Radioactive Reindeer:
The Effect of Chernobyl on the Saami People of Northern Europe.

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Introduction:

When the Chernobyl Nuclear Power Plant in the Soviet Ukraine exploded on April 26, 1986, the resulting cloud of fallout affected much more than the surrounding area. Just a few days after the Chernobyl explosion, Northern Europe experienced the highest levels of radioactive fallout ever recorded and within two weeks, radioactivity was detected throughout the northern hemisphere.[1] Even a little radiation can hurt an environment and the fallout from Chernobyl created hotspots that were concentrations 100 times worse than the natural background radiation.[2] This fallout affected not only the environment of Northern Europe but the people as well. Even the isolated, native Saami people of northern Scandinavia were touched by the fallout. Chernobyl contaminated their environment and main food source, reindeer, and changed their very way of life.

At first, scientists thought that the environmental effects of the Chernobyl accident were temporary and that the environment would heal itself over time. Scientists and anthropologists thought that the Saami eventually be able to go back to the life they led before the accident. While some of the effects of the accident have diminished, it is now clear that the accident is having a lasting and permanent effect on the Saami people and their way of life. Nuclear contamination of the reindeer hurt the Saami culturally, by contaminating their main food source and forcing them to depend on outside help. It also hurt them economically by contaminating the reindeer and they were therefore unable to sell the meat to the larger Scandinavian population. Last but certainly not least, it hurt

them spiritually. Reindeer are central to the Saami's religion and beliefs. By becoming part of the nuclear world their way of life was forever changed.

The Chernobyl Explosion:

Chernobyl is the world's most serious nuclear power accident to date. The human costs of the accident are dramatic. They included 1000 immediate injuries at the site as well as thirty-one deaths. The accident also forced 135,000 people out of their homes in the Ukraine, and caused at least $3 billion in financial losses.[3] This was only the immediate effect; the long-term effects of the explosion were even more troubling: Cancer, birth defects, damage to the environment for years to come. The former Soviet people and Northern Europe faced all these problems. The Soviets, though, at first tried to play down the explosion. When the explosion happened, it was only the seventh item of news on the main Moscow nightly news show[4]. This though, is still faster than the explosion was reported in American media. The explosion was not reported in the United States until three days after it had happened. The Soviets even went so far as to announce that they would simply "remove the consequences of the accident." [5] It was these "consequences" that affected the Saami and their way of life.

Chernobyl 4 was one of last places anyone would have thought a nuclear accident might happen. Chernobyl's 83 percent load factor in 1985 made it one of the top nuclear plants worldwide.[6] One of the questions asked to this day is how a reactor whose basic indicators showed excellent performance could have been involved in the worst accident in the history of nuclear power? Four months after the accident, representatives from sixty-two countries met in Vienna to ask this very question. As of 1986, Chernobyl had the best operating record of any nuclear power reactor in the Soviet Union. Chernobyl

was considered by the International Atomic Energy Agency (IAEA), a committee of the United Nations, to be the safest reactor in the Soviet Union for workers, but some scientists have argued this confidence in the safety of the Chernobyl reactor played a key part in the accident.[7] One person who argued this is R. F. Mould, a British scientist who has studied the Chernobyl accident for many years and in great depth. Mould argues that while Chernobyl was considered safe by the Soviet government, it really was not. At Chernobyl there were no fire drills, no adequate instrumentation, and no alarms to warn and alert operators about any dangers. Mould also states that there were no inherent safety measures built into the reactor, such as sufficient back-up power and safety valves. The lack of these safe-guard measures was a key reason that the accident happened.[8] Mould also argues that the technicians who worked at the reactor at the time did not have the proper training or qualifications to do their jobs. The Chernobyl explosion, therefore, can be considered as not only a technical failure but also a failure in management and judgment.[9]

Today, what we know about the Chernobyl Explosion comes from eyewitness accounts from scientists like Gregori Medvedev, who were called to the scene after the explosion occurred and technicians like Sasha Yuvchenko, who worked at Chernobyl, and from villagers who lived in the area, and from scientific analysis of the Chernobyl site after the accident occurred.[10] From these accounts, scientists and historians reconstructed the events that led up to the Chernobyl reactor meltdown. The Chernobyl meltdown did not happen because of a major problem; rather, it was a series of events that led to the explosion of Chernobyl's fourth reactor. This series of events was later cited by the Soviet government as a random series of events, suggesting the Chernobyl

accident was so freakish that it could never happen again[11]. The reported data, however, suggests that the Chernobyl accident was not as random or freakish as the Soviets claimed.

Chernobyl No. 4 was a new reactor that had reached the end of its first cycle on April 25, 1986. According to Soviet reports, it had only begun operating in December of 1983.[12] This was only partially true. The reactor and all its systems were completed in December 1983. There is usually a long period of tests and repairs between a reactor's being completed and becoming operational. The RBMK- 1000 model constructed at Chernobyl included 1700 different fuel channels and thousands of different pipes and valves, all tested under a variety of conditions before moving the reactor into commission. Tests for the Chernobyl 4 reactor however, were pushed ahead of schedule at the urging of Soviet government.[13] The Soviet government wanted to be able to announce that the reactor was operational by March 4th, an important national holiday for energy workers. By March 1984 the Soviets announced that 1 million kilowatts of energy from the Chernobyl four reactors had been introduced into commercial operation, two months ahead of schedule.[14]

Soviet records of the events of April 25, 1986 show that the experiment that was attempted on the Chernobyl 4 reactor was part of a series of tests that began in 1983 and were never finished. Previous tests showed that the inertia rotation of the reactor was insufficient to provide enough electric current to fill the gap in-between the loss of initial load and the beginning of reserve energy production from the standby diesel generators.[15] This gap in power was later believed by the Soviet government and scientist who surveyed the site after the explosion, to have started the series of events that would lead

to the Chernobyl meltdown.[16] This is not the report that the Soviets gave to the public at the time of the explosion. After the accident, the Soviet government released a statement to Western newspapers that simply said "An accident has occurred at the Chernobyl nuclear power plant as one of the reactors was damaged. Measures are being taken to eliminate consequences of the accident. Aid is being given to those affected. A government commission has been set up."[17]

Nuclear reactors like Chernobyl 4 have core coolant systems. The core cooling system is essential because it keeps the reactor core from melting in the intense heat of the fission process. Almost all coolant systems use water. As the reactor's uranium fuel undergoes fission, it generates heat. This heat travels through tubes that contain the fuel pellets and these fuel pellets are submerged in water that is circulated through the reactor with coolant pumps. This water keeps the tubes from melting by carrying away the heat.[18]

The Chernobyl 4 reactor was scheduled to undergo tests on April 26, 1986. The electrical engineers of the Chernobyl plant wanted to conduct a test that would determine how long the generators would continue to produce energy to run the water pumps that cooled the reactor if the normal electrical flow were interrupted. Twenty-four hours before the accident occurred, the engineers lowered the reactor's power supply and over the next few hours, the electrical technicians systematically disconnected the power regulation and emergency cooling systems that otherwise would have automatically shut the reactor down and ruined the tests that the engineers were trying to conduct.[19]

The engineers had been told by the government officials who were in charge of the Chernobyl plant that sufficient work had been done on the back-up generators so they

would be able to supply the power that was needed to keep the coolant systems running after the main power sources were turned off. It is now known though, that no work had actually been done to the back-up generators. To top it all off, the Soviet government knew that the type of diesel generator that was used as the back up power source at Chernobyl had proven to be unreliable in cold weather, from a test done at a nuclear plant in Colorado.[20] Even though all this information was know, the test was still conducted.

At 1:23 am on April 26, 1986, a little over twenty-four hours after the test had begun the flow of steam to the power turbine was completely stopped. The cooling pumps stopped almost immediately, which reduced the flow of cooling water to the core of the reactor. Within seconds there was a heat build-up in the reactor core. The engineers saw this heat build-up but it was too late and too fast to be preventable. This caused a chain reaction that was uncontrollable. The reactor core exploded. The cover plate, which weighed 1000 tons, shot upward though the roof of the reactor building, releasing a deadly plume of radioactive material into the atmosphere. More radioactive material than was released at Hiroshima and Nagasaki escaped from Chernobyl. Fires from the hot material began to burn and radioactive water from the coolant system flowed into the halls of the reactor.[21]

The analysis of the Chernobyl fallout by Swedish scientists at the Forsmark nuclear plant on the Baltic coast indicated that the worst fear of the nuclear power industry had come true: Chernobyl's core had completely melted down.[22] Particles of pure ruthenium were identified in the Chernobyl plume as it passed over Sweden. Ruthenium has a melting point of 2,250 C. This meant that the reactor core must have reached this temperature. Meltdown, therefore, must have occurred, because zirconium,

which is used for nuclear power cladding, the covering of the reactor itself, melts at 1,852 degrees Celsius.[23] The data horrified scientists, because meltdown is one of the worst possible reactor accidents that can happen. It releases because of the fallout and the resulting contamination of the area.

It was apparent, however, from the initial Soviet report that the Chernobyl accident was much worse than simply a core meltdown. In actuality a slow nuclear explosion had occurred. A slow nuclear explosion is only a few milliseconds longer than an explosion of a nuclear bomb, and it was powerful enough to destroy the reactor, instantly.[24]In an effort to downplay the significance of the disaster, the Soviet Energy Commission, which was in charge of the investigation and clean up of Chernobyl, described the disaster as a series of events that were so improbable that it could not happen anywhere else. In effect they tried to contain fear of the nuclear industry by claiming that an accident like Chernobyl was so improbable that it could not possibly happen again. But fear of the nuclear industry had taken root. Before the accident, 50% of the Swedish population opposed the nuclear industry. After the explosion that number jumped to almost 70%.[25]

The “slow” nuclear explosion at Chernobyl produced three different plumes of radioactive material that spread all over Europe, following three different weather patterns in the region. The first plume of material was deposited over north-western Russia and the Scandinavian countries. The second plume was deposited over Central Europe, and the third plume was deposited over Eastern Europe.[26] The first plume of radioactive material reached the Scandinavian countries, primarily Sweden and Finland,

and directly affected the Saami people and the tundra environment that supports the reindeer herds on which they rely.

Historiography of the Chernobyl Disaster:

The Chernobyl nuclear disaster of 1986 was the focus of study by historians, anthropologist, and reporters. The Chernobyl explosion was first reported in *The New York Times* and *The London Guardian* on April 29, 1986, three days after the accident happened. David Fairhall of *The Guardian* reported that a major nuclear power accident in the Soviet Union had sent a cloud of radioactivity over much of Scandinavia.[27] This was in contrast to the Soviet reports that the Chernobyl accident was containable and was having no lingering effects anywhere other than the Ukraine. *The Guardian* challenged this report, though, and went on to report that "Scandinavian dust samples confirm that a nuclear power reactor was the source (of fallout), probably as a result of cooling failure and severe overheating."[28]

As early as May 3, 1986 *The Guardian* reported that Swedish authorities were ordering dairy farmers to keep their cattle indoors and to not drink rain water or eat wild vegetables.[29] *The London Financial Times*, which also reported on the event about the same time *The Guardian* report, explained that by April 30, 1986 the Swedish government had found radiation in areas where new rain or snow had fallen, with radiation levels of contamination 10 times above normal.[30] The very next day, it was reported by the very same paper that the levels where not ten times above the amount of normal radiation but 100 times above the recommended amount of radiation.[31] The difference in these figures is due to the fact that scientists did not realize that some areas of Sweden and the other Scandinavian countries had gotten a much higher amount of

fallout due to the weather patterns. Once scientist knew that these areas were much more contaminated, the London papers were able to release their findings. These London news papers tended to focus on the environmental and health effects of the explosion as well as the cultural effects. The London newspapers were the first to report about the affect of Chernobyl on the Saami and the reindeer. *The London Times* reported on August 10, 1986 that, "Thousands of reindeer are to be slaughtered because they are contaminated with fallout from the Chernobyl nuclear accident."[32]

This is in stark contrast to what *The New Times* focused on during the same time period. While *The New York Times* did run articles that had information on how the environments and peoples of Europe were effected, they tended to focus on how the "faulted" Soviet Nuclear program was to blame for the accident. The very first article that *The New York Times* ran about the Chernobyl disaster was titled "Nuclear Disaster: The Consequences of a Lexicon of Nuclear Power." *The New York Times* seemed more interested in telling America about how the Soviets had failed than informing them of the dangerous nuclear radiation that now affected many of the peoples and cultures of Europe.

Over the next few months the American papers concentrated on what they considered a Soviet cover-up of the accident, and the faults of the Soviet nuclear program in comparison with the "safer," "more efficient" American nuclear program. They reported such items as, "But they (American scientists) faulted Soviet technology, which uses graphite, a form of carbon, to moderate nuclear reactions, In the United States, water is used as a moderator."[33] Later in the same article it was reported that, "The stricken reactor was not incased in a protective dome, as is customary in the United States."[34] Not

until September was the threat to Sweden and its environment even mentioned in *The New York Times.*[35]

Different viewpoints of the Chernobyl disaster are reflected in what has been written in books and journals about Chernobyl since 1986. Many scientists, anthropologists, and others who where there when the Chernobyl disaster occurred have written extensively on the subject and its effects on the environment and cultures of the areas where the fallout was deposited. These books and articles have taken many different viewpoints of the disaster and its effect on the environment and human population of Europe. Like any major disaster, Chernobyl is a hotly debated topic in the scientific and academic world.

As a Russian nuclear physicist Zhores A. Medvedev had once worked for the Soviet Energy Commission in many different Soviet nuclear facilities. He was exiled from the Soviet Union in 1973 but his knowledge and experience with Soviet nuclear facilities provide him with unusual insight into the disaster and its scientific implications. Medvedev's *The Legacy of Chernobyl,* (1990) overviewed the causes of the accident and its negative impact on the environment and cultures of Europe. He argued that the governments of the affected areas greatly underestimated the health and cultural effects of Chernobyl.[36] He suggested that the Chernobyl accident would have a lasting effect on the environments and cultures of Europe, long after the seven-year time-frame that was predicted by the Soviet Energy Commission after Chernobyl exploded.

Medvedev agreed with many of the reports that the London newspapers had produced when the disaster happened. He cited many of the reports about contamination in Sweden and the other Scandinavian countries. He used many of the ideas that the

newspapers had produced to back up his arguments about the long term affects of the Chernobyl disaster. Though written four years after the disaster Medvedev's book gives an insiders view of the disaster, and thus a detailed description of the accident and its consequences.

Another author who explored the Chernobyl explosion is Vladimir Chernousenko, a Ukrainian scientist who held a prominent role in dealing with consequences of the accident. In his book *Chernobyl: Insight from the Inside,* Chernousenko describes the clean up efforts of the Russian scientists and the firemen who were brought to Chernobyl almost immediately after the accident occurred.[37] He also detailed the continuing effects of the disaster on the Ukrainian people, especially the forced movement of many Ukrainian families out of their homes because of the disaster.[38] Like Medvedev, Chernousenko is able to give a detailed insiders view of the disaster. While he only concentrated on the effect of Chernobyl on the Ukrainian people, Chernousenko's work suggested connections between the Saami and the Ukrainian people. Chernousenko, like Medvedev, argued that the affects of Chernobyl were more far-reaching and long-lasting than reports indicated. He explored the cultural effects the disaster inflicted on the population at large.

Medvedev's and Chernousenko's books reflect an argument that any radiation, or any other foreign matter introduced into the environment, no matter how small, will have a lasting affect, forever changing that environment. This argument is in response to the concerns that began to develop in the 1960's about environmental degradation.[39] For a long time environmental scientist had been influenced by the idea that nature was a passive system that was intended for humankind to develop for its own benefit.[40] The rise

in concern over environmental degradation, though, supported the idea that the results of the Chernobyl disaster would be long lived.

Another book that explored the long term effects of Chernobyl was the book, *No Breathing Room,* by Grigori Medvedev published in 1995. Grigori Medvedev, a Russian scientist and historian, was highly influenced by Chernousenko's analysis.[41] Medvedev immigrated to America not long after the Chernobyl disaster and wrote his book there. While not related to Zhores Medvedev, his work takes up many themes that Zhores Medvedev had explored in his work. He was able to back up many of Zhores's theories of long term pollution because his book was written five years after *The Legacy of Chernobyl.* Grigori looked at the long-term affects of clean-up after the explosion on the population of the Ukraine and other affected areas. His book, in contrast with Z. Medvedev's and Chernousenko's books, focused on areas that were not commonly looked at by scientists: how people who lived in the contaminated areas are affected long after the accident. All three authors argued that the accident had much more far-reaching effects on the peoples and cultures than was first thought. Chernobyl was not just an accident that could be cleaned up and forgotten; to these authors, it was an event that changed people's lives. It made people around the accident lose their homes and changed the life ways of many cultures, including the Saami.[42]

Chernobyl (1989) by Audrey Illesh, reviewed the accident and the steps that were taken to clean up the radiation and its fallout. Illesh was a Russian reporter who visited the Chernobyl site in 1986 after the accident happened. Illesh described the affects of the explosion but also emphasized all the good things that the Soviet government did to help the populations that were affected. The book showed the efforts of the Soviets in

response to the accident. Illesh argued that the effects of Chernobyl were not all that bad and noted that the people of the Ukraine and other areas learned to live with the changes that Chernobyl brought with little effort.[43]

Chernobyl and its affects have been looked at by newspapers, scientists, historians, and anthropologists. Since the accident, ideas have changed about how much people and cultures were affected by the disaster. While some scholars have argued that the effects of the disaster were long term and permanent, others have claimed the effects were not as bad as first reported. What is known, though, is that the fallout from Chernobyl did have an effect on the Saami of Northern Europe that can still be seen seventeen years after the Chernobyl disaster.

The Saami of Northern Europe:

The Chernobyl explosion and the results of the fallout immediately affected the Saami. It had both short term effects, and long-term effects. According to Sarah Bell, an ecologist who was studying the reindeer when the Chernobyl disaster happened, the Chernobyl forced Saami people to change their herding patterns, to change their diet, and to change the structure of their culture.[44] Chernobyl affected the reindeer, which are more than just food to the Saami. The reindeer is central to the Saami's religion. The reindeer also provides the clothes that they wear and the hides for the tents that they sleep in.[45]

The Saami People are native to the northern parts of Sweden, Finland, Norway and Russia, though the Saami like to emphasize that they are one people in four countries. Getting a reliable population census for the Saami is difficult because each country has a different way of counting the Saami. In Norway, any who claim Saami ethnicity are counted in population censuses, while in Sweden only Saami who actively

participate in reindeer pastoralism are considered to be "true" Saami. Only one fifth of the Saami population still herds reindeer, so the population of 17,000 Saami that Sweden recognizes probably is only a fraction of the real total, which is likely closer to the 40,000 Saami that Norway lists in their population census.[46]

The Saami are not of Scandinavian descent. They have their own traditional styles of dress, their own distinct types of artistry, and their own unique form of singing, which helps them to preserve their rich oral history. The Saami did not have a written language until contact with Christian missionaries. Their extensive oral history has since been written down and many Saami authors have produced what are now considered Saami classics.[47].

The Saami were originally reindeer pastoralists. They raised and herded reindeer. Up till about four hundred years ago, the Saami hunted wild reindeer and only kept a few "tame" ones as transport animals. Over the last three hundred years though, the Saami began to specialize in reindeer herding.[48] They have developed extensive nomadic lifestyles, migrating over hundreds of miles with reindeer herds that often numbered in the thousands.[49] The demand for reindeer meat from the larger Scandinavian population also encouraged the Saami to increase their herds.

By 1986, reindeer not only provided food and clothing for the Saami, they also were the focus of the Saami's religion, for those Saami who still followed the traditional life ways.[50] The Saami traditionally practiced an animalistic religion, which held that animals and plants contain spirits. They also practiced shamanism: certain people in the community with the shamanistic gift were expected to get in touch with the spirits and ask them to help the community.[51] In the Saami Shamanistic belief system the reindeer

was considered one of the most important, powerful, and holy spirits. One Saami woman described her culture's relationship with the reindeer as,

> Our men care for the deer and know them. When deer are slaughtered, it is done with respect. We women know how to care for the meat, to use every bit, the blood, the head, even the feet in soup. We know how to make thread from the sinew and how to prepare the skin and furs for clothing and shoes. [52]

Another Saami woman described the reindeer as "Who we are, we are connected to our deer and to each other."[53] The Saami, in other words, felt connected to their reindeer, not only as their main food source, but as the focus of their religion and way of life.

The Saami, like many other native peoples, have a long history of contested land-rights and oppression by the larger European population. Since the early 1600's the Saami have been invaded by missionary groups seeking to Christianize their culture.[54] The bigger threat to the Saami though, has always been the encroachment on their land. In 1886 the Swedish Government designated herding zones called *samebys*. Only herders can be a registered member of a *sameby* and only members of these *samebys* can exercise the Saami's rights to herd, hunt, and fish. This policy has changed very little since 1886 and has caused a deep division among herding and non-herding Saami of Sweden.[55]

In recent years, though, the Saami have faced land encroachment problems. The Swedish Government has reduced their grazing territory four times since 1977. They are constantly under pressure to open their land up to farming and mining by the Swedish Ministry of Environment. The Ministry of Environment has passed many bills that affect the Saami without even consulting with them first. One such bill that let the larger

Swedish population have access to hunt in areas that before were reserved only for the Saami. The Saami had no way to object to these new hunting regulations, because they were told that if they did not go along with them they would not be granted their own Parliament; a right that they desperately wanted.[56]

The government restrictions on the Saami resulted in them becoming integrated into the market economy.[57] Reindeer herding became more and more high-tech. Many Saami worried that their traditional way of pastoralism would turn into nothing more than animal farming. They also feared that the Saami herding life style and culture were only artificially preserved by the government to serve the tourist market. The Saami were forced to negotiate over and over again with the government. One Saami man summed up the problem as, "The reindeer starve while its grazing rights are negotiated."[58]

Even with government regulations the Saami actively fight to keep their way of life alive. Saami schools teach the Saami language, traditional Saami handcrafts were promoted, and the traditional way of pastoralism was promoted to counteract the affect of technology on reindeer herding. The Saami actively fight for self-determination and for a meaningful voice in the development of their land and resources.

Radioactive Reindeer:

The fallout cloud from Chernobyl deposited health-threatening levels of radioactive materials on the tundra where the reindeer grazed. The plume contained many different radioactive elements such as strontium-90, plutonium, and ruthium, all with various half-lives and weights, and all bad for the environment. The variation of deposits was heavily influenced by rainfall that washed radioactive particles out of the air and into

the ground.[59] If it had not been raining so heavily over the Scandinavian countries on March 26, 1986 there might not have been such a high level of radiation deposited into the tundra environment.[60]

The reindeer were contaminated by eating the tundra vegetation. The plants of the tundra absorbed nutrients and moisture from both the air and the ground. This meant that the plants absorbed the radioactive particles and then, by eating the plants, the reindeer in turn became contaminated. The main contaminant that the reindeer absorbed from their food was strontium-90. The effect of strontium-90 is collective: the more that the reindeer ate the higher the amount of radioactive material that accumulated in their system. By the time of the annual reindeer slaughter at the end of the summer in 1986 some 97 percent of the reindeer population was estimated by the Swedish Ministry of the Environment to be above the level that is recommended by the IAEA for human consumption.[61]

This effect on the reindeer indicated that the Soviet Energy Commissions reports that Chernobyl had caused no harm outside the borders of the Soviet Union were wrong. The only possible place that all the radioactive contamination could have come from was the Chernobyl explosion and the resulting fallout. The contamination showed up in much more than just the reindeer population. In 1986 and 1987, green crops could not be cultivated in many Scandinavian areas. In some areas, the level of radiocaesium was higher than 10,000 Bq/m2.[62] This is a very high amount of radiocaesium. The maximum amount of radiocaesium that the IAEA says a person can consume safely is 5,000 Bq/m2.[63] So in these areas the amount of radiocaesium was double the safe dose, to the Swedish Ministry of the Environment, who immediately after the disaster dispatched scientist to the tundra areas, it was an extreme amount of radioactive pollution. This

pollution could cause many health threats like cancer and birth defects. The Swedish government was not only worried about the effect of the disaster on the environment, they were worried about the long term effect on the human population as well.

The Swedish government, along with the other Scandinavian governments, compensated farmers, along with the Saami reindeer herders for their losses. The government paid the farmers in full for their crops and the Saami for every reindeer that had to be slaughtered because of the contamination. The government sent agents to the Saami community to count the number of reindeer that had to be slaughtered. They would then reimburse the Saami community for what they had loss. In Sweden alone the cost of the Chernobyl accident was well over $100 million US in 1986.[64] Part of this cost was a decline in tourism to Lapland, the area in which the Saami live, which the Swedish Tourism Board had been heavily promoting. Most of the cost though, came from having to compensate the farmers and herders for the loss of their main resource.[65]

Reindeer were not the only resource of the Saami that were affected by Chernobyl. There was also a heavy contamination of lake fish. The Saami often used fish to supplement their diet. Between September 1986 and July 1987, Strontium –90 and small amounts of plutonium were also found in the fish and reindeer. The fish in the region where found to have a contaminated rate ranging from 2,600 to 28,000 Becquerel's per kilogram.[66] Becquerel is a measurement set by the IAEA that is used to describe how much radioactivity declines per hour. Strontium-90 had been found in the environment before, from both Soviet and American atmospheric tests of atomic weapons. The level of strontium-90 from the Chernobyl plume though, was up to 100 times higher than from previous atmospheric tests.[67]

The reason that the scientists were so worried about strontium-90 is that this particular isotope can be very harmful to human health. Strontium-90 can cause all sorts of health problems, not the least several types of cancer including lymphoma.[68] Stronium-90 also lowers the immune system of people who are exposed to a sufficient dose of it. This leaves people open to infections and viruses that otherwise their immune system would be able to fight off. Strontium-90 can also have an adverse affect on children that are born after their mothers were exposed to it.

In the years after Chernobyl, the natural increase in population began to abruptly drop. The death rate in Belarus, a country that neighbors the Ukraine, as of 1999, is larger than the birth rate; in a number of rural areas the death rate exceeds the birth rate by a factor of more than three.[69] The number of birth defects experienced in Belarus and other areas, including the area that the Saami live in has gone up. In Belarus it is estimated that only ten percent of the children born since the Chernobyl disaster can be considered healthy.[70] In Russia as well as the Ukraine, and Belarus, the number of birth defects has gone up by 50 percent, and the level of mental defects and learning disabilities has gone up by 30 percent.[71] Though an in-depth study, such as the one done on the children of Russia, Belarus, and the Ukraine, has never been done on the Saami, their proximity to the disaster and the amount of radiation that was deposited into their environment, means that they most likely have experienced the same effects on their population and children as the countries mentioned above. The Saami population has not grown since the Chernobyl disaster and a study done by the Swedish Ministry of the Environment showed that in the last 15 years the reindeer brought to market weigh less and have more health problems.[72]

The farmers and dairy producers of the Scandinavian countries were able to go back to producing their goods as early as the end of 1987. This was not so for the Saami people. It was estimated by the Swedish Ministry of the Environment that the reindeer that grazed in contaminated areas would be contaminated above acceptable levels for at least seven years. This estimated amount of time was based on the long half-life of cesium 137 (the main contaminate consumed by the reindeer).[73] Cesium 137, like strontium-90 effects the immune system and can cause both genetic problems and cause cancer.[74] It is estimated that the consumption of reindeer meat during this time would have a cumulative effect on the people who ingested it. The Swedish Ministry of the Environment advised the Saami people to stop eating reindeer meat or greatly reduce the amount that they consumed, and to not let children consume any meat at all.[75]

Before Chernobyl, the Ministry of the Environment had for the most part only regulated hunting and herding rights of the Saami. After the accident though, the Ministry took a much more active role it their lives. Agents of the Ministry now oversee the annual reindeer slaughter and they monitor the health of the Saami, especially the health of the Children.[76]

The Ministry of the Environment was most worried about the Children.[77] Exposure to the elements discussed above can cause many harmful effects to children. Even low doses that would not be harmful to adults could greatly affect children as they grow and mature. If exposed they can have thyroid problems, low immunobiological reactivity, suppression of protective and compensating processes, and other related problems.[78] Children were affected much more than the adults by Chernobyl, and long-term studies of children in Belarus, the Ukraine, and Russia, have shown that young

children who were exposed to these elements have suffered many health problems as they have reached maturity.[79] This is why the Swedish Ministry of the Environment, as well as the Swedish Ministry on Health, who got involved with the Saami shortly after the disaster, wanted to regulate the amount of meat that was consumed by the Saami.[80]

This decision to regulate meat consumption was very devastating to the Saami people, because according to their culture, it is wrong to waste any meat. The Saami claim they would be violating a very important precept that is held by their community.[81] Also, reindeer were their main food source. Unable to eat the reindeer, the Saami herders had to look for other food sources. The Swedish Ministry of the Environment as well as the Ministry of Health provided food during this time for the Saami to eat. This was both good and bad thing. The Saami had food to eat and did not go hungry, but it also made them dependent on the Swedish government.[82] Even though many regulations on their herding and hunting patterns had already been imposed on them by the Swedish Parliament, the Saami had always retained some autonomy from the government. Because of the reindeer and the revenue that the Saami got from selling the reindeer on the open market, they were not dependent on the government for their livelihood. This Chernobyl disaster gave the Swedish government more control over the Saami. By controlling the amount of reindeer meat marketed every year the Ministry of the Environment, and the Swedish government as a whole, gained control over the Saami's economy and livelihood. The Saami lost some of their autonomy because of this disaster; they came under closer scrutiny and observation from the outside.[83]

For the Saami, the reindeer is central to their lives. The reindeer gives them identity and define their culture and way of life, much like the buffalo that played a big

part in the lives of the Native North Americans. Whereas the Buffalo were killed off by over-hunting, the Saami were faced with the contamination of the entire population of reindeer. The reindeer were still alive and the Saami still had to take care of them, they just could not eat them. One Saami woman named Sig-Britt Toven was interviewed after the Chernobyl explosion and she said:

"It seems sometimes that things have become strange and make-believe. You see with your eyes the same mountains and lakes, the same herds, but you know there is something dangerous, something invisible, that can harm your children, that you can't see or touch or smell. Your hands keep doing the work, but your head worries about the future."[84]

To the Saami, this meant that the reindeer, which they so closely regarded in their religion and culture, were contaminated and dirty.

In response to the fallout and contamination, the government agencies that were in charge of overseeing the reindeer after the Chernobyl disaster in Norway and Sweden advised the Saami to stop their consumption of reindeer. In 1986, these governments placed large quantities of reindeer meat in frozen storage because it could not be eaten or sold by the Saami. Many of the affected Reindeer herds were killed and the carcasses destroyed. This was very hard blow for the Saami people to take. Often, the status of a Saami person is determined by the size of their family's reindeer heard. When the government killed off entire herds, it was destroying family's status and wealth in their community.[85]

This affected the structure of Saami society as well. People in the community who had once not held any power, now could. The reindeer herds had often defined a person's place in their community. With whole reindeer herds gone, people were forced to find new ways to define themselves in the culture. Traditional ways by which the Saami had organized their communities were being uprooted and changed because of the destruction

of these reindeer. With the destruction of the herds, some Saami gained status while others lost status when Chernobyl forced the Saami to reorganize there community in new, unaccustomed ways.[86]

This affected the Saami directly. Their main food supply was contaminated, as well as the meat that they would have sold to the public to buy supplies to help get them through the harsh Scandinavian winters. As mentioned before, lake fish had also been contaminated, and this was also a large source of food for the Saami. Scandinavian governments realized that limiting the consumption of reindeer was going to hurt the Saami's way of life. In response to this, the Scandinavian Government decided to look into what was considered a deadly level of contamination. After an investigation the Swedish government decided to raise the acceptable level of radiation that was allowable in the reindeer meat. Despite this decision most of the Saami reindeer herds still had unacceptable levels of radiation and could not be taken to market.

According to the Ministry of Health, the risks to the Swedish people from the Chernobyl accident were low. This statement, though, came under fire by anthropologists such as Hugh Beach and ecologists like Sarah Bell; it is argued that the scientists were not including the plight of the Saami in their studies. The Saami had arguably been exposed to much more radiation than had the rest of the population. The Swedish authorities even claimed that in the next fifty-years after the fallout they only expected a hundred extra cancer-related deaths.[87] This was, of course, if everyone followed the exact direction of the government and did not eat any contaminated food.

This meant that the Saami people had to drastically change their diet and life style. This is, at least, what the Scandinavian governments, especially Sweden, expected

the Saami to do. They even provided funds to buy alternative food for the Saami people. They underestimated how deeply the reindeer was ingrained into the Saami culture. Many of the Saami people continued to eat the reindeer meat. The Saami themselves actually began to play down the effects of Chernobyl on the reindeer. The reindeer had always given the Saami some leverage, economically, with the government and they felt that it was simply pragmatic to start rebuilding the reindeer economy. This meant playing down the effect of Chernobyl, and therefore supporting the Swedish government's stance on the effects of Chernobyl. In doing so, they furthered the state vision of northern economic development and expanded tourism.[88]

The strong market for reindeer products previously had given the Saami the economic means to gain much-wanted political leverage on the national level. By trying to downplay the effect on the reindeer the Saami also furthed their economic agenda of a strong foothold in the Swedish economy and their political agenda of more self-determination and independence from the Swedish state.[89]Also, to the Saami there seemed to be nothing physically wrong with the reindeer. The reindeer acted normal, looked normal, and tasted no different than before the accident. The Saami thought it was wrong to waste the reindeer by just killing them. The Swedish government even tried to buy the carcasses of the reindeer for a price. This did not work as well as the government had hoped. Many of the Saami groups migrated and did not stay in one location. Since Saami also lived in an isolated, hostile, and challenging environment, it was especially hard for the government to enforce its dictates.[90] Before 1986, the Swedish government had always had a problem enforcing these dictated on the part of the Saami population

that actively herded reindeer. After Chernobyl though, the government made much more of an effort to control and observe the Saami's movements.[91]

The nuclear age has affected us all and this is nowhere more apparent than among the Saami. The Chernobyl explosion made the Saami become part of a nuclear landscape that they had previously avoided. Chernobyl forced the Saami to change faster than they would have wanted. The Saami have always tried to hold on to their traditional way of life. By being forced to follow government regulations, they have been pushed in a new and to them an undesirable direction.

The effects from Chernobyl affect the Saami people to this day. After the Chernobyl explosion, scientists found many different ways to monitor the levels in not only the reindeer but also the Saami people themselves. All reindeer meat is now tested before it goes to the market. Before being authorized for market, the meat has to test lower than 1500 bq/km of radioactivity. While it is very uncommon these days to find a reindeer whose meat tests higher than that, it still happens. If meat tests higher than 1500 bq/kg it is immediately destroyed.

The Saami also have had to change their herding patterns so that they bring the reindeer to market before they would have the chance to eat the tundra lichens which still, to this day contain high levels of radioactive particles, such as ruthium and strontium-90.[92] The fallout from Chernobyl still exists in the Tundra environment. The particles that were absorbed have such a long half-life that they still exist in the soil. This has meant that the Saami have had to change herding strategies and settlement patterns to accommodate the new and changing environment. The Saami now have to bring their reindeer into market during the spring instead of the fall. This is done so the reindeer do

not have a chance to eat the contaminated lichen. This meant though, that the Saami had to change herding and settlement patterns that had existed for over three-hundred years.[93]

It is not only the reindeer that get tested these days; the Saami people also routinely get screened for radioactive particles. The Swedish Ministry of Health routinely sends workers to Saami villages to provide medical services and test the population. When the Ministry of Health is asked about cancer now, officials report that the numbers have gone up. After the explosion, the Ministry claimed that only one hundred more cases of cancer would happen in the next 50 years because of Chernobyl. Today, seventeen years after the explosion, the Ministry of Health estimates are three hundred more cases in 50 years.[94] As more tests are done by the Ministry of Health, as well as groups such as The World Health Organization, these numbers are more than likely to go up.

The Saami also continue to play down the effect of Chernobyl on their reindeer and their culture. *Samefolkt* is a journal that the Swedish Saami publish. In it there are articles about every part of the Saami's lives from child rearing to hunting rights. An examination of *Samefolkt* volumes published, over the last five years disclosed that, Chernobyl or the radiation poisoning was not mentioned, not even once. The Saami seem to want to forget Chernobyl and the effect it had on the reindeer.

Reindeer herding provides the Saami with a focus of ethnic identity, an economic independence, and political clout. They believe that by focusing on the contamination of the reindeer they would be hurting a strong local economy and hurting the solidarity of the Saami as a whole.[95] The Saami leaders would like for people to think that their lives have not been interrupted at this point, and the truth is they do go on much the same.

Reindeer are still a focus of their lives. Reindeer, after testing, go to the market and are sold. These days, hardly any meat has to be destroyed because it is over the legal limit of radiation allowed. The Saami still bring their huge herds of reindeer in every spring to be slaughtered. So, the lives of the Saami go on.

The reality is that their lives have been interrupted. Because of the radiation in the ground, the Saami now have to graze their herds in the winter instead of the summer, changing herding patterns that were hundreds of year's old.[96] They now have had to move at different times of the year. Their nomadic migratory patterns have been changed so they often have to travel during the harsh winter months. They and their reindeer are tested on a regular base for how much radioactive particles they have in their blood. This lets the Scandinavian governments have more scrutiny over their lives than they had before Chernobyl. The Swedish government now always knows where the Saami are and what they are doing. Because of Chernobyl, the Saami have lost much of their autonomy.

The reality is that Chernobyl changed the Saami's environment and way of life and forced them to become part of the nuclear world and part of a nuclear landscape for which they were not prepared. Chernobyl polluted the heart of the Saami culture: the reindeer. While the Saami have adapted to the changes that Chernobyl brought, it is certain that their lives and culture were changed and pushed in a new direction. Though they have come to live with the effect that Chernobyl brought to them, the Saami will forever be changed by the explosion of Chernobyl 4 and the consequence of it.

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