The Chernobyl Disaster

A Human Tragedy for Generations to Come

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The accident at Chernobyl caught the world by surprise. Until Chernobyl, the worldwide nuclear industry claimed—to some extent continues to do so—that in the very-worst-case nuclear accident only a tiny percentage of the reactor core and its radioactive inventory would escape the containment for dispersion into the human environment. On that fateful April day in 1986, the fatally crippled number four reactor at Chernobyl spewed out not just a tiny fraction but almost all of its contents of deadly radioactive fission products.

We now know that in the immediate aftermath of the accident the by then failing Soviet system could not cope; its seemingly ad hoc actions and disorganized countermeasures more likely added to, rather than mitigated, the short and interim term health impacts. But now, almost two decades later, the world is dealing with the longer term consequences of Chernobyl and, moreover, there is no end in sight to the human legacy of this technological catastrophe.

> "Even if there was this type of accident every year,...I would consider nuclear power to be a valid source of energy."
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> —Morris Rosen, then Head of Department of Nuclear Safety of the Vienna-based International Atomic Energy Agency, August 1986[1]

> "At least three million children in Belarus, Ukraine and the Russian Federation require physical treatment (due to the Chernobyl accident). Not until 2016, at the earliest, will we know the full number of those likely to develop serious medical conditions."
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> —Kofi Annan
> Secretary-General of the United Nations
> July 2004[2]

On April 26, 1986, unit number four of the Chernobyl nuclear power plant exploded. Reconstruction of the event, so far as it is practicable today, suggests that a "power excursion" increased the nominal energy output within four seconds by a factor of 100, followed in an instant by a factor of 1,000 or more; then a hydrogen explosion peeled open the reactor containment leaving the molten nuclear fuel and the burning graphite reactor core open to the atmosphere. No modern reactor containment has been designed to withstand such huge levels of abrupt energy liberation. A graphite fire that lasted for several days pumped radioactivity high into the atmosphere, spreading around the northern hemisphere of the globe.

Chernobyl, 100 kilometers north of the Ukrainian city of Kiev, then in the Soviet Union, has become a synonym for industrial disaster, environmental pollution, and devastating health effects.

The farther you go away from "ground zero," the more surprising are the levels of impact; the closer you get and the longer you wait, the more terrifying are the overall health consequences, both the established ones and those to be expected.

Public Unconsciousness and Government Coverups

More than 18 years after the worst industrial catastrophe in human history, the lack of public information and collective consciousness of the terrible consequences of the event is stunning. The manipulation of data on the consequences of the Chernobyl accident started with the Soviet government failing to inform the public in 1986, when it was left to the Swedish authorities, after measuring increased radiation levels, to alert the world.

Today, the Moscow News recognizes that "the failed cover-up attempt denied people in the area information that could have saved lives."[3] In 2001, however, Prof. Yuri Bandashevsky, head of the Gomel State Medical Center in Belarus, paid for his significant work on the effects of internal radiation with an eight-year prison term. Amnesty International "believes that his conviction is related to his scientific research into the Chernobyl nuclear reactor catastrophe of 1986 and his open criticism of the state authorities » and adopted him as « prisoner of conscience."[4]

Similar coverup attitudes could be seen in other

countries. In France, Prof. Pierre Pellerin, then Head of the national Agency for Radiation Protection (SCPRI), declared in a formal statement dated May 2, 1986: "Neither the current situation nor its subsequent evolution justifies in our country any sanitary countermeasure."

Part of the uniqueness of the Chernobyl accident is the geographical dimension of radioactive contamination. The general public is not aware and is therefore totally ignorant that, for example:

> • Still today, in 2004, in the United Kingdom, at 1,500 miles (2,500 km) distance from Chernobyl, a total of 382 farms with some 226,500 sheep on more than 200,000 acres (80,000 ha) of land remains under restriction order since Chernobyl.[i] Lambs are raised on contaminated pastures and, according to a complex field management scheme, have to be transferred to "clean" pastures for several months until the ratio of caesium in the meat (radioactivity per kilo) has decreased below legal limits (via a combination of the body weight gain as the lambs mature and the purging of their biological system).
> • In the most severely contaminated areas of Southern Germany, soil contamination of up to 70,000 Bq/m^2 of cesium-137 was measured. Had they been in Belarus, Russia, or Ukraine these areas would have been designated a contaminated zone.[6] In 2004 German hunters are still compensated for contaminated wild game and some varieties of mushrooms and berries continue to exceed the limits.
> • While farmers across the border in Germany and Italy ploughed their crops under following the accident, the French government considered that no precautionary measures were necessary. Although contamination levels of more than 10,000 Bq/l of iodine-131—20 times the EU legal limit—were identified in milk from Corsica, no advice was given in particular to protect children.[7] French government authorities admit that cesium contamination in some cases still reaches levels equivalent to the category in Ukraine, Belarus, and Russia that led the respective authorities to provide radiation monitoring, social protection, and countermeasures in agriculture. According to the French national Institut de Radioprotection et de Sûreté Nucléaire (IRSN), mushroom contamination today is variable, depending on the species, from 15 to 5,000 Bq/kg; wild boar, feeding on roots, glands, and mushrooms, show concentrations of cesium up to 2,000 Bq/kg, measured in the Vosges. "This situation will last for several decades yet."[8] No advice on food consumption follows this web-based information.

The French policy has been consistent over the past 18 years. In 2001, more than 200 people, including many who contracted thyroid cancer, filed a complaint along with the independent laboratory CRIIRAD for "involuntary attack on peoples' integrity" (atteinte involontaire à l'intégrité des personnes). No judgement had been pronounced as of July 2004.

Massive Evacuations

Of course, the health and economic impacts in western European countries, while they illustrate the exceptional geographical extent of the disaster, are small when compared to the tragedy sustained by millions of people throughout the areas closer to the Chernobyl plant. About 400,000 people have been dislocated from their homes in the worst Chernobyl fallout regions in Belarus, Ukraine, and Russia. Some families had to move several times because certain of the new locations turned out to be equally contaminated as the places they left in the first place.

Comparing Chernobyl with past peacetime catastrophes puts the magnitude of the human suffering into perspective. In the devastating San Francisco earthquake of 1906, "perhaps the most discussed earthquake in history,"[9] an estimated 225,000 people were left homeless, from a population of about 400,000. In the Chernobyl area, it was as if in 1906 the entire population of San Francisco had to leave its place for good and, as a Ukrainian photographer put it, "step in a new life, naked with no home, no friends, no money, no past and with very doubtful future." Not only did people quickly rebuild their homes after the San Francisco earthquake, but about one hundred years later the city has doubled its population to 800,000. The worst Chernobyl fallout regions will likely remain a mere list of ghost towns[ii] for centuries to come.

For many people, particularly in the West, large-scale evacuations and the enforcement of an exclusion zone around the destroyed reactor have given the false impression that the remainder of the population must have been safe and, therefore, lives in safe places today. The reality is different. The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) states:

> "Eighteen years ago today, nearly 8.4 million people in Belarus, Ukraine, and Russia were exposed to radiation. Some 150,000 square kilometers, an area half the size of Italy, were contaminated. Agricultural areas covering nearly 52,000 sq km, which is more than the size of Denmark, were ruined. Nearly 400,000 people were resettled but millions continued to live in an environment where continued residual exposure created a range of adverse effects.
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> "Now, roughly 6 million people live in affected areas. Economies in the region have stagnated, with the three countries directly affected spending billions of dollars to cope with

i. Originally, in 1986, a total of more than 3.3 million sheep on 4.2 million acres (1.7 million ha) of land were under restriction order.[5]

ii. More than 160 municipalities had to be evacuated.

the lingering effects of the Chernobyl disaster. Chronic health problems, especially among children, are rampant."[10]

Contaminated territories, as officially designated, account for 23% of the surface area of Belarus, 5% of Ukraine, and 1.5% of the Russian Federation. About 19% of the population of Belarus lives in such areas, 5% of the population of Ukraine, and about 1% of the population of the Russian Federation.

Who pays attention to the wounded, the economically mutilated, and the homeless?

The right to compensation payments, health holidays, new housing, and schools for registered Chernobyl victims does not mean that the support is actually being provided. A special mission on behalf of the United Nations Development Program (UNDP) and UNICEF[11] notes that in 2000 in Belarus only 60% of the 500,000 people who were eligible for health holidays were able to leave the area. The mission report states:

> "In practice, funding for the Federal Chernobyl programmes has declined steadily in recent years. This has left many projects half completed. Thus the Briansk Region in Russia has only been able to build 62% of the housing needed for relocation, 14% of the schools and 27% of outpatient centres. According to Briansk administration data, there are more than 1,200 uncompleted houses, water supply stations and other public buildings in the Region."

Widespread Long-Term Contamination

In the immediate aftermath of the Chernobyl explosion, those people living and working in the area of the developing radioactive plume were exposed to radiation in air and water and from contaminated foodstuffs. While the radioactivity in the air was especially a short-term problem, most of the radiation was deposited on the ground within days after the accident. This has resulted, over the years since the initial release, in the development of more complex uptake routes, many of which are difficult to manage on a dose-minimization basis.

The chimney effect of the fire led to significant portions of the radioactivity travelling long distances; climatic conditions—wind, rain, and atmospheric stability—determined the overall dispersion patterns and areas of radioactive fallout. Some of the health effects that are obvious now are due to short-term exposure, in 1986, to short-lived radioisotopes (particularly radioiodine-131, with a relatively short half-life of 8 days, which fixes on and concentrates in the thyroid gland, heightening the risk of cancer) that were present in significant concentrations in air, water, and food. Other emitters have intermediate half-lives, in particular cesium-137 and strontium-90, with periods of, respectively, about 30 and 28 years, with radio strontium fixing mainly in the bones and cesium in various organs. Particular problems are caused by radioisotopes with long half-lives, such as plutonium-239 (24,000 years), with the respiration of a few dozen millionths of a gram capable of triggering fatal lung cancer.

Of all of the radioisotopes released at Chernobyl, radio cesium is reckoned to have caused by far the largest share—perhaps up to 75%—of the interim and longer term radiological impact of the Chernobyl accident.[iii]

Nor will the Chernobyl health legacy fade away quickly. Some 70% to 90% of the cesium, 40% to 60% of the strontium, and up to 95% of the trans-uranium elements such as plutonium remain in the upper root-inhabited layer of the soil, which attests to the "continuing danger of radioactive contamination of agricultural production and of food, fodder and medicinal crops."[12]

Health Problems

It is part of the inhuman side of today's news jargon to focus public perception of human suffering merely on the numbers of the dead. This being so, who pays attention to the wounded, the economically mutilated, and the homeless? The Chernobyl disaster is a particularly striking example of this lack of interest in—and support for—the living and (yet) surviving.

There are literally thousands of studies into health effects of the Chernobyl catastrophe. The following description, therefore, can only constitute an incomplete overview of the kind of problems that have been identified. None of these symptoms are getting any better with time. On the contrary, most indicators tend to point to a future that will be even worse.

Demographic Disaster

Following the Chernobyl accident, the birth rate in many of the regions of serious fallout began to decline rapidly. In the Gomel region in Belarus, between 1986 and 2000, the birth rate fell by 44%, mortality increased by over 60%, and natural population growth vanished from +8% to -5%. These trends can be observed in Belarus, Ukraine, and Russia, and seem to be "a consequence of factors such as emigration and the difficult economic circumstances facing these countries, which have led to increased ill-health and caused young couples to defer having children. Demographic factors have contributed strongly to the pattern of morbidity and mortality in the affected areas."[11]

General State of Health and Various Disabilities

The UNDP-UNICEF mission sums up in 2002:

> "The health and well-being of populations in the affected regions is generally very

iii. One has to imagine that the total quantity of cesium released to the environment during the accident is estimated to be 26 to 27 kg, a volume that would fit into a backpack.

depressed....Life expectancy for men in Belarus, Russia and Ukraine, for example, is some ten years less than in Sri Lanka, which is one of the twenty poorest countries in the world and is in the middle of a long drawn out war....Cardiovascular disease and trauma (accidents and poisonings) are the two most common causes of death followed by cancer (this situation is not confined to the Chernobyl affected regions)....The health situation encountered in the populations living in the affected territories is thus a complex product of inputs ranging from radiation induced disease, through endemic disease, poverty, poor living conditions, primitive medical services, poor diet, and the psychological consequences of living with a situation that was frightening, poorly understood and over which there seemed to be little control."[11]

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Moreover, the situation is worsening at a frightening speed. In 1991, the Ukrainian government had registered around 2,000 individuals with "disabilities connected with the Chernobyl disaster," but their number had risen to almost 100,000 by January 1, 2003.[13]

Psychosocial Problems

About 14%—or 15,000—of the 110,000 children examined under the US Agency for International Development's (AID) Chernobyl Children Illness Program (CCIP) were found to be in need of assistance.[14] "Children found to have severe depression and suicidal tendencies are given immediate consultation by the mobile team psychologists. Early in the program, CCIP staff found that on-site crisis intervention was needed because many children had no one in whom they could confide or were so depressed that they had seriously considered suicide."[15]

Chronic Health Effects

Yuri Bandazhevsky has demonstrated the serious accumulation of radioactive cesium in children's organs. Bandazhevsky considers that "the Cs-137 burden in the organisms of children must be further investigated and the pathogenesis of different diseases intensively studied. This is an urgent need, as radiocontaminated agricultural land is being increasingly cultivated and radiocontaminated food is circulating countrywide."[16] In October 2003, while Bandazhevsky was still in prison, the science journal Cardinale published an article by the Belarusian scientist and his wife that revealed two spectacular research results:[17]

- The bad news: While more than 80% of the children who have a body charge of between 0 and 10 Bq cesium-137 per kilogram body weight showed a normal electrocardiogram (ECG), two thirds of the children with a burden of 11-36 Bq/kg presented ECG anomalies and 80%-90% of the children with body burdens between 37 and 100 Bq/kg had abnormal ECG.
- The good news: A cure with a substance based on apple pectin—known in the treatment of intoxication by heavy metals—reduces the body charge of cesium-137 three times faster than the application of non-contaminated food alone. Under the condition that the reduction in the body burden of cesium is significant, there seems to be a significant curing effect on degenerated heart functions (cardiomyopathies).

Dramatic Increase in Thyroid Cancers

The Belarus government has stated that from 1986 to 2001 there were 8,358 cases of thyroid cancer in Belarus alone, of which 716 occurred in children, 342 in adolescents, and 7,300 in adults.[12] According to a recent study,[18] age-adjusted average thyroid cancer incidence rates in Belarus have increased between 1970 and 2001 almost 9-fold (+775%) among males and 20-fold (+1,925%) among females. The relative 11-fold increase among males (+1,020%) and the dramatic 34-fold increase among females (+3,286%) in "high exposure" areas vastly exceeded increases among males (+571) and females (+250%) in "lower exposure" areas of the country. Dramatic increases in thyroid cancer incidence rate ratios were noted among both males and females and in all age groups. The highest incidence rate ratios were observed among people from "higher exposure" areas, ages 0-14 years at time of diagnosis.

Thus, it might be concluded that children always pay the highest price.

Hereditary Effects

Beyond the devastating consequences for the living, the Chernobyl effects have moved into successive generations. Sperling et al reported that in West Berlin, as early as January 1987, there was a significant increase in Down's syndrome; a cluster of 12 cases was found, compared with two or three expected. After excluding factors that might have explained the increase, including maternal age distribution, only exposure to radiation after the Chernobyl accident remained.[19]

Vladislav Ostapenko, head of the Belarus Radiation Medicine Institute, stated in March 2000: "It is clear that we are seeing genetic changes, especially among those who were less than six years of age when subjected to radiation. These people are now starting families." Ostapenko reports that girls in affected areas

had five times the normal rate of deformations in their reproductive systems and boys three times the norm. Each year, 2,500 births were recorded with genetic abnormalities and 500 pregnancies were terminated after testing.[20]

The Belorussian geneticist Gennady Lazjuk has elaborated a statistical record of the ten most common hereditary defects observed among newborns in Belarus since 1982. The scientist compared the number of birth defects before (1983 to 1985) and after (1987 to 2000) the Chernobyl accident. According to Lazjuk, the incidence of defects rose in proportion to the radioactive contamination of the areas.[21,22]

A study by Yuri Dubrova presented at the February 2003 IPPNW-Switzerland Conference on Health Consequences of Chernobyl in Children on germline mutation concludes that an exposure to 0.2-0.4 Gray can lead to a 1.6-fold increase in minisatellite mutation rate as found in families from Ukraine and Belarus. These data, therefore, provide "strong evidence that the elevated minisatellite mutation rates in the Ukrainian and Belarus families can be attributed to post-Chernobyl radioactive exposure."[23]

This brief review has explored the statistics of fact, leading to the axiom that the grand-grand-grandchildren of our children will suffer from the effects of an accident to a machine that was built to provide a service to people.

That machine generated power for two years, four months, and four days but the human suffering and health detriment will go on for generation after generation. Who would dare to say it was worth the risk?

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