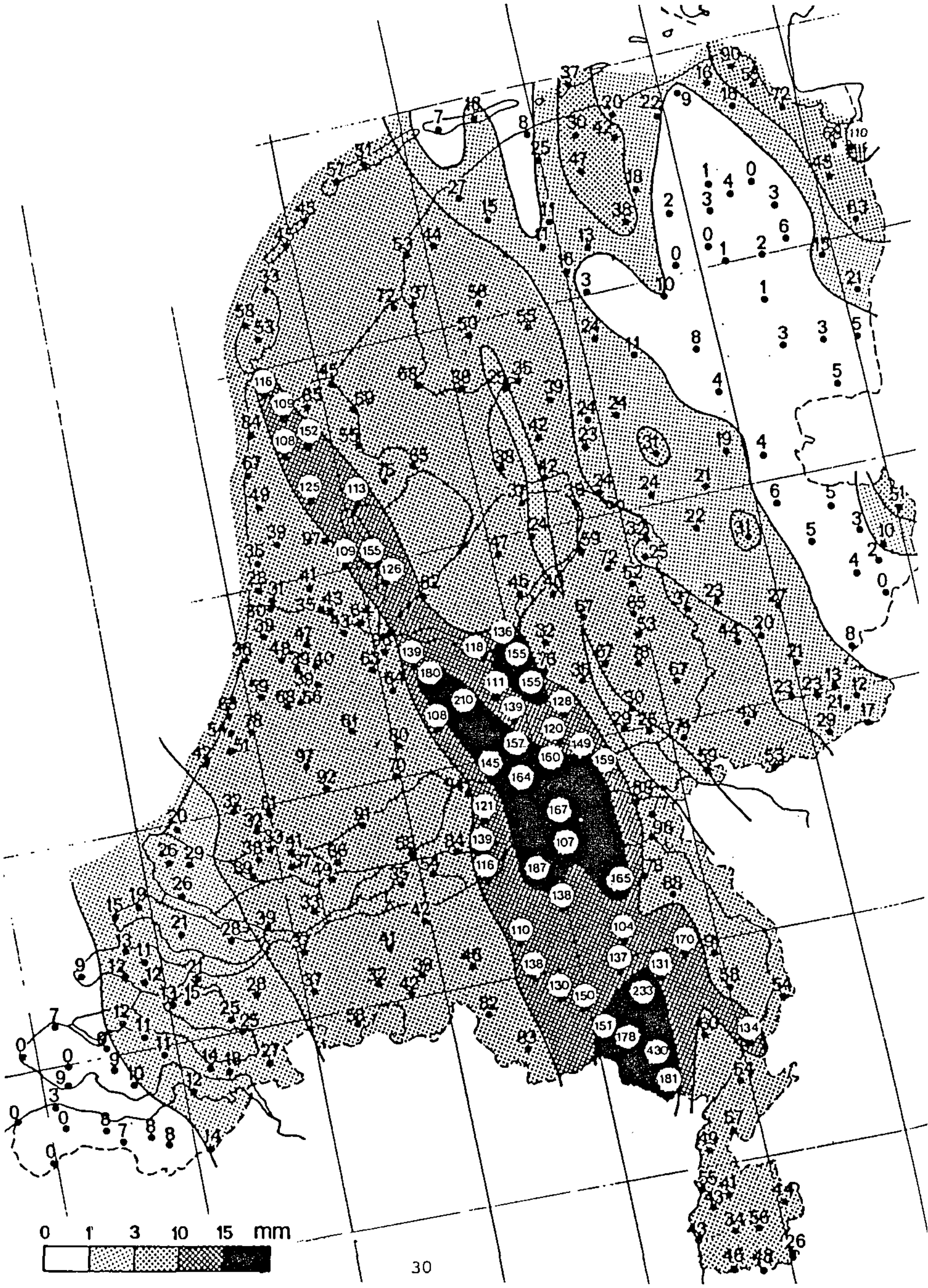

FIG. 1

Rainfall in the Netherlands on 3 and 4 May, 1986

Precipitation (0.1 mm) 3 May 08.00 h – 4 May 08.00 h UT

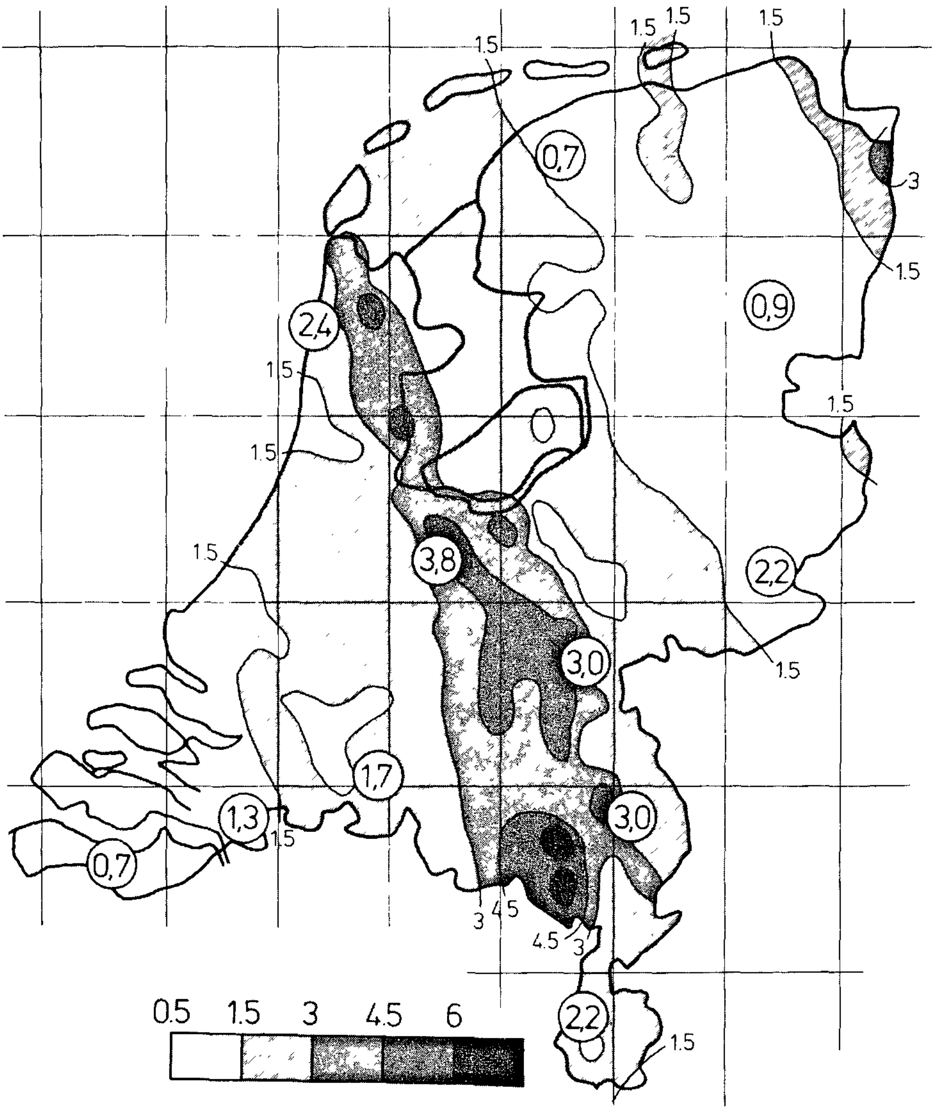

FIG. 2

Map of the Netherlands with isodeposition lines for the estimated local wet plus dry deposition of Cs-137

Circled values: measured wet deposition plus estimated dry deposition of Cs-137 in kBq/m^2

THE MONITORING SYSTEM

About 25 years ago the Ministry of Agriculture and Fisheries began action to control the radioactive contamination of food, in particular milk and meat, in case of a nuclear calamity. A rapid food measuring monitor was developed.

In the last two decades about 130 of these monitors were installed at dairy industries, slaughterhouses and other institutions. Local operators received the necessary training. Through refresher courses, ringtests and monthly exercises this National Network for Radioactivity in Food (LMRV) was kept on stand-by. In Figure 3 an outline map of such installations is given.

For data evaluation the monitors were coupled by telephone with a central computer in Wageningen. This centre was also equipped with measuring equipment, some of it more sophisticated than in the other locations.

On 2 May 1986 an *ad hoc* Measuring Centre Wageningen (MCW) became active, in which the National Network for Radioactivity in Food participated, together with staff members of the State Institute for Quality Control of Agricultural Products (RIKILT) and the local Health Physics Department (SBD-ITAL).

In the beginning of May many laboratories started investigation of milk, grass, vegetables, meat and other food products. In particular, the National Food Inspection Service Institutes of the Ministry of Agriculture and Fisheries and the Netherlands Controlling Authority on Milk and Milk Products carried out measurements on a large scale. The Measuring Centre Wageningen concentrated primarily on measurement of vegetables, the National Meat Inspection Service on meat.

As milk was assumed to be an important source of radioactivity in human food, a large number of milk and grass samples were also investigated by the Measuring Centre and the National Network. The National Food Inspection Service also measured domestic and imported milk products from 5 May onwards.

The rapid availability of measuring results was used in formulating advice by a Technical Working Group and in the decision-making of the government.

RESULTS OF MONITORING

The animal ingestion of radionuclides from feed is a selective process: elements like ruthenium and tellurium are ingested very poorly, so that iodine and caesium isotopes are practically the only contaminators of milk and meat.

Iodine is excreted very rapidly into milk. In the first days of May, peak values of 170 Bq/l for I-131 were reported. The median values per day rose to 21 Bq/l on 6 May, then decreased very rapidly with the grazing ban which went into effect for lactating cattle on 4 May. When the ban was revoked on 8 May, values increased again to a lower reading of 18 Bq/l on 14 May.

The excretion of ingested caesium into milk is much slower. Consequently, the maximum median value of 20 Bq/l for Cs-137 was reached not earlier than 21 May. Experiments with cows which continued to graze produced I-131 and Cs-137 levels

- * Milk monitors
- \+ Meat monitors
- x Central measurement system (Wageningen)
- ⊠ Dairy control installations (Leeuwarden, Leusden)
- Δ Fish monitors
- Φ Vegetable, fruit monitors
- ⊖ Cattle feed monitors

FIG. 3

National Network for Tracing Radioactivity in Food of the Ministry of Agriculture and Fisheries

5 to 10 times higher than with stalled cows. The median value for Cs-137 decreased rapidly. In August 1986 a median value of less than 3 Bq/l was reached. During the first months of the winter 1986-1987 a slight temporary increase (up to 7 Bq/l) of the median value occurred, due to the fact that silage prepared in the spring of 1986 was fed to the cattle.

So far as vegetables are concerned, spinach was shown to contain relatively high levels of iodine-131. The National Food Inspection Service reported values up to 10,000 Bq/kg for I-131 on 6 May with an average of 1,600 Bq/kg in the first week. For Cs-137 the maximum was 1,100 Bq/kg and the first week's average 200 Bq/kg. From 7 to 10 May, spinach put up for sale was destroyed. The contamination of other vegetables was considerably lower.

In beef the I-131 concentration did not rise above 200 Bq/kg with an average of 30 Bq/kg. The highest Cs-137 concentration recorded was 200 Bq/kg on 15 May. Since May the average Cs concentration of beef decreased from 20 Bq/kg to less than 10 Bq/kg in September 1986.

In mutton, high values of I-131 and Cs-137, ranging up to 1,000 Bq/kg, were reported on occasion. For this reason too, direct consumption of sheep's milk and products thereof was prohibited from 7 to 30 May.

The contamination of pork remained low, due to the fact that pigs were kept stalled and fed with non-contaminated feed.

As iodine is concentrated in the thyroid, concentrations of up to 40,000 Bq/kg for I-131 were reported in these organs of cows and sheep. On 6 May, it was decided to destroy thyroids of slaughtered animals for a period of ninety days.

Whereas in the first weeks after the accident, public health aspects were most important, attention was later focussed on commercial interests. As a result of the decreasing values, the number of samples for monitoring could be reduced almost monthly. More and more laboratory capacity was needed, however, to carry out special inspections on agricultural products destined for countries which had fixed a very low tolerance, sometimes even a zero tolerance. Attention continues to be focussed on imports from certain countries, whose products sometimes contain excessive levels of radionuclides.

For imports the Netherlands followed EEC regulations, which allow 370 Bq/kg for milk, milk products and baby food, and 600 Bq/kg for other products.

Inspection and certification is carried out by qualified laboratories, controlled by the State Institute for Quality Control of Agricultural Products.

CONSEQUENCES FOR RADIATION EXPOSURE

In Table I some existing sources of radiation are given.

The average effective radiation exposure in the Netherlands amounts to 1.7 mSv/year. In 1977 the ICPR (International Commission on Radiological Protection) set up an advisory maximum limit of 5 mSv/year (and 50 mSv/year for radiological workers). As a consequence of the Chernobyl accident, the Health and

TABLE I

Exposure of humans to radiation in the Netherlands

Natural sources	**msieverts/year**
External: cosmic rays	0.5
earth rays	0.5
Internal: human body (K-40)	0.25
Artificial sources	
Medical applications	0.2-1.0
Construction materials (bricks, concrete)	0.1-0.3
Nuclear power	0.01

Environment Department expects the average exposure in the Netherlands to increase by 4% in the 12 months after May 1986. An increase of approximately 1% is expected in the following years. This remains far below the ICPR requirements.

FURTHER RESEARCH

During discussions concerning radioactivity, it became clear that some aspects of the transfer mechanism of the major radionuclide Cs-137 were still unknown. Research projects have therefore been started for determination of the transfer of radioactive contamination from feed into milk and meat. These projects include:

- the transfer of radiocaesium from the grass contaminated in May into milk;
- the transfer of radiocaesium from contaminated milk powder into veal;
- the transfer of radiocaesium from silage into milk.

As a result of these projects the importance of setting limits on Cs-radiocontamination of feed has become clear. In particular, some tests with highly contaminated milk powder gave cause for concern. Values in veal have sometimes exceeded EEC regulations. For this reason a limit of 600 Bq/kg was set in the Netherlands on basic materials for feedstuffs. Within the EEC, discussions on this subject are still going on.

CONCLUSIONS

The Chernobyl accident has showed that a nuclear accident can have an enormous impact on agricultural products even at distances over 1,000 miles.

The accident caused a relatively low deposition of radionuclides in the Netherlands in comparison with the rest of Europe. The major radionuclides were I-131 and Cs-137. Thanks to an existing stand-by monitoring system and actions taken by the Dutch government, no food exceeding the radiation limit has been distributed. In May 1986, the radiation of Dutch agricultural products was, with a few exceptions for goat's milk and spinach, far below the limits set by the EEC (600 Bq/kg).

Cs-137 levels in milk and meat decreased rapidly in the next months from 20 Bq/kg to less than 10 Bq/kg.

Nevertheless, trade difficulties were encountered in the first months after the Chernobyl accident with some countries which have a very low or even a zero tolerance. This problem still needs to be addressed.

Development and acceptance of international standards on radionuclide contamination of foods would contribute to consumer health and trade interest. It should be possible to develop limits which in a normal situation could be used for international trade, and other limits for the home market in case of an emergency. Furthermore, it could be important to develop within the OIE a set of international rules on radionuclide contamination of live animals, especially as concerns standards and methods for international trade. In practice some countries measure live animals or their excrements, without informing exporting countries about methods and permitted levels.

*
* *

PAYS-BAS.

Résumé : *La traînée radioactive provenant de l'accident de Tchernobyl a atteint les Pays-Bas en mai 1986. Le césium-137 et l'iode-131 étaient les principaux radio-isotopes. Le réseau national de contrôle radiologique a été renforcé. Le lait et les herbages ont été particulièrement surveillés. La mise au pâturage des vaches a été interdite pendant une courte période. Le taux maximal de radioactivité enregistré a été de 170 Bq de I-131 et 20 Bq de Cs-137 par litre de lait, de 30 Bq de I-131 et 20 Bq de Cs-137 par kilo de viande de bœuf. Les deux isotopes étaient présents à de fortes concentrations dans la viande de mouton ; les glandes thyroïdes des bovins et des ovins contenaient des concentrations élevées de I-131. L'exposition de l'homme aux radiations est restée nettement inférieure au seuil recommandé.*

MOTS-CLÉS : Bovins - Contamination - Environnement - Lait - Ovins - Pays-Bas - Radioactivité - Santé publique - Surveillance - Viande.

*
* *

PAÍSES BAJOS.

Resumen: *La estela radiactiva originada por el accidente de Chernobil alcanzó los Países Bajos en mayo de 1986. El cesio-137 y el yodo-131 eran los principales radioisótopos. Se reforzó la red nacional de control radiológico, vigilándose especialmente la leche y los pastos y prohibiéndose el pastoreo de las vacas durante un corto periodo. La tasa máxima de radiactividad registrada fue de 170 Bq de I-131 y 20 Bq de Cs-137 por litro de leche, de 30 Bq de I-131 y 20 Bq de Cs-137 por kilo de carne de vaca. Estos dos isótopos se encontraron en fuertes* *concentraciones en la carne de carnero, mientras que las glándulas tiroides de bovinos y ovinos contenían elevadas concentraciones de I-131. La exposición del hombre a las radiaciones permaneció muy inferior al límite recomendado.*

PALABRAS CLAVE: Bovinos - Carne - Contaminación - Leche - Medio ambiente - Ovinos - Países Bajos - Radiactividad - Salud pública - Vigilancia.