BEHIND THE COVER-UP

Assessing conservatively the full Chernobyl death toll

Poor records and methodology, omissions, and the failure of various committees to consider all health issues resulting from the Chernobyl nuclear power plant disaster in 1986, have meant the real consequences for the many millions of affected people have been hidden from public scrutiny, **DR. ROSALIE BERTELL** reports. Using a report from a U.N. science committee in 2000, Dr Bertell identifies the many omissions and makes a very conservative, preliminary estimate of the eventual death toll from the Chernobyl disaster to be 1 to 2 million.

Introduction

The Chernobyl disaster occurred in 1986, and now 20 years after the event, there is as yet no comprehensive systematic report on the casualties. This article presents an attempt to extend the sketchy information given in the 2000 report of the United Nations Committee on the Effects of Atomic Radiation. (UNSCEAR): *"Sources and Effects of Ionizing Radiation."* This report, as Part III, gives the official U.N. agency's information on the Chernobyl accident, the release of radionuclides, exposure to individuals and health effects, as gathered by the International Atomic Energy Agency (I.A.E.A.) over the past twenty years.[1] The 2000 report omitted to assess the entire population at risk and failed to estimate fatalities due to radiation damage to tissue and/or its ability to initiate a fatal cancer.

It appears to be the only scientific document released to the public, on which the official IAEA report was based. This report, released in September 2005, claimed 4,000 deaths as the final estimated toll from Chernobyl. Although the World Health Organization was a signatory to the September 2005 Report on Chernobyl from the IAEA, they later seemed to distance themselves from the report.

"Zhanat Carr, a radiation scientist with the WHO in Geneva, says 5000 deaths were omitted because the report was a *'political communication tool.' 'Scientifically, it may not be the best approach,'* she admitted to *'New Scientist.'* She also accepts the WHO estimates did not include predicted cancers outside Ukraine, Belarus and Russia. The health impact in other countries will be 'negligible,' she says, adding there is no epidemiological research showing otherwise. The WHO *'has no reasons to deliberately mislead anyone,'* she insists. *'WHO's position is independent, free from political issues, and based on scientific evidence of the highest quality'.* The IAEA refused to comment." - *New Scientist,* 6 April 2006.

records which have been carefully kept by scientists and physicians in the former Soviet Union, have often been ignored in the west

Earlier attempts have been undertaken to estimate the number of Chernobyl victims, especially notable among them is one by Dr. John Gofman:

"My estimate in 1986, based upon releases of various non-iodine radionuclides, was 475,000 fatal cancers plus about an equal number of additional non-fatal cases, occurring over time both inside and outside the ex-Soviet Union. Such estimates, old and new, have to be based on real-world evidence from non-Chernobyl studies, because standard epidemiological studies (which "count" extra cancer cases) are the wrong tool for evaluating Chernobyl. No one can "see" even a half-million Chernobyl-induced cancers when they

Radiation hotspots resulting from the Chernobyl nuclear power plant accident.

Map from "GHOST TOWN" www.elenafilatova.com

Nearly all radiation research is sponsored by governments that fiercely defend and promote nuclear energy

are spread among a half-billion people and occur over a century." [2]

Unless there has been a conscious effort to obtain good data on both the health of the population and also the radiation dose they have received both from the original disaster and from subsequent exposure to contaminated food and water, these effects will never be properly evaluated or made visible. Yet records which have been carefully kept by scientists and physicians in the former Soviet Union, have often been ignored in the west. Instead, official pronouncements made by the International Atomic Energy Agency (IAEA), which has designated itself as lead agency on the health effects of radiation,[3] are often the work of western scientists who narrowly focus on cancer deaths.

Conflict of interest

It should also not be overlooked that the IAEA's main business is promoting nuclear power and it is currently promoting nuclear power to the majority of developing countries, for example in the speech of Richard Meserve, Chairman of the International Nuclear Safety Group, IAEA:

"Some countries without experience in the operation of nuclear power plants have expressed interest in undertaking the construction and operation of such facilities…With the completion of these five tasks — greater sharing of relevant operating experience, enhanced reliance on common standards, worldwide encouragement of safety culture, enhancement of the Convention on Nuclear Safety, and establishment of multinational design review — the global safety regime could be significantly improved. These are not revolutionary changes; they build on both the current international cooperative efforts and the national systems that have served us well. But they will help to ensure that nuclear technology can continue to be harnessed for the benefit of all humankind." In "Nuclear Safety: Impressive & Worrisome Trends," IAEA Bulletin 47/2, 1999.

The IAEA most likely has a conflict of interest in reporting fully on the health effects of the worst nuclear power plant disaster ever to have occurred. Additionally, as Dr Gofman has pointed out in his 1993 release, *"Beware the Data Diddlers"*:

"Nearly all radiation research is sponsored by governments that fiercely defend and promote nuclear energy. I believe they recognize their goals are not aided if the public comes to believe radiation is harmful, even at low doses, and even if slowly delivered."

The current situation in radiation research is a bit like relying on the tobacco industry to conduct all the research on the health effects of smoking. Assessing the health impact of a disaster requires physicians trained in disaster medicine, public health, occupational health, pediatrics and oncology. But these health specialists have been excluded from the process of assessing the health affects of the Chernobyl disaster. The IAEA, the self-designated lead agency, hires nuclear physicists and health physicists or radiologists.

The field of radiation and health has been dominated by physicists, engineers and mathematicians since the dawn of the nuclear era in 1943. Radiation health was, with a few exceptions, taken over by the physicists of the Manhattan Project after World War II, in their effort to contain the secrets of the nuclear age. Secrecy caused these "hard scientists" to fail to consider the broad range of responses and varieties of vulnerabilities possessed by a living population exposed to this hazard. Health professionals would have expected such variation in biological response.

Many of the estimates below are by their nature, speculative, and the true estimate is most likely to be higher. It should become apparent to everyone that the information presented in the 2000 UNSCEAR report is incomplete and minimizes the reality.

View from the tallest building in Pripyat, located 4 kms North of the reactor, looking towards the power plant

Many health effects excluded

The limited focus on cancer deaths attributable to Chernobyl, which is how the western world determines the seriousness of this disaster, has meant many survivors' health-related tragedies have been ignored. This is especially regrettable for those millions of children who developed heart disease, diabetes and thyroid cancers or dysfunctions, which were not fatal, or those exposed in utero, who suffered various congenital malformations and diseases.

According to available information[4] there were 46 radionuclides of note in the

Chernobyl reactor inventory at the time of the accident. About 26 of these radionuclides were released into the air at the time of the disaster.[5] Of these, 17 were found in the near zone of the failed reactor. It is important to note, the ceramic aerosolized uranium and plutonium fuel particles, similar to those that caused at least some of the devastating symptoms of the Gulf War Syndrome,[6] were ignored by UNSCEAR. But they were obviously emitted from the reactor with other nuclear debris. Only radioactive cesium was used in UNSCEAR 2000 as a basis for determining the external effective radiation doses to the larger exposed population.

A uranium fire, such as occurred at Chernobyl, burns at 3000 to 6000 degrees Centigrade, heat sufficient to aerosolize all metals exposed to it - including all radioactive heavy metals, iron, steel, nickel, copper, etc. In an internal aerosolized ceramic form, the maximum possible dose from the radioactive chemicals is delivered to the victim, and the maximum toxic metal effect can be caused. This is because in a pulverized ceramic form, of nanometer size, the surface area is maximized, the self-shielding is minimized, and the solubility in body fluid is minimized, resulting in a maximum contact dose. Nano particles can pass through the cell wall, the blood-lung and blood-brain barriers, and can penetrate to the seminal fluid or cross the placenta. They are too small to be removed by the kidney filters. This artificial debris is not life compatible. The medical profession recognizes many more radiation-related genetic and teratogentic effects of radiation than does the UNSCEAR report, and the nuclear establishment.

Contaminated food only partially considered

Exposure via the food web, thought to be the greatest source of contamination for most people, was mentioned relative to cesium contamination of soil only for those living in the local contaminated areas. However, as is well known, efforts were made to mix fresh produce and milk so as to spread the radioactivity over the larger former USSR region. Whether or not the exported contamination was subtracted from the local dose was not indicated. Internal contamination of the cesium contaminated areas, was based on annual consumption of milk and potatoes, although UNSCEAR admitted the majority of the pollution was in the milk, meat, potatoes and mushrooms, and that other radionuclides were inhaled and consumed.[7]

In this evaluation, I am omitting:

- the radiogenic thyroid diseases, not because they are not tragic, but only because they are not usually fatal.[8] Only fatalities due to radiation syndrome or radiogenic cancer (over the lifetime of the exposed persons) are included.
- Many of the fatal cancers have, of course, not yet become clinically observable.
- Important research on radiation-related heart disease in Belarus was unfortunately interrupted, and also is not included in UNCSEAR 2000 or in this analysis.

Deaths due to radiation

The very early deaths due to radiation syndrome occurred to those who suffered severe damage to the Central Nervous System. They died quickly, in Moscow Hospital 6, and are undoubtedly the 28 deaths attributed to acute radiation syndrome deaths noted in the UNSCEAR 1988 report, (Appendix to Annex G). Later UNSCEAR admitted to 30 deaths among power plant employees and firemen within a few weeks of the disaster, in addition to the 28 radiation deaths. Until the 2005 IAEA report, which revisited direct radiation deaths, the official death toll was reported as 31, with 28 due to radiation.

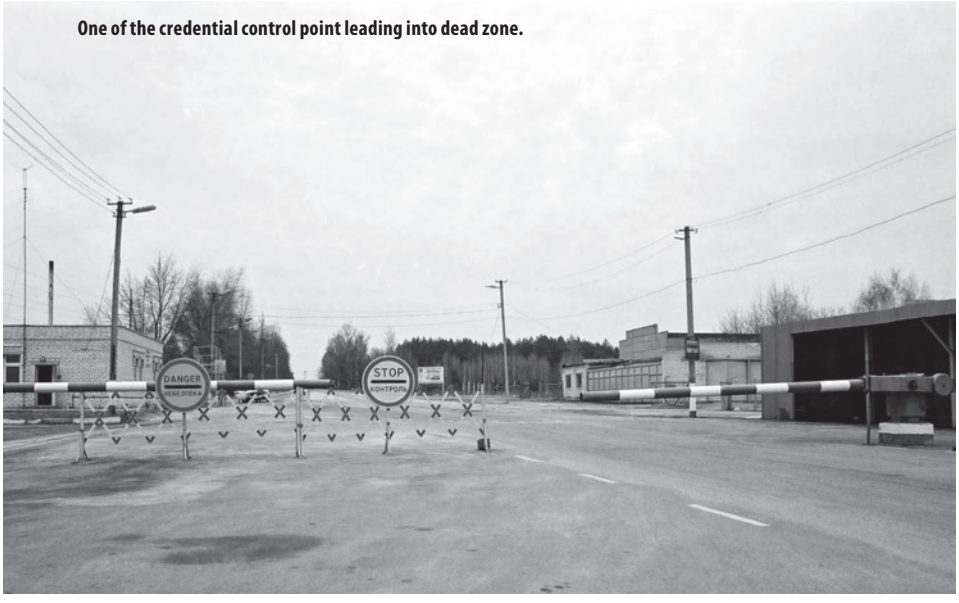
Deaths due to severe exposure of the lung tissue and the red bone marrow would be expected to occur some time over the following two years. Given the lung and bone marrow doses[9] and the fact that 713 emergency workers (87% of 820,)[10] had external effective doses of radiation above 0.5 Sv, and also that their exposure to radioactive uranium and plutonium (and americium together with other decay products of the fuel) particles from the reactor fuel was not factored in by UNSCEAR, I estimate 140 deaths due to lung irradiation and 90 deaths due to bone marrow irradiation. Thus, I would estimate deaths attributable to acute radiation exposure as: 253.[11]

Estimated fatal cancers among emergency & recovery workers

Emergency and Recovery Workers and accident Witnesses, were exposed to both external and internal radiation during the disaster. The estimated fatal cancer risks were based on doses given in Tables 16 and 17 in the UNSCEAR 2000 report.[12] Cancer Deaths were estimated using 10% per Person Sv, from UNSCEAR 1991 and BEIR V[13] reports using the DS 86 dosimetry from Hiroshima and Nagasaki. A higher 20% per Person Sv estimate is based on the cancer risks noted in the work of Drs. John Gofman,[14] Alice Stewart[15] and Steve Wing,[16] who posit risks as high as 30 to 50% per Person Sv. A risk of 20%, as used in this paper is clearly within a reasonable probability margin of the official estimate. Internal doses from the burning radioactive fuel are based on the dose quality factor of 20, for alpha particles, rather than the estimates for particular radionuclides as is reported in ECRR 2003.[17] This maintains consistency of methodology.

However, I note, the true estimate may be orders of magnitude greater due to ICRP's (International Commission on Radiological Protection) inability to include the insolubility of these particles and their non-homogeneous distribution in organs.

Cancer deaths of Emergency and Recovery Workers in 1986, based on the UNSCEAR 2000 doses, are estimated



One of the credential control point leading into dead zone.

to be 1407 to 2813. These workers undoubtedly suffered inhalation and ingestion of radioactive fuel contaminating the air, and food/water contamination, yet this was not reported by UNSCEAR in 2000. Based on the 2000 report,[18] I assumed the internal dose was about 76% of the external dose. This internal dose would be multiplied by a Quality Factor for alpha radiation of at least 20. This gives an estimate of fatal deaths due to internal contamination (not included in UNSCEAR 2000) to be: 2139 to 4277. Therefore, the estimate of cancer deaths among emergency and rescue workers was 3546 to 7090. No data on the Accident Witnesses is given, contributing to the conservative nature of this estimate.

Population evacuated & not-evacuated from highly contaminated zones

Using Table 24,[19] I calculated there were 24,727 person not evacuated from the exclusion zone and 24,705 evacuated from the exclusion zone in Belarus. Since the column marked "not evacuated" is noted as "calculated," I assume the total was artificially made equal to the number of evacuated (which was actual). This was probably done for a valid comparison of doses. The evacuated received a total of 700 Person Sv effective exposure, 0.03 Sv per person, while the not evacuated received 2248 Person Sv effective exposure, or 0.09 Sv per Person.

The numbers of persons evacuated in the Ukraine had to be culled from the text[20] from Pripyat, 49,360, from Yanov, 254 persons, from the southern part of the 10 km. zone, 10,090 persons, other residents within the 30 km. zone, 28,133 persons, and person outside of the 30 km zone, 2,858, plus 711 plus 91,405. later in 1986. I assumed that these evacuees received on average 0.03 Sv exposure. Therefore a total of 182,811 persons received 5,484 Person Sv. They would be expected to suffer between 548 and 1096 fatal cancers.

The number of persons evacuated in Belarus, 11,358 from the 30 km zone, 6,017 from outside of the 30 km zone, and later in 1986, 7,350 people beyond the 30 km zone. A total of 24,725 persons were evacuated, receiving on average 0.03 Sv each, yielding, 742 Person Sv exposure. They would be expected to suffer between 74 and 148 fatal cancers.

One hundred and eighty-six residents of the Russian Federation were evacuated. Assume an average exposure to 0.03 Sv, their total exposure would be 6 Person Seiverts, resulting in about 1 fatal cancer.

The numbers of those not evacuated is more difficult to describe. The data is very sketchy, and we have only the calculated numbers from Table 24, plus a paragraph in UNSCEAR 2000.[21] I assumed that of the 116,000 evacuees, about 1 in 4 people refused evacuation (because of farm animals or fear of never returning) and about 1 in 4 returned before the contaminated areas were declared to be habitable. Therefore assuming 58,000 not evacuated (or returned early) in the exclusion zone or its surroundings, this would be an additional 5,220 Person Sv, and an additional number of cancer fatalities, about 522 to 1044. The total number of fatal cancers expected in the evacuation areas would be: 1145 to 2281.

Cancer deaths estimate in the former U.S.S.R.

The cancer death estimate due to external irradiation of the former U.S.S.R. contaminated, but not controlled areas, using Table 53[22] was 4,260 to 8,520. This population has received an internal radiation dose from contaminated food and water since 1986, although UNSCEAR 2000 provided little information on food and water contamination. Pollution of food would include nuclear debris, primarily alpha emitters of long physical half-life, as well as cesium (measured for the UNSCEAR 2000 estimate). Having little guidance from UNSCEAR 2000, I assume this 20 years of internal irradiation dose is about 76% of the immediate external radiation dose, times a QF of 20. Therefore the cancer deaths from internal radiation exposure would be about 6476 to 12,952, giving a total cancer death toll of 10,736 to 21,472.

UNSCEAR 2000 provided little information on food and water contamination

It must be emphasized, this estimate assumes the internal dose can be safely modeled on the basis that its effects can be predicted using the external acute exposure risk model derived from the Japanese A-Bombs and promoted by ICRP. This assumption is not likely to be true, since many of the isotopes involved in the Chernobyl disaster include derivatives of the carbon moderator used

in a reactor but not a nuclear bomb, and the mixture of fission products is unlikely to be the same as in a uranium bomb as used in Hiroshima, or a plutonium bomb as used in Nagasaki. The true yield from internal irradiation is likely to be some orders of magnitude higher because of the proximity of the workers and firemen to the debris. This has been discussed by the European Committee on Radiation Risk ECRR 2003 report.[17] We can assume these estimates are conservative.

Estimated cancer deaths in Europe due to Chernobyl

For five European countries, Croatia, Greece, Hungary, Poland and Turkey, no estimate of radiation exposure was given except for radioactive iodine dose to the thyroid. It's obvious these countries also suffered direct external irradiation from fallout, and contamination of their food and water. I have no estimates for these exposures. The eight countries named: Belarus, Finland, Germany (Bavaria), Greece, Hungary, Romania, Sweden and Turkey (Black Sea Coast and Edime Province),[23] had estimated absorbed dose in mGy, seemingly for an epidemiological study of leukemia. In this study the authors assessed the dose as 1 to 4 mGy to red bone marrow. No conversion of mGy to mSv was given, and the proportions of alpha (RBE 20) or beta (REB 1.7) radiation was not given.[24] Using these estimates and the populations of the countries in 1986, this European subgroup will be expected to have at least 1,517 to 3,034 cancer deaths.[25] With dose conversion to mSv, and correction for internal radionuclides, this is likely to be significantly greater.

In 2005 the IAEA noted the numbers of cancers reported from Europe were unusually high: *"With the death toll from cancer claiming 1.7 million Europeans each year, Health Ministers and experts of leading oncology centers from 27 countries across the continent met at IAEA headquarters in Vienna this week to work together to combat the disease."*

"The IAEA has teamed up with European countries involved in its Technical Cooperation programme, The World Health Organization, professional societies and NGOs to improve cancer prevention, detection and treatment. Over the next three years the IAEA will roll out close to $24 million in funding for cancer projects on an expected cost-sharing basis with the governments involved. The projects range from improving nutrition to upgrading radiotherapy equipment and training staff to ensure cancer patients are treated safely." IAEA Press Release 3 February 2005 Meeting inVienna.

No reason for the cancer increase was given.

If we include the whole population of Europe in 1986 (minus the eight selected out) and assume 1 mSv effective dose, as an average per person to all not in this subgroup, from the Chernobyl fallout, we can estimate 887,819 to 1,775,638 fatal cancers. Obviously, since the dispersal of nuclear debris over Europe was not homogeneous, some individuals received more and some less than this amount. Any estimate would be increased by including internal contamination from food and water and conversion of energy deposits to effective collective doses. This very conservative estimate of cancer fatalities in Europe attributable to Chernobyl is 889,336 to 1,778,672.

Summary of findings

Using conservative methodology, I estimate the eventual death toll from the Chernobyl disaster will be:

- 253 due to direct radiation damage
- 904,763 to 1,809,515 due to fatal cancers

or

- 905,016 to 1,809,768 in total

This estimate of roughly 1 to 2 million deaths is conservative for several reasons, firstly, because of the failure of the radiation investigation by UNSCEAR to document the radionuclide variety and the extent of radiation contamination of food; and secondly, because of the use of faulty ICRP (International Commission on Radiation Protection) methodology, and the absence of a comprehensive scientific examination of all deaths among emergency and rescue workers, and disaster witnesses. Data was sketchy and incomplete on other populations exposed. The UNSCEAR researchers appear to have relied on elimination of all cancers occurring in the first ten years after the accident, and they reported a rough estimate (probably using a minimal risk factor reduced by a DDRF, Dose and Dose-Rate Reduction Factor) for estimating cancer deaths. It is well known that radiation, through its mutation ability, can accelerate the development of any cancers present in the population at the time of the disaster. Many early, uncounted cancers may fit into this category.

These workers undoubtedly suffered inhalation and ingestion of radioactive fuel contaminating the air, and food/water contamination, yet this was not reported

A potentially large population exposed to contaminated food, has been omitted from this analysis, and from consideration in the UNSCEAR 2000 report. This is the population of Russia, Ukraine and Belarus, who were contaminated by diluted milk and produce, distributed throughout their territories in an effort to reduce the continual contamination of those directly affected by the disaster.

There is also currently a scientific dispute about the acceptability of the ICRP methodology for assessing the internal dose, especially from ceramic aerosol nuclear fuel particles, and for certain internal radionuclides which bind to DNA as articulated by the ECRR 2003 (European Committee on Radiation Risk) and accepted by the radiation protection committee in France. These particles do not spread homogeneously in internal organs. The UNSCEAR 2000 analysis ignored these considerations.

When the international scientific critics of ICRP develop an internationally acceptable alternative to ICRP

A small gas mask abandoned along with children's toys in a Pripyat kindergarten

This estimate of roughly 1 to 2 million deaths, is conservative for several reasons . . .

methodology, and when the UNSCEAR data gaps are filled, we may be able to adjust this estimate of deaths accordingly. However, the inadequate record-keeping in this high-tech age will always be seen as an attempt to cover-up the true effects of the Chernobyl disaster. Clearly, the true damage to health attributable to the Chernobyl disaster has been hidden from the general public through poor and incomplete scientific investigation, obfuscation and poor recording of data. ■PE

NOTE: To arrive at her conclusions Dr Bertell used the usual ICRP methodology with their cancer death risk factor, 10% per person Sv, for the 1 million; and the not-yet-accepted risk factor of the many scientists who use ICRP methodology, but disagree with the cancer death risk factor of 20% per Person Sv for the 2 million. Most of the doses in the UNSCEAR report were for external not internal contamination, so there are many omissions.

Dr. Rosalie Bertell is president of the International Institute of Concern for Public Health. www.iicph.org. She has been a Grey Nun of the Sacred Heart for over 50 years; holds a doctorate in biometry (the statistical analysis of biological observations and phenomena), is an environmental epidemiologist and a world-renowned researcher in the field of mathematics and nuclear science. Dr. Bertell directed the International Medical Commission in Bhopal, which investigated the aftermath of the Union Carbide disaster in Bhopal, and the International Medical Commission in Chernobyl, which convened the Tribunal on violations of the human rights of victims in Vienna, April 1996. She has collaborated in analyses in the US, Canada, Japan, the Marshall Islands, Malaysia, India, Germany, Ukraine and other countries and has received numerous awards and five honorary Doctorate degrees since launching the IICPH in 1984. Bertell is author of Handbook for Estimating the Health Effects of Ionizing Radiation (1984, 1986) and the popular non-fiction book, No Immediate Danger: Prognosis for a Radioactive Earth, together with more than a hundred articles, book chapters and poems. Her latest book is Planet Earth: The Latest Weapon of War.

Images from "GHOST TOWN" www.elenafilatova.com
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18 ibid. Ref. 1, page 541.

19 ibid. Ref. 1, page 528

20 ibid. Ref. 1, page 472

21 page 473

22 ibid. Ref. 1, page 541

23 page 486.

24 UNSCEAR did not identify the leukemia study used, but referred the reader back to UNSCEAR 1988].

25 Table 52 on page 541 of UNSCEAR 2000 given the average absorbed dose in mGy.