

## Dissertation

Birgitta Åhman successfully defended her thesis «Radiocaesium in reindeer (*Rangifer tarandus tarandus*) after fallout from the Chernobyl accident» for the Dr. philos degree at the Swedish University of Agricultural Sciences, Uppsala, Sweden, on June 8, 1994.



Birgitta Åhman was born in 1953 in Uppsala and was educated at Uppsala University. She joined the Department of Clinical Nutrition, at the Swedish University of Agricultural Sciences, Uppsala, in 1977. Here she started research on mineral deficiency in reindeer in 1983 in collaboration with the Reindeer section at the Department of Animal Nutrition and Management. Since 1986 her research has been associated with radiocaesium contamination of reindeer after the Chernobyl accident. She has studied how radiocaesium levels in reindeer differ geographically and how they change with time. She has also studied effects of different counter measures which may reduce radiocaesium contamination in reindeer. The results of her research have been used continuously to help reindeer herders and authorities to deal with problems caused by radioactive fallout from Chernobyl.

The thesis is based on four papers:

- I. **Åhman, B. & Åhman, G.** 1994. Radiocaesium in Swedish reindeer after the Chernobyl fallout: seasonal variations and long-term decline. *Health Phys.* 66 (5): 503-512.
- II. **Åhman, B.** 1994. Body burden and distribution of  $^{137}\text{Cs}$  in reindeer. *Rangifer* 14 (1): 23-28.
- III. **Åhman, B., Forberg, S. & Åhman, G.** 1990. Zeolite and bentonite as caesium binders in reindeer feed. *Rangifer* Special Issue No. 3: 73-82.
- IV. **Åhman, B.** Effect of bentonite and ammonium-ferric(III)-hexacyanoferrate(II) (AFCF) on uptake and elimination of radiocaesium in reindeer (submitted).

*Abstract:* Fallout of radiocaesium,  $^{134}\text{Cs}$  and  $^{137}\text{Cs}$ , from the Chernobyl accident contaminated large areas of reindeer pasture in Sweden. High levels of

radiocaesium in reindeer severely affected reindeer meat production. In the present work, the transfer of radiocaesium from forage to reindeer has been studied in the field and in controlled experiments. In addition, the ability of caesium binding agents to reduce the transfer of radiocaesium from lichens to reindeer has been studied.

Muscle samples from reindeer were collected at slaughter in different parts of Sweden from 1986 to 1992. The activity concentrations of  $^{137}\text{Cs}$  in reindeer muscle were shown to correlate with ground deposition. Seasonal variation in the radiocaesium levels was demonstrated. A significant decline in activity concentrations of  $^{137}\text{Cs}$  in reindeer was observed from 1986 to 1992, corresponding to an effective ecological half-life of 3 to 4 years.

The gastro-intestinal absorption of radiocaesium in lichens was studied in reindeer calves fed contaminated lichens. Radiocaesium levels were measured in reindeer blood or directly on the animal with a portable gamma detector. The excretion of radiocaesium in faeces and urine was measured. The activity of  $^{137}\text{Cs}$  in the whole body and in muscle was measured at slaughter. About 60% of  $^{137}\text{Cs}$  in lichens seemed to be absorbed by the reindeer. The absorption was reduced by feeding the reindeer bentonite, zeolite (mordenite), or ammonium-ferric(III)-hexacyanoferrate(II) (AFCF). The most effective was AFCF ( $500 \text{ mg d}^{-1}$ ), which seemed to prevent radiocaesium absorption almost completely. The ratio between average activity concentration of  $^{137}\text{Cs}$  in the body and activity concentration of  $^{137}\text{Cs}$  in muscle was around 0.57. The biological half-life of radiocaesium was about 3 weeks in reindeer calves fed uncontaminated feed pellets. A supply of 25 g bentonite per day or 500 mg AFCF per day reduced the biological half-life by several days.