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# The co-expertise experience in Norway after the Chernobyl accident\*

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Yevgeniya Tomkiv<sup>1</sup>, Deborah Oughton<sup>1</sup>, Lavrans Skuterud<sup>2</sup>

#### Abstract

The 1986 Chernobyl accident severely impacted Norway, particularly South Sámi reindeer herders as their diet was heavily based on reindeer meat and wild products from their local environment. Specific countermeasures had to be adopted to allow for preservation of the Sámi lifestyle and culture without compromising their health and safety. This chapter details the impacts on reindeer herders including human and socio-economic consequences. It also describes how co-expertise developed as herders and scientists collaborated on countermeasures like clean feeding and live monitoring. Norway's experience highlights that managing nuclear disasters requires integrating local knowledge and involving affected communities in every decision.

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## Introduction

Among the countries outside the former Soviet Union, Norway has experienced the largest consequences of the radioactive fallout in the aftermath of the Chernobyl accident. The areas in Central and Southern Norway that suffered most from the fallout were areas where natural pastures are important for milk and meat production from sheep, cows, goats and reindeer (Liland and Skuterud, 2013). This resulted in significant and long-lasting contamination of foodstuffs above the permissible levels. In 1986, Norway had no operational

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<sup>1</sup> Faculty of Environmental Sciences and Natural Resource Management, Norwegian University of Life Sciences, Norway

<sup>2</sup> Orkland municipality, Norway

nuclear emergency plans and preparedness, and few resources to manage such an emergency. Thus, monitoring and surveys to assess the impact were delayed and authorities struggled to fill people's information needs especially related to food safety and health concerns (Liland and Skuterud, 2013).

With no pre-established central plan for the management of radioactive fallout, the authorities' responses were ad-hoc and improvised. However, some scientists were available, with relevant knowledge from studies on the remnants of atmospheric nuclear weapons testing in the 1960s that were still ongoing. Various stakeholders including authorities, experts, producers and citizens had to work together to develop management strategies. It would be an exaggeration to call this a formal "co-expertise process" with a plan and structure as outlined in this book, although some later meetings were specifically designed to follow such a process. Cooperation and involvement of stakeholders were deemed necessary at an early stage because of the overwhelming situation but were also rooted in a social democratic and egalitarian society where unions and organizations had defined roles, responsibilities and expectations. And where inhabitants have relatively short routes to someone involved in decision-making processes. The post-Chornobyl management in Norway therefore contrasts with countries where strategies were more top-down.

The Chornobyl fallout had considerable consequences for many sectors in Norway (Tveten et al., 1998), with mitigating actions and extensive monitoring lasting for decades after the fallout occurred. The practical consequences were most long-lasting for sheep farmers and reindeer herders. The control schemes and regulations in sheep and reindeer production lasted for 38 years, until 2025<sup>3</sup>, and some Sámi reindeer herders in the most contaminated areas are still advised to restrict their radionuclide intake. However, for cultural reasons the consequences have been largest for the Sámi reindeer herders, and this chapter will therefore focus on this situation.

## 1. Impacts on reindeer herding

### 1.1. *Who are the Sámi?*

The Sámi people are indigenous populations of Norway, Sweden, Finland and Russia, numbering in total some 80,000 — 100,000 persons — out of a total population of about 2 million in the area they cover. About 10-15% of the Sámi engage in reindeer husbandry, a traditional occupation tied closely to their culture and livelihood, primarily through reindeer meat production. Historically nomadic, many herders are now semi-nomadic, maintaining residences near both winter and summer grazing areas.

Despite being referred to as a single group, the Sámi consist of distinct groups with separate languages. In Norway, the Chornobyl fallout primarily affected the South Sámi, a population of around 2,000 (shared between Norway

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<sup>3</sup> [https://lovdata.no/artikkel/hva\\_er\\_nytt\\_fra\\_1\\_\\_januar\\_oversikt\\_over\\_de\\_viktigste\\_regelendringene/4964](https://lovdata.no/artikkel/hva_er_nytt_fra_1__januar_oversikt_over_de_viktigste_regelendringene/4964)

and Sweden), with most involved in reindeer herding. Approximately 350 South Sámi were directly impacted by the fallout in 1986 (Eikermann, 1991).

### **1.2. *Early stages of post-accidental management***

Reindeer herding has already been known as particularly vulnerable to radioactive contamination from the time of nuclear weapons testing, and a monitoring programme of Sámi reindeer herders in northern Norway has been ongoing since 1965. Based on this understanding, meetings were arranged between authorities and herders in the most affected areas in June 1986. The herders were engaged in vegetation sampling in the grazing areas and sacrificed reindeer during the summer for the purpose of sampling and testing for contamination levels and time-trends before the start of the slaughter season in autumn and winter. In July, radiocaesium levels (sum of  $^{134}\text{Cs}$  and  $^{137}\text{Cs}$ ) in reindeer reached up to 90,000 Bq/kg, which far exceeded the maximum permissible level of 600 Bq/kg for radiocaesium in basic foodstuffs. This prompted national concern and a ban on reindeer meat from central and southern Norway in autumn 1986 and winter 1986/87. Slaughtering was conducted as normal to avoid increases in sizes of herds, and related ecological consequences, but the carcasses were condemned and herders received financial compensation.

### **1.3. *The need for higher permissible levels***

As the 1986-87 winter and main reindeer slaughter season approached, it became clear that radiocaesium levels in reindeer meat would exceed the permissible 600 Bq/kg level even in northern Norway, which accounts for 70% of reindeer meat production. Given the very high contamination levels in central and southern Norway, and expected duration of the contamination problem based on experience from the 1960s (Figure 1), in November 1986, Norwegian health authorities chose to raise the permissible/intervention level for radiocaesium in marketed reindeer meat to 6,000 Bq/kg. One of the justifications for this decision was to avoid production for condemnation as well as to preserve Sámi lifestyle and culture (Directorate of Health and the Ministry of Agriculture, 1986). During winter 1986-87, radiocaesium levels in reindeer meat averaged 50,000 - 60,000 Bq/kg in central and southern Norway (Figure 1), peaking at 150,000 Bq/kg (Strand et al., 1992). Without raising the permissible level, 85% of national reindeer meat production would have been condemned. The increase was deemed acceptable due to low average consumption (0.5 kg/year) and minimal radiation exposure risk for the general population.

Since increasing the maximum permissible level in November 1986, the intention was always to lower it, as contamination in pastures declined. Due to the rapid decay of  $^{134}\text{Cs}$  and reduced contamination in subsequent years, the level was reduced to 3,000 Bq/kg in 1994.

### 1.4. Actions to protect Sámi reindeer herders

The Chernobyl fallout in Norway was not large enough to make external doses to either Sámi or the general population a major concern. The main challenge was dietary intake of radionuclides. The Sámi reindeer herders were especially vulnerable due to their traditional diet, which relied heavily on reindeer meat and other local wild foods. Their diet shifted seasonally, with reindeer meat consumed in winter and fish and berries in summer and autumn, while mushrooms played only a minor role.

After the Chernobyl accident in spring 1986, the herders' diet rapidly shifted from being among the healthiest to one of the most contaminated. Families avoided local fish and berries, opting instead for canned food during the summer of 1986. When all reindeer slaughtered in autumn 1986 and winter 1986-87 were condemned and the maximum permissible radiocaesium level in reindeer meat was raised to 6,000 Bq/kg, herders received meat from less contaminated areas in Northern Norway as a substitute.

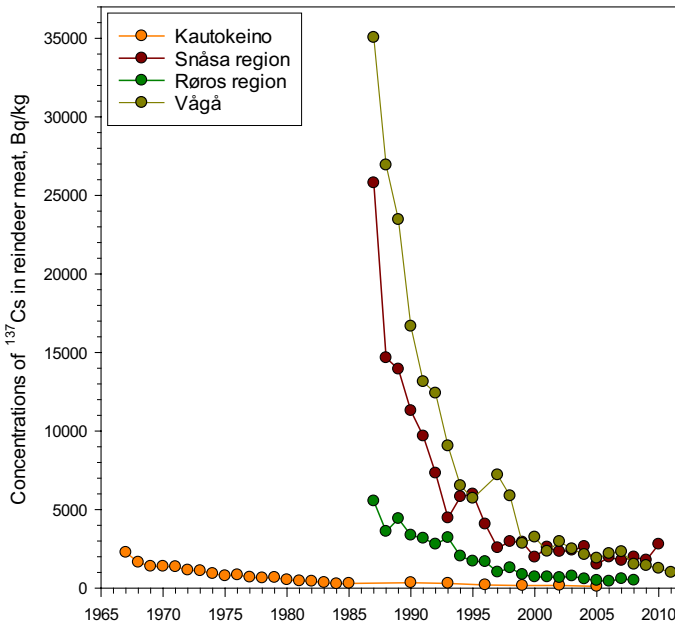


Figure 1. Concentrations of  $^{137}\text{Cs}$  in reindeer meat since the mid-1960s<sup>4</sup>.  
(A compilation of data from Skuterud et al. (2005),  
Skuterud and Thørring (2012) and Skuterud and Thørring (2015)).

In addition to offering substitutes for the most contaminated products, the health authorities also published and distributed dietary advice to reindeer herders and other members of the population who had significant intakes of wild

<sup>4</sup> Note that the graph does not include  $^{134}\text{Cs}$  after Chernobyl; e.g., in Vågå the sum of the two isotopes reached the average level of 51,000 Bq/kg.

products (Directorate of Health, 1987). The aim of the advice was to limit radio-caesium intake to a maximum of 400,000 Bq the first year after Chernobyl, and 80,000 Bq in subsequent years (corresponding to about 5mSv/y and 1 mSv/y, respectively), with half these amounts recommended for pregnant/nursing women and infants (<2 years old). The distributed leaflet included recommendations on how much could be consumed depending on the contamination level, and what cooking and preparation methods could reduce the contamination levels of the finished product (e.g., salting, discarding broth when cooking meat). However, it also highlighted the nutritional value of reindeer meat and fish and cautioned against excessive salt intake.

Given the herders' self-sufficiency lifestyle, financial constraints could lead some to consume contaminated meat. To address this, a compensation scheme was created, providing annual payments to families whose reindeer meat exceeded 600 Bq/kg, allowing them to buy alternative foods or offset extra efforts to obtain less contaminated meat. This scheme, involving various countermeasures, operated until 2007, after which it was revised to focus on direct expenses related to safer meat acquisition.

### 1.5. *The whole-body monitoring programme*

Whole-body monitoring of the reindeer herders in the most contaminated areas in central Norway was initiated in spring 1987. The monitoring aimed to track ingestion doses and trends, and to let herders assess the effectiveness of their efforts to reduce intake. Results have also supported health studies and fuelled interest in further health-related research.

Initially, portable monitoring equipment was used with mobile labs being deployed from 1996 (Figure 2). Monitoring typically occurred at selected sites near herders' winter residences, and travel expenses for the herders participating were reimbursed. Participation was voluntary, with invitations sent by post. Measurement sessions lasted 15-20 minutes, allowing for discussion with each participant (e.g., comparison with their previous monitoring results and the concrete effects of the efforts they make to limit the radiocaesium intake). Waiting rooms provided space for informal discussion with staff and other herders.



FIGURE 2. A reindeer herder (left) being monitored in the whole-body monitor chair in a mobile laboratory. © Geir Tønset, Adresseavisen.

### 1.6. Countermeasures and compensation in reindeer husbandry

In 1986, the only planned countermeasure in reindeer husbandry was condemning contaminated meat. However, high contamination levels and the expected duration of the problem led herders, universities, and authorities to start developing additional strategies. Condemnation was costly and unsatisfactory for producers, even with compensation (Strand et al., 1990; Brynildsen et al., 1996).

The increase of the maximum permissible level for radiocaesium in reindeer meat to 6,000 Bq/kg in November 1986 was the first step in reducing the impact. In winter, live monitoring procedures were introduced (Figure 3) to sort animals by contamination level; less contaminated reindeer could be slaughtered, while others underwent countermeasures like clean feeding (Brynildsen and Strand, 1994).



FIGURE 3. Monitoring of radiocaesium in reindeer before slaughter (photo: Torild A. Østmo).

Clean feeding is the preferred countermeasure to reduce radioactive contamination in the livestock. However, for the reindeer herds this measure is associated with specific challenges like fencing of sufficiently large areas and provision of clean feed. The herders were reimbursed their expenses for erecting fences and for the costs of clean feed (either bought or collected in less contaminated areas). The herders also received a compensation for each reindeer undergoing clean feeding, depending on the contamination level of the reindeer and how long they would have to be fed. An alternative to clean feeding in fenced areas was to let the herds graze in areas known to be less contaminated (which also entitled the herders to some compensation).

Changing the slaughter season was the most widely used countermeasure in reindeer herding. Traditionally, reindeer were slaughtered in winter when contamination from grazing lichens was highest. In autumn, contamination levels were only 1/4 to 1/3 of winter levels (Åhman and Åhman 1994), allowing many animals to be slaughtered without extra measures being required. However, autumn slaughter meant animals were not fully grown, so herders received compensation for lost weight gain. Many Sámi herders also disliked autumn slaughter because strong bonds still existed between reindeer does and their calves.

Caesium binders, successful in other livestock, saw limited use in reindeer. Some non-Sámi herders used salt-licks or rumen boli with ammonium ferric hexacyanoferrate (AFCF), but technical difficulties and early animal deaths discouraged widespread adoption of the boli method among Sámi herders (Hove et al., 1991).

## **2. Cultural, psychosocial and socioeconomic aspects**

Chernobyl fallout brought a range of human and socio-economic consequences for the Sámi reindeer herders. Although some of these consequences are specific to the Sámi's "Chernobyl history", others can serve as examples that resonate globally in terms of the human dimension. The South Sámi are a small minority, with their own language and culture, and even within Sámi society they are a minority. Before Chernobyl, Norwegian state policies aimed to modernize and consolidate Sámi herding, which, along with earlier assimilation efforts, created a tense relationship with authorities (Stephens, 1994). As a response, reindeer husbandry became even more central to Sámi identity and language use (Ms. Eira-Åhrén in Oughton et al., 2008; Paine, 1992).

### **2.1. Independence and self-determination**

The Chernobyl fallout created a dramatic change for the reindeer herders: from having a life-style where they were the masters with their local know-how and experience, they suddenly became dependent on decisions and recommendations by authorities and scientists. Especially in the first months when everything was new. Some were afraid that the government would use the Chernobyl fallout as an opportunity for governmental interference into the Sami herding practices (Stephens, 1994). Instead of having reindeer husbandry and the culture as a boundary against "cultural and material encroachment by the surrounding non-Sami world", the herders suddenly needed the know-how of the scientists (Paine, 1992, p. 269). However, they realized that they could not surrender to them; that would be to deliver themselves into "delegitimizing dependence and to be sold short culturally" (Paine, 1992). They needed to reassert their practices and customs and make their culture visible vis-à-vis the experts: "We must *do*. We must be active, not passive" (Paine, 1992, p. 268). The herders started searching for practical solutions, and e.g. started experimenting with clean feeding during winter 1986/87. This cultural background could also result in competition

between the knowledge of practitioners and that of “outside experts” (Paine, 1992). For example, the Sámi herders rejected the option to insert AFCE boli into the rumen of their reindeer on the grounds of animal cruelty (Oughton et al., 2008). By 1988, the reindeer herders had autonomy in terms of how things were done, and a memorandum was sent to the government ministry demanding that “individual solutions be accepted” (Paine, 1992).

## **2.2. *Raising the maximum permissible level***

Although the decision to raise the permissible level of radiocaesium in reindeer meat to 6,000 Bq/kg, “to save Sámi culture”, was supported by the reindeer herder association, it was received with considerable scepticism among several South Sámi.

Some viewed the decision as financially motivated, suspecting it was intended to reduce the government’s burden of compensating herders at market prices for animals that had to be slaughtered and condemned as unfit for human consumption (Paine, 1992). Others criticized the shifting risk management standards, questioning how a level of over 600 Bq/kg could suddenly be considered safe when it had previously been a health hazard, especially since Sweden maintained a much stricter permissible level of 300 Bq/kg. They also noted that pre-Chornobyl reindeer often exceeded even the stricter post-Chornobyl permissible level, raising doubts about the consistency and rationale of the regulations (Beach, 1990). Some felt it was more important to preserve public confidence in the quality of the meat (Stephens, 1994). Additionally, there was criticism that the larger and more politically influential North Sámi, who dominated the national herder association, were more interested in protecting their own market and easing consumer concerns than supporting the smaller South Sámi group and their cultural identity. It was argued that the North Sámi had pushed for the higher permissible level to avoid condemning their own meat, as reflected in the association’s statement that a lower permissible level would not ensure production clearance in Troms/Finmark (Paine, 1992; Stephens, 1994; Directorate of Health and Ministry of Agriculture, 1986). Opinions of some of the reindeer owners were that these differences in consequences for the North and South Sámi added to the stigmatization of their meat (Paine, 1992).

## **2.3. *Meat substitution as cultural threat***

In traditional Sámi culture, reindeer are slaughtered and handled with great respect and care. Every part of the animal — blood, organs, antlers, hooves — is used for meals or traditional handicrafts. Although most reindeer are now slaughtered in modern facilities, many families still maintain traditional practices when slaughtering for domestic use.

The initial substitution of reindeer meat in the South Sámi areas with less contaminated meat from the north provided the herders with meat, but not with blood, organs or materials needed for traditional handicraft. This loss had strong cultural implications, as traditional foods and clothing made from

reindeer are deeply tied to Sámi identity (Beach, 1990). Furthermore, as proud producers, the meat offered was not really appreciated: “It doesn’t taste right; North Sámi don’t know how to care for their reindeer as we do. This food does not nourish our bodies” (Stephens, 1994). It also disrupted the tradition of taking provision from one’s herd, serving it to guests and sending dried meat to children, who studied far away, to keep the connection (Paine, 1992). Another consequence was that herding parents feared that their children would miss the opportunity to learn the customs (Beach, 1990).

#### **2.4. *Dietary advice and risk management***

The permissible level for radiocaesium in reindeer meat was increased because the general population consumed little of it. Authorities issued dietary advice to herders and offered clean meat and compensation for reindeer exceeding 600 Bq/kg. According to Paine (1992), herders in the most affected areas followed these dietary restrictions for 16-18 months after the fallout. By 1987-88, encouraged by the success of clean feeding, they began returning to their traditional Sámi diet. However, even by 1996, one third of the population still ate less reindeer meat due to the concerns about the Chernobyl fallout (Mehli et al., 2000).

In Sweden, confusion over permissible levels led many herders to set their own limits for meat they would eat, based on consensus, expert advice, media, and personal comfort (Beach, 1990). Families with small children were especially cautious, preferring meat with the lowest contamination (Beach, 1990). This likely occurred in Norway as well. Beach (1990) also noted that most herders did not keep records of contamination values or meat quantities consumed, despite knowing this was important; many simply used the marketability limit as their personal safety threshold.

#### **2.5. *Clean feeding***

As mentioned before, herders began experimenting with clean feeding even before it was officially accepted by the government (Paine, 1992). According to Paine (1992), some scientists warned against this practice due to concerns about animal welfare and potential losses of 10-20% of the animals. Clean feeding involved fencing small groups of reindeer selected for slaughter, gathering clean lichen from less contaminated areas, and purchasing special feed. This required significant labour, including building enclosures, and represented a new husbandry routine that reduced time for managing the main herd.

Clean feeding can only be done in winter to minimize disease risk, with restrictions on animal numbers per area and limited use of enclosures before they must be moved. Reindeer accustomed to a lichen dominated winter diet must gradually adapt to a more nutrient rich diet needed for longer periods of clean feeding. A special feed was developed by scientists, while the lichen needed in the transition feeding period had to be collected. The herder families have been collecting clean lichens in areas 300-500 km south of their ranges every autumn, creating a new tradition for herder families.

While clean feeding raised animal welfare concerns, some herders appreciated how it revived older, more intensive herding traditions and fostered closer relationships with their animals. However, they also found that parts of the clean-fed reindeer, such as hides and intestines, were of poor quality and unsuitable for traditional food and handicrafts (Oughton et al., 2008).

## **2.6. *Socioeconomic consequences***

The initial period, when all reindeer meat was condemned, put significant strain on the herders. There was deep concern about long-term economic prospects and uncertainty over whether state compensation would continue if it took decades for contamination levels to drop (Stephens, 1994). Many herders felt their livelihoods were threatened, describing themselves as “wards of the state” with meaningless work, as they produced “radioactive meat” (Beach, 1990; Oughton et al., 2008).

Compensation programs covered direct economic losses but did not account for extra labour required by the countermeasures. This led to complaints about inadequate compensation, such as the NOK 2,000 per person per year for “alternative diet”, which was less than what households dependent on reindeer meat needed — and lower than the Swedish equivalent (Oughton et al., 2008). Clean feeding required additional work and costs for fencing, lichen collection, and animal care, while compensation rates often did not match the actual expenses, especially for shorter feeding periods involving fewer animals.

Other socioeconomic impacts included the inability to live off local resources like berries, mushrooms, and fish, the need to alter family diets, and the loss of materials for traditional handicrafts. For the herders, these challenges affected not just their economy, but their entire way of life and cultural identity: “not just a matter of economics, but of who we are, how we live, how we are connected to our deer and each other” (Stephens, 1994).

## **2.7. *Coping with Chernobyl — 30 years after***

In spring 2016, a study among South Sámi reindeer herders in Snåsa explored their experiences with radiation risk after Chernobyl and its impact on quality of life, culture, and daily routines, as well as their current concerns about radioactive contamination (Svenningsen, 2016). The findings revealed that herders generally had low levels of concern about radioactivity, but all reported that Chernobyl had caused significant psychological stress and extra work in the past. Initial fears included health consequences, the survival of reindeer husbandry, and the future of South Sámi culture, compounded by a lack of information and mistrust of authorities. One herder described the fallout as “an invisible enemy” and another expressed worries about cancer and the next generation. Nevertheless, community support and positive attitudes towards whole-body monitoring were highlighted.

Over time, the herders moved from a feeling of helplessness to a state of being better able to cope, gaining knowledge and control through involvement in the application of countermeasures and whole-body monitoring, with economic compensation helping to preserve reindeer husbandry. Social support from both local communities and national authorities played a crucial role in reducing stress. However, concerns about the loss of Sámi culture and traditions persist, particularly as countermeasures restrict the traditional use of reindeer materials in handicrafts, impacting future generations. The whole-body monitoring program was viewed positively, especially due to its voluntary nature.

### **3. Stakeholder engagement and co-expertise process**

Early stakeholder engagement in the early phase after the Chernobyl accident extended to fallout monitoring, where reindeer herders were enlisted to collect samples for deposition mapping, as there was no nationwide system in 1986. Collaboration among authorities, unions, and the food industry established national working groups focused on research, development, and practical implementation of countermeasures. The authorities' principal aim to limit condemnation of food products led to intensive research and collaboration among national institutes and agencies. This unified approach produced a range of measures, such as live monitoring of animals, clean feeding schemes, and the use of caesium binders, which were developed through a combination of laboratory experiments and practical field testing. Scientists worked directly with farmers and reindeer herders, whose feedback was essential for successful real-world implementation. Over time, local adaptation of centrally developed routines occurred, reflecting local expertise and evolving practices.

Following the overwhelming initial period after the fallout occurred, the wide involvement of various stakeholders gradually decreased as the overall contamination challenges were solved and mitigation strategies decided upon. For some years, stakeholder engagement in Norway primarily centred on implementing countermeasures and negotiating the associated economic compensation (Skuterud, 2006). However, the long-lasting contamination situation revealed a constant need for information and involvement. Not only due to the turnover of persons affected and involved, but also because countermeasure regimes may need revision. One such example from Norway was the alterations of the permissible level of radiocaesium in reindeer meat. The main communication channel between national authorities and the affected population was through official written hearings and annual negotiations with unions. In retrospect, it might be argued that more engagement, with meeting points like in a planned co-expertise process, could have been an important supplement to the more formal processes. The feedback from regular meetings with reindeer herders during the whole-body monitoring campaigns showed that there were communication needs that were not properly taken care of in the formal processes.

In 2008, Norway participated in the EURANOS project, which aimed at improving post-accident rehabilitation strategies (Dubreuil et al., 2010). The EURANOS project promoted greater dialogue and shared responsibility among stakeholders using the IDPA co-expertise method (Lochard et al., 2023). In Norway, two stakeholder meetings were held in spring 2008, one in Steinkjer — a Chernobyl affected region, and one in Oslo. These meetings brought together representatives from local communities, agriculture, reindeer herding, fisheries, industry, outdoor groups, and authorities (Bay-Larsen et al., 2009; Liland et al., 2010; Oughton et al., 2008).

In accordance with the co-expertise process, at the first meeting, participants identified five key challenges for further discussion during the follow-up seminar in Oslo: lowering of the intervention level in reindeer meat; local organisation of emergency preparedness; psychosocial effects; information needs and strategies; and challenges for other socio-economic sectors than agriculture and reindeer herding (Bay-Larsen et al., 2009; Liland et al., 2010; Oughton et al., 2008). The Oslo meeting achieved an even wider participation with more representatives from national authorities and other economic sectors. Participants were encouraged to formulate recommendations for the radiation protection authorities.

A possible further lowering of the maximum permissible level in reindeer meat from 3,000 Bq/kg to 1,500 or even 600 Bq/kg had been considered by national authorities, but had not previously been discussed with other stakeholders. In 1994, the decision to reduce the maximum permissible level from 6,000 to 3,000 Bq/kg was taken without a wide stakeholder involvement. During the meetings in 2008 the reindeer herder representatives voiced several concerns about potential changes to the maximum permissible levels. They worried that renewed focus on radioactivity in reindeer meat could weaken consumer trust in the domestic market. Additionally, they were apprehensive about the increased controls and actions that stricter permissible levels would necessitate, arguing that such changes would effectively mean starting over. As one participant explained, “I don’t know where to find the motivation to go back twenty years; start clean-feeding, build fences and all the practical consequences that comes with it. This also has to be considered... A reduction in the permissible level would practically be comparable to a new Chernobyl” (Bay-Larsen et al., 2009, p. 33).

There were also concerns about the health messaging such a decision would send, with one herder noting, “One has also to think about health; which signals are given by lowering the permissible levels? People start thinking; has this been dangerous to us?” (Bay-Larsen et al., 2009, p. 34). The final recommendations emphasized that any assessment of changes to the permissible level must include psycho-social and cultural consequences, concluding that “at the present time, the benefits of such a reduction appear to be small compared to the disadvantages” (Oughton et al., 2008). The maximum permissible level of radiocaesium in reindeer meat in Norway remains at 3,000 kBq/kg.

## 4. Lessons learned for the co-expertise process

Post-accident management of the consequences of the Chernobyl fallout has been a challenging task in Norway. Although Norway had no preparedness procedures in place at the time of the accident, and lacked the necessary resources for monitoring, nevertheless authorities quickly enlisted the help of a wide range of stakeholders including farmers and reindeer herders. This created a starting point for the various co-expertise processes that developed and contributed to a number of lessons that are now built into the Norwegian nuclear emergency preparedness:

- I. Involving various stakeholders in the development of practical countermeasures is crucial for the success of their implementation. A stakeholder in this context is anyone affected by the countermeasure: the animal owner, the slaughterhouse, the dairy, the local authority responsible for implementing the countermeasure, and the national authority carrying out inspections.
- II. Developing measures that leave the affected inhabitants with a set of options, provides them some influence and control over their own situation, and independence. This is particularly important where there is a situation with a degree of scepticism between stakeholders and the authorities. Giving directives with no room for individual freedom of choice, is likely to cause frustration. Local knowledge will develop quickly, and individuals will make improvements to the centrally developed directives and guidelines.
- III. Carrying out live monitoring is an effective measure to reduce condemnation of meat, and is widely accepted and appreciated by the stakeholders. Animal owners find production of meat for condemnation highly unsatisfactory when the reason is something beyond their influence, and money can only partly compensate for this. Furthermore, condemnation of food because of radioactivity can be considered especially unacceptable since permissible levels do not represent dangerous levels (as demonstrated when the authorities changed the maximum permissible levels). Live monitoring combined with other countermeasures is in most cases also considerably less expensive than condemnation.
- IV. Developing and maintaining competence in post-accident management at the national level is necessary to build confidence and trust with those affected. Although the population wants to participate in the development of strategies and influence decisions, they expect authorities and experts to know definite answers to the problems. Much experimenting and testing creates a feeling of being “guinea pigs” among the population.
- V. Engagement of stakeholders must consider potential for scepticism towards national authorities and experts. There may be general inherent scepticism among some rural populations towards the practical value of any regulation and advice coming from national authorities and experts. It’s also important to know and recognise the historical context that could contribute to this scepticism.

- VI. Recognising that co-expertise is not a consensus exercise. Involving stakeholders in discussions on countermeasures and rehabilitation strategies does not imply that a common understanding of all decisions must or can be reached. Individuals from the same stakeholder group may have varying views, political interests as well as personal costs and these may change over time.

## Conclusions

In conclusion, the Chernobyl accident had significant impacts on the minority Sámi populations. These effects extended beyond radiological and economic consequences, and include important social and cultural factors. To some extent, the actions taken by Norwegian authorities after the accident considered these aspects, since preservation of reindeer herder culture was cited as justification for the raising of permissible level and other countermeasures. Although it appears that the authorities' motivations and reasons for that increase are now largely appreciated<sup>5</sup>, it is interesting that at the time there was a certain degree of scepticism that this was driven by purely economic concerns. Whilst health and economic concerns dominated immediately after the accident, the long-term impacts on culture and heritage due to changes in traditional practice were the main concern of the Sámi.

Overall, Norway's response to the Chernobyl fallout highlights the importance of stakeholder involvement at every stage — from research and fieldwork to compensation negotiations and ongoing policy revision — ensuring that local knowledge and practical experience are integrated into national strategies.

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<sup>5</sup> Representatives of reindeer herders at NRPA's 30<sup>th</sup> anniversary seminar "From Chernobyl and Fukushima to tomorrows nuclear emergency preparedness", 18-19 April 2016.

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