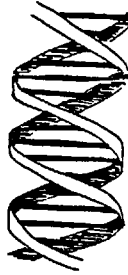




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**RADIOACTIVE FALL-OUT IN NORWAY
AFTER THE TSJERNOBYL ACCIDENT.**

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I. RADIATION MEASURINGS AND CONTROL BEFORE TSJERNOBYL.

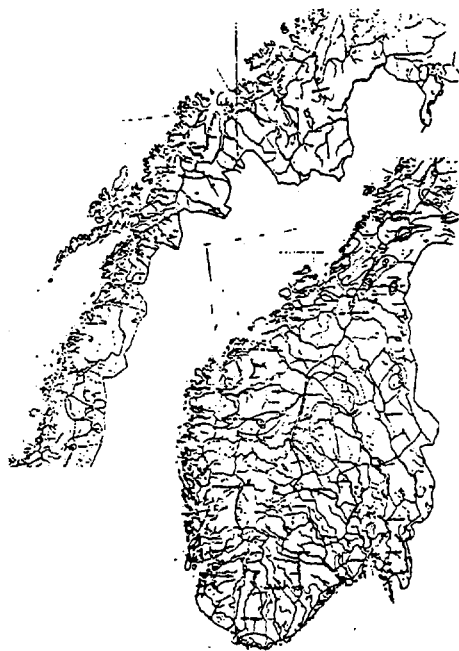
During the fall-out from the atmosphere during the fifties and sixties, a system of local control of radioactive contamination of food was built up. (LORACON- Local Radioactivity Control)



The different Meat and Food Inspection Services were equipped with Geiger Müller instruments. The system was in operation until late seventies. From 1977 there was no testing and calibration of the instruments. The development towards a reduction of the state of readiness was accelerated when the Norwegian Parliament decided that Norway should not establish any nuclear power plants (1979).

Only the Universities and special institutions as the National Institute of Radiation Hygiene and the Institute for Energy Technique were still able to analyse on radioactive isotopes.

II. RESULTS FROM THE FALLOUT FROM TSJERNOBYL

The confusion about how much radioactive fall-out Norway received lasted for some weeks in Norway. Partially, this was due to the lack of instruments, but also many experts rejected the idea that an accident so far away might cause these amounts of fall-out which was detected later. Most of the fall-out consisted of Iodine and Cesium. The map below shows the pattern of fall-out over Norway. The fall-out followed a very irregular pattern both nationally and locally with the mountain areas in Middle Norway most affected.



-  - 300-500 impulses/second
-  - >500 impulses/second

Radioactive fall-out after Tsjernobyl, measured as τ -impulses per second from ground Norway may 1986. Measured from car and aeroplane by the Norwegian Institute of Geological Investigations.

In May, some sallad was found in Middle Norway containing values above the action level. Most of the Norwegian vegetables were still in the ground during the fall-out, and no more high results were found from vegetables. A lot of samples on imported vegetables were taken in May and June, without any special results.

Radioactive contamination of fish from fresh water was detected in late June, and later on many districts have had results above 600 Bq/kg. Fish from salt water never exceeded 50 Bq/kg.

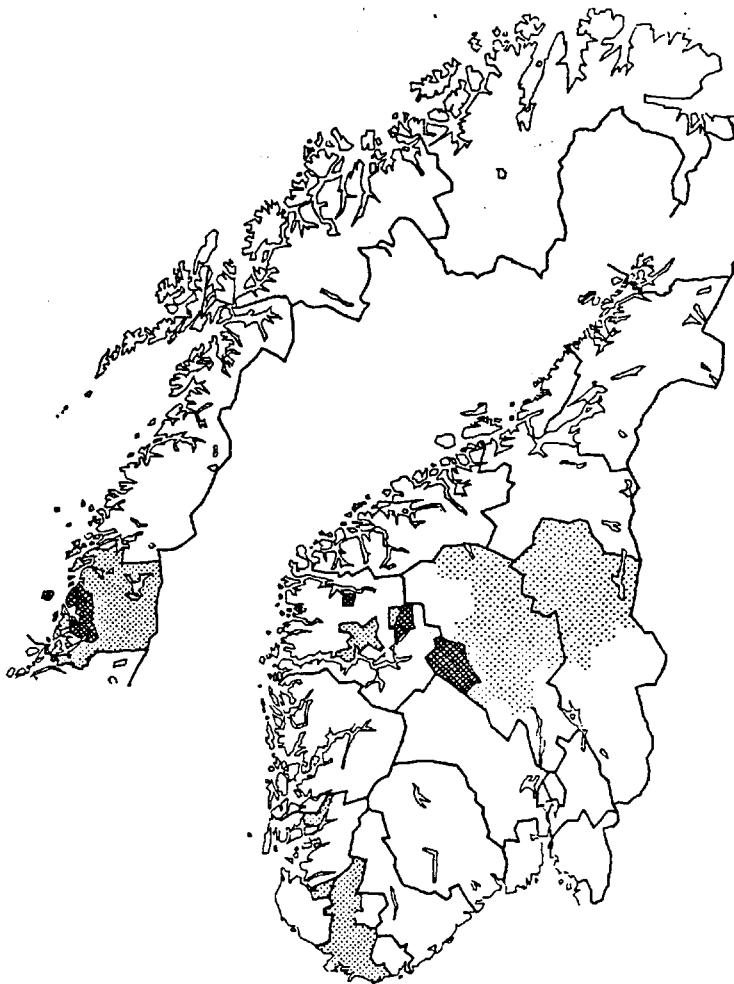
Throughout the summer, high values were recorded in game animals (roedeer, reindeer, moose), in sheep and partially in cattle. Special attention was paid to cow's milk all the time. A few results up to 370 Bq/kg were found, but most of the time the milk had low results. Some higher values were found in goat's milk. Production of brown cheese was stopped from the most affected area.

Dramatic results in reindeer from Southern Norway has been found (up to 70000 Bq/kg). Wild and domesticated reindeer show the same pattern.

Norwegian grown corn has given very low results (Mean=3 Bq/kg). Drinking water gave up to 10000 Bq (Iodine + Cesium) in small sisterna the first days, but later on, very low values have been recorded. (below 10 Bq/l in lakes and streams). Ground water never exceeded 5 Bq/l.

The figures on the following pages gives some ideas about the levels of radioactive contamination in different food products. It is not possible to give the full information about the results, and just some important trends are presented. What is clear, is that the correlation between results from ground and soil analyses and from foods seem to be very good.

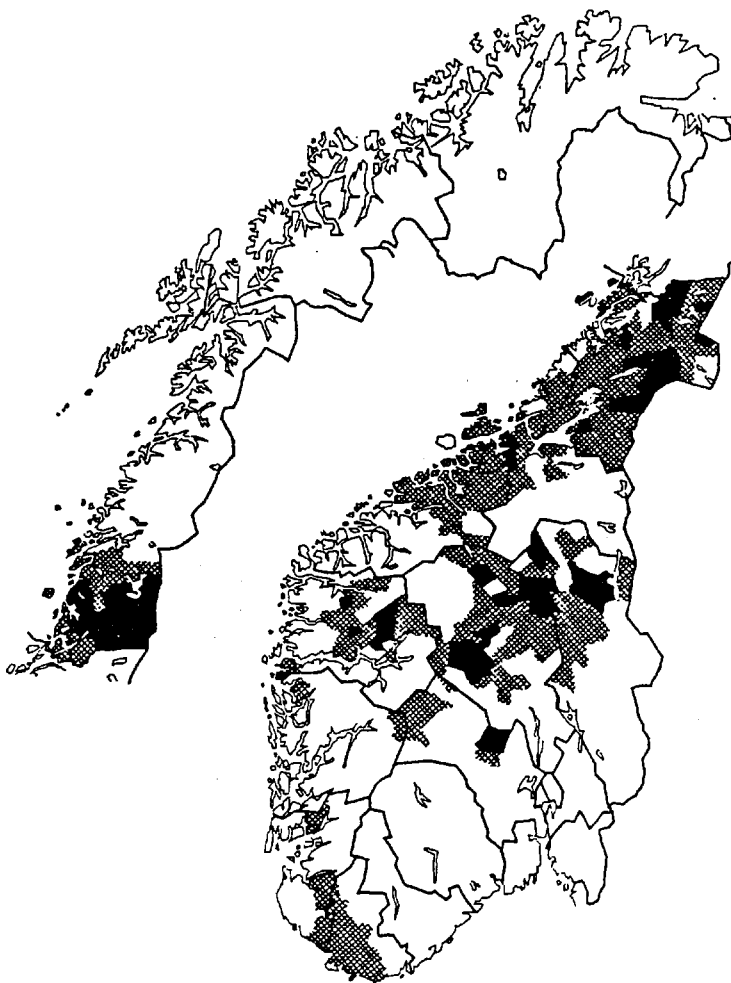
ZONES FOR SLAUGHTERING OF CATTLE IN NORWAY NOVEMBER 1986 RELATED TO
VALUES OF RADIOACTIVE CESIUM IN MEAT.



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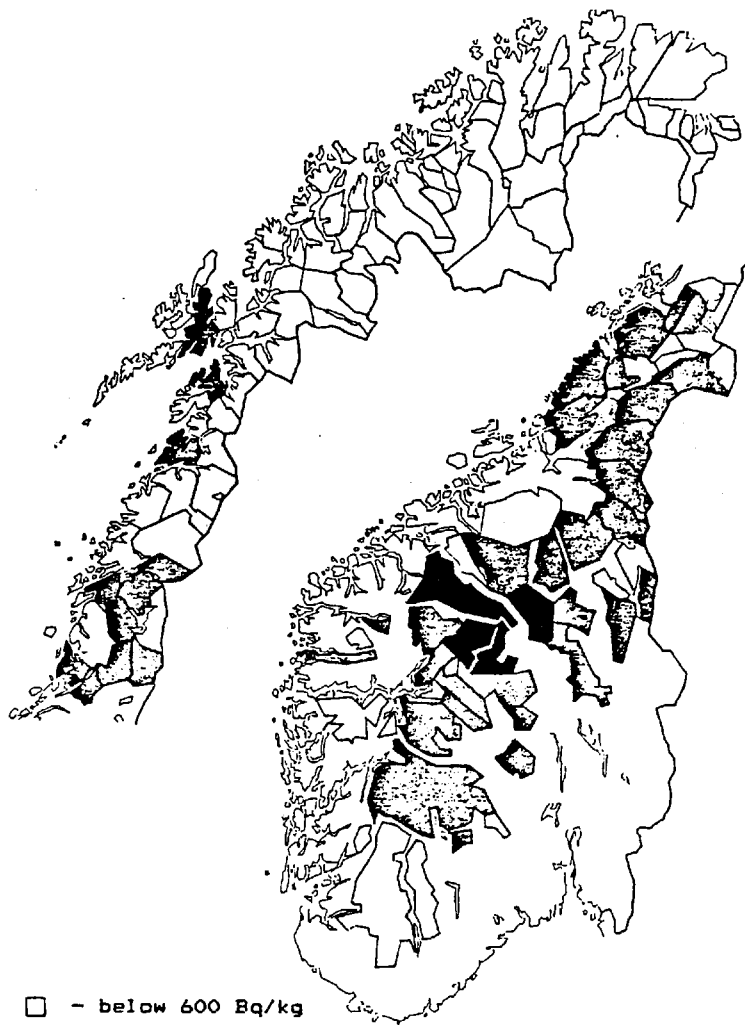
- - Zone of action (values above 600 Bq/kg, special feeding routines including bentonite required)
- ▣ - Zone of attention (below 600 Bq/kg, but some radioactive contamination of grass/silage)
- ▤ - Zone of attention (some herds)
- - Free Zones

ZONES FOR SLAUGHTERING OF SHEEP IN NORWAY SEPTEMBER 1986 RELATED TO
VALUES OF RADIOACTIVE CESIUM IN MEAT.



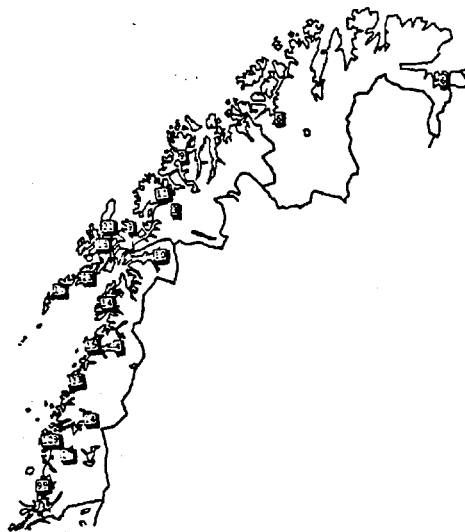
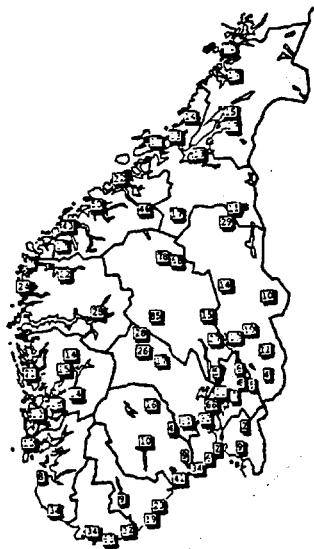
- ◆ - Carcasses condemned (values above 2000 Bq/kg in August)
- ▨ - Zone of action (values from 600-2000 Bq/kg in August, special feeding including bentonite required).
- - Free zones (values below 600 Bq/kg in August)

TOTAL RADIOACTIVE CESIUM IN REINDEER IN NORWAY MAY-AUGUST 1986



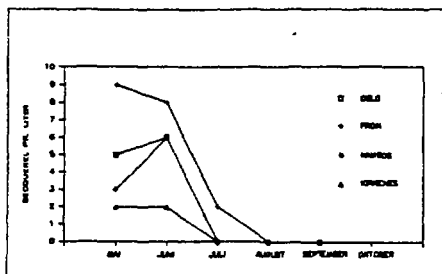
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TOTAL RADIOACTIVE CESIUM IN COW'S MILK NORWAY SEPTEMBER 1986
(MEAN VALUES, SAMPLES TAKEN 22.-28. SEPTEMBER)

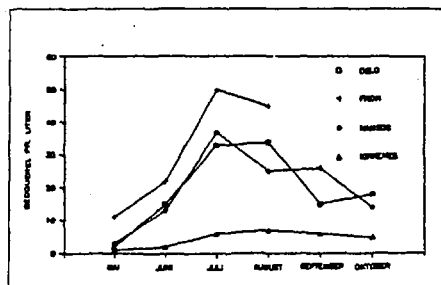


READIOACTIVE IODINE AND CESIUM IN MILK FROM FOUR DIFFERENT
REGIONS IN NORWAY 1986

A. IODINE



B. CESIUM



TOTAL RADIOACTIVE CESIUM IN FRESH WATER FISH IN NORWAY
MAY-AUGUST 1986



- - below 600 Bq/kg
- - 600-10000 Bq/kg

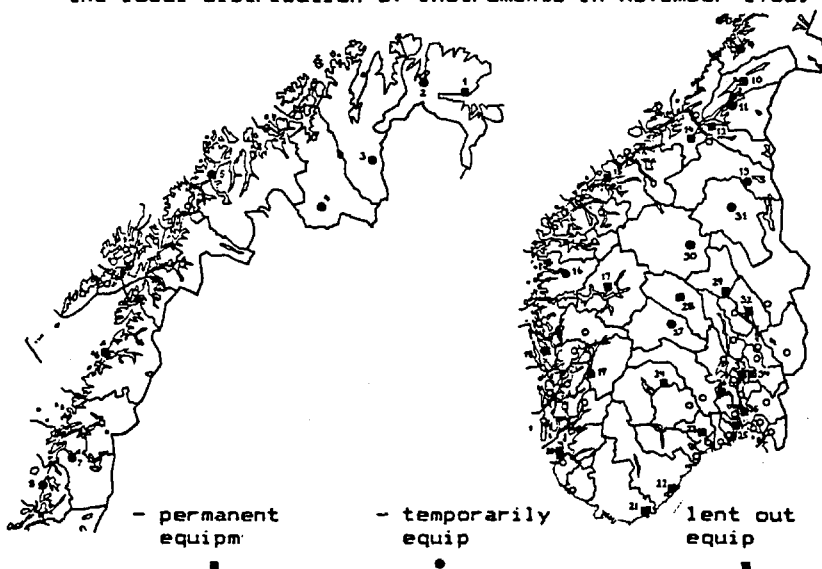
III. ACTIVITIES AFTER TSJERNOBYL

A. CONTROL ORGANISATION

After the Tsjernobyl accident, the Directorate of Health was given the responsibility to coordinate information and analyses on radioactive contamination of food. A close cooperation was from the beginning established with the Ministries of Agriculture and Fisheries and the local Meat and Food Inspection Services.

The first months after the accidents, most samples were analysed at central laboratories as the National Institute of Radiation Hygiene and the Institute of Energy Technique. Thus, a very limited capacity was available until September. Analyses were coordinated by the Directorate of Health in cooperation with other organisations and authorities.

In September some 25 local Food Inspection laboratories were provided advanced standard instruments (γ -spektrographs). From then most analyses has been taken locally. The map below shows the local distribution of instruments in November 1986.



Distribution of local instruments for analysing food for contamination with radioactive isotopes november 1986.

As the problems with meat from sheep, cattle and reindeer appeared to be most important in the fall, more and more analyses were coordinated by the Ministry of Agriculture and the County Veterinary Officer.

From May to December 1986 about 18000 analyses were analysed, giving this distribution of samples (estimate):

| | |
|-------------------------------------|------|
| Milk and dairy products | 2550 |
| Meat from animal husbandry | 9000 |
| Meat from wild animals and reindeer | 3000 |
| Saltwater fish | 130 |
| Freshwater fish | 2230 |
| Drinking water | 190 |
| Crops | 90 |
| Vegetables.. | 1000 |
| Others | 140 |


The Directorate of Health decided what products should be withdrawn from the market, and also gave frame instructions for the Ministry of Agriculture in their work about meat coming to the Public Meat Inspections.

On County level, a close cooperation was established between the County Veterinary Officer, other County authorities (health and agriculture) and the Meat and Food Inspection Services in the region. This cooperative structure functioned well from August / September when the big sheep project was implemented.


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B. ACTION LEVELS, NATIONAL


Action levels for radioactive contamination of food were established in May 1986 to be :

 ^{131}I - 1000 Bq/kg
 ^{137}Cs - 300 Bq/kg

In June (20th), the action level for Cesium was changed to fit the EEC levels:


 $^{137}\text{Cs} + ^{134}\text{Cs}$ - 600 Bq/kg for most products
 $^{137}\text{Cs} + ^{134}\text{Cs}$ - 370 Bq/kg for milk and infant food

In November, the action level for reindeer and game animals was changed to :

 $^{137}\text{Cs} + ^{134}\text{Cs}$ - 6000 Bq/kg

C. ACTION LEVELS, FEED AND FOOD IMPORT

The same action levels have been used for food import as for products of national origin :

 $^{137}\text{Cs} + ^{134}\text{Cs}$ - 600 Bq/kg for most food
 $^{137}\text{Cs} + ^{134}\text{Cs}$ - 370 Bq/kg for milk and infant food

IV. INFORMATION SYSTEMS AND RESULTS.

As in many other countries, there has been a strong critique of the way the central authorities managed to give information to the public, the press and local authorities.

No information system was available to give professional information, and especially the first months the chaos and confusion was rather severe.

The Directorate of Health who was given the main responsibility both of coordination and information established a special telephone line for the public in late June, almost two months after the accident. Advices were all the time given about the consumption of food with different amounts of radioactive contamination.

Later the Ministry of Agriculture got into a more central position of information as the reindeer, sheep and cattle were more focused.

Other institutions also made great efforts to inform the public; National Institute of Radiation Hygiene and the Institute for Energy Technique, and not to forget the local health authorities and the local Meat and Food Inspections.

The main problem was that different "experts" all the time managed to give partially contradictory information on the same subject.

If a similar situation will come, it is evident that more professional people must have the main responsibility of the information, and that a coordination between different authorities and experts must take place immediately.

V. PLANNED FUTURE ACTIVITIES CONCERNING THE CURRENT
FALL-OUT FROM TSJERNOBYL.

The problems of radioactive contamination Norway will face in 1987 and the next years will most probably be centred around meat from reindeer, sheep/goats and partially cattle. Especially the reindeer are expected to represent a problem for several years, perhaps decades. Intensive analysing programmes will be implemented for these species. When the information collected from 1986 are discussed, new programs for different feeding programs for animals will be presented. It is expected that very few cattle and sheep will have to be discarded from consumption if the correct feeding measures are used.

For reindeer the situation is more unclear. Changing the main season of slaughtering from winter to early fall will surely reduce the problem especially in the northern parts of Norway. In Southern Norway it might also be necessary to include special feeding practices some time before slaughter.

For other products, a more extensive, but still nationwide analysing programme will be implemented. Milk and dairy products, fish from fresh water and meat from wild animals will be paid special attention, but all agriculture products will be analysed. Analysing plans will be set up in cooperation with the Ministry of Agriculture and the Directorate of Health.

Some more instruments will be purchased to fill the need for analysing different products.

VI. PLANS FOR THE FUTURE CONCERNING POSSIBLE OTHER
FALLOUTS OR SIMILAR SITUATIONS.

A special group working under the Ministry of Environment is working on plans on how to handle a situation of another radioactive fallout or similar situations.

The group is going to make plans for coordination between different Ministries and other authorities in case of a similar situation.

The plans are supposed to be presented early 1987. At present it is impossible to give any information about these plans.

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