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(IPPNW)

Gesellschaft für
Strahlenschutz e.V.

The Health Effects of Chernobyl

20 years after the reactor catastrophe

Meta analysis
Preliminary translation
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Executive Summary

The Chernobyl catastrophe changed the world. Millions of people were made victims overnight. Gigantic stretches of land were made uninhabitable. The radioactive cloud spread all over the world. An understanding of the dangers of the use of nuclear energy grew in a countless number of minds. Even in Germany, people became sick and died due to the radiation they incorporated into their bodies through eating and breathing.

The number of very varying levels of facts massively handicaps an analysis of the effects of Chernobyl. Essential data on the course of events of the catastrophe and its health effects are not publicly available. They are classified in both East and West. The structures of the authorities responsible are overstretched in their capability to detect the exposition to radiation of the liquidators and the population. There has been significant migration from the most radioactively contaminated areas to less contaminated areas that is difficult to fully reconstruct today. Contaminated food was distributed in uncontaminated areas and uncontaminated food was transported to contaminated areas. This means that comparisons between contaminated and uncontaminated areas are dubious. Moreover, the age structure of the three most affected countries in the region surrounding Chernobyl has greatly changed. This makes comparisons of the cancer and disease statistics harder to consider.

Stochastic radioactive damage is very hard to prove methodically. Large epidemiological studies are very expensive and only possible with state assistance. However, not only the governments of Russia, Belarus and the Ukraine, but also the states with operational nuclear power plants in the West, and the relevant organs of the United Nations (IAEA, WHO), are not interested in comprehensive and publicly reviewed research into the effects of Chernobyl. On top of this, many studies published in Russian have not been read or considered in the Western scientific world due to the language barrier.

This paper evaluates studies that contain plausible indications of health damage caused by the Chernobyl catastrophe. The authors of this paper attach importance to the selection of methodically accurate and comprehensible analyses. Due to the already mentioned methodical difficulties, it is not our aim to present the “right” statistics in contrast to the obviously wrong ones given by the IAEA, since these can never be found. They can only supply us with indications as to which health effects we should be looking at and to what extent we are dealing with, when we talk about the health effects of Chernobyl.

According to figures given by the Russian authorities, more than 90% of the liquidators have become invalids (sick and unable to work). This would mean that 540,000 to 775,000 of the liquidators are now invalids. If one was to apply this to the overall number of liquidators (600,000 to 1,000,000) then one would have to reckon with 540,000 to 900,000 invalids in this group of people alone. The liquidators are ageing prematurely. More than average numbers are developing various forms of cancer, leukaemia, and somatic and psychological illnesses. A large number have cataracts. Due to long latency periods, a significant increase in cancers is to be expected in the coming years. Prof. Lengfelder has estimated that between 50,000 and 10,000 liquidators will have died by the year 2006. Congenital abnormalities found in the children of liquidators and people from the contaminated areas could affect future generations to an extent that cannot yet be estimated.

Infant mortality (perinatal mortality) has increased in several European countries. The studies at hand estimated the number of fatalities amongst infants as a result of Chernobyl to be about 5000.

Genetic and teratogenic damage (malformations) have also significantly risen in many European countries. In Bavaria alone, between 1000 and 3000 additional birth deformities have been found since Chernobyl. We fear that in Europe more than 10,000 severe abnormalities could have been radiation induced. The estimated figure of unreported cases is high, given that even the IAEA came to the conclusion that there were between 100,000 and 200,000 abortions in Western Europe because of the Chernobyl catastrophe.

The overall extent of the genetic damage caused by the Chernobyl catastrophe can only be vaguely estimated. By referring to UNSCEAR one arrives at between 12,000 and 83,000 children born with congenital deformations in the region of Chernobyl, and around 30,000 to 207,000 genetically damaged children worldwide. Only 10% of the overall expected damage can be seen in the first generation.

In Belarus alone, over 10,000 people developed thyroid cancer since the catastrophe. According to a WHO prognosis, in the Belarus region of Gomel alone, more than 50,000 children will develop thyroid cancer during their lives. If one adds together all age groups then about 100,000 cases of thyroid cancer have to be reckoned with in the Gomel region.

A study in the Czech Republic found over 400 additional thyroid cancers. Altogether, the number of Chernobyl related cases of thyroid cancer to be expected in Europe (outside the borders of the former Soviet Union) are between 10,000 and 20,000.

Other forms of cancer and leukaemia have also risen since Chernobyl. The liquidators and the inhabitants of highly contaminated areas are particularly affected. More women in Belarus suffer at an early age from breast cancer. The number of children in the Ukraine with malignant and benign tumours of the central nervous system has risen disconcertingly. This increase in tumours is particularly great amongst young children. In Ukraine and Belarus there has been a distinct rise in new cases of leukaemia in different sections of the population.

In more contaminated areas of Southern Germany a significant cluster of very rare tumours has been found amongst children, the so-called neuroblastoma. In Germany, Greece, Scotland and Rumania, there has been a significant increase in cases of leukaemia. In the fallout regions of Northern Sweden, there were 849 additional cases of cancer up until 1996. It is to be feared that other kinds of cancer and leukaemia since Chernobyl could amount to several tens of thousands. The steep increase in various somatic and psychological illnesses in the most severely contaminated regions has been almost entirely disregarded by the official authorities in the West.

In a paper published by the Chernobyl Ministry in the Ukraine, a multiplication of the cases of disease was registered of the endocrine system (25 times higher from 1987 to 1992), the nervous system (6 times higher), the circulatory system (44 times higher), the digestive organs (60 times higher), the cutaneous and subcutaneous tissue (50 times higher), the muscular-skeletal system and psychological dysfunctions (53 times higher). Among those evaluated, the number of healthy people sank from 1987 to 1996 from 59 % to 18%, among the population of the contaminated areas from 52% to 21% and among the children of affected parent from 81% to 30%.

It has been reported for several years that type I diabetes (insulin-dependent diabetes mellitus) has risen sharply amongst children and youth. These cases outnumber the more spectacular cases of leukaemia and cancer greatly.

At the “Chernobyl Forum of the United Nations” organised in September 2005 by the International Atomic Energy Agency and the World Health Organisation, the presentation of the results of work on the effects of Chernobyl showed serious inconsistencies. For example: the press release of the WHO and IAEA stated that in the future, at most, 4000 surplus fatalities due to cancer and leukaemia amongst the most severely affected groups of people might be expected. In the report of the WHO on which this was based, however, the actual number is given as 8.930 deaths. These deaths were not mentioned in any newspaper articles. When one examines the source quoted in the WHO report, one arrives at a number between 10,000 and 25,000 additional fatalities due to cancer and leukaemia.

Given this it can be rationally concluded that the official statements of the IAEA and the WHO have manipulated their own data. Their representation of the effects of Chernobyl has little to do with reality.

The Chernobyl Forum does not take into account that even UNSCEAR has estimated that the collective dose (the usual measurement for radiation damage) for Europe outside the region of the former Soviet Union is higher than the corresponding data for the Chernobyl region. 53% of the collective dose from the catastrophe was distributed throughout Europe, 36% throughout the affected regions in the Soviet Union, 8% in Asia, 2 % in Africa and 0.3% in America. If one takes the data and the mindset that UNSCEAR and WHO use, then between 28,000 and 69,000 deaths from cancer and leukaemia would ensue worldwide as a result of the Chernobyl catastrophe. If one were to count the cases of cancer then one would arrive at a much greater number.

Up until today, there has been no conclusive overview of the changes in the health condition of the whole of the affected population in the region of Chernobyl, not to mention the lack of an overview of the catastrophe for the people in the Northern hemisphere. The numbers referred to here may seem on the one hand to be terribly high, on the other hand rather low. But it has to be taken into account that nearly all of the collated studies dealt with relatively small sections of the population. Even supposedly slight changes in rates of sickness can signify serious health damage and a large extent of human suffering when they are extrapolated onto a larger population group.

1. Demands of IPPNW and the Society for Radiation Protection

1. Western governments and the International Atomic Energy Agency IAEO are collating data in the Chernobyl area on the results of the accidents. Although they are using sick people to gain insight into the effects of radiation on health, they are hardly contributing any medical help to the victims of the meltdown. From a physician's point of view, this is unacceptable.

> We therefore demand that the German Federal Government, the other European States and the United Nations help those people suffering from the effects of radiation in the Chernobyl area effectively and on a long-term basis.

2. Essential data on the course of events of the Chernobyl catastrophe and the subsequent effects on health are not publicly available. They are classified in both East and West. This makes independent scientific analysis of the effects of Chernobyl extremely difficult. The United Nations pro-nuclear organs such as the IAEO are attempting – with the use of questionable scientific methods – to minimise the effects of the catastrophe by inaccurate use of Chernobyl data. From a scientific point of view, this is unacceptable.

> We therefore demand that the German Federal Government, the other European States and the United Nations allow scientists, associations and interested citizens unrestricted access to data concerning the Chernobyl catastrophe.

3. The Chernobyl catastrophe and the meltdown accident in the US atomic power station Harrisburg, as well as a number of other near-accidents in East and West have shown that a sizeable nuclear accident can happen at any time and in any place. If there were a maximum credible accident (MCA) in the Biblis nuclear power station in Germany the health and economic effects would be tenfold those of Chernobyl due to the higher density of population in the Rhein-Main area. This shows that the use of nuclear energy is generally irresponsible.

> We therefore demand that the German Federal Government and the other European States immediately shut down their nuclear power stations.

2. Introduction

"Keep the public confused
on nuclear fission and fusion."
US-Präsident Eisenhower[1]

"In view of the importance of nuclear energy,
the world could endure an accident
the size of Chernobyl every year."
Hans Blix, General director of the IAEA
from1981 to 1997[2]

The Chernobyl catastrophe changed the world. Millions of people were made victims overnight. Huge stretches of land were made uninhabitable. The radioactive cloud spread all over the world. An understanding of the dangers of the use of nuclear energy grew in countless numbers of minds. Although in Western Europe we cannot forget how we were forced to think about what we ate and the sand our children played in, it was not until 1989 and "The Children of Chernobyl" that a vague awareness of the far greater problems faced by the Ukraine, Belarus and Russia began to grow. That solidarity and a willingness to help the victims of a catastrophe have now lasted for over 16 years, is a historically unique phenomenon.

From the very first day onwards, Chernobyl had a strongly polarizing effect. At first the Soviet structures tried to keep the catastrophe secret, as they had frequently and successfully done in the past. Scientific experts in neighbouring or distant countries mainly dismissed the issue. At the same time a succession of lesser-known academics came down from their ivory towers and began lecturing the now alerted population on the basics of radiation biology and the effects and risks of radiation. Established scientists had to fight as never before to maintain their credibility.

The polarization within the scientific community, in politics, and public opinion has remained up to the present day. We are confronted with very contradictory positions, each of which claims to be 'scientific'.

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1 "Ike Sought Confusion Over Nuclear Testing", Associated Press Report, April 20 1979;

cited in: Rosalie Bertel: No Immediate Danger; The Women's Press Ltd., London, 1985; page 54 and Joan Smith: Clouds of Deceit: The Deadly Legacy of Britain's Bomb Tests"; Faber and Faber; 1985; page 143.
2 Alexey Yablokov, report about a conversation with Hans Blix shortly after the catastrophe; in:
Wladimir Tchertkoff: Atomic Lies; Feldat Film; 2004.

M. Max Rosen (director of the department for nuclear safety, IAEA): „Even if there were to be an accident of this kind every year – which is far from likely – I still think that nuclear energy is an interesting source of energy" In: E.G. : Selon les experts de l'AIEA réunis à Vienne; La catastrophe de Tchernobyl pourrait être à l'origine se 24 000 décès par cancer ; Le Monde ; 28.8.1986 ; french.

This paper evaluates scientific studies that contain plausible indications of causal relationships between radiation following the Chernobyl catastrophe and greatly differing diseases and fatalities.

The authors of this paper attach importance to methodically accurate and comprehensible analyses. We have tried not to lose sight of the immense uncertainty inherent in every estimation in this field. We have taken published papers into consideration, but believe a general rejection of papers that have not been published in peer-reviewed journals is unjustified – Galileo Galilei and Albert Einstein would have had no chance of having their papers accepted by a peer-reviewed journal.

The loss of the Chernobyl nuclear power station meant first and foremost a huge direct economic loss. Radiation from Chernobyl fallout rendered large areas of land agriculturally unusable. Large and small businesses were given up, towns and villages abandoned, some were flattened by bulldozers. It could have been much worse had the Chernobyl area not been so sparsely populated compared, for example, to Germany. Millions of people were affected by radiation and lost all they had; apartments, houses, homes and social security. Many lost their jobs and were unable to find new ones, families split up because they could not tolerate being irradiated or ostracized because of their proximity to Chernobyl.

The quarrel about the number of victims of Chernobyl is as stupid as it is cynical. It is a well-known fact that the frequently quoted death toll of 31 is long past being valid. Even the number of ‘less than 50’ quoted in Vienna in September 2005 cannot possibly be true. It is an unacceptable sophistry only to recognize those who died of acute radiation disease, cancer or leukaemia as Chernobyl deaths. Following Chernobyl there was an obvious if not drastic increase of illness rates, but - typically - experts judging from a distance, without ever having treated any of the victims, do not generally accept these rates as having resulted from Chernobyl.

We refuse to haggle over whether a liquidator (clean-up worker) who received a high radiation dose, who has been an invalid for years, whose wife has left him, whose daughter is unable to find a boyfriend because of her father’s history, who suffers from diverse illnesses, the treatment of which has been given up by doctors, and who commits suicide, counts as a Chernobyl death or not.

In this way, the search for reliable data on the dead of Chernobyl has become an impossible task - in any case there are many, far too many.

There is no comprehensive picture of the consequences of Chernobyl, not yet. The following overview aims at getting you to remember all that you already knew, aims at getting you to study carefully and critically the simplified and minimised accounts given by the large organizations and to be attentive to their large uncertainties and blank spaces.

The analysis of the effects of Chernobyl is impeded by a large number of very varying levels of facts:

In the first years after the catastrophe the Ministry of Health in the USSR and the KGB issued a large number of prohibitions that resulted in vital information necessary to assess the situation being either withheld, kept secret or falsified. As a result of this, irreplaceable knowledge and information has been lost and cannot today be replaced by theoretical calculations, no matter how complicated they may be.

Official accounts of the catastrophe were mainly dominated by structures operating at the 'red table'-level in Moscow, far away from Chernobyl. These accounts determine and falsify parts of the discussion up to the present day.

Leading scientists from both East and West in the fields of radio medicine/radiation protection and reactor safety/nuclear technology were quick with appeasements. They were later not, or only partially, prepared to correct their earlier assessments in spite of the pressure of compelling facts.

The authorities responsible were overstretched by having to investigate into exposure to radiation suffered by liquidators and the population. Suitable equipment, specialists and time were not available. Uncertainties were amplified by deliberate falsification of documents.

The health effects were different than had been expected.

There was considerable migration from the heavily to the less contaminated areas that is difficult to reconstruct today. Comparisons between contaminated and uncontaminated areas thus become questionable.

There are numerous accounts of attempts at 'compensatory justice': contaminated food was distributed in 'clean' areas and clean food was transported to contaminated areas, or clean and contaminated food was mixed – further shrouding the differences between clean and contaminated areas, and no longer retraceable, but certainly having a considerable effect upon the health of the population.

None of the governments in Russia, Belarus or the Ukraine are interested in a comprehensive survey of the consequences of Chernobyl. They prefer to close the case, gradually re-cultivate and resettle lost territory and pay as little as possible to the victims. They are not interested in discussions about the mistakes that have been made. There is a tendency amongst the International Atomic Energy Agency (IAEA) and the United Nations Scientific Committee for the Effects of Atomic Radiation (UNSCEAR) to support this position. Independent scientific studies in this area are not being financed and are being obstructed or prevented.

Stochastic radiation damage is difficult to prove. Large epidemiological studies are expensive and reference to necessary data requires access that is only possible with state assistance.

Age patterns in the three mainly affected countries have changed drastically: a drop in birth rates, increases in death rates and reduction of male life expectancy by about 10 years. This is not an easy aspect to take into account when comparing cancer and disease statistics.

The Soviet system collapsed about the same time as Chernobyl. The entire health system deteriorated as a result. Medication supplies, hospital equipment and the entire social and economic structure collapsed. There are a very few very rich people and an increasing number of desperately poor people who can only feed themselves by growing their own food – regardless of whether the earth is contaminated or not. All this has a negative effect on the state of health. Definitively attributing specific health damage either to the change in the system or to Chernobyl is difficult, if not impossible.

A great many doctors are overworked and frustrated by their poorly functioning and badly equipped health service, under these conditions they have little energy or interest for scientific questions. They feel that experts on Western committees only perceive the Chernobyl area as an experimental laboratory, leaving the doctors alone to treat the patients. These doctors are accordingly hesitant about giving information to Western scientists.

The authorities responsible in European countries carry out investigations into the consequences of Chernobyl reluctantly or not at all – they presume that nothing would come of them, in view of comparatively small amounts of Chernobyl radiation fallout. Were something to come of them, the entire academic world would be turned upside-down. History has taught us that such scientific paradigm changes are often met with bitter resistance from those in office.

A considerable obstacle in the search for the truth about Chernobyl is the language barrier. There are a lot of serious analyses from scientists in Russia, Ukraine und Belarus, which have been published in Russian and discussed at congresses in Russian. They are almost completely ignored In the Western world because, in the West, Russian is a very foreign language and good translations are expensive.

In this overview we have compiled scientific studies, which clearly show that the radioactive gases and particles (isotopes) released from the destroyed reactor in Chernobyl gave, and still give, rise to numerous serious illnesses, causing many people to become sick and die. The papers evaluated here comply with scientific standards and most have been published in scientific journals.

The overview is unavoidably incomplete and inconclusive, we can only touch on the various issues – the overview would otherwise have become far too long and unreadable.

We hope that in this way we are able to reactivate that which is already known, impart new knowledge and persuade others to carry on working independently and reflect upon how to help the victims of the catastrophe

Excursus: Key data from the Chernobyl Catastrophe[3]

Directly affected:

Belarus	2,500,000
Ukraine	3,500,000
Russia	3,000,000

135,000 were evacuated,
400,000 lost their homes and had to move away

3,000,000 people live in an area with > 185,000 Bq/m^2 (5 Ci/km^2)
270,000 people live in an area with > 555,000 Bq/m^2 (15 Ci/km^2)

Contaminated area:

Belarus	30%	62,400 km^2
Ukraine	7%	42,000 km^2 und 40% of the forests
Russia,	1.6% (of the European part)	57,650 km^2

21,000 km^2 were contaminated with 185-555,000 Bq/m^2 (5-15 Ci/km^2) and
10,000 km^2 were contaminated with more than 555,000 Bq/m^2 (> 15 Ci/km^2)

Table: Population distribution in the radioactively contaminated areas of the Ukraine, Belarus and Russia in 1995[4] (Residents)

Cs137 (kBq/qm)	Belarus	Russia	Ukraine	Altogether
37- 185	1,543,00	1,654,000	1,189,000	4,386,000
185- 555	239,000	234,000	107,000	580,000
555-1,480	98,000	95,000	300	193,300
Total	1,880,000	1,983,000	1,296,300	5,159,300

Areas in Europe that were contaminated with 37-185 kBq/m^2 Cs137:

- Sweden 12,000 km^2
- Finland 11,500 km^2
- Austria 8,600 km^2
- Norway 5,200 km^2
- Bulgaria 4,800 km^2
- Switzerland 1,300 km^2

3 UN-General Assembly A/50/418, 8.9.1995

4 UN Chernobyl Forum (EGE): Environmental Consequences of the Chernobyl Accident and Their Remediation: Twenty Years of Experience, Working Material, August 2005.

- Greece 1,200 km^2
- Slovenia 300 km^2
- Italy 300 km^2
- Moldavia 60 km^2.

Number of liquidators:
800,000 (600,000 – 1,000,000) people
(compared with the size of the German army: approx. 275,000 persons)

We recommend the following background reading:

- "Strahlentelex" information service archive: www.strahlentelex.de

- Collection of Chernobyl Analyses, edited by T. Imanaka (Kyoto University, KURRI -KR-21 and KURRI-KR-79, English),

- Russian/English "International Journal of Radiation Medicine" published in Kiev (Ed. Prof. Angelina Nyagu, Kiev, ISSN 1562-1154) (complete collection available in the archives of the Society for Radiation Protection)

- Issues 5(1992) and 24(2003) from the reports of the "Otto Hug Strahleninstitut" - Bonn

- Edmund Lengfelder: "Strahlenwirkung Strahlenrisiko", ecomed-V. 1990

- Roland Scholz: "Bedrohung des Lebens durch radioaktive Strahlung", IPPNW-Studienreihe Band 4, 3rd edition, 1997

- The "Society for Radiation Protection" website: www.gfstrahlenschutz.de

- The IPPNW websites: www.ippnw.de and www.tschernobyl-folgen.de

3. Liquidators

Whether they did it voluntarily or under immense pressure, knowingly or in ignorance, the liquidators gave their lives and their health in order to limit the effects of the Chernobyl catastrophe. Through their commitment they were able to protect others from even worse harm. The liquidators have earned our respect. Unfortunately, not only did they fall victim to fire, toxins and radiation but also to an incompetent bureaucracy that has made it difficult, if not impossible, to establish the nature of their illnesses, to give them proper treatment and to support the liquidators either socially or financially.

Because of this, the exact levels of individual radiation exposure are not known (see also 10.4). What makes the situation even more difficult is the fact that the liquidators were brought from all over the Soviet Union, returning home at the end of their service. Today, the liquidators are spread throughout the whole of the former Soviet Union and the names and addresses of only about half of them are known. Only a small proportion of the liquidators were subject to regular examinations. Systematic use of confusing questions created deliberate misunderstandings, the question of whether certain diseases had been caused by exposure to radiation was interchanged with the question whether diseases had or could have appeared as a result of the Chernobyl catastrophe. In addition, the fact that links between non-cancerous illnesses and exposure to radiation, known for years to experts from the analysis of data from Hiroshima and Nagasaki, are hardly mentioned either in text and reference books or in reports from international bodies was made use of. An inadmissible chain of argument is often applied: non-cancerous – therefore not induced by radiation – therefore not as a result of Chernobyl – end of the debate.

Today a great number of liquidators are invalids and suffering from various illnesses simultaneously.[5] As early as September 1992, at the Second World Conference of Radiation Victims in Berlin, Prof. Georgiy F. Lepin from Minsk, Vice President of the Union of Chernobyl Liquidators, stated that 70.000 liquidators were invalids and 13.000 had died.[6]

In 2002, the Ukrainian Ministry of Health announced that the proportion of liquidators registered as sick had risen between 1987 and 2002 from 21.8 to 92.7 percent.[7]

On the 19th anniversary of the catastrophe, the Ukrainian embassy in Paris announced that 94 percent of the liquidators were sick.

In autumn 2005, doctors in Kiev reported that approximately 2,000 liquidators were invalids, today the number is 106,000. There is no comparable data for Russia and Belarus.

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5 Edmund Lengfelder, Christine Frenzel: 15 years after Chernobyl, the reactor catastrophe: effects and lessons, Otto Hug Strahleninstitut – MHM, Information, September 2001. (German)

6 Strahlentelex 138-139/1992, 8, CIS: Already 13,000 dead liquidators. (German)

7 Nucleonics Week, May 2, 2002. Reproduced from Oda Becker, Helmut Hirsch 2004: 18 years after Chernobyl, restoration of the sarcophagus, and the race against time. Published by Greenpeace e. V. Hamburg in April 2004.

There are registers of liquidators (as far as they are known) in several of the former Soviet Republics. 10,000 liquidators are registered in Uzbekistan. Within 5 years following the catastrophe, 8.3 percent had become invalids. In the 10 years following the catastrophe, 73.,8 percent of the liquidators had become invalids, more than 500 had died. 68.8 percent are suffering from 4-5 illnesses simultaneously. When the morbidity rates of 960 liquidators were compared with those of 200 people from the normal population they were found to have significantly higher rates of dyscirculatory encephalitis, neurocirculatory dystonia, chronic gastritis, chronic inflammation of rhe duodenal mucous membrane, chronic hepatitis, gastric and duodenal ulcers, chronic cholecystitis, arterial hypertension, ischemic heart disease, chronic bronchitis, chronic pyelonephritis, chronic inflammation of the prostate gland and degenerative diseases of he vertebral column.[8]

In reaction to the Chernobyl Forum Meeting (of UN organisations) held in Vienna at the beginning of September 2005, Tetyana Amosova, Ukraine's Deputy Minister for Emergencies said that in the Ukraine more than 17,000 families were receiving state benefits because the father had died following service as a liquidator.[9]

After considering information from different sources, Edmund Lengfelder estimates that, to date, 50,000 to 100,000 liquidators have died.[10]

3.1 Cancer and leukaemia

A statistically significant increase of leukaemia illnesses has been found amongst those Russian liquidators who were in service in Chernobyl in 1986 and 1987.[11]

According to Russian sources, a great number of liquidators are now invalids and suffering, amongst other things, from leukaemia, lung cancer and other tumours.[12]

According to Julia V. Malova the liquidators mainly suffer from cancer of the lung and the respiratory tract.[13]

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8 Sh. A. Babadjanova and A.S. Babadjanov: Health of Liquidators in the Remote Period after the Chernobyl Accident; International Journal of Radiation Medicine 2001, 3(3-4): 71-76

9 Peter Finn: Chernobyl Report Reignites Debate; Washington Post 24.9.2005

10 E. Lengfelder et al.: 20 years after Chernobyl: Experience and lessons from the reactor catastrophe; (German) Information from the Otto Hug Strahleninstitut – MHM, February 2006.

11 United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA): 3rd International Conference, Health Effects of the Chernobyl Accident, Results of 15-Year-Follow-Up Studies, Kiev, 4 to 8 June 2001, Conclusions.

12 Edmund Lengfelder, Christine Frenzel: 15 years after Chernobyl: reactor catastrophe: effects and lessons, (German) Information from the Otto Hug Strahleninstitut – MHM, Information, September 2001. (German)

13 Julia V. Malova, Russian Scientific Centre of Radiology, Psychological Rehabilitation, Moscow, 18. UICC International Cancer Congress Oslo 2002, Abstract No.O 183: Cancer patients - the participants of the liquidation of the consequences of the Chernobyl explosion: the aims and the recourses of the psychological rehabilitation. Strahlentelex 374-375/2002, 9, Reduced brain functions amongst catastrophe aid workers. (German)

Okeanov[14] et al. showed that there was a significant increase in cancer of the lung, colon, bladder, kidney and thyroid gland amongst Belarussian liquidators compared to a control group (Vitebsk area) ($p<0,05$).[15] The relative risk of liquidators in comparison to the control group (Vitebsk area) did not – with the exception of thyroid cancer – increase significantly until recent years (1997-2000), i.e. following a 12-15 years latency period.
The average annual increase for all types of cancer amongst the liquidators was 5.5 percent, but only 1.5 percent ($p<0,05$) in the comparatively clean areas of Vitebsk in northern Belarus. Cancer of the colon increased by 9.4 percent amongst liquidators, but only by 3.2 percent ($p<0,05$) amongst adults in the Vitebsk area. Renal cancer increased by 8.0 percent and 6.5 percent ($p<0,05$) and cancer of the bladder by 6,5 percent and 3.8 percent $p<0,05$) respectively.

Liquidators who had been exposed to high doses of radiation over long periods of time developed cancer significantly more often. The cancer rate was significantly higher amongst liquidators living in the heavily contaminated areas of the Gomel region.

3.2 Damage to the nervous system

As early as autumn 1990, the Belarussian psychiatrist Kondrashenko (Minsk) warned of the effects of the catastrophe on the central nervous system. He reported on organic changes to the brain amongst people exposed to radiation.[16] Decade-old reports exist on damage to nerves and senses as well as on headaches suffered by villagers living in the vicinity of the nuclear weapons testing areas of Semipalatinsk (Kazakhstan). The West had not taken this information seriously. Instead, in the aftermath of Chernobyl, the phenomenon of "radiophobia"[17] was invented, insinuating that many of the health problems that arose in the aftermath of Chernobyl were not due to radiation, but to an unfounded hysterical reaction in the population.[18]

Investigations carried out by Nadejda Gulaya, of the Pallaguin Institute for Biochemistry in Kiev, on nerve cells from both humans and animals in the Chernobyl area, show that the

14 Professor A.E. Okeanov is now prorector for research at the International Sakharov Environmental University in Minsk. In1973 he co-founded the Belarussian cancer registry and in the following years had access to the data banks of all twelve oncological clinics in Belarus as well as to the data from 95,000 liquidators.

15 A. E. Okeanov, E. Y. Sosnovskaya, O. P. Priatkina, A national cancer registry to assess trends after Chernobyl accident, Swiss Medical Weekly 2004, 134: 645-649.

16 Valentin Timofeewitsch Kondrashenko: The characteristics of neuropsychological disorders in the borderland between health and sickness amongst people living in areas with increased radioactive contamination: children from Chernobyl – Erstes Berliner Koordinierungstreffen, 27.-28.10.1990, Berlin; Enclosure 4, 1-5. (German)

17 Phobia is an excessively inadequate angst reaction, prompted by a particular situation und usually associated with an understanding of its unfoundedness. Definition in Pschyrembel: Clinical dictionary, 257th Edition, Berlin, New York, 1994 (German)

18 Sebastian Pflugbeil, Strahlentelex 374-375/2002, 9, Additional comment (German)

main cause of observed damage to the nervous system is much less due to the fear of radiation but actually caused by serious organic radiation damage.[19]

In their January 13, 1993 issue, the Moscow Times quoted a study showing that 80 percent of 1,600 liquidators examined in a clinic in St. Petersburg were suffering from serious psychological problems.[20] 40 percent of victims seeking medical help were found to be suffering from neural disorders such as loss of memory.

Tens of thousands of liquidators suffer from dysphasia, depressions, memory dysfunctions and concentration problems. [21] Julia V. Malova, psychiatrist at the Moscow Centre for radiation diseases where she is especially concerned with liquidators' health, explained: "Our theory is that, in some way, the flow of blood to the brain has been, and possibly still is, reduced." These types of illnesses occur significantly more often amongst liquidators than the rest of the population.

48 percent of the post-mortems carried out on liquidators who have since died show that death was due to a blood clot or problems with the blood circulation. Cancer, at a rate of 28 percent, takes only second place as cause of death. Barely 20,000 of the Red Army soldiers ordered into the clean-up areas are taking part in treatment or research programs. Most of them are seriously ill, both psychologically and physically. They are finding it difficult to deal with their traumatic experiences.[22]

Andreas Arnold from the ENT clinic at the Universitäts-Inselspitals in Bern came to the conclusion that symptoms of dizziness suffered by many liquidators were due to lesions in the central nervous system.[23]

A lot of drivers had to give up their jobs because they kept going to sleep at the wheel.[24]

Konstantin Loganovsky (Kiev) und Pierre Flor-Henry (Alberta, Canada)[25] observed an increase in cases of cerebral-vascular illnesses, of schizophrenia and chronic fatigue

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19 Strahlentelex 136-137.1992, 8, Chernobyl, neural damage following radioactive radiation. Detailed information below.

20 Strahlentelex 146-147.1993, 4f., Moscow: mentally ill because of Chernobyl. Based on a report in the Frankfurter Rundschau. (German)

21 Julia V. Malova, Russian Scientific Centre of Radiology, Psychological Rehabilitation, Moscow, 18. UICC International Cancer Congress Oslo 2002, Abstract No. O 183: Cancer patients - the participants of the liquidation of the consequences of the Chernobyl explosion: the aims and the recourses of the psychological rehabilitation. Strahlentelex 374-375/2002, 9, Verminderte Hirnfunktionen bei Katastrophenhelfern. Die tageszeitung (taz) July 16, 2002.

22 Julia V. Malova, Russian Scientific Centre of Radiology, Psychological Rehabilitation, Moscow, 18. UICC International Cancer Congress Oslo 2002, Abstract No. O 183: Cancer patients - the participants of the liquidation of the consequences of the Chernobyl explosion: the aims and the recourses of the psychological rehabilitation. Strahlentelex 374-375/2002, S. 9, Verminderte Hirnfunktionen bei Katastrophenhelfern. Die tageszeitung (taz). July 16, 2002.

23 A. Arnold, R. Häuser: Vestibularsyndromes, +/- associated with Cochlear Damage, in Liquidators; PSR/IPPNW-Schweiz, Kongress "Gesundheit der Liquidatoren" in Bern, 12.11.2005.

24 S. Pflugbeil, Conversations whilst travelling

(chronic tiredness) amongst liquidators. They both found correspondent EEG-changes in the left hemisphere of the brain as well as changes to the left side of the cerebral cortex in MRT examinations. They believe this indicates that various neurological and psychiatric illnesses can be caused by exposure to radiation levels between 0.15 and 0.5 Sievert.

3.3 Heart and circulatory diseases

A study by the World Health Organisation (WHO) found a significant increase of heart and circulatory diseases amongst liquidators in the Russian Federation.[26]

According to Russian information, a large proportion of liquidators are now invalids and suffer, amongst other things, from heart and circulatory problems. [27]

D. Lazyuk examined cardiovascular diseases amongst liquidators from Belarus.[28] His study showed that, in the observation period 1992 to 1997, there was a huge increase in incidences of fatal cardiovascular disease amongst liquidators (22.1 percent) compared with the general population (2.5 percent). It is under debate as to whether this is caused by radioactive damage to the blood vessels.

3.4 Other illnesses

A study carried out by the World Health Organisation (WHO) of liquidators in the Russian Federation, found a statistically significant increase in blood and endocrinal diseases, as well as a significant increase in gastro-enteritis, infections and parasite-related disease.[29]

According to Russian information, many invalided liquidators suffer from inflammatory gastro-enteritis.[30]

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25 P. Flor-Henry: Radiation and the Left Hemisphere: Increased Incidence of Schizophrenia and Chronic fatigue Syndrome (CFS) in Exposed Populations in Chernobyl, Hiroshima and Nagasaki, PSR/IPPNW-Congress "Gesundheit der Liquidatoren" in Bern, 12.11.2005.

26 The Radiological Consequences of the Chernobyl Accident, European Commission and Belarus, Russian and Ukrainian Ministries on Chernobyl Affairs, Emergency Situation and Health, Report EUR 16544 EN, 1996.

27 Edmund Lengfelder, Christine Frenzel: 15 Years after Chernobyl, reactor catastrophe: effects and lessons. Otto Hug Strahleninstitut – MHM, Information, September 2001. (German)

28 Dimitri Lazyuk: Cardiovascular Diseases among Liquidators and Populations; PSR/IPPNW-Swiss Congress "Gesundheit der Liquidatoren" in Bern, November 12, 2005.

29 The Radiological Consequences of the Chernobyl Accident, European Commission and Belarus, Russian and Ukrainian Ministries on Chernobyl Affairs, Emergency Situation and Health, Report EUR 16544 EN, 1996.

30 Edmund Lengfelder, Christine Frenzel: 15 Years after Chernobyl, reactor catastrophe: effects and lessons, Otto Hug Strahleninstitut – MHM, Information, September 2001.

Pavel Fedirko from the Research Centre for Radio Medicine at the Academy of Medical Sciences in the Ukraine reported that, of the 5,200 liquidators he examined, 95 percent suffer from eye disease – amongst other things, cataracts, macula degeneration and chronic conjunctivitis.[31]

For many years now Elena Burlakova has been looking into the effects of low dose radiation at cell level.[32] [33] [34] In a costly study involving liquidators and sections of the population, the biochemist found that low dose radiation destroyed the protective anti-oxidants-system, particularly of children and young people under 30. "People age faster", said Burlakova.[35]

31 Pavel Fedirko: Eye Diseases among Liquidators: Lesions of Fundus and Macula, Vitreous and Lens; PSR/IPPNW-congress "Gesundheit der Liquidatoren" in Bern, 12.11.2005.

32 Elena B. Burlakova, V.I. Naidich (ed.): The Effects of Low Dose Radiation; VSP Utrecht, Boston, 2004.

33 Elena B. Burlakova (ed.): Low Doses of Radiation, Are They Dangerous?; NOVA Sc.Publ. Huntington, N.Y., 2000.

34 Е. Б. Бурлакова: Последствие Чернобыльской датастрофы: Здоровье человека; Москва, 1996.

35 Elena Burlakova: Ionizing Radiation and Premature Aging; PSR/IPPNW-congress "Gesundheit der Liquidatoren" in Bern, 12.11.2005.

In the following overview Yarilin shows how the incidence rates of 12 groups of illnesses amongst liquidators had changed. It is worth calculating the multiplication rate of the values in just 7 Years:[36]

Table: Incidence of 12 morbidity groups amongst liquidators (from 100,000 persons)[37]

Illness/organ group	1986	1987	1988	1989	1990	1991	1992	1993
Infections and parasites	36	96	197	276	325	360	388	414
New formations	20	76	180	297	393	499	564	621
Malevolent new formations	13	24	40	62	85	119	159	184
Endocrinal sytem	96	335	764	1.340	2,020	2,850	3,740	4,300
Blood & blood producing organs	15	44	96	140	191	220	226	218
Psychic changes	621	9,487	1,580	2.550	3,380	3,930	4,540	4,930
Neural system and sense organs	232	790	1,810	2.880	4,100	5,850	8,110	9,890
Circulation	183	537	1,150	1.910	2,450	3,090	3,770	4,250
Respiratory System	645	1,770	3,730	5.630	6,390	6,950	7,010	7,110
Digestive Organs	82	487	1,270	2.350	3,210	4,200	5,290	6,100
Urogenital System	34	112	253	424	646	903	1,180	1,410
Skin and subcutaneous tissue	46	160	365	556	686	747	756	726

3.5 Children of liquidators

An unusually high number of mutations have been found in the genetic make-up of the children of liquidators. Scientists from Haifa University have found up to a sevenfold higher number of changes in the genomes of these children compared to siblings who were conceived prior to service in Chernobyl. These mutations do not occur in connection with serious illnesses their accumulation however, indicates that they will be passed on to future generations. An increase in the number of mutations was found particularly in children who were conceived immediately following the accident. The numbers decrease in relation to the amount of time following the accident. The fathers of the children had received radiation doses of between 50 and 200 milliSievert. That is approximately the amount that nuclear power station workers receive during a10-year period.[38]

Professor Sheban and his colleague Prilebslaya looked into the development of thyroid cancer in children of liquidators. In the study a cohort of 700 persons was examined. It was shown that the incidence of thyroid diseases was significantly greater for children of

36 A.A. Yarilin: Immunological Disturbances; in: Chernobyl Catastrophe Consequences: Human Health, Moscow, 1996, 68-96, Russ. In: Burlakova et al.: Peculiarities of Biological Action of Low Irradiation Doses and their Probable Relation to the Health Status of Participants of Chernobyl Accident Liquidation; in: Imanaka (ed.): KURRI-KR-21, 1998, 223-234.

37 A.A. Yarilin: Immunological Disturbances …

38 Weinberg HS, Korol AB, Kirzhner VM, Avivi A, Fahima T, Nevo E et al. Very high mutation rate in offspring of Chernobyl accident liquidators. Proc Biol Sci 2001; 268 (1471):1001-5, Proceedings the Royal Society of London (Bd. 268, 1001).in Strahlentelex 346-347/2001, 8, Erbgutschäden bei Kindern.

liquidators than for children of unexposed parents.[39] This phenomenon raises questions for which there are no satisfactory answers.

Tsyb reported of a significant rise in the frequency of all types of illnesses amongst the children of liquidators compared to Russian children from Obninsk (1994-2002). More frequent amongst liquidator's children are particularly cancer and leukaemia, congenital deformations, endocrinal and metabolic illnesses as well as mental disturbances and behaviour problems. Within a number of years there was also a significant increase in cases of disease of the urogenital and neural system and the sense organs. In 1999 the rate of illness was particularly high.[40]

39 Angelika Claußen: The catastrophe in Chernobyl. Contact made during a visit in the restricted zone, IPPNW-Forum 96/2005, 6f. (German)

40 A.F. Tsyb et al.: General characterization of health in first-generation offspring born to liquidators of the Chernobyl NPP accident consequences; Int. J. Rad. Med. 2004, 6(1-4): 116-121.

4. Infant mortality

During the last century infant mortality had gradually decreased. This was due to a number of factors – the most important being improved medical care, vaccinations and improved living conditions. Every country pays particular attention to the development of infant mortality rates and presenting proudly any drop in death rates as proof of an efficient health service. Therefore a lot of countries have several decades worth of reliable data on infant mortality.

It is known from the period of atmospheric nuclear weapons testing that the infant mortality parameter is sensitive to radioactivity. It does therefore no surprise that there are now numerous studies showing that infant mortality is not only higher in the vicinity of Chernobyl – but also further away in Europe. In the textbooks there is nothing to be found on this yet, but it is in a number of different journals.

4.1 Chernobyl area

In1987, the year following the reactor accident, there was an increase in the number of stillbirths and perinatal deaths in the Ukrainian and Belarussian areas around Chernobyl. Alfred Körblein came to the conclusion that this is connected to caesium exposure. After 1989 there was a second increase in perinatal mortality in Belarus and in the Ukraine. For this further increase a link has been established to the exposure of pregnant women strontium.[41]

In the Ukraine the "strontium effect" is more dominant than the "caesium effect". From the difference between the expected and the actual rate of perinatal mortality it becomes clear that alone in the three Ukrainian regions Zhytomyr, rural Kiev and Kiev city, in 1987 151 children died mainly because of the caesium effect and between 1988 and 1991 712 children died as a result of the strontium effect. This means, that following Chernobyl there was a total of 863 perinatal deaths in the area as a result of caesium and strontium exposure.[42]

A different study noticed increased perinatal mortality and other unfavourable pregnancy outcomes in two heavily contaminated areas of the Ukraine close to the Chernobyl reactor.[43]

41 A. Körblein: Strontium fallout from Chernobyl and perinatal mortality in Ukraine and Belarus. Radiats Biol Radioecol. 2003 Mar-Apr;43(2):197-202. Strahlentelex, 398-399/2003, 5.

42 Alfred Körblein 2005: Studies of pregnancy outcome following the Chernobyl accident. Unpublished.

43 V.I. Kulakov, T.N. Sokur, A.I. Volobuev, I.S. Tzibulskaya, V.A. Malisheva, B.I. Zikin, L.C. Ezova, L.A. Belyaeva, P.D. Bonartzev, N.V. Speranskaya, et.al.: Female reproductive function in areas affected by radiation after the Chernobyl power station accident, Environ Health Perspect. 1993 Jul;101 Suppl 2:117-123. reproduced by: Alfred Körblein 2005: Studies of pregnancy outcome following the Chernobyl accident. Unpublished.

In 1987 in Belarus there was a greater increase (not significant) in perinatal mortality in the highly contaminated region of Gomel than in the other areas of Belarus.[44] Decisive for A. Körblein though, is the fact that in the first half of the 1990s perinatal mortality in the area of Gomel was about 30 percent higher than in the rest of the rural areas of Belarus. This is possibly a delayed effect following increased absorption of strontium during puberty. The analysis showed that between 1987 and 1998 than were 431 more perinatal deaths in the Gomel area than could have been expected from the data of comparable areas.[45]

Whilst the effect of radioactive caesium was essentially limited to 1987, the strontium effect continued until the end of the investigation period in 1998. The number of newborns that died in addition to this after1988 outweighs the effect of 1987 by ten times the amount. Dose estimates from Belarus assume that strontium makes up only about 5 percent of the caesium dose. Körbleins calculations deviate from current dose estimates by at least 2 orders. One possible explanation for this discrepancy is that the valid dose factor massively underestimates the effect of strontium.

Körblein's results are consistent with changes in perinatal mortality in Germany following the above-ground atom bomb tests in the 1950s and 1960s.

Excursus: Aborts and pregnancy terminations

Aborts and pregnancy terminations after Chernobyl were generally silently ignored. There are however a number of unsettling indications:

▪ in Poland there were considerably less live births in 1986 compared to previous years.[46] [47]

▪ in1987 Trichopoulos reported on pregnancy terminations following Chernobyl. He came to the conclusion that in May 1986, 23 percent of early pregnancies in Greece were terminated. Altogether about 2,500 wanted pregnancies were terminated because of Chernobyl.[48]

▪ Ketchum refers to data from the IAEA with the information that there were 100,000 to 200,000 additional terminations in Western Europe because of the Chernobyl catastrophe.[49]

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44 Alfred Körblein: Infant mortality following Chernobyl. Report no. 24/2003 Otto Hug Strahleninstituts, 6-34. (German)

45 Alfred Körblein 2005: Studies of pregnancy outcome following the Chernobyl accident. Unpublished.

46 J. Gould, Lecture on 18/19.11.1987 in Hamburg.

47 J.M. Gould: Mortality Consequences of Chernobyl Radiation in the US, First Global Radiation Victims Congress, New York, 29.9.1987.

48 D. Tricholoulos: The Victims of Chernobyl in Greece: induced abortions after the accident. Brit. Med. J. 295(1987) 1100.

49 L.E. Ketchum: Lessons of Chernobyl: SNM Members Try to Decontaminate World Threatened by Fallout; The Journal of Nuclear Medicine 28(1987) 6, 933ff.

▪ there have been numerous indications from doctors and women in the Chernobyl area that in the days and weeks following Chernobyl abortions were systematically carried out. No one wants to talk about it; we have no knowledge of accurate data on it.

Dr. Mole, longstanding member of the ICRP and the NRPB, had already addressed this issue prior to Chernobyl as follows: "The most important consideration is the generally accepted value judgement that early abortions of embryos have little personal and social importance."[50]

We do not share Dr. Mole's evaluation. We count these appallingly high numbers of aborted embryos to the victims of Chernobyl.

4.2 Germany

In1986 in Berlin, an unusual increase of infant mortality was noticed. Compared to 1985 infant mortality in Berlin rose in 1986 from 10.6 to12.5 per 1,000 live births in the first year of life. The mortality rate of non-German infants increased over-proportionally from 9.6 auf 14.3 per thousand. The mortality rate even increased between the end of the first week and the end of the first year of life by 26 percent. There had previously been a decrease in infant mortality.[51]

For the years 1975 to 1987 M. Schmidt, H. Ziggel and G. Lüning, working with the physicist prof. Dr. Jens Scheer in Bremen, had looked into infant mortality within the first seven days of life.[52] Whereas, early infant mortality in the entire republic had been on the decrease up to spring 1986 a change began to take place in the months following Chernobyl: In the southern areas of the Federal Republic, particularly in Bavaria and Baden-Württemberg where the highest amounts of radiation had been detected, considerably more deaths were registered amongst newborns than in those (northern) areas where there had been less radioactive rain. The extrapolation had however omitted to take sufficient account of previous changes in infant mortality brought about by rain following atmospheric atomic weapon tests.

50 Mole, Brit.J.Radiol. 52(1979)614,84-101.

51 Strahlentelex 7/1987, 2. Strahlentelex 8/1987, 3.

52 G. Lüning, J. Scheer, M. Schmidt, H. Ziggel: Early infant mortality in West Germany before and after Chernobyl. Lancet. 1989 Nov 4;2(8671): 1081-1083. Strahlentelex, 78-79/1990, 8, Säuglingssterblichkeit nach Tschernobyl

A paper published in 1997 by Alfred Körblein[53] and Helmut Küchenhoff, came to the conclusion that there was a significant increase in perinatal mortality in the whole of Germany following Chernobyl. The analysis of the monthly death rates showed an increase in perinatal mortality seven months after the exposure of pregnant women to radioactive caesium was calculated to have been at its height.[54] The author put this increase down to the fact that in the winter of 1986/1987 agricultural products came onto the market after the animals had been given contaminated feed.

In 1987Hagen Scherb und Eveline Weigelt from the GSF-research centre for environment and health in Neuherberg, found a significant increase of about 5 percent of perinatal mortality in Germany compared to the trend in other years.[55] This is the equivalent of about 300 additional cases. On the basis of stillbirth statistics from other European countries Scherb and Weigelt even consider it possible that this figure underestimates the effect (see below).

Following Chernobyl there was also an increase in perinatal mortality in southern Germany. In 1991 Munich's institute for the environment published a study on the effects of the reactor accident in Chernobyl from April 1986, on perinatal mortality in areas of the Federal Republic of Germany that had been weakly or heavily contaminated with radioactivity. This showed that in the more heavily contaminated southern Germany the incidence rate of early neonatal mortality went up twice, in early summer 1986 and in winter 1986/87.[56]

Körblein also examined birth rate developments in order to record any increase in spontaneous abortions as a result of Chernobyl.[57] It was found that birth rates in southern and northern Bavaria differed. In southern Bavaria, more badly hit by Chernobyl fallout than northern Bavaria, the birth rate in February 1987 showed an 11 percent significant ($p=0.0043$) decrease against the expected value. The birth deficit is 615. In northern Bavaria there was only a 4-percent insignificant ($p=0.184$) reduction.

53 Dr. Alfred Körblein (Environmental Institute Munich) had already drawn the wrath of the establishment upon himself by disrespectfully and carefully reading the renowned studies from the Cancer Register in Mainz (Director: Prof. Dr. Jörg Michaelis) on cancer incidences in the vicinity of German nuclear power plants and coming to very different results than Michaelis and the minister for the environment at the time, Angela Merkel. The resoluteness of Körblein and the coherence of his arguments have played a great part in prompting a new analysis of cancer incidents in the vicinity of German nuclear power plants.

54 A. Körblein, H. Küchenhoff: Perinatal Mortality in Germany following the Chernobyl accident. Radiat Environ Biophys 1997; 36(1): 3-7.

55 Hagen Scherb, Eveline Weigelt: Increase in perinatal mortality, stillbirths and malformations in Germany, Europe and in heavily contaminated areas of German and European regions following the reactor accident in Chernobyl in April 1986. Report no. 24/2003 from the Otto Hug Strahleninstituts, 35-75. (German)

56 Strahlentelex 108-109/1991, p. 4, Perinatal mortality increased in southern Germany. (German)

57 Alfred Körblein: Perinatal mortality following Chernobyl. Report no. 24/2003 Otto Hug Strahleninstituts, 6-34. (German)

4.3 Other countries

Upon studying the monthly data, Körblein found there had been a significant increase of perinatal mortality at the beginning 1987 in the Ukrainian area of Zhytomyr as well as in Poland of.[58]

Scherb and Weigelt also examined stillbirth rates in several States/regions outside the Chernobyl area that had also been relatively heavily contaminated by Chernobyl fallout.[59] According to their analysis the perinatal mortality rate in the combined countries/regions of Bavaria, East Germany, West-Berlin, Denmark, Iceland, Latvia, Norway, Poland, Sweden and Hungary increased in 1986 by 4.6 percent (p=0.0022) and from 1987-1992 by a highly significant 8.8 percent (p=0.33E-6) compared to the trends based on the periods 1981-1985 and 1987-1992. According to this model, it follows that for the years 1986 to 1992 there were about 3,200 stillbirths ($\pm$1,300=2σ) more than had been expected. That is an average of about 460 additional stillbirths per annum in this period of time and group of countries.[60] [61] [62] [63] [64]

Finland is the Scandinavian country most heavily polluted by Chernobyl. A Finnish study showed a distinctive increase in premature births of children who had been conceived in the first four months after Chernobyl in the areas with the highest dose rates and ground contamination with caesium-137.[65]

Scherb und Weigelt examined the development of stillbirths in Finland.[66] The scientists criticized the fact that in1987, of all years, Finland changed their definition of stillbirth. But Scherb and Weigelt still believe, albeit for different reasons, that the stillbirth statistics published in February 2001 by Auvinen and colleagues, provide them with consistent and

58 Alfred Körblein: Perinatal mortality following Chernobyl. Report no. 24/2003 Otto Hug Strahleninstitut, 6-34 (German).

59 Hagen Scherb, Eveline Weigelt: Increase in perinatal mortality, stillbirths and malformations in Germany, Europe and in heavily contaminated areas of German and European regions following the reactor accident in Chernobyl in April 1986. Report no. 24/2003 from the Otto Hug Strahleninstituts, 35-75. (German)

60 H. Scherb, E. Weigelt: Increase in perinatal mortality, stillbirths and malformations in Germany, Europe and in heavily contaminated areas of German and European regions following the reactor accident in Chernobyl in April 1986. Report no. 24/2003 from the Otto Hug Strahleninstituts, 35-75.(German)

61 H. Scherb, E. Weigelt, I. Brüske-Hohlfeld: European stillbirth proportions before and after the Chernobyl accident; International Journal of Epidemiology 1999; 28:932-940.

62 H. Scherb, E. Weigelt: Spatial-temporal change-point regression models for European perinatal data; European Radiation Research 2000, 30th Annual Meeting of the European Society for Radiation Biology, Warzawa, August 27-31, 2000.

63 H. Scherb, E. Weigelt, I. Brüske-Hohlfeld: Regression Analysis of Time Trends in Perinatal Mortality in Germany 1980-1993; Environmental Health Perspectives Vol. 108, No. 2, February 2000.

64 H. Scherb, E. Weigelt: Spatial-temporal logistic regression of the cesium contamination and the time trend in annual stillbirth proportions on a district level in Bavaria, 1980 to 1993; in: Friedl, H. et al. (eds): Proceedings of the 14th International Workshop on Statistical Modelling, Technical University Graz, 647-650.

65 T. Harjulehto, T. Aro, H. Rita, T. Rytömaa, L. Saxén: The accident at Chernobyl and outcome of pregnancy in Finland. Br Med J. 1989; 298: 995-997. Strahlentelex 178-189/1994, 7, Neugeborenensterblichkeit nach Tschernobyl.

66 Hagen Scherb, Eveline Weigelt: Increase in perinatal mortality, stillbirths and malformations in Germany, Europe and in heavily contaminated areas in German and European regions following the reactor accident in Chernobyl in April 1986. Report no. 24/2003 from the Otto Hug Strahleninstituts, 35-75. (German)

usable data for the years 1977 to 1992. Backed by this data, Scherb and Weigelt analysed the trend in stillbirths in Finland from 1977 to 1994. They found a highly significant change-point in 1987. The effect was approximately double that in Sweden and about two thirds of the effect in Hungary.

5. Genetic and teratogenic damage malformations)

One of the main difficulties of monitoring genetic damage is the fact that the greater number of changes does not become visible for several generations. For this reason basic knowledge at the beginning of genetic science came from flies, of which several generations could be examined in a laboratory in a short space of time because of their short life span. Our observations of genetic damage to humans following the Chernobyl catastrophe are therefore still in the early stages.

The following assessments on genetic damage in the aftermath of the Chernobyl catastrophe came from the Vavilov Institute of General Genetics of the Russian Academy of Sciences [67]: With reference to the UNSCEAR-Report from1988,[68] the collective doses for all the affected countries in the Northern hemisphere amounts to 600,000 man Sv. 40 percent of this, i.e., 240,000 man Sv. fell on the territories of the former USSR. People of childbearing age constitute about 40 percent of the population, therefore about 40 percent of the collective doses affects future generations. That would be 240,000 man Sv. for all affected countries and 96,000 man Sv. for the affected states of the Chernobyl region (former USSR). Based on this key data it is possible to estimate the extent of genetic damage resulting from the Chernobyl catastrophe. If the risk evaluation takes multifactor hereditary diseases into consideration then 1,200 to 8,300 cases of genetic damage in the first generation can be expected in the affected countries within the territory of the former USSR. About 10 percent of the expected genetic damage occurs in the first generation – this means that that we have to reckon with a total of 12,000 – 83,000 genetically damaged people in the affected countries of the Chernobyl region. That would be a total of 3,300 – 23,000 in the first generation and in the long-term, 30,000 – 207,500 people affected in the Northern hemisphere by the Chernobyl catastrophe.

It is surprising that in this UNSCEAR estimate the collective dose for Europe is greater than the collective dose for the Chernobyl area, from which it necessarily follows that the estimates concerning the number of victims and the extent of genetic damage in Europe are going to be even higher than those for the Chernobyl area. This is due mainly to the much higher population density in the European countries

UNSCEAR names a collective dose of 318,000 man Sv for Europe from which follows that under the conditions named above, there will be 1,800 – 12,200 genetically damaged people in Europe in the first generation following Chernobyl. Altogether we have to consider a total

67 V.A. Shevchenko: Assessment of Genetic Risk from Exposure of Human Populations to Radiation; in: E.B. Burlakova: Consequences of the Chernobyl Catastrophe: Human Health; Moscow, 1996, 46-61.

68 United Nations: Sources, Effects and Risk of Ionizing Radiation; UNSCEAR, New York, 1988, Report to the General Assembly, United Nations, New York, 1988. N° 1.35-44.

of 18,000 – 122,000 genetically injured people in Europe as a result of the Chernobyl catastrophe.[69]

Table: Estimated size of the genetic risk for the northern hemisphere, the Chernobyl area and for Europe following Chernobyl (from Shevchenko[70] und UNSCEAR 88)

Area	Collective doses [Man Sv]	Collective doses for the childbearing age group [mSv]	Genetic damage in the 1st generation (10%)	Genetic damage altogether (100%)
Northern hemisphere	600,000	240,000	3,300-23,000	33,000-230,000
Chernobyl area	216,000	86,400	1,200-8,300	12,000-83,000
Europe	318,000	127,200	1,800-12,200	18,000-122,000

5.1 Chernobyl area

Approximately one week after the reactor catastrophe in Chernobyl a number of German citizens returned to the Federal Republic of Germany from their various locations in the Ukraine. Analyses of their chromosomes showed a surprisingly clear increase in chromosome anomalies (genetic malformations): Acentric chromosome anomalies were about twice as frequent as dicentric. Centric rings were also found. Most of those examined were in the Ukraine on behalf of a company and had been located up to about 400 kilometres away from Chernobyl. Whole-blood cultures were examined of blood samples taken in May 1986[71].

In Belarus a paper from Lazjuk and colleagues diagnosed an increased number of deformities in 5-12 week old foetuses.[72] Lazjuk published data on the rate of congenital malformations over the period from 1985 to 1994. In 1985 in Belarus there were12.5 birth defects per 1,000 live births. In 1994 the figures were 17.7/1,000. Lazjuk points out that from 1991 on ultrasonic examinations were introduced in order to recognise malformations at an early stage. If those pregnancies that were terminated following ultrasonic examination are taken into account (1.551 cases), the rate for 1994 is 22.4 birth defects per 1,000 live births or pregnancies, i.e. the rate of birth defects has almost doubled in 10 years. There were

69 These thoughts essentially adhere to data given by V.A. Shevchenko: Assessment of Genetic Risk from Exposure of Human Populations to Radiation; in: E.B. Burlakova: Consequences of the Chernobyl Catastrophe: Human Health; Moscow, 1996, S. 46-61, but elaborate on those for Europe. Figures were very much rounded-down, as at this point only a rough estimate of size is required.

70 V.A. Shevchenko: Assessment of Genetic Risk from Exposure of Human Populations to Radiation; in: E.B. Burlakova: Consequences of the Chernobyl Catastrophe: Human Health; Moscow, 1996, 46-61.

71 G. Stephan, U. Oestreicher: An increased frequency of structural chromosome aberrations in persons present in the vicinity of Chernobyl during and after the reactor accident. Is this effect caused by radiation exposure? Mutation Research, 223(1989) 7-12. Strahlentelex, 58-59/1989, 2, Radiation damage, more chromosome damage amongst travellers from the Soviet Union. (German)

72 G.I. Lazjuk, I.A. Kirillova, I.u.E. Dubrova, I.V. Novikova: Incidence of developmental defects in human embryos in the territory of Byelarus after the accident at the Chernobyl nuclear power station, Genetika, 1994 Sep; 30(9): 1268-1273 (Russian). Reproduced from: Alfred Körblein 2005: Studies of pregnancy outcome following the Chernobyl accident. Unpublished.

particularly high rates of anencephaly (missing brain), spina bifida (open spine), cleft lip/ palate, polydactylia (supernumery digit) and muscular atrophy of limbs. [73]
In Belarus, Petrova and colleagues also noticed an increase in the rate of children suffering from anaemia or congenital malformations.[74]

In January 1987 - nine months after Chernobyl – cases of Trisomie 21 (Down syndrome) in newborns became more frequent in Belarus. Zatsepin et al. had carried out examinations in the period from 1981 to 2001. The authors deduce that because of the time correlation to the Chernobyl accident the increase in Down syndrome in January 1987 is due to Chernobyl fallout. Other possible influencing factors such as prenatal diagnostic or altered maternal age distribution can be excluded as causes.[75]

Scientists from the universities of Moscow and Leicester examined blood samples from 79 families, the parents of which had been living within a 300-kilometre radius of the reactor. The scientists were surprised by the fact that in those children born between February and September 1994 cases of mutations had doubled. The genetic scientists reasoned, that as the examined children were only two years old this was due to genetic changes in the parental germ cells. Professor David Hillis from the university of Texas in Austin drew attention to the correlation with measurement results from field mice that had lived off highly contaminated food in the area around the Chernobyl sarcophagus: "The rate of mutation amongst the field mice is one hundred thousand times higher than normal".[76]

Godlevsky reported on morbidity amongst newborns up to 7-days old as well as on the dynamics of congenital development anomalies amongst newborns in the Ukrainian district of Lugyny. Morbidity rose from 80 cases per 1,000 births in 1985 to about 4-fold in 1995 (shown in the chart). The absolute number of development anomalies rose from 4 in 1985 with varying high values to 17 in 1989 and 33 in 1992, in 1996 the value then falls to 11.[77]

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73 Hoffmann, W.: Fallout from the Chernobyl nuclear disaster and congenital malformations in Europe. Archives of Environmental Health 56 (2001) 478-484. Strahlentelex, 374-375/2002, 9 f. Inge Schmitz-Feuerhake, Malformations in Europe and Turkey. (German)

74 A. Petrova, T. Gnedko, I. Maistrova, M. Zafranskaya, N. Dainiak: Morbidity in a large cohort study of children born to mothers exposed to radiation from Chernobyl, Stem Cells, 1997; 15 Supp 2:141-150. Reproduced by: Alfred Körblein 2005: Studies of pregnancy outcome following the Chernobyl accident. Unpublished.

75 Zatsepin et. al., Cluster of Down's syndrome cases registered in January 1987 in the Republic of Belarus as a possible effect of the Chernobyl accident.

76 GID 112/113, June 1996. Deutschland-Radio Newsletter, 27.04.1996. Strahlentelex, 228-229/1996, 9, Genotype changes amongst children doubled. (German)

77 Ivan Godlevsky, O. Nasvit: Dynamics of Health Status of Residents in the Lugyny District after the Accident at the ChNPP; In T. Imanaka: KURRI-KR-21, Kyoto, 1998, 149-156.

Table: Teratogene effects observed following the Chernobyl accident.

Country	Effects	References
Belarus National Genetic Monitoring Registry	Anencephaly, open spine, cleft lip/palette, polydactylia, musc. atrophy of limbs, Down syndrome	Lazjuk et al. 1997
Belarus High contamination area Gomel District Chechersky in the Gomel region Region of Mogilev Region of Brest	 congenital malformations congenital malformations congenital malformations congenital malformations	 Bogdanovich 1997; Savchenko 1995 Kulakov et al. 1993 Petrova et al. 1997 Shidlovskii 1992
Ukraine District of Polessky in the Kiev area Region of Lygyny	 congenital malformations	 Kulakov et al. 1993 Godlevsky, Nasvit 1998
Turkey	Anencephaly, open spine	Akar et al.1988/89; Caglayan et al. 1990; Güvenc et al. 1993; Mocan et al. 1990
Bulgarian, Pleven area	Malformations of heart and central nervous system, multiple malformations	Moumdjiev et al. 1992
Croatia	Malformations upon autopsy of stillborns and cases of early death	Kruslin et al. 1998
Germany German Democratic Republic, Central registry Bavaria Annual Health Report of West Berlin 1987 City of Jena (Registry of congenital malformations)	 Cleft lip and/or palate Cleft lip and/or palate Congenital malformations Malformations in stillborns Isolated malformations	 Zieglowski, Hemprich 1999 Scherb, Weigelt 2004 Körblein 2003, 2004; Scherb, Weigelt 2003 Strahlentelex 1989 Lotz et al. 1996

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Akar, N., Ata, Y., and Aytekin, A.F., 1989, Neural Tube defects and Chernobyl? Paediatric and Perinatal Epidemiol. 3:102-103.
Bogdanovich, I.P., 1997, Comparative analysis of the death rate of children, aged 0-5, in 1994 in radiocontaminated and conventionally clean areas of Belarus, in: Medicobiological effects and the ways of overcoming the Chernobyl accident consequence, Collected book of scientific papers dedicated to the 10th anniversary of the Chernobyl accident, Minsk-Vitebsk, p. 4.
Caglayan, S. Kayhan, B., Mentesoglu, S., and Aksit, S., 1990, Changing incidence of neural tube defects in Aegean Turkey, Paediatric and Perinatal Epidemiol. 4:264-268.
Godlevsky, I., and Nasvit, O., 1998, Dynamics of health status of residents in the Lugnyny district after the accident of the ChNPS, in: Research activities about the radiological consequences of the Chernobyl NPS accident and social activities to assist the sufferers by the accident, T. Imanaka, ed., Research Reactor Institute, Kyoto University, KURRI-KR-21, pp.149-156.
Güvenc, H., Uslu, M.A., Güvenc, M., Ozkici, U., Kocabay, K., and Bektas, S., 1993, Changing trend of neural tube defects in Eastern Turkey, J. Epidemiol. Community Health 47:40-41.
Körblein, A., Säuglingssterblichkeit nach Tschernobyl, 2003, Berichte Otto Hug Strahleninstitut 24:6-34.
Kulakov, V.I., Sokur, T.N., Volobuev, A.I., Tzibulskaya, I.S., Malisheva,V.A., Zikin, B.I., Ezova, L.C., Belyaeva, L.A., Bonartzev, P.D., Speranskaya, N.V., Tchesnokova, J.M., Matveeva, N.K., Kaliznuk, E.S., Miturova, L.B., and Orlova, N.S., 1993, Female reproduction function in areas affected by radiation after the Chernobyl power station accident, Environ Health Persp. 101, Suppl. 2:117-123.
Kruslin, B., Jukic, S., Kos, M., Simic, G., and Cviko, A., 1998, Congenital anomalies of the central nervous system at autopsy in Croatia in the period before and after Chernobyl, Acta Med. Croatica 52:103-107.
Lazjuk, G.I., Nikolaev, D.L., and Novikova, I.V., 1997, Changes in registered congenital anomalies in the Republic of Belarus after the Chernobyl accident, Stem Cells 15, Suppl. 2:255-260.
Lotz, B., Haerting, J., and Schulze, E., 1996, Veränderungen im fetalen und kindlichen Sektionsgut im Raum Jena nach dem Reaktorunfall von Tschernobyl, Oral presentation at the International Conference of the Society for

Medical Documentation, Statistics, and Epidemiology, Bonn, Germany.
Mocan, H., Bozkaya, H., Mocan, Z.M., Furtun, E.M., 1990, Changing incidence of anencephaly in the eastern Black Sea region of Turkey and Chernobyl, Paediatric and Perinatal Epidemiol. 4:264-268.
Moumdjiev, N., Nedkova, V., Christova, V., Kostova, Sv., 1992, Influence of the Chernobyl reactor accident on the child health in the region of Pleven, Bulgaria, in: 20th Int. Congr. Pediatrics Sept. 6-10, 1992 in Brasil, p.57. Cited by Akar, N., Further notes on neural tube defects and Chernobyl (Letter), Paediatric and Perinatal Epidemiol. 8, 1994, 456-457.
Petrova, A., Gnedko, T., Maistrova, I., Zafranskaya, M., Dainiak, N., 1997, Morbidity in a large cohort study of children born to mothers exposed to radiation from Chernobyl. Stem Cells 16, Suppl. 2: 141-150
Scherb, H., and Weigelt, E., 2003, Congenital malformation and stillbirth in Germany and Europe before and after the Chernobyl nuclear power plant accident, Environ. Sci.& Pollut.Res. 10 Special (1):117-125.
Scherb, H., and Weigelt, E., 2004, Cleft lip and cleft palate birth rate in Bavaria before and after the Chernobyl nuclear power plant accident, Mund Kiefer Gesichtschir. 8:106-110 (in German).
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Zieglowski, V., and Hemprich, A., 1999, Facial cleft birth rate in former East Germany before and after the reactor accident in Chernobyl, Mund Kiefer Gesichtschir. 3:195-199 (in German).

5.2 Germany

In January 1987, nine months after Chernobyl, in a laboratory for genetic diagnostic in Munich (Dr. Klaus Waldenmeyer), it was found that the frequency of Trisomie 21 (Down syndrome) was three times the normal figure.[78] Even with the necessary prudence that, according to Dr. Waldenmeyer, is mandatory in judging such observations, an increase in the occurrence of genetic changes exactly nine months after the catastrophe is extremely conspicuous[79]. In Munich six cases of Trisomie 21 became known[80].

K. Sperling also observed a sharp rise in cases of Trisomie 21 (Down syndrome) in Berlin nine months after Chernobyl. In January 1987 12 children were born with Down syndrome in West Berlin, whereas normally only two or three cases would be expected. This figure qualifies as "highly significant", thereby excluding a coincidental fluctuation.[81] In eight of these cases the probable date of conception was at the time of the highest measured rise of radioactivity in Berlin[82]. K. Sperling et al. confirmed the observed increase of the rate of Down syndrome in 1987 in an extensive data analysis published in the British Medical Journal. Sperling was able to support his analysis with unusually accurate figures. Due to the earlier ‘island-status’ of the city and his institute’s responsibility for the supervision of all

78 People with Down syndrome have a chromosome set, in which chromosome 21 occurs three times instead of twice. They therefore have a total of 47 instead of 46 chromosomes, the carriers of genetic information. These genetic changes occur as a result of a defective meiosis of the sexual cell, usually of the mother, prior to fertilization. The results are a typical physical appearance of the children, low intelligence quota, reduced defence against infection and malformations of internal organs for example, cardiac defects

79 Strahlentelex, 3/1987, Feb. 19,1987, 1f, Down syndrome following Chernobyl two to three times more frequent (German)

80 Strahlentelex, 5/1987, March 19, 1987, 1f. , "Mongolismus" 9 Monate nach Tschernobyl

81 Strahlentelex, 5/1987, March 19, 1987, 1f. , "Mongolismus" 9 Monate nach Tschernobyl

82 Strahlentelex, 166-167/1993, 4, Chernobyl effects also measurable in Germany. (German)

children with Down syndrome in West Berlin, Sperling's figures were practically complete compared to the figures from the other Federal States. Sperling was able to eliminate other causes for the accumulation of chromosome disorders, in particular the mother's age, except for radioactive fallout in spring. Five couples had conceived their child between April 29 and Mai 8, 1986 when radiation was at its highest in Berlin, for a further five couples the date of conception was also either during this period or shortly after. By means of genetic cell examination Sperling and Mikkensen were able to establish that in six from seven cases the extra chromosome was on the maternal side. According to Sperling, in eight of the total of 12 cases a link between increased radioactivity and the chromosome anomaly was probable and could in any case not be excluded. Sperling assumed that the cause could have been radioactive Iodine-131 due to its half-life of about 8 days and its heavy concentration in the environment, in the air and in food in the spring of 1986. It is being debated whether there is interaction between the ovaries and the thyroid gland as well as direct storage in the ovaries. In earlier medical studies of mothers and children with Trisomie 21 an accumulation of thyroid diseases such as hyperthyroidism (Clark 1929) and autoimmune reactions (Fialkow 1964) had been observed.[83]

Following his observations in Berlin, professor Sperling initiated a national survey of 40 human genetic institutes and places of research in the Federal Republic of Germany. Evaluation of the 28,737 prenatal chromosome analyses from 1986 showed at the time, 393 incidences of deviation from the normal number of chromosome, 237 of these were cases of Trisomie 21. The greatest number of deviations was amongst embryos that had been conceived in the days following the Chernobyl disaster. The accumulation was greater in the more heavily radioactively contaminated southern part of Germany.[84]

Professor Sperling's Trisomie-21-study for Berlin was later verified in a re-analysis. Pierre Verger from the institute for nuclear safety and radiation protection in Fontenay-aux Roses Cedex (France) examined the available papers for a possible connection between ionising radiation and the emergence of the chromosome anomaly responsible for Down syndrome, taking the ages of the mothers as well as possible prenatal radiation into consideration. [85]

In Hamburg in the Chernobyl year of 1986, there was the second highest rise in 30 years of the number of defective and prematurely born infants under 2,500 grams. These figures

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83 Karl Sperling, Jörg Pelz, Rolf-Dieter Wegner, Andrea Dörries, Annette Grüters, Margareta Mikkelsen, Significant increase in trisomy 21 in Berlin nine months after the Chernobyl reactor accident, temporal correlation or causal relation? British Medical Journal 1994, 309: 158-62, 16 July 1994. Karl Sperling, Jörg Pelz, Rolf-Dieter Wegner, I. Schulzke, E. Struck, Frequency of trisomy 21 in Germany before and after the Chernobyl accident, Biomed & Pharmacother, 1991, 45, 255-262. Strahlentelex, 184-185/1994, 1 f., Handicapped children in Berlin because of Chernobyl. (German)

84 Karl Sperling, Jörg Pelz, Rolf-Dieter Wegner, Andrea Dörries, Annette Grüters, Margareta Mikkelsen, Significant increase in trisomy 21 in Berlin nine months after the Chernobyl reactor accident, temporal correlation or causal relation? British Medical Journal 1994, 309: 158-62, 16 July 1994. Karl Sperling, Jörg Pelz, Rolf-Dieter Wegner, I. Schulzke, E. Struck, Frequency of trisomy 21 in Germany before and after the Chernobyl accident, Biomed & Pharmacother, 1991, 45, 255-262. Strahlentelex, 184-185/1994, Handicapped children in Berlin because of Chernobyl. (German)

85 Pierre Verger, Down Syndrom und Ionizing Radiation, Health Physics, December 1997, Vol 73:6, 882-893. Strahlentelex, 268-269/1998, 1-4. In a re-analysis, the Trisomie-21 study of the Berlin human geneticist Sperling was confirmed.

include not only newborn but also prematurely born infants. The Hamburg senate gave this information in answer to a short question put by member of the senate Ursula Caberta y Diaz (SPD). Whereas from 1981 to 1985 an average of 60 per 1,000 infants were born at a low birth weight (in 1982 the figure was 65), in Chernobyl year there were 67 underweight infants.[86]

Following Chernobyl there was also an increase of radiation-typical congenital malformations in the GDR where it was legal regulation that all abortions and all deaths of children under 16-year of age had to be autopsied. In 1986-87 the register of congenital malformations in Jena detected a 4-fold increase in isolated malformations compared to 1985, which then subsided in subsequent years. The increase mainly affected the central nervous system and the abdominal wall.[87] An analysis of the GDR central register of congenital malformations showed an increase in cases of cleft lip and palette of about 9.4% in 1987 (compared to the mean values for 1980 and 1986), which was more pronounced in the 3 northern areas, which hat been most affected by fallout. [88]

According to the 1987annual health report for Berlin, in West Berlin the incidence of malformations of stillborn infants doubled. The hands and feet were most commonly affected, then the heart and urethra, the incidence of facial clefts also increased.[89]

In the southern part of Bavaria, where the contamination by radioactive fallout had been comparatively high, the rate of congenital malformations at the end of 1987, seven months after the highest contamination of pregnant women with caesium, was almost twice as high as in northern Bavaria. In November and December 1987 the rate of congenital malformations in Bavarian districts showed a high significant dependency upon ground contamination levels of caesium. A. Körblein and H. Küchenhoff showed that there was a temporal correlation between the rate of congenital malformations in southern and northern Bavaria and the seven-month delayed effect of exposure to caesium of pregnant women. In November and December 1987, the rate of congenital malformations in the 24 Bavarian districts most heavily contaminated was almost three times that of the 24 Bavarian districts with the lowest contamination. In the ten most heavily contaminated districts the rate of congenital malformations was in fact almost eight times higher than in the ten least contaminated (odds ratio = 7.8, $p<0.001$). The results are also compatible with an increased stillbirth rate. Bavaria is the only German state that has data on congenital malformations

86 Strahlentelex, 47/1988, S. 6, Hamburg, In Chernobyl year 1986 more underweight children born. (German)

87 Lotz, B. et al.: Changes in dissected tissue of foetus and children in the area of Jena following the reactor accident in Chernobyl, Bonn, Lecture: Society for Medical Documentation, Statistics and Epidemiology, 1996. In Hoffmann, W.: Fallout …(German)

88 Zieglowski, V., A. Hemprich: Facial cleft birth rate in former East Germany before and after the reactor accident in Chernobyl. Mund Kiefer Gesichtschirurgie 1999; 3:195-199; In Hoffmann, W.: Fallout from the Chernobyl nuclear disaster and congenital malformations in Europe. Archives of Environmental Health 56 (2001) 478-484. Strahlentelex, 374-375/2002, 9 f. Inge Schmitz-Feuerhake, Malformations in Europe and Turkey. (Ger)

89 Hoffmann, W.: Fallout from the Chernobyl nuclear disaster and congenital malformations in Europe. Archives of Environmental Health 56 (2001) 478-484. Strahlentelex, 374-375/2002, 9 f. Inge Schmitz-Feuerhake, Malformations in Europe and Turkey. (German)

from before and after Chernobyl. They were retrospectively ascertained for 1984 to 1991 by order of the Bavarian ministry of state for development and environmental issues.[90]

H. Scherb et al. found that there was a relationship between the rise in the rate of congenital malformations following Chernobyl and ground contamination levels of caesium in the Bavarian districts. For the group of orofacial cleft anomalies they found an increase in the accumulation of malformation in the years following Chernobyl (1987-1991) compared to previous years (1984-1986).[91]

The second main focus of Scherb aund Weigelt's work comprised the analysis of the data on malformations that had been ascertained in Bavaria by order of the Bavarian ministry of the environment. They allow the estimate that following Chernobyl, between October 1986 and December 1991 there were 1,000 to 3,000 excess congenital malformations in Bavaria.[92] The authors arrive at a risk estimation that ranges in size similar to that of the stillbirth risk from 0.5%-2.0%/(1 kBq/m^2). Even with cautious interpretation this means that there is a relative risk coefficient of 1.6/(1mSv/a), if only the external dose of the caesium isotopes Cs134 and 137 is taken into consideration. This contradicts the opinion that with regard to reproduction disorders there is a (relatively high) threshold value.[93] [94] [95]

Excursus: Chernobyl effects on animals in Europe

In Germany in the aftermath of Chernobyl, malformations were not only noticed amongst people but also amongst animals. There have always been malformations amongst animals. Alone the genetics department of the faculty of veterinary medicine at the university of Giessen has about 8.000 specimens. One year after Chernobyl there was an influx as had never been seen before: miscarriages and premature births by cows in Bavaria and Corsica, piglets without eyes, chicks with three legs, rabbits without legs, sheep without fleece or with only one eye, foals with areas of skin missing, baby goats with corkscrew legs or open abdomen. Some breeders reported a loss of up to 40% of young animals. Goats are regarded as the domestic animals most sensitive to radioactivity. In 1987 a lot of breeding animals did not become pregnant. Further, there was an accumulation of miscarriages, premature births, still births and problematic births, lambs that were too small, lambs that

90 Alfred Körblein: Effects of Chernobyl: Malformations of newborns in Bavaria. Umweltnachrichten 94/2001, Umweltinstitut München e.V. December 2001, 11-16. H. Scherb, E. Weigelt, Cleft birth rate in Bavaria before and after the reactor accident in Cernobyl, Mund Kiefer Gesichtschirurgie 8: 106-110. Strahlentelex, 360-361/2002, 5f., Malformations of newborns in Bavaria. (German)

91 Scherb, E. Weigelt, Cleft birth rate in Bavaria before and after the reactor accident in Cernobyl, Mund Kiefer Gesichtschirurgie 8: 106-110. Strahlentelex, 416-417/2004, 4f., Malformations of newborns in Bavaria. (German)

92 Otto-Hug-report no. 24. Strahlentelex, 388-389/2003, 6f., In Germany and other European countries decidedly more infants also died following Chernobyl, there were more malformations and stillbirths. (German)

93 BEIR V: Health effects of exposures to low levels of ionising radiation. National Research Council, Committee on the biological effects of ionising radiation, Nat. Academy Press, Washington, 1990.

94 A.M. Kellerer: Reactor catastrophe and infant mortality? GSF-Report 19/98. Neuherberg. (German)

95 Radiation Protection Commission: Effects following prenatal radiation; BMU ed., 1989.

were too big, with no swallowing reflex, problems of the thyroid gland, premature deaths of lambs and serious malformations. The reports came from the Rhineland, Saarland, Saar-Pfalz, Rhineland-Pfalz and from the Sauerland. They often came in spite of some considerable pressure from the goat breeders associations who did not want the problem to be reported.[96]

For 1987an above average increase in the occurrence of hermaphrodites, stillbirths and malformations was found amongst the goat population of the southern German states in a survey carried out by the institute for animal husbandry and the genetics of domestic animal at the university of Gießen under the direction of Prof. Dr. J. Steinbach. Data from before Chernobyl (1985-1986) and after the catastrophe (1987) was taken in 133 randomly chosen goat-keeping farms in eight Federal States. No permission was granted to the study group for Bavaria. A total of 890 litters prior to Chernobyl and 794 litters in the aftermath of the nuclear disaster were examined. According to the study the litter-size decreased from 1.93 to 1.82 after Chernobyl. The proportion of hermaphrodites rose from 2.20 to 3.48 percent. Stillbirths increased from 4.66 to 5.77 percent. Congenital malformations of dead lambs increased from 0.93 to 1.32 percent and congenital malformations of live-born lambs from 0.31 to 1.10 percent. The effects appeared mainly in the southern States, which had been heavily contaminated by fallout from Chernobyl.[97]

Impressive evidence of genetic damage amongst animals can be taken from the scientific drawings of Cornelia Hesse-Honegger. Prior to Chernobyl she had already been professionally involved with drawing genetic damage in flies following various kinds of stress. After Chernobyl she spent many years documenting the different genetic changes found amongst leaf bugs (heteroptera). Apart from that she also documented the genetic changes to heteroptera in the environment of different nuclear facilities. Her drawings are not only artistically impressive – they also draw attention to a level of radiation damage which does not immediately come to mind, but which is none the less to be taken very seriously.[98]

In Great Britain restrictive measures due to continuing radioactive pollution are still in force for 379 farming business with a total of 74,000 hectare and 200,000 sheep, 19 years after Chernobyl.[99] Similar restrictions are to be found in certain areas of other EU member countries, for example, in Sweden and Finland because of the reindeer and in Ireland. In a survey carried out by the European Commission in 2002 the commission received confirmation that, for example in game (wild boar, deer), mushrooms and wild berries, as well as in carnivorous fish from lakes in certain areas of Germany, Austria, Italy, Sweden,

96 Irene Noll, Strahlentelex, 9/1987, 1f.(German)

97 Strahlentelex, 31/1988, 5, More hermaphrodites, stillbirths and malformations in S. German goatherds.(Ger)

98 C. Hesse-Honegger: Heteroptera, Das Schöne und das Andere oder Bilder einer mutierenden Welt; Steidl-Verlag, Göttingen, 2003

99 Response of the European Commission to a question by the EP member Rebecca Harms, P-1234/05DE on 21.4.2005.

Finland, Lithuania and Poland contamination values of caesium-137 could sometimes reach levels as high as several thousand becquerel per kilogram.[100] [101]

5.3 Other countries

At the beginning of 1987 an accumulation of congenital malformations was reported in western Turkey, which had been particularly badly hit by Chernobyl rain. In November 1986 in Düzce on the west coast of the Black Sea, ten babies were born without brains. According to Faruk Tezer, head physician at a private clinic in Düzce, normal occurrence of the lethal malformation anencephaly would only be three cases. Another conspicuous malformation that was reported was neural tube defect.[102] [103] [104] [105] [106] [107] [108]

In Finland an increase in the rate of congenital malformations (including defects to the central nervous system (CNS) and malformations of limbs) was also registered in the more heavily contaminated areas. More cases of CNS-defects were also observed in Denmark, Hungary and Austria. [109]

In the Pleven region of Bulgaria malformations of the heart, CNS and multiple anomalies were observed. At the university clinic of Zagreb in Croatia, between 1980 and 1993 all premature stillbirths and newborns that died within 28 days were autopsied. Following Chernobyl An increased rate of CNS-anomalies was also found here. [110]

In Finland, L. Saxén et al. found a significant increase in premature births amongst children born between August and December 1986 and whose mother had spent their first three

100 Th.D.: 19 years after Chernobyl, British sheep are still radioactively contaminated; Strahlentelex Nr.440-441/2005, 6f. (German)

101 A. McSmith: Chernobyl: A poisonous legacy; Independent, 14.3.2006.

102 Güvenc, H., Uslu, M.A., Güvenc, M., Ozkici, U., Kocabay, K., Bektas, S.: Changing trend of neural tube defects in Eastern Turkey; J. Epidemiol. Community Health, 1993, 47:40-41.

103 Caglayan, S., Kayhan, B., Mentesoglu, S., Aksit, S.: Changing incidence of neural tube defects in Aegean Turkey; Pediatric and Perinatal Epidemiology, 1990, 4:264-268.

104 N. Akar, Cavadar, A.O., Arcasoy, A.: High incidence of Neural Tube defects in Bursa, Turkey; Pediatric and Perinatal Epidemiology 1988, 2:89-92.

105 Strahlentelex, 3/1987,1f. Down syndrome following Chernobyl two to three times more frequent. (German)

106 Hoffmann, W.: Fallout from the Chernobyl nuclear disaster and congenital malformations in Europe. Archives of Environmental Health 56 (2001) 478-484.

107 Mocan, H., Bozkaya, H., Mocan, Z.M., Furtun, E.M.: Changing incidence of anencephaly in the eastern Black Sea region of Turkey and Chernobyl; Pediatric and Perinatal Epidemiology 1990, 4:264-268.

108 Inge Schmitz-Feuerhake, Malformations in Europe and Turkey, Strahlentelex, 374-375/2002, 9 f (German)

109 Hoffmann, W.: Fallout from the Chernobyl nuclear disaster and congenital malformations in Europe. Archives of Environmental Health 56 (2001) 478-484. Inge Schmitz-Feuerhake, Malformations in Europe and Turkey, Strahlentelex, 374-375/2002, 9 f. (German)

110 Akar 1994. Hoffmann, W.: Fallout from the Chernobyl nuclear disaster and congenital malformations in Europe. Archives of Environmental Health 56 (2001) 478-484. Inge Schmitz-Feuerhake, Malformation in Europe and Turkey, Strahlentelex, 374-375/2002, 9 f. (German)

months of pregnancy living in those areas of Finland that had been heavily contaminated by Chernobyl fallout. The results of this study show that the level of radioactive fallout to which the Finnish population was exposed, was not sufficient to cause foetal damage to those children born after full gestation. This study does not however, exclude the possibility of hereditary defects in children who were irradiated during their foetal development. They were also unable to explain the accumulation of premature births of handicapped children in the more heavily contaminated areas of Finland.[111]

In 1991, J. Pohl-Rüling et al. published the results of a study on chromosome damage to the lymphocytes of people living in Salzburg (Austria) in the aftermath of the reactor disaster in Chernobyl. The radiation doses absorbed by the tested persons in 1987 as a result of Chernobyl fallout were between 15 and 68 percent higher than previous radiation levels. Before Chernobyl The radiation level in Salzburg had a median value of 0.9 milligray per annum, following Chernobyl it was 2 milligray per annum. At the same time the amount of damage to the lymphocyte chromosomes in the peripheral blood of the test persons initially increased by about 6-fold compared to before Chernobyl. With higher additional doses the amount of chromosome damage was reduced. According to Pohl-Rüling et al. the dose/effect curve shows the same tendency as the results from other studies.[112].

In Scotland[113] and Sweden[114]- similar to Berlin and Belarus – there were sudden increases in cases of Down syndrome (Trisomie 21) following Chernobyl.[115]

Hoffmann believes that the current argument - calculated on the basis of model estimates – that fallout doses from Chernobyl in neighbouring countries are far too small to produce measurable effects, refuted by the fact that outside the states directly affected by Chernobyl (Ukraine, Belarus and Russia) there was proof of increased chromosome aberration following the accident. With the aid of biological dosimetry it was shown that the assumptions regarding the population's exposure to radiation contain underestimations.[116]

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111 L. Saxén, T. Rytömaa, British Medical Journal 1989, 298: 995-997. Strahlentelex, 60-61/1989, 8, More premature births of handicapped children in Finland. (German)

112 J. Pohl-Rüling, O. Haas, A. Brogger et al.: The effect on lymphocyte chromosomes of additional radiation burden due to fallout in Salzburg (Austria) from the Chernobyl accident. Mutation Research, 262(1991), 209-217, in: Strahlentelex, 106-107/1991, 1ff., Chromosomenschäden in Salzburg. (German)

113 Ramsay C.N. et al.: Down's syndrome in the Lothian region in Scotland – 1978-1989; Biomed. Pharmacother. 1991; 45:267-272, in: Hoffmann, W.: Fallout …

114 Ericson, A., Kallen, B.: Pregnancy outcome in Sweden after the Chernobyl accident. Environ. Res. 1994; 67:149-159.

115 Hoffmann, W.: Fallout from the Chernobyl nuclear disaster and congenital malformations in Europe. Archives of Environmental Health 56 (2001) 478-484. Inge Schmitz-Feuerhake, Malformations in Europe and Turkey, Strahlentelex, 374-375/2002, 9 f. (German)

116 Hoffmann, W.: Fallout from the Chernobyl nuclear disaster and congenital malformations in Europe. Archives of Environmental Health 56 (2001) 478-484. Inge Schmitz-Feuerhake, Malformations in Europe and Turkey, Strahlentelex, 374-375/2002, 9 f. (German)

6. Thyroid cancer and other thyroid diseases

6.1 Chernobyl area

On the second anniversary of the catastrophe the Soviet minister for health, E. Tschasow, wrote in the “Pravda“ (the central organ of the CPSU), “that today we can be sure that the disaster in the atomic power station in Chernobyl had no effect upon the health of the population in the afflicted areas.”

In Moscow in March 1989, following years of secrecy, Prof. L.A. Ilyin et al. presented the first report on contamination patterns and possible consequences to health after Chernobyl[117]. Ilyin, made the prognosis, amongst other things, that in 39 districts in 9 relatively heavily contaminated areas 90 from 158,000 children (0-7 years old) would develop thyroid cancer in the following 30 years

If these prognoses are compared to the following facts it becomes apparent just how far they are from reality. Even today Ilyin represents Russia in the decisive international bodies on questions regarding radiation (ICRP, UNSCEAR) where he is still considered to be a competent expert on the consequences of Chernobyl (s. also capital 10)

In January 1990,A.M. Kellerer, director of the radiobiological institute in Munich, presented a “report to the Red Cross”[118]. In it he wrote, “A particular problem is the fears regarding damage to thyroid function. … As thyroid testing is now more widely carried out a great many more dysfunctions are being discovered. These are being attributed to radiation exposition, although in spite of high doses of radioiodine no pathological changes or dysfunctions are to be expected. … The population and the greater part of the medical world attribute the increased rates of illness to irradiation. A critical assessment of the situation however, leads to the conclusion that the increases could be due to any of three factors:
1. Changed and restricted living and nutritional conditions
2. Serious anxiety states
3. More frequent and intensive medical examinations and fuller reports on illness in the contaminated areas.”

Four yeas after Chernobyl, D. Arndt, head physician in the department of radio medicine in the state office for nuclear safety and radiation protection in the GDR, wrote to S. Pflugbeil: “that the problems in the areas around Chernobyl are not of a radiobiological but of a

117 L.A. Ilyin et al.: Ecological particularities and medical, biological consequences of the accident of Chernobyl nuclear power plant. Report by 23 scientists for meeting of USSR Medical Sciences Academy, 21-23 of March.1989, in: A. Yaroshinskaya: Overview of Different Informations about Acute Radiation Syndrome among Inhabitants around Chernobyl; in: T. Imanaka (ed.): KURRI-KR-21.

118 A.M. Kellerer: Report to the Red Cross on a mission undertaken by a group of experts from the league of Red Cross and Red Crescent organisations to those areas in the Soviet Union effected by the reactor accident in Chernobyl. January 1990.

psychosomatic nature and brought on by changed habits (vitamin deficiency / major confinement to the living quarters).”[119]

It is this kind of uninformed expert position that has prevented timely and effective medical intervention – it would seem that ultimately, people in the area of Chernobyl only had themselves to blame if they did not go for walks and eat enough vegetables.

The first detailed information outside the USSR on the facts about thyroid diseases following Chernobyl appeared in autumn 1990 in Berlin.[120] The Minsk doctor, Maria Ankudowitsch reported that irradiation could not only cause thyroid cancer but much more often swellings in the thyroid gland, various types of autoimmune thyroiditis and hypothyroidism. Due to the changed hormonal status of children with an irradiated thyroid gland there is a growing risk of dysfunctions and defective development amongst children and young adults. Due to disturbed neuroendocrinal regulation there is an increased possibility of carcinoma occurring in other glands: in the pituary, the adrenal cortex, the pancreas, breast and ovaries. M. Ankudowitsch reported that approx. 5 percent of the children in the southern areas of Belarus received irradiation doses of more than 10 gray, about 20 percent of the children in the areas that had not been controlled received approx. 1 Gy. Particularly noticeable is the development of thyroid cancer amongst children from Belarus. Thyroid cancer is an illness that usually occurs in older people. It is an extremely rare illness amongst children. Prior to 1986 there were 0-2 new cases amongst children in Belarus per annum, in1989 the figure was 7, up to the autumn of 1990 there were 22 cases. At this point in time it was already obvious that an avalanche was approaching – bigger and faster than had been held possible on the basis of previous experience. The candour of this courageous doctor seriously damaged her career chances.

In the spring of 1991 the IAEA presented the results of the International Chernobyl Project. In this extensive study can be read: “The children examined were found to be generally healthy“. And: “The data shows no clear increase in incidences of leukaemia and thyroid cancer since the accident.“[121]

As the data on cases of thyroid cancer in Belarus all come together at one place, a telephone call would have sufficed to learn the real figures. Today we know:

▪ that tissue samples from children in the Chernobyl area already lay on the desk of one of the leading scientists on this project – Prof. F.A. Mettler, USA -, he knew about it and wrote untruths in the report.[122]

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119 Dietrich Arndt: Letter to Dipl.-Phys. Pflugbeil from 24.4.1988, Pflugbeil archive.

120 Maria Ankudowitsch: State of health of the children in the vicinity of Chernobyl; in “Kinder von Tschernobyl”, Erstes Berliner Koordinationstreffen, 27.-28.10.1990, Berlin, Attachment 3,1-4. (German)

121 The International Chernobyl Project, An Overview, Assessment of Radiological Consequences and Evaluation of Protective Measures, Report by an International Advisory Committee, IAEA, Vienna, 1991.

122 BBC 2: Chernobyl – 10 years on. In the TV series HORIZON, 1.4.1996.

▪ that the scientists on the Chernobyl Project were in possession of a report from the Belarussian minister of health, in which he explicitly drew attention to the significant increase in incidences of thyroid diseases amongst children in the heavily contaminated areas in the district of Gomel.[123] This report was ignored.

From November 20 to 23 in 1995, the World Health Organisation (WHO) hosted an international conference in Geneva, Switzerland on the effects on health of the reactor catastrophe in Chernobyl and other nuclear accidents. At the conference the results of studies were presented showing that there had been a steep rise in incidences of thyroid diseases particularly amongst children living in the highly contaminated areas. The rates of illness had increased much faster than had been expected.[124]

In the view of the WHO-expert Keith Baverstock, the time span between the reactor accident and the increase in the incidence of cancer was “surprisingly short”, In addition the tumours suffered by the children in Belarus are unusually aggressive and spread to other parts of the body.[125]

The strongest increase in the incidence of thyroid cancer in children occurred in the Gomel area, which been most heavily affected by Chernobyl. About 50 percent of all cases of thyroid cancer amongst children in Belarus have occurred in this region. This area also takes first place in the number of Incidences of thyroid cancer amongst adults. In 1998 the annual number of new cases of illness amongst children between 0 and 18 years of age in the Gomel area was already 58-times higher than in the 13 years prior to Chernobyl.[126] [127]

The greater number of children with thyroid cancer were younger than 6 at the time of the accident, more than half of them were younger than 4. In 1995 the incidence rate of new illnesses amongst children (0-14 years old) in Belarus peaked. The aggressive rate of growth of thyroid cancer amongst children and the rapid development of metastases in other organs – particularly in the lungs – had been noticed at an early stage. The emergent cases were almost entirely identified as papillary thyroid cancer.

In the Ukraine the Nuclear explosion in Chernobyl also led to an increase in incidences of thyroid cancer. Following Chernobyl the amount of radioactive iodine in the thyroid glands of 110,000 children and 40,000 adults was measured and a cancer register was created. By 1993 there were 418 cases of thyroid cancer amongst children in this register. Encoding the information into areas showed evidence of a clear relationship to ionising radiation.[128]

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123 V.S. Ulashchik: Some Medical Aspects of the Consequences of the Accident at the Chernobyl Nuclear Power Plant (Based on Belarussian Data). Appendix 5 of the Draft Proposal “The Radiological Consequences in the USSR from the Chernobyl Accident: Assessment of Health and Environmental Effects and Evaluation of Protective Measures”. The International Chernobyl Project. IAEA, Vienna, 1990-04-18.

124 Heiko Ziggel: Thyroid cancer increases faster than expected, Strahlentelex 214-215/1995, 1ff. (German)

125 Strahlentelex 138-139/1992, p. 1ff. Higher child cancer morbidity. (German)

126 Strahlentelex 326-327/2000, p. 6 f., Disinformation on thyroid cancer illnesses following Chernobyl. (German)

127 Edmund Lengfelder et al.: Münchner Medizinische Wochenschrift – Progress in medicine. 43(2000)355-357. (German)

128 Nature, 375(1995), 365, in Strahlentelex, 206-207/1995, 11.

Thyroid diseases in Belarus as well as in the Ukraine and in Russia were the subject of a widely applied study by M. Fuzik et al.[129] The study is based on figures from the cancer registers of Belarus, Russia and the Ukraine. The data from these three states also shows that the highest incidences of illness were amongst people who were small children at the time of the reactor catastrophe. It appears that those children born before Chernobyl (1982-1986) and those who had just been born or were only a few years old at the time of the reactor catastrophe, are more likely to develop thyroid cancer than children born in the years following Chernobyl (1987-1991).

The fact that children were strongly affected is taken as a robust indication of the sensitivity of the thyroid glands of infants and small children to the carcinogenic radiation effect of ionising radiation. The aggressiveness of thyroid cancer amongst children in Belarus can be seen in the early development of metastases. In the primary tumour stage pT1 of the TNM classification – only 1 tumour nodule of 10 mm maximum diameter unilaterally in one thyroid lobe – 43 percent of the cases show an affection of the regional lymph nodes, in 3 percent of cases metastasis have also development in other organs.[130]

According to the study by Fuzik et al., in all 12 areas investigated in the three states most affected by Chernobyl, Belarus, Russia and the Ukraine, there was a significant increase in thyroid cancer amongst children 0 to14 years old with a latency period of about 4 to 5 years after the reactor catastrophe. [131] The areas involved were the Ukrainian regions Vinnitsa, Zhytomir, Cherkassy, Chernigov Land, Kiev and Kiev city, the Belarussian regions Gomel and Mogilev as well as the Russian regions Bryansk, Kursk, Orjol and Tula. The area where the increase was greatest was the Gomel region, followed by the regions of Bryansk, Orjol, Kiev city, Kiev, Chernigov, Mogilev and Zhytomir.

According to Vassili Kazakov from the ministry of health in Minsk, the incidence of thyroid cancer amongst children in Belarus in 1992 was up to 80 times higher than the global average.[132]

According to Lengfelder et al. by the end of 2001 there were already more than 1,000 cases of thyroid cancer amongst children and young adults in Belarus alone.[133]

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129 M.M. Fuzik, A.Ye. Prysyazhnyuk, V.G. Gristchenko, V.A. Zakordonets, Ye.M. Slipenyuk, Z.P. Fedorenko, L.O. Gulak, A.Ye. Okeanov, V.V. Starinsky, Thyroid cancer, Peculiarities of epidemiological process in a cohort being irradiated in childhood in Republic of Belarus, Russian Federation, and Ukraine, International Journal of Radiation Medicine 2004, 6(1-4): 24-29.

130 Edmund Lengfelder, Christine Frenzel: 16 years after Chernobyl. Continuing dramatic increases in thyroid carcinoma in Belarus. Recovery chances of numerous patients are still dependent upon intensive Western aid. Otto Hug Strahleninstitut MHM. Sept. 2002.(German)

131 M.M. Fuzik, A.Ye. Prysyazhnyuk, V.G. Gristchenko, V.A. Zakordonets, Ye.M. Slipenyuk, Z.P. Fedorenko, L.O. Gulak, A.Ye. Okeanov, V.V. Starinsky, Thyroid cancer, Peculiarities of epidemiological process in a cohort being irradiated in childhood in Republic of Belarus, Russian Federation, and Ukraine, International Journal of Radiation Medicine 2004, 6(1-4): 24-29.

132 V. Kazakov: Nature, 3. September 1992. in: Strahlentelex 138-139/1992, 1ff. Die Kinder erkranken jetzt öfter an Krebs.

133 Edmund Lengfelder, Christine Frenzel: 16 years after Chernobyl. Continuing dramatic increases in thyroid carcinoma in Belarus. Recovery chances of numerous patients are still dependent upon intensive Western aid. Otto Hug Strahleninstitut MHM. Sept. 2002. (German)

In a paper published in 2004, Okeanov et al. declared that the rate of illness amongst children in Belarus with thyroid cancer had increased by 100 fold.[134]

Okeanov et al. pointed out that the incidence of thyroid cancer had also increased amongst adults. Prior to Chernobyl thyroid cancer was a relatively rare disease amongst Belarussian adults. After 1990 – four years after Chernobyl – there was a massive increase in the rate of illness, which reached the highest worldwide level that has been seen in recent years. In 1980 the standardized annual rate of illness for thyroid cancer amongst adults over 30 was 1.24 per 100,000 inhabitants. In 1990 the index was 1.96 and in the year 2000 it was 5.67[135]

Lengfelder et al. pointed out that with the increased temporal distance to the accident ever more children who had been contaminated by iodine in 1986 were turning into young adults and would eventually reach adulthood. They will carry the risk of cancer – which they will be unable to get rid of for the rest of their lives – with them into the older age groups. But the risk of cancer amongst those who were already adults at the time of the catastrophe has also risen strongly: Fact is, in the age group 50 to 64 the rate of incidence of thyroid cancer following Chernobyl (1986-1998) compared to the period before Chernobyl (1973-1985) increased 5-fold. Even amongst the over 64 year olds the incidence rate still rose 2.6-fold.

Thyroid cancer in the Gomel area (Belarus) for 13 years before and 13 years after the Chernobyl catastrophe[136]

Age	1973-1985	1986-1998	Increase
0-18	7	407	58-fold
19-34	40	211	5,3-fold
35-49	54	326	6-fold
50-64	63	314	5-fold
>64	56	146	2.6-fold

By the year 2000 in Belarus alone there were over 3,000 excess cases of thyroid cancer amongst adults.[137]

In the mean time excess cases of thyroid cancer in Belarus since Chernobyl amongst children, young adults and adults add up to more than 10,000.[138]

134 A. E. Okeanov, E. Y. Sosnovskaya, O. P. Priatkina, A national cancer registry to assess trends after Chernobyl accident, Swiss Medical Weekly 2004, 134: 645-649.

135 A. E. Okeanov, E. Y. Sosnovskaya, O. P. Priatkina, A national cancer registry to assess trends after Chernobyl accident, Swiss Wkly 2004, 134: 645-649.

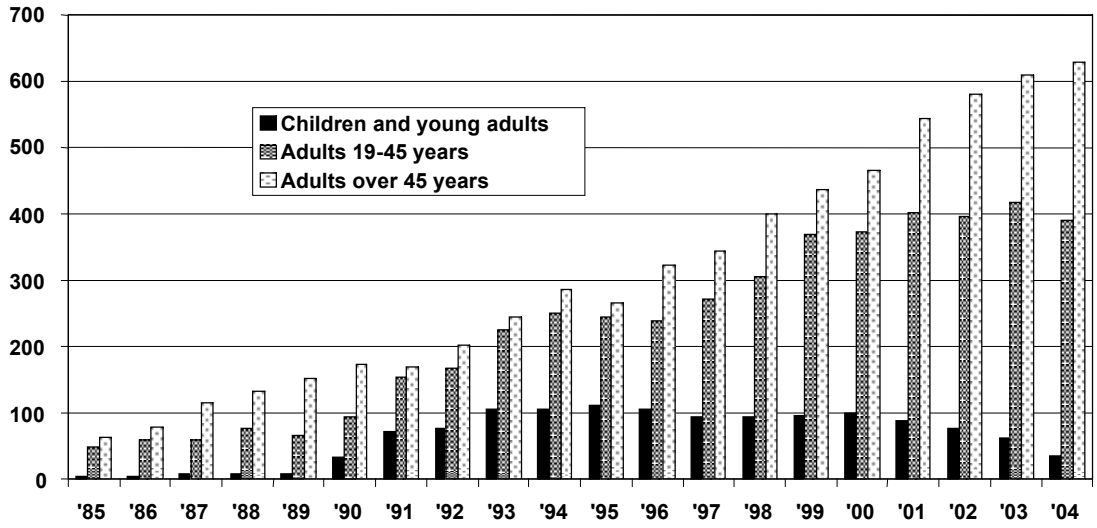
136 E. Lengfelder et al.: Learning from the Chernobyl catastrophe. Extend iodine prophylaxis to all age groups. MMW-Fortschr. Med. 41(2000)355-356.(German)

137 Edmund Lengfelder, Christine Frenzel: 16 years after Chernobyl. Continuing dramatic increases in thyroid carcinoma in Belarus. Recovery chances of numerous patients are still dependent upon intensive Western aid. Otto Hug Strahleninstitut MHM. Sept. 2002 (German)

138 In a telephone message from Edmund Lengfelder on February 1, 2006. Cp. also E. Lengfelder, H. Rabes, H. Scherb, Ch. Frenzel: Factors influencing the assessment of Chernobyl health consequences and the contribution of international non-governmental organisations to research and treatment of thyroid pathologies in Belarus. 4th International Conference, June 2-6, 2003, Kiev, Ukraine, Chernobyl Children – Health effects and psychosocial rehabilitation, Proceedings, International Journal of Radiation Medicine 2003, Addendum.

In July 1998 an international symposium on radiation and the thyroid gland was held in Cambridge (MA). It was hosted by the European Commission, the US department of energy and the National Cancer Institute of the US health department.

Fig. Incidence of thyroid cancer in Belarus 1985-2004[139]



At this symposium representatives of the World Health Organisation (WHO) developed a prognosis based on the temporal progress of incidences of childhood thyroid cancer that had so far arisen: From all children in the Gomel area 0 to 4 years old at the time of the reactor catastrophe one third will develop thyroid cancer during their lifetime.[140] According to the WHO prognosis this means that alone in the Gomel area of Belarus more than 50,000 people who were 0-4 years old at the time of the catastrophe in will develop thyroid cancer. If the prognosis is extended to all age groups (including adolescents and all adult groups) of people living in the Gomel area at the time of the reactor catastrophe, then in this area alone more than 100,000 cases of thyroid cancer can be expected in the aftermath.[141]

The number of patients being treated in the Gomel area also gives an impression of the extent of thyroid cancer there. According to Lengfelder et al., by the year 2002 more than

139 Edmund Lengfelder, Christine Frenzel: 20 years after Chernobyl. Experiences and lessons from the reactor catastrophe. Otto Hug Strahleninstitut MHM. Information, February 2006. (German)

140 E. Cardis et.al. Observed and predicted thyroid cancer following the Chernobyl accident: Evidence for factors influencing susceptibility to radiation induced thyroid cancer. In: G. Thomas et al.: Radiation and Thyroid Cancer. EUR 18552 EN, World Scientific, Singapore 1999, 395-405.

141 Edmund Lengfelder, Christine Frenzel: 20 years after Chernobyl. Experiences and lessons from the reactor catastrophe. Otto Hug Strahleninstitut MHM. Information, February 2006. (German)

70,000 patients had already undergone extensive thyroid therapy in the thyroid centre in Gomel. [142]

6.2 Germany

The state agency for medical, nutritional and veterinary inspection in Dillenburg, Middle Hesse disclosed, that following Chernobyl in 1986 an increase in the rate of thyroid under-function (hypothyroidism) had been found amongst newborns during the course of regular early-diagnosis examinations in the federal state of Hesse.[143]

At the end of June 1987, the paediatric clinic of the Free university of Berlin in the “Kaiserin-Auguste-Viktoria-Haus” (KAVH) told the “ Strahlentelex ” journal that in 1986in Berlin, an increase in incidences of thyroid disease had been detected. In 1986 in Berlin fourteen children were born with an under-function of the thyroid gland (hypothyroidism). In the previous years the median value had only been three to four, maximum seven.[144]

To the present date, data needed to carry out extensive investigations into thyroid diseases in Germany before and after of Chernobyl has been denied

6.3 Other countries

A study carried out by the radiobiological institute of the university of Munich (Stefan Mürbeth, Prof. Lengfelder), the Czech NRO Fakultni nemocnice Plzen in Pilsen, Czech Republic (Milena Rousarova) and the GSF research centre for environment and health in Neuherberg (Hagen Scherb) found an increase in incidences of thyroid cancer amongst adults in the Czech Republic.[145] The Czech Republic was affected by Chernobyl fallout in a similar way to Eastern Germany and Bavaria. The investigations were carried out in the Czech Republic because they – as opposed to Germany – also keep a cancer register for adults. The study is particularly revealing as it draws on long-term data from a large population –a total of 247 million person-years all told.

From 1975 onwards there had been a collective increase of incidences of thyroid cancer amongst men, women and children of both sexes. However from 1990 on, following Chernobyl there was a significant change in the increase rate of incidences of thyroid cancer for both sexes from 2.0 percent per annum to 4.6 percent per annum (95%-CI: 1.2-4.1, p=0.0003). The values for women are noticeably higher than those for men, the significant

142 Edmund Lengfelder, Christine Frenzel: 16 years after Chernobyl. Further dramatic rise in cases of thyroid carcinoma in Belarus. Recovery chances for many patients are still dependent upon intensive Western aid. Otto Hug Strahleninstitut MHM. Sept. 2002 (German)

143 Strahlentelex 20/1987, 6, Hesse: After Chernobyl more children born with thyroid under function. (German)

144 Strahlentelex 12/1987, 2, Berlin: More thyroid illnesses amongst newborns. (German)

145 Stefan Mürbeth, Milena Rousarova, Hagen Scherb, Edmund Lengfelder: Thyroid cancer has increased in the adult populations of countries moderately affected by Chernobyl fallout. Med Sci Monit, 2004; 10(7): CR300-306.

increase occurred as early as 1989 (p=0.0005). All in all there were 426 excess cases of thyroid cancer in the Czech Republic alone following Chernobyl (95%-CI: 187-688).

A minimal latency period of 4 years from the reactor catastrophe to the outbreak of illness has been found. This latency period is comparable to that in the Chernobyl area.

There were also increases of incidences of thyroid cancer amongst adolescents and adults in Poland[146] and in the North of England[147].

146 Z. Szybinski, P. Olko, E. Przybylik-Mazurek, M. Burzynski: Ionizing radiation as a risk factor for thyroid cancer in Krakow and Nowy Sacz regions. Wiad Lek, 2001, 54(Suppl. 1): 151-156 (Polish).

147 S.J. Cotterill, M.S. Pearce, L. Parker: Thyroid cancer in children and young adults in the North of England. Is increasing incidence related to the Chernobyl accident? Eur J Cancer, 2001, 37(8): 1020-1026.

7. All cancers and leukaemia

7.1 Chernobyl area

A national cancer register, in which information on all malignant tumours is registered, has been maintained in Belarus since 1973. A study from Okeanov et al. compared cancer cases from the years 1976 to 1985 with those from 1990 to 2000[148]. The study showed a significant increase in cancer rates in Belarus of about 39.8 percent. Prior to Chernobyl the annual rate of illness had been 155.9 cases per 100,000 inhabitants, following Chernobyl the rate of illness was 217.9 cases. The main increases applied to cancer of the colon, lung, bladder and thyroid gland.

The increase in the rates of cancer was significant in all areas of Belarus. In the Gomel area however, which had received the highest radiation dose from Chernobyl, the increase in the cancer rate by 55.9 percent was significantly higher than in those areas of Belarus that had been less contaminated. Prior to Chernobyl the cancer rate in Gomel, at an annual 147.5 cases per 100,000 inhabitants, had been below the state average (155.9). Following Chernobyl the rate of cancer in Gomel with 224.6 cases was clearly above the state average (217.9). The Vitebsk area, where there had been less radioactive fallout, served as "control area". The direct comparison of the two Belarussian regions showed that the increase in the rate of illness was also significantly stronger in Gomel than in Vitebsk. The greatest increase in the regression coefficient from 2.79 to 5.8 was registered in Gomel, although there was no significant increase in the regression coefficient shown in the other Belarussian areas (Belarus altogether 3.76 or 3.15).

The increase in the rate of cancer was especially high amongst the Gomel population living in areas with a particularly high caesium 137-burden of above 555,000 becquerel/m². Between 1993 and 2002 the above-average rate of illness from cancer of the digestive and respiratory organs was significantly higher compared to the areas with the smallest radioactive burden (cancer/illness rates of digestive organs: 141.5 in the most burdened areas compared to 104.7 in the least burdened areas. Cancer/illness rates in respiratory organs: 83.7 against 53.1).

Noticeable problems were also seen with regard to rates of breast cancer amongst women. In the areas with a particularly high caesium-burden – Gomel and Mogilev – cancer of the breast is typically found between the ages 45 and 49, this is 15 years earlier than amongst women in the area of Vitebsk that was less affected by Chernobyl. The illness-rate curves show that the deviations of the time of onset of the illness toward the younger age groups are particularly strong amongst the more heavily radioactively burdened rural population from contaminated areas.

148 A. E. Okeanov, E. Y. Sosnovskaya, O. P. Priatkina: A national cancer registry to assess trends after Chernobyl accident, Swiss Medical Weekly 2004, 134: 645-649.

The increase in incidences of breast cancer was confirmed in a paper that appeared in the International Journal of Cancer.[149] The authors found an increase in incidences of breast cancer in the areas of Gomel and Mogiljow (Belarus) and Chernigov, Kiev and Zhytomir (Ukraine). They also found an approx. 2-fold risk increase in the most contaminated areas for the period 1997-2000 compared to that in the least contaminated areas. The authors consider it improbable that the increases are due to increased diagnostic activity in these areas.

A study carried out in the district of Lugyny (Ukraine) points out that life expectancy following the diagnosis with stomach and lung cancer following Chernobyl has decreased noticeably.[150] Whereas in 1985 it was still 57 or 42 months following the diagnosis of stomach or lung cancer, 10 years after Chernobyl is had gone down to 2.3 or 2 months.

The same paper also called attention to an increase of destructive forms of tuberculosis amongst the diagnosed cases of tuberculosis illnesses. Whereas in 1985 17.2 percent of tuberculoses were destructive, in 1995 it was 50%. Godlevsky attributed both phenomena to dysfunctions of the immune system.

Table: Life expectancy following the diagnosis of malign stomach and lung tumours before and after the Chernobyl accident (District of Lugyny, Schitomir area, Ukraine)

Year	Life expectancy (in months) following the diagnosis of	
	Stomach cancer	Lung cancer
1984	62	38
1985	57	42
–	–	–
1992	15,5	8,0
1993	11,0	5,6
1994	7,5	7,6
1995	7,2	5,2
1996	2,3	2,0

Yuri Orlov et al. reported on CNS tumours amongst children up to 15 years of age, over a period of 25 years (Ukraine without the Districts Dnepropetrovsk, Donetsk, Zaporozzhye and Charkov). A total of 2,633 children were treated during this time. In the 10-year period prior to Chernobyl (1976-1985) there were 756 patients, in the 10 years following Chernobyl (1986-1995) 1,315 children i.e. 76.9% more than in the previous period, were treated despite a simultaneous decrease of more than three million in the numbers of children in the population.[151]

149 E. Pukkala, S. Poliakov, A. Ryzhov, A. Kesminiene, V. Drozdevich, L. Kovgan, P. KKyyronen, I.V. Malakhova, L. Gulak, E. Cardis: Breast cancer in Belarus and Ukraine after the Chernobyl accident. International Journal of Cancer, 2006, February 27th.

150 Ivan Godlevsky, O. Nasvit: Dynamics of Health Status of Residents in the Lugyny District after the Accident at the ChNPP; in: T. Imanaka (ed.): Research Activities about the Radiological Consequences of the Chernobyl NPS Accident and Social Activities to Assist the Sufferers by the Accident, KURRI-KR-21, 149-159.

151 Y.A. Orlov e al.: Tumors of the central nervous system in children (morbidity rates in Ukraine for 25 Years); Int. J. Rad. Med. 2002, 4(1-4): 233-240.

Even more unsettling is the situation amongst infants. Orlov und Shaversky reported on a series of 188 brain tumours amongst children less than three years of age, 9 cases from the years 1981-1985 and 179 cases from the period 1986-2002. The number of patients rose in comparison to the 5-year period prior to Chernobyl (9 cases 1981-185) 5.1-fold 1986-1990 (46 cases), 7.7-fold 1991-1995 (69 cases) and by 5.3-fold 1996-2000 (48 cases). In the period 2001-2002, 16 children were operated. The number of sick children rose from 1.8 to 14 with highest the values in 1988 and 1994 (18 patients).

The increase in the number of tumours of the central nervous systems amongst nursing infants was even greater. 1981-1985 there was not one single histological case examination. 1986-1990 there were 4 cases, 1991-1995 16 and 1996-2000 11 cases.

Altogether the number of patients up to three years of age increased 5.8-fold, amongst children up to one year the number of patients was tenfold. If the simultaneously sinking birth rate is taken into consideration the increase becomes very evident. Not only is the accumulation of malignant but also of benign tumours considerable. Even though benign tumours do not create metastases and do not spread into other tissues, they do constitute a seriously life-threatening illness, particularly in the brain and in particular in the brains of infant, because they displace healthy brain tissue.[152] [153]

Radioactive fallout from the Chernobyl accident in1986 affected more than 4 million people in the Ukraine. In order to examine the effects of radiation on pregnancy and the development of leukaemia Noshchenko et al. examined the incidence of different types of leukaemia amongst children who were born in the accident year of 1986. The development of the children was followed over the ten-year period up to 1996 and the cumulative rate of illness amongst children from contaminated and non-contaminated areas was compared. The relative risk amongst all types of leukaemia is significantly higher in contaminated areas; this applies to girls as well as boys and to both sexes together. The rate of risk for acute lymphatic leukaemia (ALL) is dramatically increased for boys as well as for girls, although the increase here is not quite so severe. For both sexes combined the relative risk of acute lymphatic leukaemia is more than three times higher in contaminated areas than in non-contaminated (relative risk RR = 3.4). The results of the study suggest that the increased risk of developing leukaemia for children born in 1986 who continued living in radioactively contaminated areas is due to Chernobyl fallout.[154]

Just one year later Noshchenko et al. published the results of a case-controlled study that examined the risk of radiation-induced acute leukaemia in the period 1987-1997 amongst those aged 0 -20 years at the time of the catastrophe. They found a statistically significant

152 Y.A. Orlov, A.V. Shaversky: Indices of neuro-oncological morbidity dynamics among younger children in Ukraine; Int. J. Rad. Med. 2004 6(1-4): 72-77.

153 Y.A. Orlov et al.: Tumors of the central nervous system in children; morbidity rates in Ukraine for 25 years. Intern. J. Rad. Med. 2002, 4(1-4):233-240.

154 Andrey G Noshchenko, Kirsten B Moysich, Alexandra Bondar, Pavlo V Zamostyan, Vera D Drosdova, Arthur M Michalek: Patterns of acute leukaemia occurrence among children in the Chernobyl region, Int. Journal of Epidemiology. 2001;30:125-129. Strahlentelex, 408-409/2004, 2f. Epidemiologie Vermehrt akute Leukämie bei Kindern um Tschernobyl.

increase for the leukaemia risk of men whose estimated radiation exposition had been greater than 10 mSv. The correlation to radiation exposure was significant for acute leukaemia in the period 1993-1997 and particularly for acute lymphatic leukaemia. An analogous correlation was also found for acute myeloid leukaemia for the period 1987-1992.[155]

In 1994, Ja. I. Vygovskaja et al. reported a noticeable increase in incidences of cancer of the haematopoietic system amongst the child and adult population in the Rovno area (Ukraine) in the years following the reactor catastrophe in Chernobyl. The study compared those areas of the Ukraine more heavily contaminated with radioactivity with less contaminated areas. The six northern districts of the Rovno area had been particularly heavily contaminated with radionuclides. The scientists compared the five years prior to Chernobyl (1981-1985) with the six years following Chernobyl (1987-1992). The analysis of the data showed that the incidence of haemoblastoma following Chernobyl was higher than before the nuclear catastrophe. The median standardized incidence value for malign blood diseases for the entire Rovno area prior to Chernobyl was 11.53; following Chernobyl it was 15.06 ($p<0.05$). The increase in incidences of chronic lymphatic leukaemia, myelomas and malign lymphoma proved to be significant. There was a steep increase in the incidence of acute leukaemias in the heavily contaminated areas compared to less heavily contaminated areas.[156]

A study published in 1996 by Netschaj on the development of haematological diseases in the Gomel area of Belarus, showed a clear increase in the incidence of malign blood diseases: it investigated one 5-year period prior to and two 5-year periods following Chernobyl. The analysis showed a clear and continuous increase in incidences of acute leukaemias, chronic lymphatic leukaemia and of the myelodysplastic syndrome in both the first and second 5-year periods following Chernobyl. [157]

Table: Incidence of blood diseases in the Gomel area (number)[158]

Disease	Five year period		
	1981-1985	1986-1990	1991-1995
AL	115	162	210
- of children	55	71	66
CLL	191	255	266
CML	84	95	147

155 A.G. Noshchenko, P.V. Zamostyan, O.Y. Bondar, V.D. Drosdova: Radiation-induced Leukemia risk among those aged 0-20 at the time of the Chernobyl accident: a case-control study: Int. J.Cancer 99,609-618(2002).

156 Ja. I. Vygovskaja, B.V. Katschorovskij, A.A. Mazurok, L.M. Lukavezkij, V.V. Orlik, Incidence of haemoblastoma in the Rovno area (Ukraine) before and after the accident in the nuclear power station in Chernobyl, Haematologye and Transfusiology, 39/1994, 22-24 (Russ.). Strahlentelex, 266-267/1998,1f.Im Gebiet Rovno in der Ukraine nahm die Zahl der Blutkrebserkrankungen drastisch zu.

157 V.V. Netschai, Epidemiology of several blood diseases in the Gomel area prior to and following the catastrophe in Chernobyl, Chernobyl, Ecology and Health, 2/1996, 42-44 (Russ.). Strahlentelex, 266-267/1998, 1f. In recent years the number of cancerous blood diseases in the Rovno area of the Ukraine has drastically increased. (German)

158 V.V. Netschai: Epidemiology of several blood diseases in the Gomel area prior to and following the catastrophe in Chernobyl, Chernobyl, Ecology and Health, 2/1996, 42-44 (Russ) Strahlentelex, 266-267/1998, 1f. In recent years the number of cancerous blood diseases in the Rovno area of the Ukraine has drastically increased. (German)

Erythraemia	42	64	63
Other CL	50	70	64
All leukaemias	482	646	752
Multiple myeloma	50	79	82
Myelodisplastic syndrome	n.d.	8	43
Aplastic anaemia	24	38	22

Table: Incidence increases in the 1st and 2nd 5-year periods following the catastrophe compared to the 5-year period prior to the catastrophe (absolute (in %)) in the Gomel area[159]

Disease	Increase in incidence against 1981-1985	
	1986-1990	1991-1995
AL	+47(40.9%)	+95(82.6%)
- of children	+16(29.1%)	+11(20.0%)
CLL	+64(33.5%)	+75(39.2%)
CML	+11(13.1%)	+63(75.0%)
Erythraemia	+22(52.4%)	+21(50.0%)
Other CL	+20(40.0%)	+14(28.0%)
All leukaemias	+164(34.0%)	+270(56.0%)
Multiple myeloma	+29(58.0%)	+32(64.0%)
Myelodisplastic syndrome	-	-
Aplastic anaemia	+14(58.3%)	-2(8.3%)

In 1998 the Belarussian Ministry of Exceptional Situations and the National Academy of Sciences made the following statements in a national report to the Belarussian Parliament.[160]:

▪ in the years 1979-1985 there was an annual average of 624 new cases of leukaemia

▪ in the years 1992-1994 there was an annual average of 805 new cases of leukaemia

The report alleges, "that following the Chernobyl disaster a significant increase in incidences of leukaemia and lymphomas can be observe in Belarus. The accumulation of all leukaemias including the unspecific forms was

▪ in the 7 years prior to the disaster 9.34 per 100,000 persons,

▪ in the 7 years following the disaster 11.62 per 100,000 persons."

“In the aftermath of the disaster at the nuclear power station in Chernobyl
▪ chronic lymphatic leukaemia,
▪ multiple myeloma
▪ Hodgkin lymphoma and
▪ non-Hodgkin lymphoma

159 Netschaj: Epidemiology of several blood diseases in the Gomel area prior to and following the catastrophe in Chernobyl, Chernobyl, Ecology and Health, 2/1996, 42-44 (Russ) Strahlentelex, 266-267/1998, 1f. In recent years the number of cancerous blood diseases in the Rovno area of the Ukraine has drastically increased. (German)

160 Belarus Ministry of Exceptional Situations, National Academy of Sciences of Belarus: Chernobyl accident: Overcoming the consequences, national report 1998, (Russ)

have significantly increased."

The following data was given in detail[161]:

Table: Leukaemias in Belarus in cases per annum[162]

	7 years before Chernobyl	7 years after Chernobyl
Chronic lymphatic leukaemia	2041	2830*
Multiple myeloma	782	1055*
Non Hodgkin lymphoma	1554	2285*
Hodgkin Lymphoma	1760	2029*

Note: *significant, p<0.05

The following averages for new incidences per annum prior to and following Chernobyl, per 100.000 inhabitants of Belarus, arise out of the report:

Table:

Average rate of incidence for leucocytes, lymphoma and myelodysplastic syndrome in Belarus[163]

		1979-1985	1986-1992	1993-1996
Leucocytes	adults	7.99	9.91	8.76
	children	4.34	4.42	3.69
Lymphoma	adults	6.35	7.91	7.3
	children	1.12	2.31	1.82
Myelodysplastic syndrome	adults	0.03	0.13	0.50
	children	0.01	0.18	0.14

Prysyazhnyuk gives standardised incidence ratios (SIR) for different forms of leukaemia in the most heavily radioactive-contaminated areas of the Ukraine. He compares the data from two 5-year periods (1986-1991 and 1992-1998) with the period 1980-1985. We have shown the data for 1986-1991. It is evident that in these years leukaemia rates were higher than the expected values.

161 Belarussian Ministry of Exceptional Situations, National Academy of Sciences in Belarus: Chernobyl accident Overcoming the consequences, national report 1998, (Russ.).

162 Belarussian Ministry of Exceptional Situations, National Academy of Sciences in Belarus: Chernobyl accident Overcoming the consequences, national report 1998, (Russ.).

163 Belarussian Ministry of Exceptional Situations, National Academy of Sciences in Belarus: Chernobyl accident Overcoming the consequences, national report 1998, (Russ.).

Table: SIR for different forms of leukaemia in the most heavily radioactive-contaminated areas of the Ukraine[164] 1986 – 1991

Code ICD-9	Leukaemia type	Observed	Expected	SIR	Confidence interval (95%)
204-208	All leukaemias	132	90.1	146.44	121.46-171.42
204-208.0	All acute leukaemias	65	44.3	146.59	110.95-182.22
204-208.1-9	All chronic leukaemias	64	38.8	165.00	124.58-205.43
204	Lymphatic leukaemia	70	48.3	144.95	110.99-178.91
204.0	Akute lymphat. leukaemia	20	7.8	256.01	143.81-368.22
204.1-9	Chron. lymphat. leukaemia	47	35.4	132.73	94.78-170.67
205	Myeloische leukaemia	24	6.3	379.64	227.75-531.52
205.0	Akute myeloic leukaemia	10	2.9	339.42	129.04-549.79
205.1-9	Chron. myeloic leukaemia	14	3.4	414.74	197.49-631.99
206-208	Other leukaemias	38	35.5	106.97	72.96-140.98
206-208.0	other acute leukaemias	35	33.6	104.22	69.69-138.74

7.2 Germany

A study published in 1993 by the children's cancer register in Mainz, gave evidence of a statistically significant accumulation - two years after Chernobyl in the more heavily contaminated areas - of a very rare childhood tumour, the so called neuroblastoma, amongst children born in 1988. The incidence of neuroblastoma increased in ratio to ground-contamination. This proof of a dose-effect correlation is taken as evidence of a causal relationship. According to the authors of the study the discovery of the accumulation of neuroblastoma represents "one of the most conspicuous fluctuations in the existence of the children's cancer register". It is being debated whether this could be due to parental germ cell damage prior to conception. [165] According to Prof. Dr. Günter Henze the affected children come from areas in Southern Germany that were subject to higher radiation levels following Chernobyl.[166]

J. Michaelis et al. found that in West Germany in the aftermath of Chernobyl, one and a half times as many children under one year of age developed leukaemia than the average for the 1980s. The authors investigated the accumulation of leukaemia amongst German infants born in West Germany between July 1st 1986 and December 31st 1987. Michaelis expressed astonishment at the results: 35 from just under 930,000 children under one developed

164 A. Prysyazhnyuk et al.: Results of long-term monitoring of solid cancers and leukaemia in population still living in the most contaminated with radionuclides territories of the Ukraine after the Chernobyl accident; Int. J. Rad. Med. 2003, 5(1-2): 60-72.

165 J. Michaelis et. Al., Case controlled study on the rise in incidences of neuroblastoma in children born in 1988; Medizinische Informatik, Biometrie und Epidemiologie 76/1993. Strahlentelex, 166-167/1993, S. 4, Dr. Hayo Dieckmann, Chernobyl effects also measurable in Germany (German)

166 Günter Henze, 30.10.91, FU Berlin, in Strahlentelex, 122-123/1992, 8, Increased neuroblastoma in infants in southern Germany. (German)

leukaemia, this is equivalent to a 1.5-fold increase compared to the illness rates of other children who developed the disease in the 1980s.[167]

7.3 Other countries

In Greece children still growing in their mother's wombs at the time of the reactor catastrophe in Chernobyl developed leukaemia 2.6 times more often than children born either before or a certain length of time after the catastrophe. E. Petridou et al. have analysed all incidences of childhood leukaemia in Greece since Chernobyl. They have found that in children born relatively soon after the Chernobyl accident (between July 1st 1986 and December 31st 1987), leukaemias occurred in the first year of life 2.6 times as often as amongst children born before or after this period (between January 1st 1980 and December 31st 1985 and between January 1st 1988 and December 31st 1990). The authors surmise that this increase of incidences is due to *intra uterine* radiation exposure following the Chernobyl accident.[168]

In 1987, leukaemia illnesses amongst children under four in Scotland rose by 37 percent.[169] The study counted a total of 48 cases of childhood leukaemia in 1987. That was 13 cases more than were to be expected. Amongst them were 33 diagnosed cases only of children under four years of age.

There are also reports of leukaemia amongst children following the Chernobyl catastrophe from Rumania. Davidescu et al. carried out an ecological study in 5 East Rumanian districts over the period 1986 – 2000. The exposed group numbered 137,072 children (37 leukaemia cases), the non-exposed group numbered 774,789 children (204 leukaemia cases). Exposure is ascribed to food being contaminated over a three-year period with Cs134, Cs137, Sr90 and J131. The leukaemia incidence for the age group 0-10 is not significantly higher in the contaminated areas than it is in the comparison area (270 against 263, $p>0.05$). If however the leukaemia incidence rate of children born between July 1986 and March 1987 is examined, it is found to be significantly higher than that for those born between April 1987 and December 1987 (386 against 173, $p=0.03$). The most noticeable effect is in the age group 0-1. The incidence rate correlates with the equivalent dose for red bone marrow.[170]

According to calculations from Martin Tondel et al., by 1996 the reactor catastrophe in Chernobyl had led to 849 excess incidences of cancer in the fallout areas of northern Sweden. The authors carried out a cohort study that embraced all inhabitants of northern

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167 J. Michaelis, U. Kaletsch, W. Burkart, B. Grosche, Infant leukaemia after the Chernobyl accident, Nature, Vol. 387, 15 May 1997, 246. J. Michaelis, Mainz, press release from 11.06.1997. Strahlentelex, 252-253,1f. Kinderleukämien, nach dem Tschernobyl-Unfall erkrankten mehr Säuglinge in Deutschland an Blutkrebs.

168 Nature, 24.7.1996, in Strahlentelex, 230-231/1996, 12, Leukaemia in Greece. Strahlentelex, 252-253, 1f., Child leukaemias, Following the Chernobyl accident more children in Germany became sick with cancer of the blood.

169 The Lancet Sept. 1988; Strahlentelex, 42/1988, More leukaemias in Scotland.

170 Doina Davidescu et al.: Infant leukaemia in eastern Romania in relation to exposure in Utero due to the Chernobyl accident; Int. J. Rad. Med. 2004, 6(1-4): 38-43.

Sweden who were 60 and under at the time of the catastrophe (1986-1987; 1,143,182 persons). Ground pollution with caesium-137 was set in relation to the number of incidences of cancer (22,409 persons from 1988 to 1996). The cancer risk for all cancer illnesses put together and the risk of lung cancer increased with the amount of fallout pollution. The risk increase is put at 11 percent per 100,000 Bq/m² (95%CI= 0.03-0.20).[171]

Tondel et al. continued their investigations and see the results also verified in their latest publication.[172]

171 M. Tondel et al.: Increase of regional total cancer incidence in north Sweden due to the Chernobyl accident? J. Epidemiol. Community Health 58(2004)1011-1016. , Strahlentelex, 430-431/2004, Vermehrt Krebserkrankungen in Nordschweden nach der Katastrophe von Tschernobyl.

172 M. Tondel, P. Lindgren, P. Hjalmarsson, L.Hardll, B. Persson: Increased Incidence of Malignancies in Sweden After the Chernobyl Accident – A Promoting Effect?: American Journal of Industrial Medicine 49:159-168 (2006).

8. Other illnesses following Chernobyl

The following tables give an overview of the changes in illness statistics following Chernobyl for morbidity groups for which the relationship to radiation exposition was not immediately noticed. Although for a number of years now there has been data pertaining to this area from the victims of Hiroshima and Nagasaki, there is a reluctance to connect non-cancerous illnesses to incidences of radiation. Missing data additionally hampers investigations into this area.

The data in the following tables is taken from a paper by A. Nyagu et al.,[173] in which a population in the area around Chernobyl was repeatedly examined in the same way and over a number of years. For all morbidity groups mentioned, obvious to enormous increases in illness rates are apparent. In each case the figures are per 100,000 inhabitants, it is evident that a lot of inhabitants suffer from more then one illness.

Table: Dynamic psychosomatic illnesses amongst inhabitants of northern Ukraine who were affected by the accident at the nuclear power plant in Chernobyl (1987 - 1992)[174]

	Registered illnesses per 100,000 inhabitants					
	Adults and adolescents					
Illness/organ	1987	1988	1989	1990	1991	1992
III Endocrinal system	631	825	886	1,008	4,550	16,304
V Psychological disturbances	249	438	576	1,157	5,769	13,145
VI Neural system	2,641	2,423	3,559	5,634	15,518	15,101
VII Circulatory system	2,236	3,417	4,986	5,684	29,503	98,363
IX Digestive organs	1,041	1,589	2,249	3,399	14,486	62,920
XII Skin & subcutaneous tissue	1,194	947	1,262	1,366	4,268	60,271
XIII Muscular-skeletal system	768	1,694	2,100	2,879	9,746	73,440

The following table is taken from the same source. It shows the decrease over time of the numbers of healthy members of four population groups. Whereas, for example 78.2 percent of liquidators were still healthy in 1987, by 1996 the proportion of healthy liquidators had decreased to 15 percent.

The most alarming group is IV – children of effected parents. These are children who were themselves not affected by Chernobyl fallout, but the children of parents who witnessed Chernobyl. Amongst these children the state of health has deteriorated considerably over time. This is an indication of the possibility that genetic changes may have already taken place. A lot of questions are however still unanswered.

173 Nyagu, A.I.: Medical consequences of the Chernobyl accident in the Ukraine, Chernobyl ministry of the Ukraine, Scientific Centre for Radiation Medicine, Academy of Medical Sciences in the Ukraine, Scientific-Industrial Union PRIPJAT, Scientific-Technical Centre Kiev - Chernobyl 1994 (Russ.).

174 Nyagu, A.I.: Medical Consequences of the Chernobyl accident in the Ukraine, Chernobyl ministry of the Ukraine, Scientific Centre for Radiation Medicine, Academy of Medical Sciences in the Ukraine, Scientific-Industrial Union PRIPJAT, Scientific-Technical Centre Kiev - Chernobyl 1994 (Russ.).

Table: Deterioration in the states of health of the affected population in the Ukraine[175]

Category of the victim	Healthy proportion of the population in %									
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
I Liquidators	78.2	74.4	66.4	53.3	35.8	28.8	23	19.8	17.6	15
II Evacuees	58.7	51.6	35.2	26.2	29.7	27.5	24.3	21.1	19.5	17.9
III Inhabitants in the effected areas	51.7	35.4	35.2	26	31.7	38.2	27.9	24.5	23.1	20.5
IV Children of effected parents	80.9	66.8	74.2	62.9	40.6	n.s.	36.9	32.4	32.1	29.9

The following table describes the changes in the health spectrum of children from the highly polluted Gomel area in southern Belarus. The table begins in 1985. This column raises the question of whether the children's state of health had not been less intensively registered in1985. But even if this column is ignored there is still a strong dynamic to be found in the remaining columns from 1990 to 1997. It is evident that the greater number of illnesses is in the non-cancerous category. From data taken at all primary diagnoses it is noticeable that a considerable proportion of the children suffer from more than one illness simultaneously.

How exactly radiation exposure "functions" in the non-cancerous group is only beginning to be understood. The question is not being forced because official recognition of the entire range of the morbidity group of radiation-inducible illnesses would cause the figure for the number of all radiation victims (not only in relation to Chernobyl) to suddenly skyrocket. Investigations of this question in the Western World it almost impossible, as there is no relevant data and no register.

175 Nyagu, A.I.: Medical consequences of the Chernobyl accident in the Ukraine, Chernobyl ministry of the Ukraine, Scientific Centre for Radiation Medicine, Academy of Medical Sciences in the Ukraine, Scientific-Industrial Union PRIPJAT, Scientific-Technical Centre Kiev - Chernobyl 1994 (Russ.).1994, Kryshanovskaja: Data for 1993-1996, personal memorandum.

New illnesses amongst children in the Gomel area (Belarus) per 100,000 children[176]

Morbidity group/Organ	1985	1990	1993	1994	1995	1996	1997
Primary diagnoses altogether	9,771.20	73,754.20	108,567.50	120,940.90	127,768.80	120,829.00	124,440.60
Infectious illnesses and parasites	4,761.10	6,567.70	8,903.30	13,738.00	11,923.50	10,028.40	8,694.20
Neoplasm *	1.40	32.50	144.60	151.30	144.60	139.20	134.50
Endocrinological illnesses and nutritional, metabolic and immune system disturbances	3.70	116.10	1,515.50	3,961.00	3,549.30	2,425.50	1,111.40
Blood & haematopoietic tissue	54.30	502.40	753.00	877.60	859.10	1,066.90	1,146.90
Mental disorders	95.50	664.30	930.00	1,204.20	908.60	978.60	867.60
Neural and sense organs	644.80	2,359.60	5,951.80	6,666.60	7,649.30	7,501.10	7,040.00
Circulatory illnesses	32.30	158.00	375.10	379.80	358.20	422.70	425.10
Respiratory organs	760.10	49,895.60	71,546.00	72,626.30	81,282.50	75,024.70	82,688.90
Digestive organs	26.00	3,107.60	5,503.80	5,840.90	5,879.20	5,935.90	5,547.90
Urogenital system	24.50	555.20	994.80	1,016.00	961.20	1,163.70	1,198.80
Skin and subcutaneous tissue	159.00	4,529.10	5,488.30	6,748.20	7,012.60	6,455.00	7,100.40
Muscular-skeletal system/ connective tissue	13.40	266.00	727.70	937.70	847.40	989.90	1,035.90
Congenital malformations **	50.80	121.90	265.30	307.90	210.10	256.20	339.60
Accidents and toxication	2,590.20	3,209.70	4,122.70	4,409.80	4,326.10	4,199.10	4,343.00

* 1985 only malign neuroplasms, ** high estimation of unreported cases through abortions

In cooperation between endocrinologists from the Heinrich-Heine-University in Düsseldorf and the Belarussian endocrine advice centre in Minsk the development of diabetes amongst children and young adults in Belarus was investigated. Over the long period 1980 to 2002 the incidence rate (new illness accumulation per annum) of diabetes mellitus Type1 – diabetes with insulin deficiency, mainly amongst young adults – was observed in two areas of Belarus that had been contaminated to very different degrees. Data from the highly contaminated Gomel area was compared with that of the relatively low contaminated area of Minsk in the periods 1980 -1986 and 1987 -2002. A total of 643 patients from the Gomel area and 302 patients from the Minsk area were involved in the analysis. In the years 1980 -1986 (before Chernobyl) there was no significant difference between the incidence rates in Gomel and Minsk. In contrast to this, for the years following Chernobyl (1987-2002), there was evidence ($p<0.001$) of a significant difference in the incidence rates of both areas. The authors also discovered that the incidence rate in the Minsk area prior to and following Chernobyl was not significantly different, which it was however in the highly contaminated Gomel area ($p<0.05$), where annually about twice as many children and young adults became ill with diabetes mellitus Type 1 following Chernobyl compared to the years before Chernobyl. The highest medial incidence rate was registered in the Gomel area in 1998.[177]

Neural damage following radiation exposure

176 Organisational-methodical dept. of the Gomel district hospital, state health centre for the Gomel area: Basic data on inhabitant morbidity in the Gomel area from 1985-1997, Gomel 1998.

177 A. Zalutskaya, T. Mokhort, D. Garmaev, S. R. Bornstein: Did the Chernobyl incident cause an increase in Type 1 diabetes mellitus incidence in children and adolescents? Diabetologia 2004 Jan; 47(1): 147-8. Strahlentelex, 416/2004, Zuckerkrank nach Tschernobyl.

Mental disturbances suffered by many of the former inhabitants of the Chernobyl area could be a result of damage to the neural cells by radioactive radiation. Nadejda Gulaya from the Pallaguin Institute for Biochemistry in Kiev expressed this view as early as 1992.[178]

Scientists from different countries support the opinion that the effect of the Chernobyl catastrophe on the mental health of the population constitutes the largest problem. (At this point the issue is not 'radiophobia', a fantasy illness invented by Moscow that they allege to be the 'real' source of all the other illnesses in order to avert attention from radioactivity as a cause of illness.) The expert group on health from the WHO and IAEA Chernobyl Forum designated the following four areas for particular attention; stress-related symptoms, effects on the developing brains of small children, organic brain damage amongst highly exposed clean-up workers and suicide rates. K.Loganovsky points out that there is already a high rate of schizophrenia amongst Japanese survivors of the nuclear bombings, i.e. 6 percent. There can be no doubt that Chernobyl liquidators also carry the greatest risk of mental illness not only from radiation but also because of other causes occurring in the aftermath of the accident.[179]

Loganovsky points to a number of different investigations into morbidity risks for liquidators of non-cancerous illnesses that have produced statistically significant results. Accordingly, the risk increase per Gray absorbed dose (excess relative risk ERR/Gy) is; for mental disturbance: ERR/Gy=0.4 (95%CI= 0.17-0.64); for neurological and sensitivity disorders ERR/Gy=0.35 (95%CI=0.19-0.52); for hormonal (endocrinal) disorders ERR/Gy= 0.58 (95%CI=0.3-0.87) (Biriukov et al. 2001 and Buzunov et al. 2001, 2003). The greatest risk amongst the mental disorders (Biriukov et al. 2001) is of neurotic disorders with ERR/Gy=0.82 (95%CI= 0.32-1.32). The highest risk increase overall is however of blood circulatory disorders of the brain (cerebrovascular dysfunction) with ERR/Gy=1.17 (95%CI=0.45-1.88) (Ivanov et al. 2000). And recently a significant risk increase for external radiation doses larger than 150 Milligray (mGy) with a risk increase of ERR pro 100 mGy pro Tag = 2.17 (95%CI 0.64-3.69) has been quoted for cerebrovascular dysfunction (Ivanov et al. 2005). These results were not however achieved with the help of properly designed psychiatric studies and standardised diagnostic procedures, but are based merely on information interpreted by the state health system on mental disturbances. The textbook knowledge of psychiatry in the successor countries of the Soviet Union however, encourages dramatic underestimations of mental disturbances misinterpreting them as physical illnesses, as well as false diagnoses within the system of the mental disturbances (e.g. neurotic instead of psychotic or organic). Accordingly, the Ukrainian Ministry of Health put the occurrence of mental disturbance amongst the Ukrainian population in 1990 at 2.27 percent, 1995 also at 2.27 percent and in 2000 at 2.43 percent. However, using standardised procedures the World Mental Health (WMH) Survey Initiative of the World Health Organisation has calculated 20.5 percent (95%CI=17.7-23.3%) for the Ukraine – the state health system apparently underestimated the occurrence of mental disturbance by tenfold and more. The WMH System embraces so-called psychological disturbances such as angst, depression,

178 Strahlentelex 136-137/1992, 8.

179 Strahlentelex 454-455/2005, 1ff. Cancer, leukaemia and mental illnesses are being found more frequently by Russian, Belarussian and Ukrainian researchers amongst their fellow citizens. (German)

psychosomatic disturbances, and alcohol abuse, and avoids using terminology such as psychosis, organically based mental disorders and mental backwardness (retardation).

Another study within the framework of the French-German Chernobyl Initiative using standardised structured psychiatric interviews (Romanenko et al. 2004) put the extent of mental disturbance amongst liquidators at 36 percent and at 20.5 percent for the entire Ukrainian population. The accumulation of depressions turned out to be really dramatic: 24.5 percent amongst liquidators and 9.1 percent for the general population in the Ukraine (Demyttenaere et al. 2004)

A progressive increase in neuro-psychiatric disturbances has also been noticed amongst liquidators who worked in the restricted area around Chernobyl from 1986 until 1987, and in particular amongst those who spent 3 to 5 years there. The accumulation of neuro-psychiatric disturbances amongst the workforce who had been there since 1986/1987 and received radiation doses of more than 250 milliSievert (mSv), was put at 80.5 percent and for radiation doses under 250 mSv at 21.4 percent ($p<0,001$) (Nyagu et al. 2004). Loganovsky reported that since 1990, there has been an increase of schizophrenia illnesses: 5.4 per 10,000 amongst the workforce against 1.1 per 10,000 in the general population. Compared to the Ukrainian population the accumulation of schizophrenia amongst the people living and working in the Chernobyl zone rose 2.4-fold in the period 1986-1997 and 3.4-fold in the period 1990-1997 (Loganovsky & Loganovskaya, 2000).

Another symptom complex found particularly often amongst liquidators is the Chronic Fatigue Syndrome (CFS). According to Loganovsky (2000, 2003) the diagnostic criteria for CFS apply to 26 percent of the people with a radiation burden of less than 0.3 Sievert. The accumulation of CFS has decreased from 65.5 percent of liquidators in 1990-1995 to 10.5 percent in 1995-2001 at the same time the so-called Metabolic Syndrome X (MSX) has increased from 15 to 48.2 percent. CFS and MSX are regarded as being expressions of the development of other neuro-psychiatric and physical illnesses. CFS is also regarded as being an environmentally influenced vulnerability to, and indication of approaching neuro-degeneration, of cognitive impairment and neuro-psychiatric disturbances. The left side of the brain appears to be more vulnerable than the right side.

P. Flor-Henry reported that the observed depressive status-displays and clinical syndromes such as schizophrenia and CFS, that prevail amongst a high percentage of the liquidators, are accompanied by organic changes in the brain, mainly in the left cerebrum (by right-handers) and can be objectified with the aid of the electroencephalogram (EEG). The symptoms are also expressed in the form of the premature aging phenomenon. These neurological clinical pictures appear earlier and more severely the younger the victim was at the time of exposure to radiation. Flor-Henry reported that similar clinical syndromes, which are accompanied by EEG-changes in the left cerebrum, have also been observed amongst liquidators suffering from acute radiation syndrome. It surprises him that neither these psychiatric illnesses nor EEG- changes have appeared amongst the Russian veterans of the lost war in Afghanistan. These soldiers had after all, been subject to enormous levels of stress but unlike the Chernobyl liquidators had not been treated as heroes in their homeland. However, with the aid of magnet resonance tomography (MRT), EEG and positron emissions

tomography (PET) it is possible to prove that cerebral changes in Chernobyl liquidators and veterans of the first Gulf war as well as the war in Bosnia are very similar. Flor-Henry attributes this to the use of projectiles containing uranium (depleted Uranium, DU), in both the Gulf and Bosnian wars, which released uranium-238-oxide dust into the air upon impact, allowing it to be inhaled. He has found that those victims who were exposed to uranium-238 developed similar neuropsychiatric syndromes as the atom bomb survivors of Japan in 1945.

Premature aging

P. Fedirko reported on special radiation-specific eye diseases such as radiation cataract (that do not occur below a certain threshold level) and retinopathies. Together with the non-radiation-specific conditions, which do however occur more frequently in irradiated areas, a picture is presented of radiation-caused premature aging of the eye.

Elena B. Burlakova et al. irradiated test animals with gamma rays from caesium-137 in low dose rates of 0,041.6, 0,004.16 and 0,000.416 milligray per minute (mGy/min) and total doses of 0,000.6 to 1.2 Gray (Gy). They then examined various biophysical and biochemical parameters from the genetic and membrane apparatus of cells from organs taken from the irradiated animals. On the whole an unusual dose dependency was shown. The dose/effect relationships were not uniform, they were non-linear and of differing character. Low-dose exposure generally increased the effect of damaging factors. The effects of irradiation were dependent upon the output parameters of the bio-object. Within certain dose intervals fractionated low-dose radiation is more effective than one single acute irradiation. The investigations by Burlakova et al. showed changes following irradiation, not only in animals but also in humans, in the structure and in the properties of the cell membranes, the activity of antioxidantives and regulating enzymes and in the concentrations of the antioxidants. Thereby verifying the so-called Petkau effect[180] and going beyond it. Antioxidants such as tocopherol, vitamin A and ceruloplasmine decrease, free radicals and their by-products increase, membranes demonstrate more rigidity and the liquidity of the lipid and protein components change. All in all, according to Burlakova, ratios change following irradiation in the same way as they do in the aging process. “The liquidators”, said Burlakova, “have aged 10 to 15 years earlier than the rest of the population. The same effect can also be shown on animals and in their case one cannot speak of radiation angst or radiophobia.” As possible therapy Frau Burlakova recommends antioxidants: however, exact dosage is essential as too much could achieve exactly the opposite effect. In animal tests they have at least succeeded in delaying illness in the initial stage of leucosis by 80 to 250 days.[181]

180 Abram Petkau, Canadian physician and biophysicist. In1972 he made important observations regarding the behaviour of radioactively irradiated membranes. His original paper is difficult to obtain. Credit goes to Ralph Graeub (Switzerland), for drawing attention to Petkau’s work in a number of books, which have now been translated into a number of languages. Ralph Graeub: Der Petkau-Effekt und unsere strahlende Zukunft, Zytglogge-Verlag 1990.

181 Strahlentelex 454-455/2005, 1ff, cancer, leukaemia and mental illnesses are being found more frequently by Russian, Belarussian and Ukrainian researchers amongst their fellow citizens.(German).

Excursus: Consequences of a nuclear meltdown in Germany

Following Chernobyl scientists estimated the consequences of a nuclear meltdown in Germany. The 7-10-fold higher population density was taken into consideration. A risk factor of 500 respective 1,000 cancer and leukaemia deaths per 10,000 person Sievert was assumed. In alternative1, the same radiation exposure as that following Chernobyl was assumed. In alternatives 2 and 3 – based on figures from the German Risk Study of nuclear power stations (phase B) – greater radiation exposure following a maximum credible accident was assumed (alternatives 2 and 3).

Alternative 1:[182]
Collective dose: 2.4 million man Sievert (Chernobyl)
10-fold higher population density in Germany allowed for
Cancer cases per 10,000 person Sievert: 1,000
2,400,000:10,000x1,000 x10
Cancer deaths[183]: 2.4 million

Alternative 2:[184]
as alternative 1, but
5-fold higher emission than Chernobyl (equivalent high-pressure meltdown F1-SBV in the German risk study, phase B), maximal release
Collective dose 12 mill. person Sievert
12,000,000:10,000x1,000x10
Cancer deaths 12 million

Alternative 3:[185]
Collective dose 4.8 mill person Sievert
7 times higher population density as Chernobyl allowed for
Cancer deaths per 10,000 person Sievert: 500

182 Olav Hohmeyer: Soziale Kosten des Energieverbrauchs. Berlin, 1989.

183 In estimates of this kind, cancer mortality is often confused with cancer morbidity. In view of the inaccuracy of the estimates and the size of the numbers of both illnesses and deaths this confusion of terms is only of secondary importance. The UNSCEAR reports 1994 and 2000 give a lifetime risk factor for death from cancer and leukaemia of 1,200 for 10,000 person Sievert, the basic risk factors in alternatives 1 and 2 of 1,000 for 10,000 person Sievert are therefore not exaggerated.

184 Olav Hohmeyer: State of international and national debates on the social costs of diverse energy technologies. In: Deutsche Gesellschaft für Sonnenenergie (Hrsg.): 7. Internationales Sonnenforum. Rational energy expenditure and utility of renewable energy sources in regional and communal context. What can you contribute towards averting the threat to the climate? Frankfurt, 9.-12.10.1990. DGS-Sonnenenergie Verlag München, 1990, 2039-2044 (German)

185 Hans-Jürgen Ewers, Klaus Rennings: Estimating the damage caused by a so-called Maximum credible accident. In: PROGNOS-Schriftenreihe „Identifizierung und Internalisierung externer Kosten der Energieversorgung“, Band 2, 1992. Expertise commissioned by the German Ministry of Economics. (German)

4,800,000:10,000x500x7
Cancer deaths: 1.7 million

9. Official minimisation of the consequences of Chernobyl

9.1 The original Russian statements

In autumn 1986 the USSR presented their report on the Chernobyl catastrophe at a large conference of the IAEA in Vienna. As at that time strict secrecy regulations were being enforced by the KGB on almost all relevant questions pertaining to Chernobyl. To the present day it is unclear whether the authors of the report had ignored the KGB directives and reported to the best of their knowledge and beliefs or if they had served up fairy tales to the entire assembly of international experts.

The report was presented in Vienna by Prof. V.A. Legassov, at that time active member of the academy and deputy director of the Kurtschatov-Institute in Moscow. His suicide in 1988 together with the harrowing testament he wrote on the Chernobyl problem indicates that the latter could be true. Pravda published long passages from this text and in the title Lagassov was quoted with the words: „It is my duty to report on these things …“.[186]

In the 1986 report the following facts are found scattered in appendix 7:

Area	Inhabitants (Mill)	Population dose over 50 years (Mio man rem)	Comments
30-km-zone	0.135	1.6	Evacuees
Ukraine-SSR Belarus SSR Mold. SSR Bryansk Region Kaliningrad Region Smolensk Region Orjol, Kursk, Lipetsk	50.8 9.9 4.1 1.5 0.8 4.0 3.4		External gamma burden due to fallout
	74.5	29	
Ukraine Belarus-Poles'ye		210	Consumption of Cs-contaminated food over 70 years
Altogether		240.6	

To evaluate this data one needs to know that the collective dose is the product of the number of affected persons and the average received radiation dose. At the time of the catastrophe the dose was measured in rem, today dosage is given in Sievert (Sv). The relationship between rem and Sv is: 100 rem = 1 Sv.

186 V.A. Legassov: "It is my duty to report upon …", Pravda 141(25493) from 20.5.1988, p. 3+8., cit. in „Energie und Umwelt“, published by the League of Evangelical Churches in the GDR, written by Sebastian Pflugbeil and Joachim Listing, 1988/1989, 102f. (German)

Collective dose (man-rem) = Number of persons (man) x average dose (rem) or
Collective dose (man Sv) = Number of persons (man) x average dose (Sv)

The collective dose is a measure of the radiation damage to a population. If the collective dose is multiplied by the risk factor the number of expected cancer and leukaemia deaths is obtained (somewhat simplified):

Excess cancer and leukaemia deaths = collective dose (man Sv) x risk factor (Sv^{-1})

At first glance the results of this relationship appear strange. It could be that irradiation of a small group of people with a high radiation dose results in the same number of cancer deaths as irradiation of a large population with a low radiation dose. (This simple form of relationship is only valid for a linear correlation between dose and effect. For the range of radiation doses that are relevant in connection to Chernobyl an over linear relationship between dose and effect is probably valid – meaning, the simplified use of the linear relationship underestimates the problem.)

In1986 ICRP guideline no. 26 from 1976 was still valid. It gives the number of excess cancer and leukaemia deaths that was then thought would result in the case of one million people being irradiated with one rem. For this occurrence the ICRP gave the risk factor of 125. Based on the conventions of the time this means a total of 240,6 x 125 = 30.075 expected excess cancer and leukaemia deaths.

This is a rough calculation – but after all, in the 1986 IAEA bulletin Rosen arrived at almost the same figure[187], but then thought that it would probably be less. At the time the UNSCEAR anticipated 18,800 cases of genetic encumbrances per generation. At that time simple cancer illnesses had not yet been included in the calculation, also not included was the entire range of non-cancer illnesses.

In the following years the pressure of new results from Hiroshima and Nagasaki led to the ICRP raising the risk factor. In their guideline no. 60 from 1990 it was increased from 500 per mill. man rem to the then changed measure of 500 per 10,000 person Sievert or simpler, 5%/Sv. If the Russian data from1986 are linked to the new risk factor one arrives at the figure of 240.6 x 500 = 120,300 excess cancer and leukaemia deaths.

The new risk factor, as was the old, is the result of a compromise between the business interests of the atom industry and the pressure of the original results from the RERF regarding the analysis of the Hiroshima/Nagasaki-data. In the year 2000 UNSCEAR specified a risk factor of 11%/Sievert – compared to the Russian data from 1986 this would lead to a total of 264,660 excess cancer and leukaemia deaths.

The thoughts deliberated here do no more than link the Russian information with that of those bodies (ICRP, UNSCEAR) that take it upon themselves to define the state of science in this area. The basic data sets are extremely imprecise so that the rough calculations only convey a vague impression of the dimension in which the expected damage will be found.

187 Rosen: Health Effects, IAEA-Bulletin 28(1986) 3,65

They only refer however directly to the Chernobyl area. These figures do not present a very positive picture of the use of nuclear energy. And thus, the high collective dose for the effected area of the Soviet Union is no longer to be found in papers that were written at a later date. In particular the largest entry – radiation burden of contaminated food – had been calculated down to about 1/10.

Extensive data material on the Chernobyl catastrophe can be found in the UNSCEAR report from 1988. Instead of the aforementioned 2,406,000 man Sv taken from the first USSR report in 1986 the UNSCEAR report only gives 226,000 man Sv for the effected areas of the Soviet Union. This is astonishing as in the same UNSCEAR report the data on the estimated rates of release are distinctly scaled up: e.g. for caesium-137 from an original 13% to 25% of the radioactive inventory at the time of the catastrophe or for caesium-134 from 10% to 18%. A few years later the estimates for rates of release go up even further: for caesium-137 to 33+/-10% and for iodine-131 to 50-60% of inventory. This does not however lead to an analogous increase in the collective doses.

Until now it has been insufficiently noticed that UNSCEAR estimates the collective dose for Europe and with it the number of expected victims in Europe, higher than the equivalent data for the Chernobyl area.[188] [189]
The collective dose in the aftermath of the Chernobyl catastrophe was distributed to 53% on Europe (outside the area of the former Soviet Union), 36% on the effected area of the Soviet Union, 8% on Asia, 2% on Africa and 0.3% on America.[190] Putting the total of feared victims to at least double the figure for the victims in the Chernobyl area alone is therefore a conservative estimate.

9.2 The IAEA Chernobyl Project

In order to save their image and following a request from the USSR the International Chernobyl Project was commissioned – the Commission of the European Communities (CEC), the International Labour Organisation (ILO), WHO, the World Meteorological Organisation (WMO), the Food and Agriculture Organisation of the United Nations (FAO), UNSCEAR, the governments of the USSR and representatives of the Belarus and Ukrainian SSR worked together under the chair of the IAEA. The results were presented in the spring of 1991 in Vienna. 200 Western and 500 Russian scientists came to the conclusion that there were no health disorders that could be directly assigned to radiation exposure, and, the children that had been examined were generally healthy.[191] A more cynical slap in the face of the people affected as well as in the faces of the doctors who, under appalling conditions and

188 UNSCEAR-Report 1988, Annex D Tab. 24, 69.

189 UNSCEAR-Report 1993, Annex B, § 146, 115

190 UNSCEAR-Report 1988, Annex D, § 198, 342.

191 International Advisory Committee: The International Chernobyl Project, an Overview, Assessment of Radiological Consequences an Evaluation of Protective Measures; 1991, IAEA, Vienna.

on a daily basis are confronted with the deteriorating state of health of the population, is hardly imaginable.

Within the framework of the Chernobyl Project the particularly affected groups of liquidators and evacuees were not even examined, the restricted are was not taken into consideration.

The Academies of Sciences in Belarus and Ukraine protested sharply against this blunder.

The UNSCEAR report 2000 was similarly tendentious: with the exception of childhood thyroid cancer there was no scientific proof of an increase in the incidence of cancer (new illnesses per annum) or cancer mortality (cancer deaths per annum) or non-cancerous morbidity, that can be related to exposition to radiation. The IAEA gave the report in a press release.[192]

9.3 The Chernobyl Forum of the United Nations and their errors

In 2003 in an impressive show of strength hardly noticed by the public, the Chernobyl Forum of the United Nations was founded. It united organisations with fine sounding names: IAEA, WHO, FAO, United Nations Development Program (UNDP), United Nations Environmental Program (UNEP), UN-OCHA, UNSCEAR, World Bank, the governments of Belarus, Russia and the Ukraine.

The results were presented on September 6 and 7, 2005 during a conference organised by the IAEA in Vienna. The point of the collaboration, which took several years, was: to formulate terminology regulations in the run up to the 20th anniversary of the catastrophe at the highest possible level -that of UN organisations and governments, to finalize all research projects pertaining to Chernobyl and to communicate the assumption that the main problem in the area is poverty – and not Chernobyl.

The drafts of three papers with a total volume of 600 pages were presented:

1. Environmental Consequences of the Chernobyl Accident and Their Remediation: Twenty Years of Experience[193]

2. Health Effects of the Chernobyl Accident and Special Care Health Programs; Working Draft[194] (compiled by the WHO) and

3. The Socio-economic Impact of the Chernobyl Nuclear Accident.[195]

192 IAEA: Radiological Consequences of Chernobyl Accident: UN Scientific Committee on Effects of Atomic Radiation Confirms Earlier IAEA Assessments; PR 2000/15, 13.6.2000.

193 UN Chernobyl Forum: Environmental Consequences of the Chernobyl Accident and Their Remediation: Twenty Years f Experience; Working material, August 2005, 246

194 WHO: Report of the UN Chernobyl Forum: Health Effects of the Chernobyl Accident and Special Health Care Programmes; Working Draft, July 26, 2005

195 UNDP: The Socio-economic Impact of the Chernobyl Nuclear Accident; not available on the internet

Amongst the participants were high-ranking experts from Russia: for example, Prof. L.A. Ilyn of the Institute for Biophysics at the Ministry for Health in Moscow. Ilyn is an important man: over decades all (secret) reports on radiation occurrences in the area of the Soviet Union landed on his desk. Over a number of years he was the representative of the Soviet Union, later Russia, on the UNSCEAR Committee and at the ICRP. Belarussian doctors do not think much of him as they hold him personally responsible for forbidding doctors to carry out iodine prophylaxis immediately following the Chernobyl catastrophe.

Ilyn's hope at the time was that he would be able to keep the catastrophe secret from the public, later it would simply be too late. Many thousands of children and adults with thyroid cancer became ill as a result of this wrong decision. Also present was Prof. Yu. A. Izrael from the Institute for World Climate and Ecology in Moscow. Izrael was responsible for measuring the fallout. As early as 1990, in the German periodical 'Atomwirtschaft' (Nuclear Industry) he had declared that: "There is no evidence of radiation-related morbidity amongst the population."

At this point we will give some exemplary details of the WHO report to the Chernobyl Forum on the effects of the Chernobyl accidents on health.[196]

The report put before the WHO was only a study of the existing literature. The authors met on four occasions in Geneva for talks on the report. The report displays serious shortcomings. For a number of topics the report draws upon data that is ten and more years old.

Verification of the evidence is difficult, if not impossible. Exact data on dosimetry and data on the affected population is not available – instead, only rough estimates can be used for which, however no margins of error can be given. Mean values were built perforce for large cohort groups without knowledge of the individual values. More than questionable assumptions that only occur marginally, if at all, but are included in the assessments, have considerable influence on the conclusions.

In the WHO report all attempts to even roughly estimate the dimension of the total damage to health are avoided, apart from questionable statements on long-term expected cancer and leukaemia deaths that we will look into later.

Health damage that occurred outside the Ukraine, Belarus and Russia is not seriously evaluated.

But even data that is available in principle is not freely available to external scientists for verification of the presented report. One can therefore only believe what the scientists of the UN body put forward – or not, as the case may be.

This has very little to do with science. A well-founded scientific discussion is impossible as long as the original data is only accessible to one side.

196 WHO: Report of the UN Chernobyl Forum: Health Effects of the Chernobyl Accident and Special Health Care Programmes; Working Draft, July 26, 2005

Part of the WHO report deals with liquidators. By 1996, 200,000 liquidators were in the registers of Belarus, the Ukraine and Russia; in the WHO report a figure of about 400,000 registered liquidators is given. At the same time, it is admitted that a total of 600-800,000 liquidators had been in action.

One must therefore assume that about half of the liquidators – mainly young soldiers – were released from service somewhere into their homelands without documents, without being registered, without knowing their exposure levels and typically, without access to trained doctors with specialist knowledge of possible radiation damage.

Even the data on registered liquidators is incomplete. Only incomplete and hardly robust records exist of the actual work that they carried out (this would have allow conclusions to be drawn on permitted doses). Dose rates are available for 63 percent of Russian liquidators who were deployed from 1986 from1989, for 56 percent of the Ukrainian and only for 9% of the Belarussian liquidators. The quality of the dose information varies enormously. Even if the fact is ignored that manipulated data was knowingly recorded, as liquidators have plausibly reported[197], the accuracy of dose rates still poses a serious problem.

In the WHO report for the Chernobyl Forum the failure quota for different types of dose determination is given: 50 percent for method a, up to factor 3 for method b, up to factor 5 for methods c and d.[198] To illustrate: a measurement failure of the size factor 5 would mean that for a newly developed thermometer the value shown would be somewhere between 7.5°C and 170°C when the actual temperature was 37°C.

How many and which liquidators had been observed using which methods is not given. In spite of this, for the external dose the report gives mean values, median values and 75 and 95 percent percentiles. What is the value of data like this under these conditions? The inaccuracy of the dose rates is linked directly to all estimations of expected consequences. In an extreme case the data on expected cancer and leukaemia deaths could be 5 times higher or lower than one would expect to believe if the inaccuracies were not taken into account. The information given in the WHO report is not sufficient to be able follow this question up.

The report does not mention regulation U-2617 C from 27.6.1986, issued by the 111 Administrative Centre of the Ministry of Health, on increasing the secrecy measures for clean-up work at the nuclear power station in Chernobyl (signed by Schulschenko): “Declared secret is data on the accident, declared secret are results on recovery from illnesses, declared secret is data on the extent of irradiation amongst the workforce that took part in the clean-up of the accident at the nuclear power station in Chernobyl.”[199]

197 E. Andreoli, W. Tschertkoff: Sacrifice; Feldat Film, 2003

198 V.A. Pitkevich et al.: Exposure levels for persons involved in recovery operations after the Chernobyl accident. Statistical analysis based on the data of the Russian National Medical and Dosimetric Registry (RNMDR), Radiat Environ Biophys 36, 1997, 149-160. In: WHO report.

199 USSR Ministry of Health regulation U-2617 C from 27.6.1986, admin. centre 111, sig. Schulschenko: Increased security measures for clean-up work at the nuclear power station in Chernobyl. in: E. Lengfelder: The significance of modified factors for the collection, evaluation and distribution of investigation results on the effects of the reactor catastrophe in Chernobyl, report from the Otto-Hug-Strahleninstituts Bonn, report no. 5, 1992, 3-21 (German)

The following governmental decree no. 52617, regulation no. 205 from 8.7.1987 and issued by the same institution was also not evaluated: “The acute and chronic illnesses of persons who took part in the clean-up of the results of the accident at the nuclear power station in Chernobyl and who received a dose of less than 50 rem (500 mSv in the new measure) are not to be linked to the effects of ionising particles.”[200]

These two regulations are only examples from a long list of bans and secrecy regulations that were issued at different levels, including from the Soviet secret service KGB.

If these regulations were to be applied to the Hiroshima/Nagasaki data trying to find radiation victims there would be almost impossible. No or deliberate false documentation was made under pressure from the government and KGB and according to regulations during the first years after the catastrophe, the worst of all times This can no longer be reconstructed today, no matter how inventive the attempt. The longer the data is pushed around, the more obscure and unreliable the results become.

In the present report from the Chernobyl Forum only 200,000 of the liquidators who were in action during the worst years of 1986 and 1987 have been taken into consideration. The question remains open, why not all the 350,000 liquidators who, according to the IAEA in August 2005 were active in both of these years, were considered. Taking the present IAEA information the expected number of excess cancer and leukaemia deaths just amongst liquidators active in 1986 and 1987 would increase by 1,650.

With regard to incidences of thyroid cancer the Chernobyl Forum follows the line of argument taken so far by the international bodies and national authorities: there is an obvious increase of thyroid cancer amongst children and young adults but today this unfortunate illness can be easily treated. The fact that children who have had the thyroid glands removed require life-long medication goes by the board. In Western Europe this may amount to a problem that can be readily ignored, under the living conditions of Belarus and the Ukraine, it does not.

It also goes by the board that the children require frequent medical care in specialist clinics in order to diagnose newly formed cancerous lumps and metastases in other organs at an early stage. A lot of parents simply do not have the money to travel to the clinics and, mislead by diminishing and palliative statements from distinguished experts, believe that the urgently needed regular controls are not so important and can sometimes be neglected.

And the fact is being played down that the incidence of thyroid cancer amongst adults has also risen dramatically. In Munich’s “Medizinischen Wochenschriften” (weekly medical journal), E. Lengfelder wrote that in the Gomel area of Belarus there had been a fifty-eight-fold increase in the rate of thyroid cancer amongst 0-18-year olds in the 13 years following the catastrophe in comparison to the 13 years before it. In the age group 19 – 64 the rate of

200 USSR Ministry of Health, governmental decree no. 2617, regulation no. 205 from 8.7.1987 Admin. Centre 111, sig. Schulschenko: Classification of illnesses in connection with the accident in the nuclear power station in Chernobyl. In: E. Lengfelder: The significance of modified factors for the collection, evaluation and distribution of investigation results on the effects of the reactor catastrophe in Chernobyl, report from the Otto-Hug Strahleninstituts Bonn, report no. 5, 1992, 3-21 (German)

thyroid cancer following the catastrophe is still 5 – 6 times higher than it was prior to the catastrophe. The WHO report played this down with the assumption that the higher values amongst adults were due to more frequent medical examinations and would have to be investigated further. No evidence was given for this.

The WHO report carefully avoids mentioning their own above-stated prognoses for the very high number of expected incidences of thyroid cancer. Only in exceptional cases is it possible to do ones own calculations as basic data is being kept secret or is at least not publicly available. What one can try to do however is to examine the presented report for consistencies with the given references. We are doing this by example of the statements concerning expected long-term excess Chernobyl-related cancer and leukaemia deaths.

The following table brings together relevant values taken from the WHO report.

Table: Simplified overview according to table 16.4 in WHO: Health Effects of the Chernobyl Accident and Special Health Programmes, p. 133.

	Population [No. of persons)	Mean dose [mSv]	Lifetime risk predicted excess deaths cancer and leukaemia
Liquidators	200,000	100	2,200
Evacuees	135,000	10	160
Strictly controlled zone	270,000	50	1,600
Other contaminated areas	6,800,000	7	4,970
Altogether			8,930

If, for example, the data from this table is compared to the paper from E. Cardis et. al.,[201] who is quoted as being the only source of the table in the WHO report, curious details become apparent:

In her original paper Cardis gives estimates for the number of expected cancer and leukaemia deaths during the entire lifespan for; some of the liquidators, evacuees from the 30-km zone, people living in the " strictly controlled zone " and people who live in "other contaminated areas“. For these, amongst others, she gives; the number of persons, the average received radiation dose and the predicted incidence of excess cancer and leukaemia deaths. In her original paper she also gives a number of areas of uncertainty – for example, 6 -20 mSv for the average dose with which the population in “other affected areas” was contaminated. (This is unusual because an average value is one value and not a pair of values). It is also unclear whether the uncertainty of the measuring procedure is included in this domain of uncertainty - we consider it unlikely. In Table I of the paper Cardis gives the

201 E. Cardis, L. Anspaugh, V.K. Ivanov; I.A. Likhtariov, K. Mabuchi, A.E. Okeanov, A.E. Prsyazhniuk: Estimated long term health effects of the Chernobyl accident. In: One Decade After Chernobyl. Summing up the Consequences of the Accident. Proceedings of an International Conference, Vienna, 1996. STI/PUB/1001, IAEA, Vienna, 1996, Vienna.

collective dose for people who live in “other affected areas" also in the form of a range: in this case 35,000 - 100,000.

In the original paper there is an easily overseen index ([a]) next to this information. In the relevant footnote one finds that for the inhabitants of the “strictly controlled zone" and the inhabitants of “other contaminated areas" only the radiation doses from 1986 -1995 have been recorded. If the longer period from 1996 -2056 were to add to this (thus giving a total of 70 years), the collective dose would increase by 50 percent in each case. That would change the given values for the collective dose to values between 52,000 and 150,000.

From information relating to the liquidators and the evacuees one can see that E. Cardis used a risk factor of 11%/Sv. We used the same risk factor to calculate the expected incidence of cancer and leukaemia deaths from the collective dose values for the “strictly controlled zone” and the “other contaminated areas”.

At this point we give values taken from the original paper of E. Cardis et al., including footnote a, to which we have only added the additional number of deaths for the “strictly controlled zone” and the “other contaminated areas” in the manner described above:

Table: Data from Tab. I for 70 years (including contents of footnote a) In: Cardis et al.: Estimated long-term health effects...1996.

	Population [No. of persons]	Mean dose [mSv]	Collective dose from tab. I [man Sv] (70 years)	Predicted excess deaths cancer and leukaemia (no. of persons) (70 years)
Liquidators	200,000	100		2200
Evacuees	135,000	10		160
Strictly controlled zone	270,000	50-60	15,000 – 30,000	1,650 – 3,300
Other contaminated areas	6,800,000	6-20	52,500 – 150,000	5,775 – 16,500
Altogether				9,785 – 22,160

If the data from the table in the WHO report is compared with the data in the original paper from E. Cardis et al., two aspects are noticeable:

▪ the uncertainties given in the original paper are missing in the WHO report and

▪ for the " strictly controlled zone" the WHO report gives a value just below the lowest value of area of uncertainty given in the original paper and for the "other contaminated areas" the expected number of cancer and leukaemia deaths of around 5,775 – 16,500 in the original paper are drastically rounded down to 4,970 cases.

In the press releases from the WHO and the IAEA on the Viennese Conference of the Chernobyl Forum there was no mention of the 8,930 dead from the WHO report presented at the conference. Therefore there was also no mentioned of them in any of the newspaper articles on the conference, even though they had been specifically mentioned not only in the full-length written version of the WHO report but also in the speech given by E. Cardis in front

of the Chernobyl Forum. In the press releases from WHO and IAEA the only mention was of 4,000 possible future deaths due to Chernobyl. The largest of the four examined topics– the expected number of cancer and leukaemia deaths amongst the 6,800,000 inhabitants of "other contaminated areas" –was even suppressed altogether.

As early as September 2005 S. Pflugbeil had pointed to the discrepancies between press releases, WHO report and the underlying source of data from Cardis et al.[202] Up to the present day the Chernobyl Forum, IAEA and WHO have not deemed it necessary to inform the public that, based on their own analyses a 2- to 5-fold higher value for expected cancer and leukaemia deaths is anticipated in the aftermath of the Chernobyl catastrophe than they had stated in their press releases.

“Who does not know the truth, is simply a fool...
Yet who knows the truth and calls it a lie,
is a criminal.”
(B. Brecht: Galileo Galilei)

202 S. Pflugbeil: Disastrous use of language. Strahlentelex Nr. 450-451, 19. Jahrg., 6. Oktober 2005,1-5.(Ger)