

## PERCEPTIONS OF RISK, DILEMMAS OF POLICY: NUCLEAR FALLOUT IN SWEDISH LAPLAND

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**Abstract**—This paper concerns risk perceptions of Swedish Saami reindeer herders in conjunction with the Chernobyl nuclear disaster. Focus is also placed upon their experiences of damage and their efforts to deal with these problems. Data relating to these social aspects of the Chernobyl event come from interviews with members of Saami herding families. The initial governmental policy of establishing a simple contamination limit for the marketability of all foodstuffs was beset with shortcomings. I propose that all contaminated foods should be labeled with contamination specifications along a fully graded scale. In addition, there should be consumer education and recommendations for the entire population, not just one segment. An absolutely necessary step in the construction of valid policies is the health calibration of low-dose radiation. Without such knowledge, any marketability limit is suspect. With such knowledge, policy can be firmly based on human health.

**Key words**—Chernobyl, Saami, reindeer meat, cesium

### INTRODUCTION

The Chernobyl nuclear disaster of April 1986 led to the deposition of radioactive fallout over Sweden in highly variable concentrations depending upon prevailing winds and rains. The lichens of Lapland, basic winter food for the thousands of semi-domesticated reindeer (*Rangifer tarandus*) herded by the Saami (Lapps), absorb like sponges all manner of dissolved materials including fallout, passing high levels of cesium-134 and -137 onto the reindeer and further to humans. Countless freshwater lakes were also contaminated, rendering vast quantities of inland fish unfit for human consumption. Within days the subsistence food sources of the Saami herders and many other northern inhabitants was gravely contaminated, threatening human health. Moreover, for the herders, this blow struck also at their main source of income, the reindeer-meat market.

The impact of the Chernobyl nuclear disaster has revealed itself gradually. The degree of reindeer-meat contamination was not fully appreciated until the autumn as the reindeer began to make the transition from their so-called 'green' diet to a lichen diet. As test results were reviewed of the Cs-137 concentrations in reindeer from the autumn slaughters of 1986, the reindeer industry in the whole of Swedish Lapland came, by geographical increments, to be subjected to careful controls. Reindeer meat with Cs-137 concentrations of 300 becquerels (Bq)/kg or higher was declared unfit for human consumption and thrown into pits or ground into fodder for animals on fur farms. To save herders from economic ruin and to buttress the Saami culture—so locally dependent upon the continuation of reindeer herding—the Swedish state instituted wide-ranging compensation policies in a decision taken on 18 June, 1986 [1].

The cesium concentrations of lichen pastures, reindeer, and humans have all been painstakingly monitored. Much research has been devoted to decontaminating living reindeer and removing cesium

from meat during the cooking process. Yet, at the same time, no one can provide a credible account of the risks involved with the consumption of various quantities of reindeer meat of various cesium concentrations. Expert statements straddle the spectrum from claiming there is virtually nothing to fear with few precautions necessary, to predicting hundreds of additional cancer deaths. Seemingly a consensus exists that a yearly intake of 2 mSv is twice as dangerous as that of 1 mSv, but the risks to health and the cost of additional deaths is unknown for either dosage; the assumption is that this risk is scale neutral [2, p. 8]. In short, while there is a questionable attempt to *scale* the risks from contamination, there is no credible *calibration* to risk.

The irony of a small ethnic minority, with a lifestyle close to nature, becoming the victim of nuclear power can hardly go unnoticed. News of the threatened destruction of Saami society and culture became sensationalized in the media and a hot issue in nuclear power debates. While nuclear power enthusiasts point out that the damage to human health of such low-dose radiation cannot be demonstrated, others point out that the long-term studies needed to establish the basis for controlled health comparison has often been hampered by the nuclear power block. Lack of conclusive proof of health damage should not support the conclusion that they are nonexistent. Doomsday prophesies for the Saami have vied with contractive rhetoric that the health risk imposed by Chernobyl is equivalent to driving a car 480 miles or living 3 hr for a 60-yr-old man—hardly verifiable attempts at calibration [2, p. 17]. Needless to say, the attitudes reflected and generated in mass media impinge upon the herders' own recognition of risk.

Suddenly reindeer herders are no longer the consu-mate experts of the status of their own reindeer. A machine in a far-off laboratory scans a sample of reindeer meat to determine the marketability of a reindeer carcass. Of course herders may still consume

their own reindeer regardless of the degree of contamination. For the average consumer, only able to purchase reindeer meat somewhere within the governmental limit on marketability, the decision between eating a little reindeer meat or not at all is one between trusting authorities despite the confusion of expert statements, and of taking no chance whatsoever. The average Swede consumed about 200 g of reindeer meat per year before the Chernobyl disaster [3]. The omission of reindeer meat from this diet is to him hardly significant, and he will very likely avoid purchasing any at the slightest hint of risk.

The reindeer herder still today, in 1989, faces a far more complex situation: he has access to meat of many different levels of contamination, above as well as below the limit. For him, reindeer meat is a staple, not just a rare delicacy. Should a herder refrain from eating the meat from his own herd, he will likely have to substitute this loss with other foods bought for cash. As a result, he may come to feel himself a ward of the state, subsidized by state compensation payments, one whose work is meaningless.

A strong cultural issue is also involved, since traditional foods prepared from the reindeer are significant to Saami identity. The Saami who cannot slaughter and prepare food from his own reindeer according to his own special customs feels himself culturally impoverished. Herding parents fear that their children will miss the opportunity to learn these customs, and that young Saami recruits to the herding livelihood will not be as numerous as would otherwise have been the case.

On a more strategic and political level, those interested in a hasty return to previous conditions and a remedy for the average consumer's post-Chernobyl purchasing resistance to reindeer meat, appear to be best served by down-playing risks. Those interested in compensation payments might consider gains to be made by playing up the risks and damages. These are but some of the many points influencing the practical application of cesium risk. For the Saami, the cesium health risk is inevitably weighed against both economic and cultural risks.

The primary focus of this paper will be on the various forms of risk consequent to the Chernobyl nuclear disaster recognized by individuals in Swedish Saami reindeer-herding families and their actual experience of damages. Few studies have concerned the social aspects of the Chernobyl disaster. Such a focus reveals a myriad of unforeseen consequences, not only from the contamination itself, but also from the compensatory policies it has occasioned. Attention to these socio-cultural issues will provide useful insights for dealing with general environmental pollution, especially that involving a population composed of ethnic groups, with different modes of livelihood, with differential access to foodstuffs, and different dietary customs. Therefore, the problems facing the Saami are not only their own.

The data presented here stem from interviews made in the field with members of herding families as part of a long-term study financed by the Bank of Sweden Tercentenary Foundation and administered under the Center for Arctic Cultural Research at Umeå University, Sweden. Both male and female research

team members interviewed people in two main regions, one hard hit by nuclear fallout (Vilhelmina), and one relatively lightly impacted (Jokkmokk). Care was taken to interview herders and family members of different sexes and ages as well as to include families with young children. Nonherding Saami, Saami handicraftsmen, and non-Saami fishermen were also interviewed in Vilhelmina and Jokkmokk in summer 1987, autumn 1987, winter 1987/88, and interviews are continuing.

Sample selection among the highly mobile fishing, hunting and reindeer-herding families of Lapland must be opportunistic. Besides the difficulties in reaching interview subjects, all those contacted are not necessarily willing to be interviewed, so that in order to insure an interview sample which can fulfill our needs both as to number and variety, we have kept selection directed but open. We have welcomed discussion with anyone engaged wholly or partially in a subsistence livelihood in the wider area, but we have also prioritized our efforts to contact herding families in the Vilhelmina Södra Sameby of the Vilhelmina region and in the Tuorpon Sameby of the Jokkmokk region. Together these two samebys encompass about 50 families. To date we have interviewed approx. 90 different people at length, sometimes individually and sometimes together in a large family context. A number of these people have since become key informants whom we have interviewed repeatedly. Altogether close to 120 interviews have been made, each lasting on the average 1 hr but often going on for 2 hr or more.

Most of the herding families in the two above mentioned samebys have been reached through at least one family member. Seven individuals for whom fishing is the dominant source of livelihood—and such people are now rare in these localities—have been interviewed. The directors of three reindeer slaughter companies serving the areas of study have been interviewed regularly. Moreover, representatives from the Swedish National Institute of Radiation Protection (SSI) and the National Food Administration (SLV) have been consulted as have researchers at departments concerned with reindeer breeding at the Swedish Agricultural School in Uppsala. District veterinarians engaged in reindeer slaughter inspections and becquerel testing have been interviewed frequently. Representatives of the major Swedish Saami Political organizations have been consulted.

During the interview period many changes have occurred and still are occurring in state policy, most prominently the raising of the cesium becquerel concentration limit for reindeer-meat marketability [4, p. 57; 5]. Of course, many changes also occurred in the actual cesium status of the reindeer, largely due to the normal seasonal shifts in grazing as well as to the use of artificial fodder. Such changes bring about revisions in the perceived time frame of the cesium problem and are directly pertinent to assessments of risk. Regional dissimilarities in lichen contamination (see Fig. 1) have been compounded with marked temporal differences in reindeer-meat contamination [6], leading to considerable variation in impact and compensation for our informants during the period of investigation.

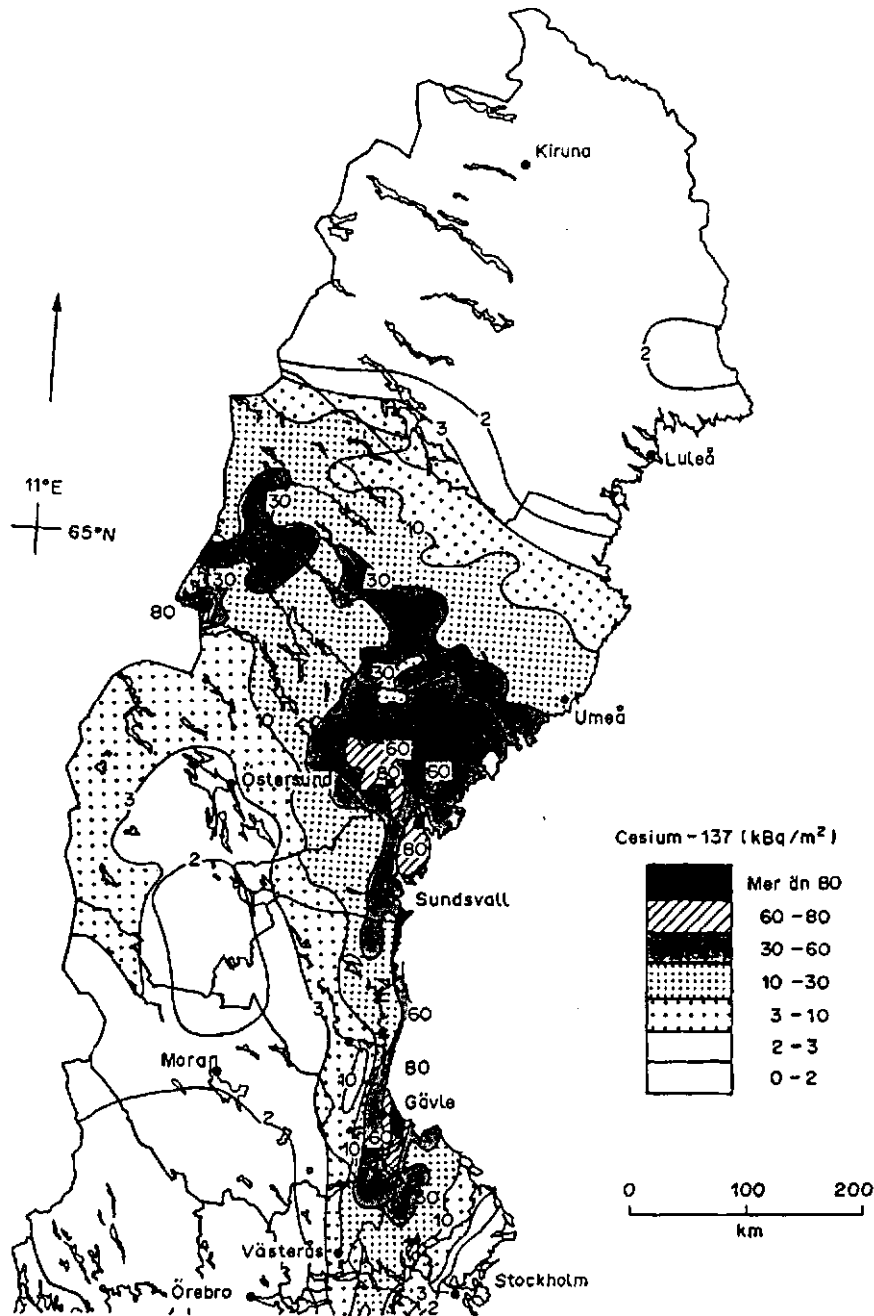


Fig. 1. Ground cover distribution of Cs-137 kBq/m<sup>2</sup> in northern Sweden, based on Sveriges Geologiska AB measurements. Source: Ref. [6, p. 13].

**BACKGROUND**

The reindeer-herding area of Sweden is currently divided into 51 grazing districts called samebys. Membership in these samebys is tightly controlled both by regulations in the Swedish Reindeer Herding Act of 1971 and by the existing members themselves. Membership embraces, besides the right to graze one's reindeer on sameby territory, certain hunting and fishing rights. The right to herd reindeer in Sweden is almost exclusively reserved for those of Saami heritage. A sameby, therefore, defines both a territorial and a social unit. While reindeer are owned

individually, the work of herding in the field is collectivized to different degrees in the different samebys. Each sameby has a communal treasury, but the Swedish State confines the economic activities of the samebys to reindeer herding alone. To avoid overgrazing, the state imposes a so-called rational reindeer limit on each sameby based upon its grazing capacity [7, 8, pp. 44-45].

Reindeer herding is centrally administered under the National Board of Agriculture, to which is tied an advisory body with Saami representation. Regionally, herding questions are handled under three

provincial agriculture committees. The samebys all belong to the Swedish Saami Parliamentary Organization (SSR), which is the main political body of Saami in Sweden. In Sweden today, there are only about 900 active reindeer herders, with family members bringing the total of those directly dependent upon herding to approx. 2500 people. The summer reindeer stock in Sweden is estimated at about 285,000 head [9, p. 19]. Reindeer herding is not of major economic importance to the Swedish State. It is tolerated under normal circumstances and has been supported during the Chernobyl crisis largely as a concession to the cultural viability of the Saami minority. The reindeer industry is hard pressed even in the best of times to assert itself against the heavy industrial exploitation of the grazing lands [10].

In the early 1980s, the reindeer-slaughter company, Sameprodukter, servicing a major part of the reindeer-herding area, was reorganized and taken over predominately by Saami. SSR, the Saami political organization, bought controlling interest in the company. Although the restructured firm, Nya Sameprodukter AB, is one of the largest and most modern slaughter facilities active in the Jokkmokk area, it is not the only one. There are a number of other, smaller slaughter companies competing for the purchase of reindeer from the herders. The Vilhelmina area is almost entirely serviced by the large and fully modern slaughter facility of Lappandsvilt. The different slaughter companies are capable of meeting different hygienic standards, and these differences in turn determine the extent to which the meat can be exported.

Previous to the Chernobyl disaster, it was enough that meat slated for sale within the province be subjected to so-called 'bureau inspection'. For meat to be sold elsewhere in Sweden it would have to be 'control inspected'. Both inspections would be performed by a veterinarian, but control inspection requires that it be performed at a slaughter facility meeting higher standards. Still higher standards are generally required if the meat is to be exported to foreign countries.

The Swedish National Institute of Radiation Protection (SSI) is responsible for setting the safety standards for the nuclear power industry, and it is also SSI which announced the yearly becquerel dosages per person considered acceptable following upon the Chernobyl disaster. However, it is another department, the National Food Administration (SLV), which has had the responsibility of converting the dosages set by SSI into limits applied to specific foods. While SSI determines what risk level of nuclear contamination is biologically 'acceptable', SLV determines what marketability limits to set and how they are to be applied [11].

Fallout from the Chernobyl disaster reached even the populous areas of central and southern Sweden. Cesium-137, with its long half life of approx. 30 yr, has become the abiding problem, but in the early days following the disaster, iodine-131, with a half-life of only 8 days, also provided cause for worry. The release of the farmers' cows from the barn onto summer pastures was delayed in order for the iodine-131 risk to abate [2, p. 26; 11, p. 124]. SSI followed international practice and the recommendation of

the International Council for Radiation Protection (ICRP) with the ruling that (for the first year at least) no one should consume more than a yearly fallout dosage of 1 mSV. SLV set a single limit of 300 Bq/kg for the marketability of all foodstuffs. This figure was designed with respect to the needs and vulnerability of newborn children, and was obtained by dividing the maximum contamination dose recommended per newborn per year (about one-fifth the maximum dosage acceptable for adults) by the average consumption of basic foodstuffs (notably milk) per newborn child per year [4,11, p. 187; 12]. The alternatives of setting variable marketability limits for different foodstuffs or of marking the becquerel content of different foods and issuing consumer recommendations separately tailored to adults and to newborns were considered both impractical and unnecessary with respect to the insignificantly low fallout dosages most Swedes would acquire from eating normally. Spot checks had been made of shoppers' food purchases, and dosages calculated. Almost all foods contained low Cs-137 counts. If that which was considered of possible risk to newborns was not even to appear on the market, less vulnerable adults would be all the more secure without the necessity for variable policies or dietary constraints. In fact, any food which could not be consumed by the newborn at the same rate as milk without exceeding the newborn's becquerel risk limit was not to be available on the market. Since almost all foods would clear this limit without difficulty, the problem occasioned by this simple marketability limit for the business of food production and sale would be acceptable. At the outset, however, the policy makers realized that reindeer meat was a glaring exception, and that the simple-limit policy would hit the Saami very hard (Leif Moberg, research secretariat SSI, personal communication).

For the average Swede, reindeer-meat consumption is far below the average yearly milk consumption of newborns. Reindeer meat is not a basic food for newborn children. Yet the results of the policy would have far-reaching effects for the reindeer industry. Throughout Sweden, reindeer meat was to show values far above the marketability limit set by SLV. Not only were the northern regions hard hit by fallout, but the reindeer lichen forage, without real root systems and without a seasonal cycle of withering and regeneration, retain all of the fallout and other substances they accumulate from the atmosphere far longer than do vascular plants. In effect, the marketability limit derived on the basis of the average Swedish newborn's milk-drinking habits and low becquerel tolerance came to disqualify hundreds of thousands of kilograms of reindeer meat from sale on the market [4, p. 59].

Since the risks of low-dose contamination are so little known, it can be argued that the limit calculated on the basis of the milk consumption of newborn children, overly strict though it may seem when applied to reindeer meat, might nonetheless be in the interests of health and even save lives. However, herders sending frozen samples of meat from reindeer slaughtered *before* Chernobyl to the contamination laboratory were shocked to learn that this meat, too, contained higher cesium levels than allowed on the

market. Actually, to the scientists who had monitored the nuclear contamination of the reindeer from the 1960s following upon atmospheric atomic bomb tests in the Soviet union, these results were hardly surprising [11, p. 188; 13, p. 54]. In the mid 1960s, Swedish reindeer showed values of 3000 Bq/kg [14], 10 times the limit for marketability applied in 1986. If, the Saami ask, the limit of 300 Bq/kg really is a good one even with respect to the consumption of reindeer meat, why had such a limit not been imposed before? It appears either that the health of the herders (the main consumers of reindeer meat) was ignored in the past, or else that thousands of perfectly edible reindeer have been destroyed following Chernobyl as a sacrifice measure to the milk and dietary habits of newborns.

Some important questions of principle can be extracted from the above situation. Should the safety recommendations applicable to the most vulnerable part of the population (newborns) based upon their special dietary habits come to dominate regulations for the entire population? Through such a policy, the population as a whole, less at risk, came to enjoy a considerable margin of safety, especially with respect to reindeer meat; but should this extra margin of safety be tolerated at any cost?

Evidently not, for the policy did not last long. In May 1987, with the announcement of new marketability limits for reindeer meat, wild game, and inland fish (1500 Bq/kg), SLV adopted for the first time the policy of fixing different limits on different foodstuffs [5, p. 2; 15]. Obviously, at least the monetary costs of compensating the herders for their confiscated meat had become too high for the government to tolerate any longer. By raising the limit on reindeer meat 5 times over, most of the herding areas came to be categorized as safe. Meat marketed after the change of limit could have 5 times the cesium content of meat destroyed the previous years.

#### RISKS AND FEARS

A common misconception is that the marketability contamination limit, defining the degree of risk considered acceptable by the authorities, constitutes a risk threshold. Since meat with a value of 301 Bq/kg was confiscated ('junked'), but meat with a value of 299 Bq/kg was considered acceptable, it follows that many herders attributed major significance to crossing this limit. When, suddenly, the new limit for reindeer meat was fixed at 1500 Bq/kg in May of 1987, most herders understandably viewed this as a move to reduce compensation payments. Many conceived of 300 Bq/kg as the 'real' health threshold. Whether the old limit was conceived of as a threshold of major risk significance or not, herders often and correctly remarked that a piece of meat is not any less dangerous just because SLV changes its marketability limit.

SLV has argued that the change in limit will eventually prove beneficial to the herders, as it will put more reindeer meat on the market [16, 17]. This justification, however, is based on the premise that the observed 40% of reduced reindeer-meat sales reported by the slaughterhouses stemmed mainly from lack of supply rather than from purchasing

resistance. If purchasing resistance were a major cause of reduced sales, the raised limit might put more meat on the market but even less in people's mouths. Fear of reindeer meat might rise [12, 18].

SLV has pointed out that the average Swede eats so little reindeer meat that, even if the risk involved with eating meat of 1500 Bq/kg is 5 times greater than that involved with eating the same amount of meat at 300 Bq/kg, it is so insignificant as to keep the average consumer well under the international yearly recommended dosage [19]. However, although the average Swede eats far less reindeer meat than a newborn child drinks milk, the average member of a Saami herding family eats far more. For the reindeer herder, reindeer meat is a basic food.

SLV sought to meet the obvious criticism for having established one health limit for the basic foods of the Swedish majority and another for the basic foods of the Saami minority by issuing a pamphlet of dietary recommendations [5] to each herding family. In it, those with a high consumption of reindeer meat were advised to keep records of the quantity and contamination level of all the reindeer meat they ate, the dosage being a product of the two. As long as the yearly recommended dosage was not exceeded, the pamphlet did not discourage the consumption of meat with values under 10,000 Bq/kg. Yet, at the same time, expert statements claimed the risks from low-dose radiation to be directly proportional to exposure, whether it be for an instant or over the years. The analogy of driving a car was invoked; the more one drives, the greater the danger of accident. (Note that this analogy should be broadened to include the risk to fellow 'passengers' so as to encompass the possible risk of genetic disorder to the offspring even if the 'driver' appears to survive the 'traffic' unscathed.) Some herders wonder: If it is not the becquerel value itself but the product of becquerel value times quantity consumed which is important, why should the tally for one year be significant rather than the compounded tally of Bq/kg times kg over a lifetime?

Obviously, confusion over the issue of health risk is widespread. Almost none of the herders we interviewed bothered to keep records of the contamination values and quantities of the meat they consumed. Although they were well aware that it was becquerel value times quantity which was important, many still treated the marketability limit as a health risk threshold, even if they would rather take the risks than respect this value. The quintupling of what many tended to regard as the health risk limit was met with great cynicism by those who had previously had faith in the authorities. Had the initial limit been set at 1500 Bq/kg, the matter would have been different.

We found from our interviews that herders had an individual and highly variable approach to their reindeer-meat consumption. In the early stages of our study, we found that many older men in particular were careful of their becquerel intake. They performed all manner of salting, cooking, and re-cooking methods to decontaminate their meat. With time, however, some Saami tended to grow bolder and sometimes seemed a bit ashamed over their earlier concern during what they now called "the time of Bq

hysteria, before we knew whether 300 Bq/kg was high or low." In some families we found that highly contaminated meat was reserved for the old, while 'good' meat was served for the young. Some did their best to obtain meat under the old limit even after the limit was raised, while others had set their own personal limit, for example at 1000 Bq/kg, regardless of what SLV advocated.

A Saami school teacher who had carefully secured meat under 300 Bq/kg for the children attending the Saami school, where reindeer meat was served frequently, found she could no longer be sure of the meat sold on the market once the limit had been raised to 1500 Bq/kg. Under the new rules, it could be as high as 1499 Bq/kg. The admonition to eat less reindeer meat when it was a staple was hardly welcome, and one can well understand her anger upon discovery that the nearby slaughterhouse did indeed sort out meat with values under 600 Bq/kg for export to Germany (Jan-Eric Hogane, director Nya Sameprodukter AB; Jahn Eliasson, director of Lapp-landsvilt, personal communications). This meat, however, was not available to the Saami school children. Moreover, the German limit of 600 Bq/kg meant that most of the low-level meat was set aside for German export, and the Saami children would have access mainly to meat between the levels of 600 and 1500 Bq/kg.

The above example demonstrates yet another variant of contamination limit policy, that of differential limits applied to the same food item distinguished as to use—home market as opposed to export.

During the early period, most of the herders in the Jokkmokk area still ate their own reindeer, although efforts were made to take deer with low values. Contamination levels of Jokkmokk reindeer ranged on the whole between the old and the new market-ability limits. By autumn of 1987, after the limit had been raised to 1500 Bq/kg, northern Lapland (including Jokkmokk) was categorized as safe, and herders were little concerned with the values of their deer. They knew they were under the limit. Further south in the Vilhelmina area, however, late autumn and winter deer were still well above the limit, and the herders were still avid 'Bq watchers'. Scrutiny of the contamination values grew intense when it was found to general surprise that just prior to the transition to lichen grazing, a good number of the reindeer could actually pass under the new limit. Slaughter at this time entailed taking lighter deer, but it would enable herders once again to slaughter their own household deer and to prepare their food according to custom.

We have been able to discover little consistency in the way in which herders deal with becquerel contamination risks as they are presented by experts. It is probable that the Saami, for their part, find little logic in the expert statements [4, 20]. Many of our informants, when pressed to explain their personal levels, said simply that they could not. They had become so confused by the experts and the media coverage that they could no longer reach reliable conclusions on the issue. It seems that behavior was established with an eye both to general social consensus (neighbors, experts, media, the Norwegian limits) and to personal discomfort. For example, a herder

unable to obtain a low-level reindeer from northern Lapland with ease might go ahead and eat a reindeer from southern Lapland with a level higher than he would have liked, rather than go without. On the other hand, if he had low-level European elk meat available from the hunt, he might eat this instead of reindeer meat and bide his time more patiently for a low-level deer.

Of course, the experience of personal discomfort includes that occasioned by social and cultural parameters. The preparation and consumption of not only reindeer meat, but also of foods obtained from the blood and internal organs of the reindeer, are of major importance to Saami identity. Herders in the hardest-hit regions are frequently able to purchase frozen, low-level reindeer carcasses from further north, but although these provide meat, they do not provide blood and organs. Herders frequently complain that these reindeer, purchased from the slaughterhouses, are not handled or slaughtered to their liking. Many herders accept the risk of greater contamination within bounds in order to slaughter and butcher their own household reindeer, rather than to obtain safer meat from the north.

Understandably, certain health risk arguments were proffered in defense of behavior concerning becquerel consumption, even though other factors were probably determinant. We found that obvious counterarguments would frequently be ignored. Herders eating meat well over the new limit might observe that they were probably eating meat over the limit long before Chernobyl without visible ill effects; they would then use this fact as an argument to defy recommendations. It would often be pointed out that the risks incurred from 'becquerel meat' are very likely lower than the risks incurred from other kinds of foodstuffs—for example, the meat of animals bred on hormones or grains grown with chemicals. But, while these points are well taken and bring up important areas for research, they are no substitute for a realistic calibration of becquerel risks.

The Chernobyl disaster has occasioned two main sources of economic risk to the Saami herder, that pertaining to the household and that pertaining to the slaughterhouse. Although the state announced at an early stage that persons would be compensated for losses due to Chernobyl, practical questions of implementation have remained. Exactly for what would compensation be paid? How would the amount be calculated and what would the procedure be for obtaining it? For how long could the herders count on such compensation?

Through an old policy already established before Chernobyl, reindeer meat is subsidized by the state: for every reindeer carcass brought in for inspection, the herder is given a set amount [7, p. 341]. The herder who wants to slaughter one of his own reindeer for household use must still bring the carcass in for inspection if he is to obtain the subsidy. Besides being a form of subsidy, this policy serves as an inducement to herders to bring their reindeer carcasses in for veterinary inspection (where the reindeer are also registered for tax purposes and can no longer be the subject of 'black' sales).

After a good deal of bidding and negotiation between the slaughterhouses and the state, the com

pensation rate to the herders was finally fixed at 28 crowns/kg, a price in keeping with that then (1986) paid by the slaughterhouses for marketable meat [21]. The reindeer would be sold as usual to a slaughterhouse where, as part of the control inspection by the veterinarian, a meat sample would be sent for a contamination test to a laboratory. If the test indicated that the meat was over the limit, the meat would be dyed blue (to ensure that it would not be sold for human consumption), then either buried or ground up for mink fodder.

Slaughterhouses which had access to reindeer under the contamination limit would sometimes allow herders to make a simple exchange of 'bad' meat for an equal amount of 'good' meat. At other times, however, this would not be feasible. In either case, the testing itself would supposedly leave the herders several options of choice. Herders would be allowed to choose themselves whether or not they wanted to keep the meat of a high-level reindeer for their own use—as long as it was not sold. But events proved that frequently the slaughterhouses could not guarantee such special treatment, and all reindeer over the limit, whether or not one was chosen by a herder for his own personal use, would be confiscated. Many herders complained that when they tried to collect the reindeer they had picked for their own household use, they found that it had been destroyed already, even if the test results showed it to have had a becquerel level as low as only 310 Bq/kg. To avoid this, many herders took to sending in their own meat samples for testing without ever bringing in for control inspection the reindeer picked for household use. Should they choose to eat the reindeer as a result of the test, they would simply have to forego the subsidy. Large-scale testing and compensation operations were hardly geared for the needs of the herding family to provide its own meat supply.

The effort to decontaminate the reindeer before slaughter has brought about considerable extra costs. Among these are expenses incurred through changes in reindeer management scheduling. Some herders have claimed that because of initial policy delays by the authorities, the September slaughter of bulls near full rut in their samebys was also delayed, with the result that hormone levels increased enough to render the meat unusable. Other herders in the hard-hit regions, realizing that their bulls would all be junked at the usual autumn slaughter anyway, held up this slaughter of their own accord in order to use the time to hunt European elk. Meat from the European elk is not nearly as contaminated as reindeer meat, and therefore is more attractive to the herders as food [4, p. 36]. In a hasty measure intended to make up for the losses from delayed autumn slaughters, the Minister of Energy agreed on 6 September 1986 that additional compensation would be provided for all 'rut' bulls slaughtered, i.e. for those bulls which had progressed too far in the rutting cycle to be saleable. This compensation would apply whether or not the meat passed becquerel safety standards. Unfortunately this policy caused more problems than it solved.

Some herders had indeed lost the opportunity to harvest the bulls they had planned for slaughter

through policy delays. It happened that herders slaughtered bulls knowing full well they were too advanced in the rut cycle for sale. Compensation would be forthcoming in any case, whether or not it was policy delays or a rescheduling of the European elk hunt that had hampered the autumn slaughter in their districts. A reindeer disqualified from sale because of the rut need hardly be disqualified again because of radioactive contamination, so 'rut' bulls were junked without contamination tests. Undoubtedly a number of bulls slaughtered and junked because of this rut compensation would have been declared perfectly good according to contamination tests. Many of the rut bulls would never have been considered for slaughter had it not been for the existence of the rut compensation policy. Another indirect consequence of rut-bull compensation was spoilage of the meat from other animals. After slaughter, the odor from the meat of the rut bulls frequently spread into carcasses of nonrutting reindeer, rendering them unfit for consumption as well. Fortunately, this rut-bull compensation was a temporary affair.

A more permanent extra expense occasioned by alterations in the scheduling of herding events has been that brought about by early slaughters in southern Lapland. In the Vihelmina area, the discovery that slaughters in late August might result in meat under the limit—in contrast to the high values recorded during the winter—causes earlier-than-normal slaughters. Currently, the relatively low becquerel levels in the Jokkmokk area and the institutionalization of the raised marketability limit necessitate no changes in slaughter timing for the reindeer to clear the limit. Previous to the raising of the limit, however, many samebys, even in the more lightly contaminated areas, corralled their reindeer for autumn slaughters earlier than customary in order that the reindeer would be slaughtered before making the transition to the heavily contaminated lichen diet. In southern Lapland, the early slaughters will probably continue for many years to come. Such changes in scheduling have had unforeseen ramifications. In the Swedish mountain sameby herding cycle, earlier in autumn also means that the reindeer are further toward the west and more spread out. Bringing their reindeer to slaughter has necessitated in many instances a far greater reliance upon air support, notably helicopters, than usual. This added a sizable cost, one that was initially, at least, borne by the state.

A number of our informants indicated that the promise of compensation for the extra flying time needed has resulted in an overly carefree use of helicopters. They worry that, should this compensation continue for many years, the herding system would become far too helicopter-dependent. Herders and reindeer would no longer know any other way. The emergency measure would become customary, and before long even a necessity, driving up the costs of herding. Even before Chernobyl, the over-use of technological equipment has been viewed as a growing problem by many herders [7, p. 373], and some regard the compensation measures as aggravating the problem. Other herders do not see the use of modern equipment as a problem at all, but they are concerned

that compensation policies will generate costly habits of use which will prove ruinous once state compensation ceases.

Of course, the added expense of rounding the herd up for early slaughter stems not only from increased use of helicopters, but also from reduced sales income. The earlier in autumn the bulls are slaughtered, the less they weigh. The herders have been granted compensation through the National Board of Agriculture (LBS) to cover the weight sacrificed to the cause of producing marketable meat [21].

A number of herders in the hardest hit areas have obtained permission to transport their reindeer to pastures of relatively low contamination outside of their own sameby territories. The trucking of live reindeer for many miles to safer pastures entails a considerable expense. Herders embarking upon this course must also bear the costs and discomfort of long separation from their families and homes. In its effort to promote the production of safer meat, the government has agreed to bear much of the added expense this shift of pasture involves, but only if the meat resulting from these efforts proves marketable [21].

To be sure of the marketability of their reindeer, herders in the hard-hit areas must resort to the use of artificial fodder. This too entails added expenses as well as additional labor. The government has agreed to compensate herders for the purchase of the fodder, but implementation of this general ruling seems to have varied somewhat. In Jokkmokk, some herders have complained about the policy that fodder compensation would only be paid to the sameby as a collective unit rather than to individual herders. Herders with a very small number of reindeer might not see an advantage in performing the extra labor connected with the use of the fodder. They were accused of preferring to collect the easy compensation money for their contaminated deer rather than to engage themselves in the effort to bring these deer below the limit. Herders who wished to begin with the use of artificial fodder were fearful that those who were not so inclined would ruin their chances for fodder compensation.

Besides compensation for contaminated reindeer meat itself and for the expenses connected with producing marketable meat, the government has also compensated the northern inhabitant, Saami as well as Swedes, for lost fishing and berry picking harvests. Compensation of this sort, however, involves quite a different process from that related to reindeer meat. Whereas the herders are compensated for the unmarketable meat they produced, they certainly have not been required to catch the contamination fish or pick the contaminated berries only to throw them away after establishing compensation demands. Instead, estimates of lost income or food value have been made on the basis of a person's previous harvest record. Those seeking such compensation are supposed to file for it, giving information about lost harvests. Often a standard sum in compensation is given to each applicant, who, if he or she thinks it is too little, can appeal the decision. To substantiate a case of high compensation demand, the authorities usually have requested the applicant to demonstrate

his or her customary harvest size on the basis of the tax declaration of 1985. Many of my informants have accepted what they consider grossly inadequate compensation rather than subject themselves to what they regard as a rude inspection of their tax records.

Herders in different provinces, when comparing notes, have found similar applications have resulted in vastly dissimilar compensation payments. Within each province, the strictness of the rules for distributing compensation varies according to the ratio of the total demand for compensation in relation to the amount of funds allocated to the province for that purpose by the central government. While a herder in the Norrbotten province might receive good compensation for the loss of his traditional catch of fish (even if small), a herder in Västerbotten with similar demands might receive nothing because the fishing is not considered his major source of income. Rather than administering a single policy for the entire country, so that similar demands would lead consistently to similar compensation, the central government has given the provinces the job. The provinces have received neither adequate nor commensurable compensation funds to distribute in relation to demands.

As a result of the Chernobyl disaster, herding households suffer a blow to their herding directly and also to their herding lifestyle in general, a lifestyle to considerable degree dependent upon supplemental incomes from nonherding sources and nonherding subsistence resources. Besides the loss of fishing and berry picking, tourism has decreased. The earlier slaughter of reindeer has made it more difficult to obtain reindeer antlers of a quality fit for handicraft work. In short, the economic flexibility of the family has decreased, and herders must weigh the trouble and humiliation of seeking compensation against taking greater becquerel risks.

The impact of the Chernobyl disaster and its accompanying compensation policies with respect to the reindeer slaughterhouses are topics of vital concern to the herding industry. In the Jokkmokk area, where slaughterhouses are numerous and habitually in competition for reindeer, herders have been constantly discussing slaughterhouse policies. Although a herder will usually sell to whichever slaughterhouse is on the scene and gives the best price, herders have often expressed strong preferences and loyalties to particular slaughter companies. A number of herders have voiced the suspicion that government compensation to the slaughterhouses is being distributed in an unfair manner partly in an effort to promote re-structuring of the slaughter industry according to state plans.

Most slaughterhouses are paid a set sum for each so-called 'becquerel reindeer' they slaughter, but some (usually larger companies) have been allowed to submit in addition a bill of expenses for the work to be compensated and are thereby able to make greater profits. In order to obtain more becquerel reindeer for slaughter, thus gaining more compensation without much effort (since the meat would simply be junked), one slaughterhouse with such a compensation expense account offered a slightly better price for the meat than the government rate of compensation, if in



return the samebys would not invite other slaughterhouses to attend the slaughter. Naturally this has caused a storm of protest by other slaughter companies and the herders supporting them. Was compensation payment to be utilized as a weapon in market wars between slaughterhouses? Moreover, if one slaughterhouse tried to meet the problems imposed by Chernobyl, for example, by laying off personnel so as to minimize losses, should this company receive less compensation than another slaughterhouse that refused to cut back and therefore could demonstrate a larger loss incurred by Chernobyl?

Of course, the slaughterhouses are granted much compensation for the amount of becquerel meat they have junked, as well as for the loss of profit which they otherwise would have made through the selling of a refined delicacy product. But the differential payments to the different slaughterhouses have appeared quite arbitrary. The authorities are accused of helping a few big companies while ruining the small companies' ability to compete. If this is so (I have not been able to establish for certain that it is), one speculates that it may be motivated by an understandable wish to rationalize the reindeer slaughtering business. Even so, while it may well be that the authorities deem it unnecessary to have so many competing companies given the scale of the reindeer slaughters, nonetheless one can as a matter of principle question whether disaster compensation payments should be slanted in such a way as to promote the restructuring of a business, favoring some against others.

Some herders fear there is a risk that many of the small slaughterhouses will be forced from the field and that herders will lose the benefit of a competitive market for their reindeer. Given a lack of competition in the slaughter industry, some herders fear too that the price given them, even for their good meat, will drop with the rationale that purchasing resistance demands it. While it may well be that some resistance to the purchase of reindeer meat forces down the price the slaughterhouses can in turn pay the herders for the meat, it is practically impossible to know what part of a price drop is due to real purchasing resistance and what part is due to the slaughterhouses' desire for greater profits.

There is cause for concern in the fact that Nya Sameprodukter AB, one of the largest slaughter companies to receive massive state support in the form of Chernobyl compensation payments, is mostly owned by SSR, the Saami herders' major political organization. Just prior to the Chernobyl disaster, Nya Sameprodukter AB seemed to be on the verge of bankruptcy. Now, as a result of large compensation payments, it appears to have made a fast recovery. Slaughterhouse competitors speculate that the Swedish state, sworn to protect the Saami herders and the Saami culture from the ills of Chernobyl, can hardly afford to let Nya Sameprodukter AB be victim. While the aid to Nya Sameprodukter AB is generally applauded by the herders, many are worried if this economic link to their political organization might not in some way come to compromise its other political efforts for the Saami in its confrontations with the state.

## CLOSING

The above presentation of risks and fears stemming from the Chernobyl nuclear disaster as expressed especially by herding informants is by no means complete. It is adequate, however, to demonstrate the broad range of concerns and the extent to which factors related to personal health, economy, and culture are integrated. I have reviewed a number of policies and discussed some of their consequences. The initial procedure of establishing one standard limit of contamination for marketability applied to all foodstuffs was beset with shortcomings. If the point of departure in establishing the level of this marketability limit is to protect a vulnerable, but proportionally very small social group (newborn infants or, for that matter, reindeer breeders) and to accommodate its special diet, then obviously the major part of the population is likely to be unnecessarily constrained. Good products might well be sacrificed on a large scale, at great cost to the producer and the state if a policy of compensation is invoked.

Especially if becquerel risk remains uncalibrated, it seems almost inevitable that the expenses connected with the single limit system will lead to a raising of the limit to a new level or at least the raising of the level for that particular food item generating the great expense. While such a raise will not be condoned should it jeopardize the health of the average citizen, it might well be undertaken if those whose dosages the policy would tend to push beyond recommended limits constitute only to a small, weak segment of the population, as in the case of the Saami.

In Sweden we have seen the development of multiple limits for different foods, multiple limits for the same food and dietary recommendations advocating consumer consciousness of dosage as a product of contamination level times quantity of intake. All the ingredients are present, if not highly evolved, for still another policy alternative which I herewith propose: viz., that all contaminated foods should be labeled with contamination specifications along a fully graded scale. There should also be consumer education and recommendations for the entire population, not just one segment. Of course such a system can and should be combined with an upper limit on marketability if contamination is extremely high. One should also expect the development of price fractionation between similar items with different contamination levels. With the contamination specification procedure, consumers would know the exact becquerel value of whatever food they purchased, instead of knowing merely that it was somewhere under the limit. Citizens with different access to foods, with different dietary habits, and in regions of different degrees of contamination would thereby take responsibility for their own consumption without victimizing unnecessarily any segment of society.

The purchasing resistance that currently exists and which under the labeling system proposed might at first increase, will subside with the growing evidence that nuclear contamination is widespread though fortunately still in low doses in most foods. But this reduction of general anxiety levels should not lead to the other extreme of apathy or indifference. If

low-dose radiation poses serious problems in the human diet it should be confronted by reducing contamination in all foods, not simply by avoiding the consumption of the most contaminated varieties. Nuclear pollution is on the rise and should therefore be met with valid long-range policies, not ad hoc measures. As we have already seen on a small scale, the implementation of an inadequate policy leads to distrust and lingering misconceptions. An absolutely necessary step in the construction of valid policies is the health calibration of low-dose radiation. This will require long-range studies with a broad statistical base. Without such knowledge, any marketability limit is suspect. With this knowledge, policies can be firmly predicated on human health. The pressure to change limit policies in order to avoid high compensation payments will be balanced with an awareness of overall costs in terms of human health.

Many issues of policy other than contamination specification and marketability limits have been touched upon here. These mainly involve economic compensation and the maintenance of cultural traditions. Policies devised to deal with such matters must largely form themselves around the policies designed to safeguard human health. Sensitivity to the reactions all these kinds of policies precipitate and how matters of health, economic compensation, and culture integrate is essential. Recognition of the many unforeseen problems is a first step toward their resolution.

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