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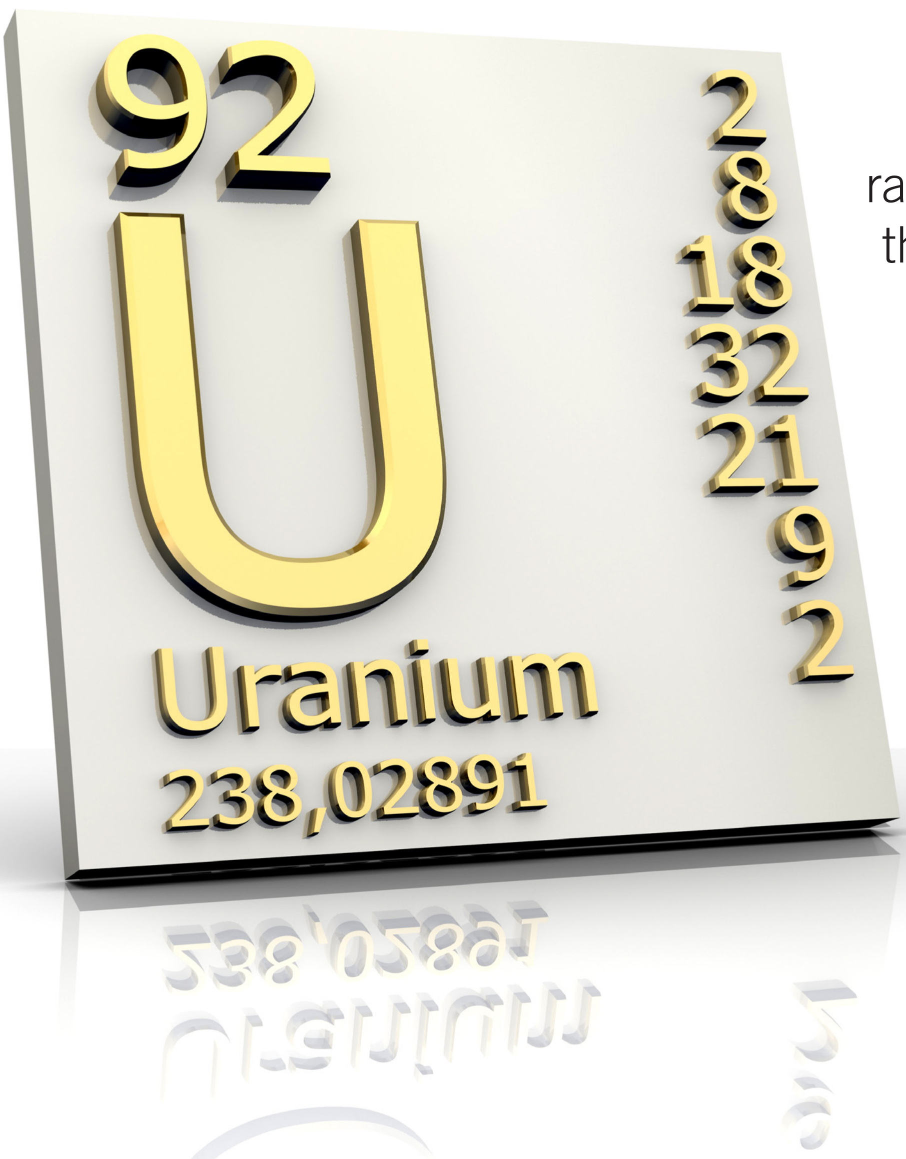
Nuclear **Safety**

This Factfile summarises the main sources of radiation exposure in the United Kingdom and examines the Chernobyl disaster.



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Radiation Exposure in the United Kingdom

It has long been known that very high doses of radiation can cause death through the destruction of body tissues and that lower doses can increase the risk of cancer and may lead to genetic damage. It is probably because of the association of radiation with nuclear weapons and with cancer that it inspires fear in many people. More is probably known, however, about the effects of radiation than almost any other environmental agent.

It is not generally appreciated that we are all inescapably exposed to **natural radiation** arising from sources such as cosmic rays, rocks and soil, building materials and natural radioactivity in the food we eat. The average person in the UK normally receives more than 85% of his or her annual radiation dose from their surroundings, although there is a wide variation. Some people living in the granite areas of Cornwall and Scotland, for example, receive doses several times higher than average, but there is no clear evidence that people living in areas such as these with higher background radiation levels suffer more cancers than the rest of the population.

Most of the rest of the annual radiation dose that we receive arises from **medical exposure**, although this also varies widely from person to person. A further small contribution arises from fall-out from bomb tests, air travel, domestic coal burning and other miscellaneous manmade activities. If the contribution from medical diagnosis is excluded, man-made sources normally represent about 1% of the total annual dose to people. **The proportion due to the discharge of radioactive substances from nuclear plant in the UK represents less than 0.1% of the total**.

These figures are put into perspective in **Table 1**. **Table 2** relates the risk of death from radiation to that of other common causes of death. For more than fifty years the International Commission on Radiological Protection (ICRP) has considered all the evidence and formulated guidelines to minimise the hazards of radiation. The ICRP draws its expertise from leading experts on radiation protection worldwide and reviews the body of scientific evidence in assessing the risks involved in exposure to radiation. Other international bodies, such as the UN Standing Committee on the Effects of Atomic Radiation (UNSCEAR), and, from the EC, the Article 31 Group, also play a major role in these assessments. In the UK, bodies such as the Radiation Protection Division of the Health Protection Agency[i] and the Health and Safety Commission (HSC) provide advice to government on the radiological protection of the general public and radiation workers.

Much of the information on the health effects of radiation comes from the health records of the Japanese atomic bomb survivors and from studies of patients who received large doses of radiation as part of their medical treatment. The doses for which such data are available range from about 50 millisieverts (mSv) upwards. The health effects of the much lower doses (typically very small fractions of a millisievert), to which members of the public may be exposed as a result of the operation of nuclear power stations, have to be estimated on the basis of these observations made at much higher doses. Allowance is made for the fact that the body's repair mechanisms for dealing with the damage caused by radiation may be more efficient at low doses.

Source	Average Annual Dose (mSv)[1]	%
Natural (2.20 mSv or 87%)		
Cosmic	0.25	10
Terrestrial Gamma[2] (from rocks, soil, etc)	0.33	14
Internal Irradiation (from naturally occuring radiation in the food we eat)	0.3	12
Radon/Thoron[2] (radioactive gases emitted from some rocks and building materials)	1.30	51
Man Made (0.326 mSv or 13%)		
Medical	0.3	12
Miscellaneous[3]	0.01	0.4
Fallout	0.01	0.4
Occupational Exposure	0.005	0.2
Radioactive Waste Disposal (all sources including nuclear power stations, nuclear re-processing plants, hospitals and research laboratories)	0.001	<0.1
Total	**2.526**	**100**

Table 1: Sources of radiation exposure for members of the public in the UK

Source:

Derived from Hughes, J.S., K.B. Shaw & M.C. O'Riordan (1989)

Radiation Exposure of the UK Population 1988 Review, NRPB-R227, HMSO.

Notes:

1. 1 millisievert is a thousandth of a sievert.
2. These figures vary widely from one part of the UK to another. Terrestrial gamma dose is estimated to vary from 0.1 to 1mSv and exposure to radon and its decay products from 0.3 to 100mSv.
3. Summary of doses from miscellaneous sources (mSv):

Luminous watches	0.001
Smoke detectors	0.00001
Colour Television	0.000003
Air Travel	0.01
Coal burning	0.0002
Total (rounded)	0.01

Cause	Risk of death per year
Smoking 10 cigarettes a day[1]	1 in 200 or 500×10^{-5}
Natural causes, 40 years old	1 in 700 or 140×10^{-5}
Accidents on the road	1 in 10,000 or 10×10^{-5}
Accidents in the home	1 in 10,000 or 10×10^{-5}
Accidents at work	1 in 50,000 or 2×10^{-5}
Most exposed from nuclear effluents (0.3 mSv)[2 3]	1 in 70,000 or 1.4×10^{-5}
All causes	1 in 80 or 1200×10^{-5}

Table 2: Comparative health risks of radiation - Average annual risk of death in the UK from some common causes

Source:

NRPB (1989) Living with Radiation.

Notes:

1. For smoking the risk indicated here includes all the adverse effects of smoking; for lung cancer only the risk is about halved.
2. Regular consumers of sea foods collected off Cumbrian coast in vicinity of Sellafield.
3. Estimated, not observed.

In the late 1980s the major international bodies responsible for advice on **radiological protection** reviewed the risks associated with radiation exposure. All of these bodies reached much the same conclusion about the magnitude of the risks, and the ICRP subsequently drew up revised recommendations regarding radiological protection both of radiation workers and members of the public.

The ICRP examined the detriment to health associated with given levels of dose. They took into consideration not only the actual size of the risk of cancer, but also the fact that fatal and non-fatal cancers have different impacts on the quantity and quality of life, that a radiation-induced cancer develops only after a latent period, which can be many years, and that hereditary disease affects future generations rather than the present one. The dose limits were then set by a consideration of risk levels which might, in a modern society, be regarded as tolerable or intolerable. People and organisations which use sources of radiation are, however, not merely obliged to keep doses to individual workers and members of the public below dose limits. They must also apply the **ALARA** principle: doses must be kept **A**s **L**ow **A**s **R**easonably **A**chievable, taking into account economic and social factors.

The current legal dose limits (based on earlier ICRP recommendations), the new ICRP 60 dose limits, and guidance given by the National Radiological Protection Board are shown in **Table 3**.

Emissions during normal operation of Nuclear Power Plant

Those living close to a nuclear power station may receive a small additional dose due to its operation. In communities within a few kilometres of a power station, the most exposed individuals may receive an additional radiation dose, which is typically a per cent or two of the average natural background dose. Some very small groups of people living very close to power stations may receive higher doses than this. For example, children born in the town of Seascale, especially in the early days of operation of the Sellafield plant, have received doses to their bone marrow which are a substantial fraction more than the dose from natural background radiation.

	Current Legal Limit	ICRP 60 (1991)	NRPB GS 9 Guidance
General Public	5	1 (averaged over 5 years)	0.5 (effluent discharges)
Workers	50	20 (averaged over 5 years)	15

Table 3: Radiation dose limits and guidance levels (mSv per year)

In recent years, people have become very concerned over reports of **clusters of leukaemia** in children living near some nuclear plants. This concern first arose in 1983 when Yorkshire Television produced a programme "Windscale – the Nuclear Laundry", which reported on an excess of leukaemia and other cancers in children living near the Sellafield site. The Government set up a Committee, chaired by Sir Douglas Black, to report on the allegations made in the programme. The Black Committee concluded that there was a small excess of leukaemia cases in children living in Seascale and some other communities to the south of the site. They felt, however, that doses resulting from radioactive discharges from the site were too small to account for the observations, and in addition concluded that there was no evidence of a general risk to health for children or adults living near Sellafield.

Since 1983, excesses of leukaemia cases have been reported in the vicinity of Dounreay in Northern Scotland, the Atomic Weapons Establishment, Aldermaston, and the Royal Ordnance Factory, Burghfield. These reported excesses were thoroughly investigated by a Committee set up in 1985 as the result of a recommendation in the Black Report, called the Committee on Medical Aspects of Radiation in the Environment, or **COMARE**. COMARE confirmed the existence of an excess in each case, but found that doses to people living near the sites arising from the activities carried on there were very much smaller (in the case of Burghfield millions of times smaller) than doses from natural background radiation.

When one is dealing with a rare disease, such as **childhood leukaemia**, the very nature of the statistics means that whether or not significant excess is found during an investigation depends on the statistical methods used, and the areas and time periods chosen for study. There has certainly been a small excess of cases near some plants, but the situation regarding nuclear installations in general is unclear.

Recent studies have indicated that it may be some feature of the areas in which nuclear plant is constructed which is associated with a raised risk of leukaemia. Researchers from the Imperial Cancer Research Fund have found that in areas around nuclear sites in Britain there is a small general excess of leukaemia in children - the risk is about 15% higher than in the country as a whole. The researchers also, however, found similar excesses around sites that had been investigated as possible locations for nuclear power stations, but where construction had never taken place.

Studies in **France**, the **USA** and **Canada** have not found excesses of childhood leukaemia near nuclear installations. The **West German** experience, however, seems to parallel that of the British, with excesses seen in certain age-groups in certain areas but with even larger excesses seen in the locations of "potential" nuclear sites.

A number of interesting theories on the causes of childhood leukaemia have been proposed, which **link the disease to aspects of community lifestyle and to childhood infectious diseases**. Dr Kinlenj of the Cancer Research Campaign has hypothesised that l**eukaemia is a rare response to a common infection and may occur more frequently when populations with different histories of exposure to infection are mixed together**. He has found excesses of childhood leukaemia in new towns established in rural areas and in those communities which experienced the greatest increase in commuting levels between the 1971 and 1981 UK censuses.

Professor Greaves of the Leukaemia Research Fund has put forward a hypothesis that links leukaemia in very young children to the timing of childhood infections. His hypothesis is supported by the observation that leukaemia incidence is increased in isolated communities of high socio-economic status.

Public concern was further heightened when, in 1990, Professor Gardner's case-control study of leukaemia in West Cumbria indicated that children of fathers who had received doses in excess of 100mSv in the period prior to their conception, or who had received doses in excess of 10mSv in the six month period immediately preceding conception, were 6-8 times more likely to contract the disease. As in all research of this type, the number of cases involved is small (the findings are based on only 4 case fathers in the high dose group).

No excess sufferers of leukaemia have been seen among the children of the atomic bomb survivors and Professor Gardner's theory is inconsistent with current thinking on transmission of genetic disease. A case-control study carried out in the vicinity of Dounreay has not found raised risks in children in respect of paternal employment at the site or of any level of pre-conceptual radiation exposure. This was a small study however, which, while it does not support Professor Gardner's findings, does not disprove them either. A much larger Canadian study published in August 1992 has also failed to observe an association between childhood leukaemia and a father's radiation exposure. The nature of statistics mean we are not in a position to say that there is no risk, but the evidence is that if such a risk does exist, it must be smaller than that reported at Sellafield.

More recently, **COMARE** was able to carry out a systematic analysis comparing the incidence of childhood cancers around nuclear installations to distribution patterns around the rest of the UK. **These reports demonstrated a lack of evidence for increased risk of childhood cancers in the vicinity of nuclear power generation sites**. The studies also confirmed earlier evidence of raised incidence of some types of cancer around other kinds of nuclear installation, but no consistency regarding the type of nuclear activity at the installations, the time span or the nature of the the cases involved. There remains a lack of a convincing explanation for this patterning. However, the authors acknowledge that the **clustering effect is consistent with prevailing theories linking the development of childhood cancers to an infection/immune system process**, i.e. a rare and unusual response to an infection.

In the meantime, a large amount of radiobiological and epidemiological research, much of it funded by the Nuclear Industry, is being carried on into the causes of childhood leukaemia. It is also relevant to note that, perhaps because of the public fear of radiation, considerable publicity has been given to radioactive leaks from UK power stations and particularly from the Sellafield reprocessing plant. The number of reported incidents caused considerable disquiet and as a result, the safety performance of Sellafield was audited by the Health and Safety Executive. In 1985, two new facilities designed to reduce the level of routine emissions into the Irish Sea came into operation. These are the Salt Evaporator and the Site Ion Exchange Effluent Plant. These have resulted in substantial decreases. For example, the amount of radiocaesium discharged has reduced from 1289 TBq in 1983 to 13 TBq in 1987.

Accidents at Nuclear Power Stations

A nuclear power reactor cannot explode like a nuclear bomb. In a nuclear weapon, the chain reaction is triggered by a conventional explosion in a layer surrounding the nuclear material. As the nuclear material is compressed by this explosion, it's power is concentrated; energy is released in fractions of microseconds and the material is instantly vapourised, resulting in an explosion of massive force. The aim in **nuclear power reactor design**, by contrast, is to ensure that changes in power output are small, with permitted power changes taking place in tens of seconds. If a fault occurred such that power changes did take place very rapidly (for example, increasing by factors of 100 in a few tenths of a second), the design is such that the fuel would melt or disintegrate releasing its energy as heat, but would not lead to a nuclear (e.g. fission generated) explosion. The rapid transfer of heat to a liquid coolant, however, can generate a rise in pressure capable of causing severe structural damage, as in the Chernobyl accident (**see Appendix**).

There is clearly, therefore, an element of risk in operating a nuclear reactor, just as in any other large and complex installation, such as an oil refinery or chemical plant. What makes a nuclear reactor different is that, if some sort of failure should release large quantities of radioactive material into the atmosphere, the incident could possibly affect thousands of square kilometres around the plant. Although the same sort of failure in a chemical plant can have very serious local effects, as was seen at Flixborough and Bhopal, chemical accidents do not normally compare with the most severe nuclear reactor accidents in terms of potential for causing long-range and long-term contamination.

The major safety concern in **designing** and **operating** a nuclear power reactor is, therefore, to prevent the fuel temperatures from reaching a level where large quantities of fission products can be released into the reactor coolant and ultimately into the atmosphere. Automatic systems have, therefore, been designed to detect faults and then shut the reactor down. To do this, a large number of control rods are held out of the core by an electrical supply. In the event of high temperature, excess power, or loss of cooling being detected, the electrical supply to the control rods is disconnected and the rods simply fall into the core as a result of gravity.

Even following satisfactory shutdown, there is still a need to cool the reactor, as it continues to produce several megawatts of heat from radioactive decay. The reactors are therefore provided with adequate shutdown cooling so that excessive temperatures are not reached even if some post-shutdown cooling plant fails to function. The reactor coolant is normally pressurised to increase its density and heat carrying ability, but the post-trip cooling system is designed to provide adequate cooling in the event of the reactor depressurising.

Since the accident at the **Chernobyl nuclear station in the USSR** (now Ukraine) on 26 April 1986, concern about possible major accidents at nuclear stations in the UK has naturally heightened. Prior to the Chernobyl incident, the worst accident to a nuclear power station occurred at **Three Mile Island in the United States** in 1979. Due to a combination of equipment failures, misinterpreted information and human error, much damage was done to the core of the reactor. The ultimate protective barriers and containment built into the plant, however, did work effectively and prevented a major release of radioactive material into the atmosphere. Nobody was killed as a result of the Three Mile Island incident. Nevertheless, it was both serious and costly.

Details of the **Chernobyl accident** were revealed by the Russians to the International Atomic Energy Authority at a meeting in Vienna on 25-29 August 1986 (**see Appendix**).

Three factors combined to produce the disastrous chain of events at Chernobyl. **The most fundamental factor was the design failing in the RBMK reactor, which made it unstable at low power**. The other factors were the carrying out of an **intrinsically unsafe experiment** and a **series of operator errors** once the experiment had started, as a result of which safety devices were deliberately switched off and warnings ignored.

At a Seminar held in London by the British Nuclear Energy Society on 3 October 1986, the consensus of opinion was that an accident comparable to the one at Chernobyl could not arise in the UK. This is because an RBMK type reactor (or other comparably unstable design) would never be built, such a dangerous experiment would never have survived the vetting process, and Western reactors have diverse automatic protection systems which cannot be switched off.

Both the Three Mile Island and Chernobyl accidents were caused by unlikely combinations of events. In the UK, in order to ensure an adequate design, very detailed studies have been carried out for nuclear power stations currently being designed or built, using fault-tree and probabilistic analyses to try to postulate all possible pathways by which failures could take place in various combinations. They indicate that for these stations the probability of an uncontrolled release of radioactivity would be about one in a million per annum.

For early UK designs of nuclear power stations, these analytical methods were not available, but updating studies are carried out as part of the continual process of confirming to the Nuclear Installations Inspectorate that the power stations remain safe to operate.

Earthquakes, Air Crashes, Terrorism & Nuclear Proliferation

Concern has also been expressed that nuclear power stations in the UK may not be proof against **earthquake** or **air crash**. Whilst it is true that events of this nature were not explicitly taken into account in the design of Britain's early nuclear reactors, they were, however, built to high civil engineering standards. Studies have been carried out to analyse in detail the effects of external hazards on these structures to confirm either that the reactors can safely withstand such an event, or that the probability of causing sufficient damage to affect the safety of the reactor is extremely small. External hazards such as these are now specifically taken into account in the design of modern power stations.

External hazards such as terrorism have also been the subject of concern. Nuclear power stations are built to withstand major external hazards, with massive shielding around the radioactive core. It would be extremely difficult, therefore, for terrorists to carry out attacks that could lead to major releases of radioactivity. Equally, the transport of spent fuel in strong, heavily-shielded containers, able to survive major train crashes, means that these would also be extremely difficult targets.

One major concern is that the construction of civil nuclear power stations around the world could lead to more countries developing nuclear weapons. It is certainly true that nuclear power stations could be operated to produce weapons grade material. It is likely, however, that any country with sufficient technical competence to use materials from civil nuclear power stations for the purpose of fabricating nuclear weapons, would be able to develop the technology to manufacture nuclear weapons more directly, independent of nuclear power stations. Agreements such as the **Treaty on the Non-Proliferation of Nuclear Weapons**, to which over one hundred countries are now a party, are designed to reduce these dangers.

In arguing that nuclear power provides a major opportunity for developing countries to increase their standard of living without making further demands upon world fossil fuels supplies, the dangers of nuclear proliferation must be recognised. Furthermore, there may be higher risks associated with the operation of nuclear power stations in countries where there is not a well-developed industrial, technological and safety infrastructure. These dangers must be balanced against the advantages of securing a major new energy supply, which in itself should act to reduce the potential for international tension.

Appendix - Chernobyl

Although this factsheet is concerned with nuclear power in the UK, it is impossible to divorce this from events in the rest of the world. In particular, it would be impossible to discuss the subject without reference to **the incident at Chernobyl in the USSR on 26 April 1986, when the Number-4 reactor on the site was catastrophically damaged, releasing radiation over much of Europe**. A resume of the accident, as revealed to the Post-Accident Review meeting of the International Atomic Energy Agency in Vienna on 25-29 August 1986, follows:

Unit 4 was an RBMK pressure tube reactor normally producing 1000 MW(e). In order to minimise the need for fuel enrichment, the RBMK design is over-moderated and, under certain conditions, has a positive void coefficient of reactivity. That is to say, if steam production increases, so does reactivity and, therefore, reactor power. Whether the overall process is stable or not depends on other factors, which themselves vary with power level. The designers were well aware of the resulting stability problems and the operators were forbidden to operate the plant in the unstable low power region, but there was no automatic shut down if that region was entered. **It was these design failings that were the root cause of the subsequent accident**.

At the time of the accident the operators were carrying out an experiment to test how long the coolant pumps would continue to function in the event of a power cut from the grid, before the plant's back-up supplies were switched on.

There are two 500 MW(e) turbo-generators on each RBMK reactor. Under normal circumstances, the reactor shuts down automatically whenever the turbo-generators trip. In order to test several different control mechanisms, this trip was disabled and the reactor was scheduled to be operated at 20% power, with one turbo-alternator shut down and the other synchronised to the grid.

In practice, it proved impossible to stabilise the reactor at the 20% power level and the test was performed from a lower power, **well within the forbidden operating zone**. At this low level of power, and because the recent reduction from full power had caused the temporary build-up of neutron-absorbing isotopes within the fuel, most of the control rods had to be withdrawn to keep the reactor critical. This not only worsened the stability of the reactor but also resulted in the control rods being initially too far out of the core to be effective when a rapid shut down was required.

The Emergency Core Cooling System (ECCS) was deliberately switched off, to prevent it interfering with the experiment. In the event, however, the accident was so severe that the ECCS would have been of no use anyway. At such very low power levels virtually no cooling water is supplied to the boiler drums, thus the directly circulated cooling water would be virtually boiling. **The operators had thereby set the scene for the ensuing catastrophe, and even though the station-monitoring computer advised them that the reactivity margin was such that the plant was unsafe, they ignored it and started the test**.

The remaining turbo-generator was tripped and as it lost speed, so too did the coolant circulating pumps. This caused a significant increase in steam production in the core which (due to the reactor's positive void coefficient) caused an enormous change in power generation in a fraction of a second. As soon as the operators realised they were in trouble they tripped the reactor manually, but they were too late and the control rods were too far out of the core to have any effect.

Reactor power increased to an estimated 100 times above full power in one second. Under these conditions the fuel rapidly disintegrated, and rapidly transferred its energy to the water, which promptly vapourised and produced a steam explosion, blowing the top off the reactor, wrecking the containment building, and releasing radioactive material to the atmosphere. The nuclear reaction was terminated by the explosive disassembly of the core. The graphite, on exposure to air, ignited. This had little consequence except in presenting an additional task for the ill-fated firemen to deal with.

It is estimated that 3% of the radioactive material of the reactor core was released, that 10 to 15% of the volatile materials (tellurium and caesium) subsequently escaped, and that all the noble gases (xenon, krypton, etc) were released over the next few days. **Thousands of tons of sand, clay and lead were dropped onto the top of the reactor and it appears that this acted as an effective filter, preventing further release of all the fission products**.

This appendix has covered the facts of the accident as revealed to the IAEA. At the present time it is still impossible to be definite about its consequences. So far as is known, the effect on the UK has been minimal. Unfortunately, the same cannot be said of the region surrounding Chernobyl, where the full extent of the accident and its long-term consequences will only become clear after the next decade or so.

A report by the Chernobyl Forum of U.N. agencies twenty years after the event noted that while the total amount of radioactivity released by the accident over 10 days was huge, reaching 14 exabecquerels (14 x 10^{18} becquerels), **the majority of residents and emergency workers received relatively low doses of radiation, comparable to naturally occurring levels of exposure**.

The report reached a conservative estimate of the number of deaths in the surrounding region resulting from the accident. It concluded that **the accident had caused fewer than 50 deaths directly attributable to radiation**, most of them among emergency workers who died in the first months after the accident. In addition, about 4,000 eventual radiation-related deaths are predicted among 600,000 people in the affected area, including emergency workers and residents. This would represent **an increase of about 4% over naturally occurring cancer deaths**. The increase in cancer deaths among the 5 million exposed to lower levels of radiation in the surrounding regions is expected to be much lower, but difficult to detect among the natural variation in cancer mortality rates.

The Chernobyl Forum report is more ambivalent with regard to the impact of the accident on the quality of life of the inhanbitants of the affected regions. **A significant increase in thyroid cancer among those exposed to radiation from the accident as children is the only unequivocal outcome in terms of radiation-related disease**.

There has been no demonstrable increase in other forms of cancer, but this may be due to the absence of large scale epidemiologcial studies. An expected spike in fertility problems and birth defects has also failed to materialize.

However, the report concludes that **"the mental health impact of Chernobyl is the largest public health problem unleashed by the accident to date"**. Lifestyle diseases, such as alcoholism, exacerbated by the trauma of relocation, health fears and the ensuing socio-economic deprivation among affected residents, posed a much greater threat than radiation exposure. While the verdict on the direct impact of radiation exposure from the Chernobyl accident on long-term health remains inconclusive, the report suggests very strongly that the ability to protect the public from nuclear accidents relates not only to technical safeguards but also to wider norms of governance.

Looking ahead on the engineering front, the Authorities plan to construct a **New Safe Confinement (NSC) over the damaged reactor**. This will cover the existing shelter which was erected shortly after the accident and has a limited life. The NSC should have a 100 service life. It is expected to allow for the dismantling of the current shelter, removal of the highly radioactive fuel mass, and eventually decommissioning of the damaged reactor whilst minimising any further damage.

Notes

i. This division was formed in April 2005 when the National Radiological Protection Board merged with the Health Protection Agency.

Further Information

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- **Glossary of nuclear terms**
  http://www.theiet.org/factfiles/energy/nuc-terms-page.cfm

Further Reading

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- Article 31 Group of the European Commission: http://ec.europa.eu/energy/node/1183
- Committee on Medical Aspects of Radiation in the Environment (COMARE): http://www.comare.org.uk
- International Commission on Radiological Protection (ICRP): http://www.icrp.org
- Radiation Protection Group of the Health Protection Agency: http://www.hpa.org.uk/radiation/
- UN Standing Committee on the Effects of Atomic Radiation (UNSCEAR): http://www.unscear.org
- International Atomic Energy Authority (IAEA): **Chernobyl 20 Years Later**: http://www.iaea.org/NewsCenter/Focus/Chernobyl/

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