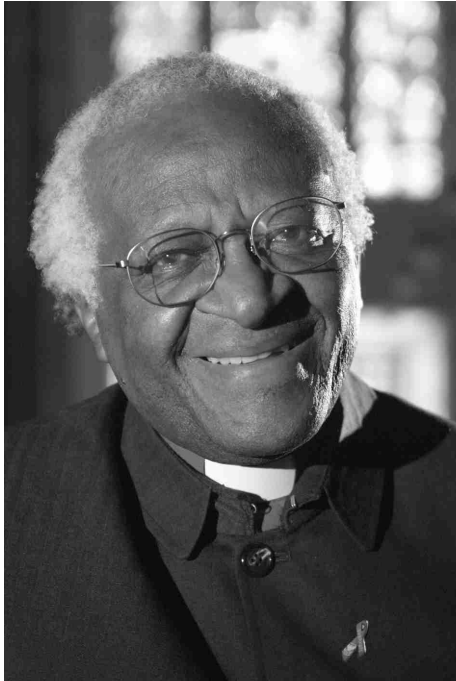


*"The nuclear industry should be phased out in the shortest possible time."
- ANC Environment Desk, 1994*



*"We do not need nuclear power.
The world does not need nuclear
power. To visit death upon
current and future generations
from radiation is unforgiveable."*

*- Archbishop Desmond Tutu
August 2002*

*"The poor of the world stand at the gates of the
comfortable mansions occupied by each and every
King and Queen, Prime Minister and minister privileged
to attend this unique meeting.*

*The question these billions ask is - what are you
doing, you in whom we have placed our trust, what are
you doing to end the deliberate and savage violence
against us that, everyday, sentences many of us to a
degrading and unnecessary death?"*

*- Thabo Mbeki - Statement to the
Millennium Summit, September 2000*



*"Our policy must rest on the solid moral foundation of
dedication to the primacy of people and their long-term well
being. We have to be on guard against temptations of short-
term benefits and pressures from powerful forces at the
expense of the long-term interests of all. We cannot afford
to bargain away the birthright of future generations."*

*- Nelson Mandela
Opening the 5th session of the
World Commission on the Ocean*

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How to use this booklet:

It is important that you read pages 4-5, *Understanding Radiation*. You may then turn to the factsheets on topics that interest you. All the topics are able to be read individually.

Understanding radiation

Radiation is a form of energy that, in general cannot be seen, felt, or tasted. Radiation is released from the smallest (subatomic) parts of substances called "radionuclides" and other radioactive materials. Radionuclides are just substances, metals for example, that because of their make-up emit radiation. Uranium and plutonium are well-known radionuclides. Other substances like water, air and metals can become radioactive when exposed to radiation. At which point, they too release radiation and become potential health hazards.

Radiation occurs in three basic forms, alpha, beta and gamma radiation.

Alpha radiation consists of heavy, high-energy charged particles. These have little penetrating power, being stopped by human skin, but because of their high energy, alpha particles can do significant damage to human tissue if alpha emitters, such as uranium, plutonium or radium, are inhaled or ingested (swallowed).

Beta radiation also consists of high-energy charged particles, but these are smaller and lighter than alpha radiation. This allows them to penetrate human skin, so that beta emitters can do damage even from outside the body.

Beta emitters often emit gamma radiation together with betas. Gamma radiation consists of extremely high energy photons. These are able to penetrate hundreds of metres through air, and often pass directly through us, without doing any damage. Those that do interact with human tissue can however cause damage.

When alpha, beta and gamma radiation interact with human tissue, they can either kill tissue, or damage the genetic material contained in our cells. When large doses of radiation are received, large amounts of tissue in the body may be killed, sometimes with fatal effects. At lower doses, genetic damage is more likely, causing mutations and possibly cancer. Since these cancers may take years or decades to appear, it is very difficult

to determine whether a dose of radiation has caused a specific cancer. Normally, epidemiological data are used, where an exposed community is monitored and the long term effects of that exposure observed. None such studies exist in South Africa.

Radiation is all around us. We often hear that the rocks around us, the bricks in our houses, even the water that we drink and the food that we eat contain low levels of radioactivity. Even flying in aircraft exposes us to radiation. Why should we then be concerned about nuclear power and other industries that may release radioactivity into the environment?

Firstly, the levels of radioactivity in the environment are usually quite low. For example, in the uranium mining areas of the Erzgebirge of South

Eastern Germany, river water that is not contaminated by mining generally contains less than a microgram of uranium per litre. This is below what is considered dangerous to drink. On the other hand, river water in the vicinity of uranium mines is often contaminated at levels which are unfit for human consumption.

When it comes to nuclear power, the situation is even worse. In the process of producing nuclear energy, new radioactive substances are produced. These substances do not exist in nature at all, and therefore our bodies do not know what to do with them. Worse still, since they are often the radioactive isotopes of elements that exist in nature, they are absorbed in the body where they may decay potentially causing cancer. For example iodine-131, a radioactive isotope of iodine found in nuclear waste and fallout concentrates (along with the non-radioactive isotopes) in the thyroid gland.

"Thyroid cancer is caused by iodine-131, which comprised 10 to 15 percent of Chernobyl's fallout.

When alpha, beta and gamma radiation interact with human tissue, they can either kill tissue, or damage the genetic material contained in our cells. When large doses of radiation are received, large amounts of tissue in the body may be killed, sometimes with fatal effects. At lower doses, genetic damage is more likely, causing mutations and possibly cancer. Since these cancers may take years or decades to appear, it is very difficult to determine whether a dose of radiation has caused a specific cancer.

Today, the rate of thyroid cancer is 10 times higher than that any scientist anticipated after the meltdown. The UN estimates the number of thyroid cancers among children in Belarus - where 70 percent of the fallout landed - at 285 times the pre-Chernobyl number."¹

Another important factor is the half-life of the radionuclides contained in waste. This determines the rate at which they decay and ultimately disappear. Typically it takes at least ten half-lives for radioactive material to decay to acceptable levels. Iodine-131 remains radioactive for around six weeks. Some of the other radionuclides released by nuclear facilities may remain active for many many years. For example, Uranium 238's half-life is 4.5 billion years. The half-life of an element is the time it takes for 1/2 of a given mass of Uranium 238 to breakdown and become its daughter elements. That means if you have a kilogram of Uranium 238 today, in 4.5 billion years you will have 0.5 kilograms and an array of its breakdown elements.

Some other examples are Strontium-90, which concentrates in the bones by mimicking calcium, causing leukaemia and caesium-137, which concentrates in the muscles and other internal organs, where it can lead to cancer. Radium is also a "bone-seeker". Likewise, plutonium when absorbed into the bloodstream, concentrates in bones as well as the liver. The thyroid will absorb radioactive iodine. Cesium will concentrate in muscles. Any radioactive element in particulate form, that is dust, can lodge in the lungs.

Plutonium is a major constituent of nuclear reactor waste. This substance has been described as the most carcinogenic element. Plutonium is also used in the nuclear weapons industry and in a number of experimental reactors. The genetic damage can also be carried into future generations. Scientists studying the effects of the Chernobyl disaster have found that birth defects in the most affected area have doubled since 1986. Mutations in rodents living close to the power station have increased by a factor of 1000.

NEW YORK, New York, December 12, 2001 (ENS) - Low doses of radiation from natural sources can trigger widespread mutations in living cells at much lower doses than the amount scientists previously believed could do such damage. The Columbia University study appears in the December 4 issue of the journal "Proceedings of the National Academy of

In the process of producing nuclear energy, new radioactive substances are produced. These substances do not exist in nature at all, and therefore our bodies do not know what to do with them. Worse still, since they are often the radioactive isotopes of elements that exist in nature, they are absorbed in the body where they may decay potentially causing cancer.

Science."

One particularly dangerous place radiation causes harm is in the proteins that make DNA and RNA. Damage to DNA and RNA has many harmful effects. It can weaken a person's defences against disease, decrease ability to heal, and undermine one's ability to adapt to environmental changes. This process can also cause abnormal cell division (benign tumours or various kinds of cancer) and genetic/hereditary deformities.

Radiation exposure has entirely different implications on reproductive organs and the unborn. A mutated reproductive cell has the potential of passing on the "defect" to one's offspring. An additional harmful effect of radiation on progeny may take years to surface. Genetic defects that can be passed on to your offspring include children with deformed or underdeveloped physical characteristics, children born mentally handicapped, children born with weakened immune systems, and children born with congenital diseases. Embryos and foetuses are particularly vulnerable to radiation because their cells are dividing so rapidly. Damaging a cell that early on can lead to numerous defects, syndromes and illnesses. One such disability in foetuses that can be caused by radiation is Down's Syndrome. Radiation exposure has also been known to cause sterility in men as well as making women unable to conceive or carry a child to term.

Young children in general have a high risk of health problems due to radiation exposure because of their rapid rate of growth. The chronically ill, the elderly, and the malnourished are also more susceptible to health damage from radiation because of their inability to heal as well as others.

¹ From: *Chernobyl: A Global Tragedy Nuclear Amnesia* by John M. LaForge (http://www.earthisland.org/eijournal/new_articles.cfm?articleID=188&journalID=47)

Background

Eskom wishes to build more nuclear reactors, based on a full scale model that has been tried and abandoned in the North. Despite the fact that the “new” reactor has yet to be fully designed, the approval process is going ahead. These reactors are called Pebble Bed Modular Reactors (PBMRs) . The first is planned for Koeberg, near Cape Town. The proposal is that the fuel for these PBMRs be produced at Pelindaba.

In addition there are fourteen thousand tons of radioactive weapons scrap metal at Pelindaba from decommissioned nuclear facilities.

NECSA (Nuclear Energy Corporation of South Africa) wishes to smelt this waste and sell the metal on the open market, followed by commercialisation of the smelter process - this process is not international best practice, and could turn South Africa into the North's radioactive waste dumping ground.

The proposed reactors, radioactive fuel plant, and the proposed radioactive waste smelter, will emit many kilograms of radioactive emissions into the air, water and soil every year. Pelindaba is located within two kilometres of a World Heritage Site, The Cradle of Humankind, and ten kilometres from the townships of Atteridgeville and Diepsloot.

At full production, for all the planned reactors, there would be nine trucks carrying nuclear material, and 145 trucks carrying chemicals every day between

Durban, Pelindaba and Koeberg for forty years!

There is no doubt that radiation is harmful. Furthermore, the level of what is considered a "safe" dose has been lowered consistently, and now stands at a few percent of what was originally considered a "safe dose".

One of the arguments for the PBMR is that South Africa will need massive amounts of new power. This will not be true for at least ten years. In this time, we will be able to install all of South Africa's power requirements using safe and clean Renewable Energy Technologies, which are available off the shelf, and can be installed within weeks.

Further, the planned ten nuclear reactors for South Africa in the near future will generate less than 2.5% of our current electricity generation capacity, but with hazardous consequences for hundreds of thousands of years.

Safe, clean, and sustainable alternatives exist, which are proving far more viable, from an economic and health, safety and environmental point of view.

These factsheets are part of the Nuclear Energy Costs The Earth Campaign. They spell out the problems, indicate some solutions, and seek to gain your support, in declaring South Africa a nuclear free zone.

Acronyms

CDM - Clean Development Mechanism - a way of managing the reduction of GHGs

COSATU - Congress of South African Trade Unions

Decommissioning - the dismantling and management of the reactor and manufacturing plants after the end of its useful life.

DNA - deoxyribonucleic acid - is a substance carrying an organism's genetic information, DNA molecules contain the genetic code which is the blueprint for a living organism.

GHG - Greenhouse gases, such as carbon dioxide and methane.

NECSA - Nuclear Energy Corporation of South Africa

PBMR - Pebble Bed Modular Reactor

RE - renewable energy, such as wind, wave, tidal, solar, solar thermal, and micro-hydro.

Measurements

cGr - centigrays

kWh - kilowatt hour - a thousand watts of power used for an hour. For example, 10 X 100 watt lightbulbs used for one hour.

MW - Megawatt - a million watts.

Watt - a measure of power, e.g. electricity. For example, a lightbulb can be 40 watts, 60 watts or 100 watts.

The truth about the Chernobyl disaster

Supporters of nuclear power claim that only thirty people died at Chernobyl, the world's largest nuclear disaster, and that there have been no other impacts since then. Here is some information to clear up that lie.

On April 26, 1986, at 1:23 am, reactor number four at the Chernobyl atomic energy station exploded and caught fire, releasing 260 million curies of radiation (280 times the radiation released from the bombing of Hiroshima). The burning was greatly accelerated by graphite. Graphite is the material proposed for the Pebble Bed Nuclear Reactor.

Rainfall and the subsequent shift in wind direction spread the deadly cloud over a wide area, including the northern regions of the Ukraine and the southern border of European Russia. This massive dose of radiation unleashed a legacy of disease and suffering, not only for the existing population, but for those yet to be born.

About 3.4 million of Ukraine's fifty million people are still suffering the effects of this disaster. The statistics are startling. Thyroid cancer among children living near Chernobyl is eighty times higher than normal,

leukaemia has tripled since 1986 (many cancers don't develop for ten to twenty years after exposure), and infant mortality has climbed to levels three times the European average. Birth defects, including Down's syndrome and polydactylism (abnormal numbers of fingers and toes) have nearly doubled.

A study of children close to Gomel, eighty miles northeast of the Chernobyl plant, found that 80% of children who had been exposed to the highest levels of radiation had irregular heart rhythms and other cardiac disorders which, in many cases, proved fatal.¹

Scientists say there is evidence that low radiation doses can cause multiple changes in human DNA, that are passed on to future generations. They found "an unexpectedly high increase" in mutations among children born after the 1986 Chernobyl disaster.² The children were born to parents who had cleaned up the reactor, and were conceived after it exploded.

This clearly proves the consequences of radiation at Chernobyl. There is much more evidence in this regard. The message is simple: radiation is dangerous to all life, for thousands of years.

This table shows what happened to those who were cleaning up Chernobyl. Indices (standardized against age) of the accumulated (during 1986-1991) incidence of chronic non-tumour diseases among the members of liquidator groups who worked in 1986-1987, according to the external irradiation dose (per 1000 persons). Source: Ten years after the accident at Chernobyl

Disease classification	Dose lower than 25 cGr	Dose higher than 25 cGr
All diseases	580.60	685.10
Diseases of the endocrine system	74.30	72.50
Diseases of the blood and blood-forming organs	4.64	6.57
Psychiatric disturbances	50.80	72.70
Diseases of the nervous system and organs of senses	168.60	190.50
Diseases of circulatory system	91.80	93.20
Diseases of respiratory organs	30.20	38.80
Disease of digestive system	93.10	128.50
Diseases of urogenital system	8.80	9.80
Diseases of skin and subcutaneous fat	6.30	10.00
Diseases of bones and muscles	42.30	52.00

1 <http://www.sunday-times.co.uk/news/pages/sti/2001>. Thursday 7 February, 2002. *Atomic tests 'caused genetic damage'*.

2 *Chernobyl children show DNA changes* http://news.bbc.co.uk/hi/english/sci/tech/newsid_1319000/1319386.stm

Global climate change, attributed to the rising levels of atmospheric carbon dioxide and other greenhouse gases (GHG), has caught the attention of the international community.

In 1992, the United Nations Framework Convention on Climate Change committed signatories to work towards the stabilisation of the level of GHGs in order to slow the effects of these gases on the global climate.

Some nations have made a small start in reducing their emissions, but the overall concentrations of gases are still rising.

The energy industry is a primary source of emissions. Alternatives to traditional sources of energy are being sought to help reduce climate change.

Despite nuclear energy being excluded from the Clean Development Mechanism of the Kyoto Protocol (an international instrument designed to reduce GHG emissions) the nuclear industry is trying to exploit international concern about climate change by claiming to be an appropriate option for reducing GHGs.

However, while nuclear reactions involved in generating energy do not in themselves release GHGs, the nuclear power industry does have significant emissions.

Nuclear energy is obtained through a process which includes more than merely electricity generation. The cycle of production includes mining, fuel production, transport, plant construction and decommissioning. All these processes release carbon dioxide. According to the Oke Institute, 34 grams of carbon dioxide are emitted per nuclear generated kWh in Germany. Other international studies estimate up to 60 grams per kWh.

Uranium mining and enrichment, required for fuel production, is extremely energy intensive. If uranium

use were to significantly increase, use of lower grade ores would require more processing and therefore an increase of carbon dioxide emissions per unit energy. Using current ore grades, when the entire cycle of production is considered, nuclear energy produces three to four times more carbon dioxide per unit energy than renewable energy sources.

Even Germany, whose technology Eskom wishes to use, "rejects the use of nuclear energy as eligible projects in the framework of CDM (an international

mechanism used to minimise GHGs)." The European Commission saw the flaws in the nuclear industry's claims when they concluded "Nuclear may need climate change more than climate change needs nuclear."

South Africa must realise the motivations behind the arguments claiming the nuclear industry has low GHG emissions.

Nuclear power is not a cost effective method of reducing GHGs.¹

Energy efficiency - improvements in practises and products that reduce

the use of energy necessary to provide energy services - could cut South Africa's energy use dramatically. Technology exists that can reduce energy consumption by 20-50% in existing installations, or 50-90% for new installations, while delivering the same output. The cost of making many of these alterations pay for themselves through savings within a year.

Ten rand spent on energy efficiency could displace 50 kWh of energy, whereas only 7.4 kWh of nuclear energy could be produced at the same cost.

Energy efficiency and renewable energy technologies both avoid greenhouse gas emissions more cost effectively than nuclear power. Considering the limited resources for energy investment, spending on nuclear effectively takes resources away from energy efficiency investment and thus results in greater GHG emissions.

When the entire process of generating energy is considered, renewable energy and energy efficiency prove to be more economical, effective and internationally accepted methods of reducing carbon dioxide emissions.

1 Conservative estimates in the IPCC Third Assessment Report (WGIII): for nuclear power, carbon abatement costs are between US\$ 46 to 426 per t/C (ton of carbon), for wind it is \$ -43 (i.e. economic gain) to \$92, for biomass it is -60 to 224.

Communities and nuclear power

There are many reasons why communities, particularly disadvantaged and poor communities, will never benefit from Eskom's nuclear power plans.

* Enriched uranium is the fuel for nuclear plants. So long as there is a nuclear industry, workers will be exposed to this dangerous mining. Even the National Union of Mineworkers want the nuclear industry to be closed down.

* Local communities will never be able to own and maintain a nuclear power plant. They are by nature capital intensive and large scale, leaving the generation capacity within a monopoly owned and operated by a wealthy elite. Renewable alternatives are easier to understand, safe to operate, modular, and substantially less expensive - making renewable energy perfect for community empowerment. Renewable energies such as wind, solar thermal and photovoltaics can be made in small factories in more places, thereby employing local people. For example, there is a wind turbine factory in Zimbabwe, which employs twenty people. They sell all the windmills they can make, to South Africa, the United Kingdom and America.

* Communities close to either Pelindaba or Koeberg do not know what is happening, and will be ill prepared for evacuation in times of emergency. In addition, the authorities, Eskom and NECSA are badly prepared. By law, they are supposed to make emergency plans known to everyone living around these plants. People in Pelindaba were last consulted many years ago, and people in Atteridgeville only ten kilometres away have never been consulted. A practice emergency evacuation was held at Koeberg some years ago - they got the wind direction 180 degrees wrong. If this had been a real evacuation, they would have been driving the community into the radiation. Even today, less than half of the people around Koeberg can be reached, and much less around Pelindaba.

* Local communities will bear the brunt of the health impacts as nuclear facilities emit radiation even when there are no accidents. International studies show that radiation released under "normal" operating conditions will build up in the area, and people living nearby will be affected, developing cancers over time.

* Very few South Africans will get jobs in this process. Eskom admit that excluding the short term construction

jobs, only seventy jobs will be created, most of which will be for nuclear experts. It is planned that most components will be made overseas.

* Communities along proposed fuel transport routes will also carry the cost of an accident, and will not be prepared for evacuation. Enriched uranium will be transported from Durban harbour to Pelindaba, and fuel balls will be transported firstly to Koeberg, and then wherever else reactors are built. As we know our roads are very busy, in some places very narrow and potholed, and most small towns along the route cannot afford the emergency units needed to cope with an accident involving nuclear material.

* Communities living close to uranium mine dumps will continue to have high levels of cancer and other impacts of radiation.

* It is true that access to electricity can alleviate poverty by giving people light to study with, make more time available to women who normally spend hours collecting fuel, and the power to set up small businesses. However, electricity can be made in many ways. Using nuclear reactors to generate electricity has been shown, worldwide, to increase the cost of electricity. Already many of our people cannot afford to pay for electricity after their area has been electrified - nuclear power will make this worse.

* Traditional healing plants could lose their healing properties. The hills around Pelindaba contain many ancient sites of spiritual significance to our people which are, to this day, visited by sangomas. Healers such as Credo Mutwa are concerned that radiation will affect these places and render indigenous healing plants like *Sutherlandii*, given to our people, useless.

* Eskom claim that the PBMR will particularly help our rural communities. This is not the case because the PBMR, according to Eskom, is only viable in units of ten¹, requiring a sophisticated infrastructure, including good roads, water, and access to the national grid. The reason why most rural communities do not have power is that they are too far from the grid - the PBMR will not change this situation.

There will be very few, if any, benefits to communities. Nuclear power will limit community benefits from power generation options, and impact negatively on the health of communities.

The money that Eskom wants to spend on the PBMR over the next forty years, can be used to generate more electricity using safe, sustainable and clean generation options. Although Eskom claim the PBMR will cost “about one billion rand,” even their own figures show that to be untrue. Their information document¹ shows that it could cost as much as R4.2 billion. Their own partner, Exelon, says that a PBMR will cost “about \$300 million” (R3 billion).²

The proposed ten PBMR reactors, according to American academics,³ will cost at least R40 billion in its proposed forty year life, assuming that everything works first time, with no cost overruns, which has never happened in the nuclear industry - it is always more expensive.

For that amount of money, between 4400 MW and 5100 MW of safe, sustainable and clean renewable energy can be installed at today's prices, which are fast dropping. (At 35% efficiency, it will still deliver more, with zero radiation danger, at least 60% local content, and about four times the job creation, than the PBMR installation).

States in the USA that use nuclear power to generate electricity have significantly higher electricity rates - on average 25 percent higher - than states that do not.⁴ Why do Eskom think that the PBMR project will be any different?

The nuclear industry is very expensive

The entire fuel chain - from uranium mining to disposal - is expensive. It is expensive even if one doesn't count cleaning up the uranium mine and the uranium waste in mine dumps, and the costs of the final dumps, and leaving out the infrastructure costs, including the massive decommissioning costs.

An example of the high cost of waste disposal is the case of Yucca Mountain in America. Here, scientists have studied the site as a potential site for radioactive waste since 1982. Roughly R80 billion (R10 = US\$1) has been spent on this and they are still years from

obtaining final approvals and constructing the repository.

In Canada, the 1978 estimate for Ontario Hydro's Darlington Nuclear Generating Station was \$3.95 billion. However, the final cost of the station was over \$14 billion (more than 350% over budget). The estimated construction costs of a new production reactor, the MAPLE-X10, escalated from \$23 million in 1989 to an extraordinary \$100 million by 1994 (over 400% over budget). Our NECSA also has a history of cost overruns. The Pickering A project was originally estimated at US\$508 million, but the final cost was US\$746 million (over 150% over budget).

Decommissioning costs are also very high. In the case of Canada, AECL (Canada) made a preliminary and partial estimate of decommissioning costs at about \$300 million. However, the Auditor General's office has estimated federal decommissioning costs at \$850 million, including AECL's portion.⁵

In South Africa's case, Eskom should fully account for decommissioning liabilities and the creation of a fund to cover those costs up front. Otherwise future taxpayers will be carrying the cost, estimated (conservatively) at about R2 billion at today's prices. To date Eskom's cost figures have excluded the source and final disposal costs.

There would also be an ongoing cost to taxpayers, as the nuclear industry will need subsidies, just as nuclear power in the rest of the world does.

For example, the cost of setting up and maintaining suitable safety services in all the municipalities along the proposed transport routes (basically the roads between Durban and Johannesburg and Johannesburg and Cape Town) will be paid for by local taxpayers. There is only one instrument to measure radiation between Durban and Johannesburg. These very expensive instruments are only an example of the emergency infrastructure that will be required. The cost of an accident (according to a USA study in 1980) could be as much as R16 billion (See the factsheet on transport).

1 Eskom PBMR information document January 2001

2 *Nucleonics Week* October 11, 2001

3 Costing based on figures from www.min.uc.edu/nuclear/kadak

4 *Public Citizen*

5 *Nuclear Sunset: The Economic Costs of the Canadian Nuclear Industry* by David H. Martin - Nuclear Awareness Project and David Argue David Argue Consulting

One of the justifications for the PBMR projects is that some 200 reactors will be sold into the international market. This market is however going to be shaped by the constraints of the Kyoto Protocol. Selling the PBMR into a market that is closed to nuclear for climate change mitigation is going to be difficult, if not impossible.

Nuclear power cannot exist without massive

government subsidies. Can we afford to subsidise Eskom and their overseas partners, and deprive our people of access to safe and clean energy?

Given the limited resources South Africa has at her disposal, we should be redirecting the funding to job creating sustainable energy options, instead of an expensive and wasteful nuclear path.

Why nuclear power is a bad idea for energy provision

A forty year study of USA nuclear reactors shows that reactors consume up to five times more energy than they produce for consumers.⁶ "Thus the nuclear energy programmes are net energy consumers."

Nuclear generated power is a very expensive and energy inefficient way to produce energy. If we calculate the energy used in mining, transport, enriching fuel, constructing plants, supplying plants (including associated transport), maintenance, decommissioning, and waste management; then the amount of energy used is much, much more than the energy the plant will produce in its life.

Why are we investing in the possibility of this kind of inefficient delivery of energy to our people? Why do we think that it is a good investment to subsidise the profits that will be made by a privatised Eskom, Exelon in the USA and BNFL in the UK? Why should South African taxpayers subsidise them? Renewable energy, on the other hand, does not need fuel of any kind, and once built, provides energy for life, with low maintenance costs.

Factsheet

5

Energy efficiency

Energy efficiency means using electricity and other energy sources, such as fuelwood and petrol, in such a way that we do not waste it. This can be achieved by using more efficient lighting, motors, and other such appliances. We can also stop using energy when it is not needed, for example, by switching lights off when they are not needed. Using today's new energy saving technology, which is already available, we could save as much as half of the electricity we use at present. This would mean that the pollution from the coal fired power stations would drop by up to half, and our electricity bills would also drop a lot. This means we can have the same quality of life, but not use so much electricity. This would also make the electricity saved available for use by others, who do not have electricity.

Eskom does not want this to happen, as they will not be able to make as much money if our electricity accounts drop. They will not be able to build as many electricity generating plants, which they control, and continue to determine the price of electricity to us all.

It is time we used the energy at home and at work more efficiently, so that we pay less, but still have a

better quality of life.

We can get the same level of light, for example, from a 15W compact fluorescent light (CFL) as we can if we use a 100 W normal globe. That means, we get the same light for about one-sixth of the electricity cost; or, that we can use six lights for the same amount of electricity as one globe.

There are many ways to save energy. For example: passive solar design of buildings so that they are naturally cooler in summer and warmer in winter, and pre-heating water using simple solar technologies. The list is endless.

Energy efficiency will defer the need, and cost, of developing new electricity generating capacity for many years. Even without energy efficiency, we can still implement safe and clean alternatives to nuclear energy in a very short time.

Energy efficiency programmes should be made compulsory for all businesses, factories, and homes. In that way, we can develop safe, clean and well proven ways of making electricity, instead of nuclear, which will increase costs to everyone, for the profit of a few.

⁶ *Energy audit of nuclear fuel cycles* by R. Ashok Kumar. The study found that although the gross nuclear capacity of the USA reached 104 820 MW, less than 20 000 MW energy capacity was in fact delivered to society in 1991. (More detailed technical information on the energy balance study is available on request.)

In the event of radiation releases, all radiation releases from Pelindaba will reach Diepsloot and Atteridgeville in less than two hours. They will reach Johannesburg or Pretoria within five hours, at an average windspeed of three metres per second. This is similar to what would happen at Koeberg with regard to reaching Cape Town.

In the case of an accident, this means that a large amount of radiation will hit major cities before most people even know there is a problem. This is a clear case of imposed risk on an unknowing populace. It is impossible to warn or evacuate potential victims - we would simply have to be irradiated, and pay the price.

It is normal practice to give citizens potassium iodide, said to help remove radiation from our bodies, in case of an emergency. It is the responsibility of the nuclear industry to provide and pay for this, but is not happening. We know of nobody in South Africa who has been issued with these tablets.

The evacuation plans (of Eskom and the Department of Minerals and Energy, through the National Nuclear Regulator) call for at least a ten kilometre zone to be evacuated. Yet hardly anyone near either site (Koeberg or Pelindaba) has even heard of this, and no full scale evacuation plan has ever been tested. We believe that it is impossible to evacuate people at risk in the time available - less than two hours. How will people be informed? How will people who speak different languages be informed? Where will they go? How will they get there? How many buses will it take? Are these available? Of course, none of the above answers are forthcoming.

Our law states that Eskom and NECSA should be paying these costs. They are not going to do so, as it will make nuclear power too expensive - the taxpayer will subsidise them again.

It seems that it is acceptable that we get harmed by radiation, so that Eskom and NECSA people can keep

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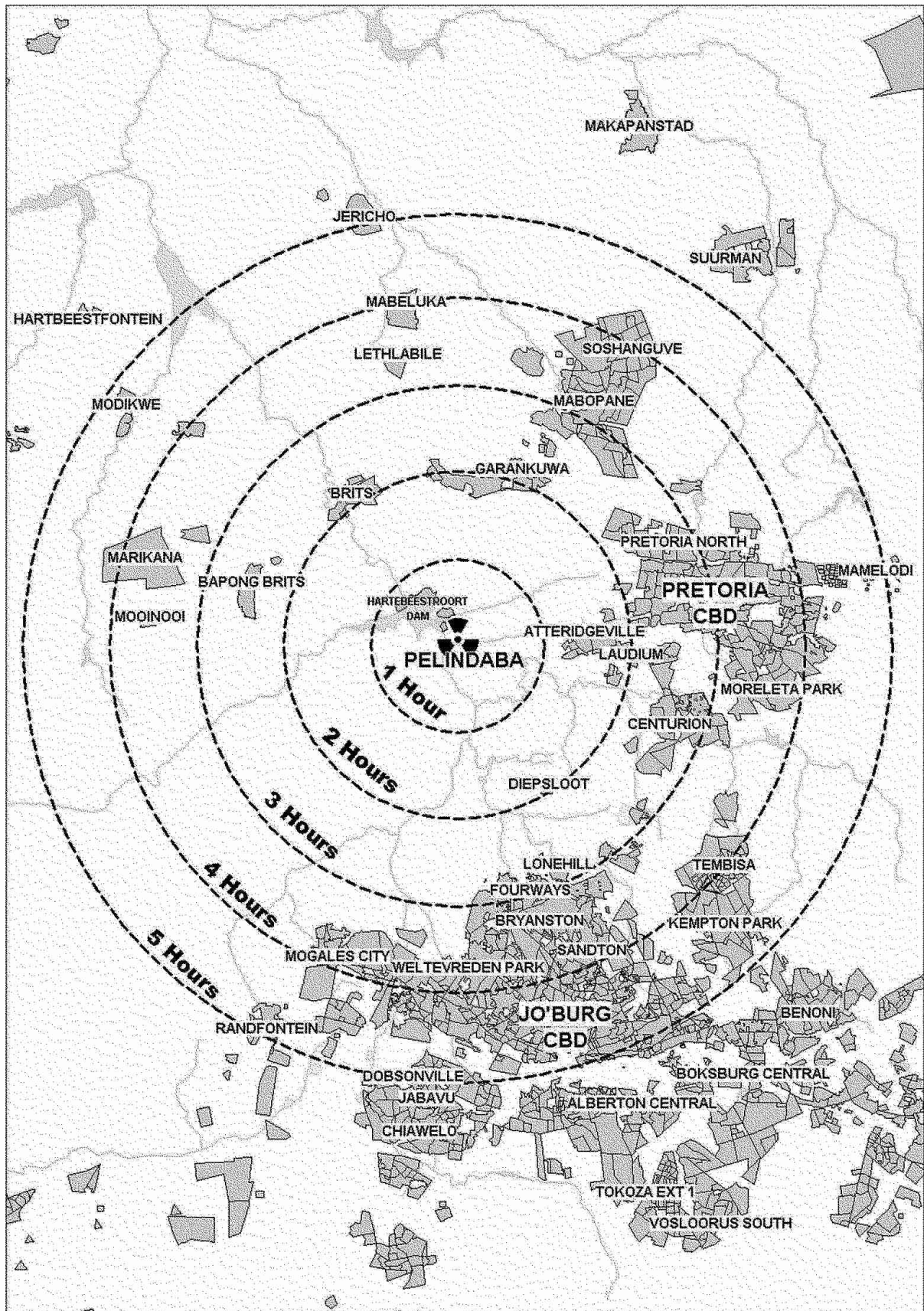
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their high paying jobs, and keep any benefits to themselves. Our risk - their reward!

The problem also affects communities that live along the main roads between Durban and Johannesburg, and between Johannesburg and Cape Town. The potential impact of a nuclear transport accident would impact on communities living within 50 kilometres or more from the road. This would be a massive problem, as along the entire route, only one emergency service (eThekweni) has a meter that can detect the presence of radiation. There could be as many as nine trucks per day carrying radioactive material every working day for forty years.

We must stop the nuclear programme, because they are willing to harm us for their own profit. They refuse to carry all these costs that are needed in the event of an accident, or other impacts of radiation, such as those which will come daily from the nuclear plants.

This diagram shows how long it will take for radiation to reach the areas around Pelindaba - a similar diagram applies to Koeberg. Evacuating this area will be impossible in case of an accident.



Radiation is harmful to all life on the planet - to people, of course, and also to animals and plants (see the factsheet on health). For example, deformed plants, including the Gloriosa daisy, deformed dandelion flowers; giant dandelions; misshapen maple leaves with grossly deformed margins, and deformed rosebuds, are all still to be found within a few miles of Three Mile Island, site of yet another nuclear disaster in America.

The genetic heritage developed over millions of years can be lost, through mutated and genetically harmed species.

A report by the Nuclear Information and Resource Service (NIRS) and the Safe Energy Council (SEC) shows how many US nuclear power plants kill large numbers of marine wildlife, including endangered species, as a result of their cooling systems.¹

How does this happen?

- (1) Firstly, large amounts of water are used to condense either the steam or the gas after it has passed through the turbines. This also contains wildlife from the sea, lake or river it was drawn from. In the case of Koeberg, it is of course the sea.
- (2) The water gets sucked in at a high velocity, which traps larger organisms against screens, racks, bars and barrier nets, whichever are applicable. They can then drown or suffocate after this, called "impingement".
- (3) Smaller organisms pass through, and may get killed when the water is heated by up to fourteen degrees celsius, with the condenser system pulverising some organisms - this also harms aquatic plant life by blocking the light needed for photosynthesis.
- (4) The heated water is then returned to the ocean, with potentially catastrophic impacts - for example, the endangered red and black abalone populations in the sea near Diablo Canyon in California were nearly obliterated.

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- (5) Problems can also occur following emergency reactor shutdowns, when the temperature drops very quickly, resulting in thermal shock. In December 2000, equipment failure at the Clinton nuclear plant in Illinois caused the temperature to drop from fourteen degrees celsius to two degrees celsius in about five hours. The resulting thermal shock killed more than 7000 fish in the lake.

Radiation is dangerous to all forms of life. We must stop producing radioactive material, emissions and waste immediately.

1. *Licensed to Kill: how the nuclear power industry destroys endangered marine wildlife and ocean habitat to save money*, Safe Energy Council / Nuclear Information and Resource Service, 22 February 2001.

The global agenda behind the PBMR

Hidden in Eskom's plans to revive the abandoned PBMR are worrying issues around who really is going to benefit.

- (1) Eskom has two partners from outside our borders - Exelon from the USA (currently involved in a political funding scandal) and British Nuclear Fuels Limited (BNFL) from the United Kingdom. BNFL is known to have one of the worst safety records in the entire nuclear industry, and were caught falsifying information to Japanese clients. They have also been responsible for many releases of radioactive material, often at their problem-filled plant at Sellafield in the United Kingdom. Even the co-CEO of Exelon, James Rowe, has written that he believes the PBMR is an experimental design, not ready for prime-time. BNFL is technically insolvent. Their government has taken over the losses. This has happened because they cannot afford to clean up their nuclear mess, the same situation we think South Africa will find itself in, if the PBMR goes ahead.
- (2) The vast majority of the parts will come from overseas, so there is a Northern agenda at play here. There is no prospect that any of these companies will move to South Africa. Very few of the jobs created by the PBMR will be in South Africa.
- (3) The people employed by PBMR Pty Ltd include many foreigners, some of whom were involved in supporting the nuclear weapons industry. The people at PBMR earn approximately R40 000¹ per month, and are understandably pushing hard for the PBMR to go ahead.
- (4) The risk exists that the large quantities of enriched uranium, as well as the fuel, could be targets for the international underground market in radioactive substances.
- (5) The fuel, even if embedded in graphite, is simple to recover for nuclear weapons use - simply crush, and boil in acid. For each kilogram of enriched uranium produced, five to ten kilograms of depleted uranium is produced. Depleted uranium has killed, and continues to kill, many people in Iraq, Kuwait,

It is time we asserted ourselves as Africans, and start saying no to dirty and discredited industries, and moving to a development path that is forward looking, with more jobs and benefits for more of our people, rather than profits for a few, and expenses for generations of South Africans.

Kosovo and other battlefields.

- (6) Exelon in the USA wants to use South Africa as a "guinea pig" to test the PBMR. They have already asked the USA nuclear regulator to look at the possibility of accepting the South African results, so that they do not have to do the required health, safety and environment tests and studies, which are much stricter in the USA. We in Africa are expendable if this does not work.
- (7) Africa is already becoming a radioactive waste dump for the North - a report by Ligambiente 2001,² indicates that Italy is a source and transit country for radioactive waste that is shipped to Somalia, Malawi, Zaire, Sudan, Eritrea, Algeria, and Mozambique.

"The developing South has become the dump for hundreds of thousands of tonnes of radioactive waste from the world's rich countries, a colossal business which is linked to money laundering and gun running, say lawmakers and activists in Italy. "The trafficking of radioactive waste, a large part of which goes to countries of the South, constitutes a business of gigantic proportions, amounting to more than seven billion dollars a year in Italy alone," Massimo Scalia, the chairman of an investigative commission set up by the Italian parliament, told IPS.

He said that every shipload of nuclear waste represents around five million dollars in profits. Maurizio Dematteis, with the Italian environmental umbrella Ligambiente, said there were three enormous illegal dumps - "among the largest in the world" - in Somalia. There, workers handle the radioactive waste without any kind of safeguard or protective gear - not even gloves. The workers do not know what they are handling, and if one of them dies, the family is persuaded to keep quiet with a small bit of cash," the activist added.

In South Africa, the proposed radioactive waste smelter will be commercially operated, with no restriction on what waste could be brought in, or what level of radioactivity the waste will carry. A simple agreement between the ministers of two countries will allow the import of such waste.

(8) When highly radioactive material is used, some of it can be made into weapons of mass destruction, such as nuclear bombs, similar to those manufactured by NECSA under apartheid, as well as ammunition using "depleted uranium" (which is still very dangerous). This could lead to nuclear weapons being made available to anybody - contrary to the International Nuclear Non-proliferation Treaty, to which South Africa is a signatory.

(9) Eskom's share of the cost of setting up the reactors and the fuel plant will come from money paid by South Africans. The profits, if any, will be shared with overseas companies. However, the long term costs (over many thousands of years) will be paid for by South Africans. This is simply unfair to our people.

The Pebble Bed Modular Nuclear Reactor is a failed technology, but the international nuclear industry wishes to make money from Eskom, our health and our environment in this programme.

It is time we asserted ourselves as Africans, and start saying no to dirty and discredited industries, and start moving to a development path that is forward looking, with more jobs and benefits for more of our people, rather than profits for a few, and expenses for generations of South Africans.

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1 Trade, Environment and Sustainable Development - Briefing Document: 5 Trading in Nuclear Power and Pebble-Beds July 2001.

2 IPS - http://www.oneworld.net/ips2/apr01/18_00_061.html

Why our health is at risk from radiation

A study, *The Enemy Within*, by Dr Sternglass and others showed that 55 of 60 nuclear sites had increased cancers surrounding them, and they found that the data was “highly statistically significant.”¹

The study contains a summary of work showing how the government vastly underestimated the effects. Sternglass found that there is a significant health effect...especially in the downwind areas.

The book is full of references to other literature, including in the Government's own publication - the Journal of the Institute of Environmental Health. In this journal, Dr. Wing and others at the University of North Carolina concluded again that there was a significant increase in cancer and lung cancer specifically around Three Mile Island.

Radiation exposure, which is a known risk factor for cancer, may also significantly increase the risk of other diseases, including heart disease, stroke, pneumonia, and liver problems.²

A so-called “allowable dose” of radiation becomes a high and more dangerous dose in a short time, as radiation accumulates, and soon adds up to a very unsafe dose indeed!

Some opposition to nuclear power is because of its danger to our genes (our bodies' blueprint) and health, a problem that will last for hundreds and thousands of years after the electric plants are gone. The nuclear industry believes that if they were able to convince people that nuclear pollution does not matter - by convincing them that low-dose ionising radiation represents a low or even non-existent health hazard - then opposition to nuclear power would decrease. Such a public belief would reduce the cost of nuclear power a lot, by reducing the cost of containing its radioactive pollution during “normal” plant operations.

This is exactly what is happening with Eskom's Pebble Bed Modular Nuclear Reactor, with plans that propose no containment building, decreasing the costs, but increasing the risk.

For instance, today there is insistence on a host of costly measures to try to prevent escape of radionuclides into the environment during routine operations and

during accidents. If low doses were to be safe, why bother? Many containment efforts would disappear, and the price of nuclear power would become more nearly competitive. This would help its revival a great deal, even though a recent report commissioned by the UK government (New Scientist 15 December 2001) says that there is no future for nuclear power within twenty years.

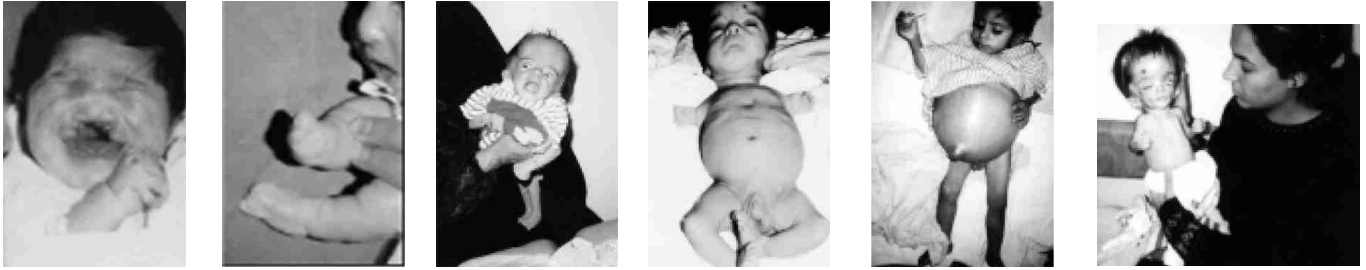
Public belief in a low or nonexistent health hazard would also greatly reduce the cost of containing radioactive waste after operation of nuclear plants. Obviously, if the public were to believe that nuclear pollution were harmless at “low levels,” why would anyone worry about short-term or long-term containment of “low level” nuclear waste? Opposition to de-regulating disposal of such waste would disappear, and such waste would go right into thousands of local landfills and incinerators. Although not allowed in developed countries, South Africa currently sells over 100 000 tons of radioactive metal as scrap metal, annually!

Using a scientifically realistic estimate like 26.6 cancer deaths per 10,000 person-rems, we can illustrate the meaning of intentional nuclear pollution policies like BRC (Below Regulatory Concern). At the moment, the Nuclear Regulatory Commission (USA) proposes that each de-regulated dumping activity be allowed to deliver a population dose up to 1,000 person-rems every year. The numbers mean that this would be permission for each dumping activity to inflict 2.6 fatal cancers among the public every year.

No safe dose or dose-rate

Proof already exists that there is no safe dose or dose-rate of ionising radiation. In other words, there is no threshold level below which the risk of radiation-induced cancer disappears. Contrary to claims by the radiation community that it is impossible to know what happens at low doses, the mainstream professional literature already provides good human evidence of cancer-induction by the lowest conceivable doses and dose-rates.

On 12 December 2001 Environmental News Services reported that low doses of radiation from natural sources



The children above were harmed by uranium radiation when they were still unborn.⁴

can trigger widespread mutations in living cells at much lower doses than the amount scientists previously believed could do such damage. New research from Columbia University suggests that public health officials may need to reconsider what levels of radiation in nature should be deemed safe.

The level of what is considered a “safe” dose has been lowered consistently, and now stands at a few percent of what was originally considered a “safe dose” - from 0.1 roentgen per day in 1931 to 1934, to 5 rem per year in 1954, to 5 rem for workers (always higher than public) per year in the 80s to 2 rem for workers per year in 1991. The trend is clear - no safe dose!

The same evidence implies (but does not prove with quite the same conclusiveness) that there is no safe dose or dose-rate with respect to heritable genetic injuries.

Some segments of the radiation community appear to believe passionately that no one should impede the nuclear enterprise on the basis of what they label as speculation and conjecture about injury from low doses and dose-rates. Instead, they ask the world to accept their speculation and conjecture that low doses and dose-rates are safe - a notion which would surely result in increased exposures.

The nuclear industry want us to believe that “there is a safe level of ionizing radiation, and even the worst sorts of nuclear accidents may kill very few people.”

Yet the reality is that Chernobyl fallout will continue to irradiate people for over a century.³ A scientifically reasonable estimate of Chernobyl-induced cancers, occurring in Europe and the USSR during the next century and beyond, is about 475,000 fatal cancers. This huge number, however, will be rendered undetectable by the far greater number of cancer deaths which will arise in these countries from other causes over the same time-span. But the existing proof in INDY that there is no safe dose or dose-rate means this: The Chernobyl-induced cancers will not be “hypothetical” or “mere conjecture.” They will occur.

Another aspect of reality: It is not more acceptable to inflict death on a half-million people scattered over time and place than to inflict death on a half-million people in a brief period in one city. Killing is killing. But if the deaths are scattered and unseen, it is far easier to mould public perception than if the deaths are seen.

The so-called “depleted uranium” is used to make ammunition harder, so that it can penetrate metal. Uranium is the raw material for the nuclear reactor fuel Eskom wish to impose on us.

We ask: why do we need to have these threats in South Africa at all, if safe, clean, job creating, proven alternatives exist, and are being used successfully by many countries around the world? The health of South Africans, now and for generations to come, is not for sale.

1. *The Enemy within* by Jay M. Gould in cooperation with Dr E. J. Sternglass, Joseph J. Mangano and William McDonnell. See also Dr. Sternglass’s book *Secret Fallout: Low-level radiation from Hiroshima to Three Mile Island* which is available on the Internet. Published originally by McGraw-Hill, it is an analysis of how we “grossly underestimated the reality.”

2 *Radiation Research* 1999;152:374-389.

3 *The Greening of Nuclear Power and The De-Regulating of Nuclear Waste: Gofman*

4 Pictures were taken by Dr. Siegwart Horst-Gunther, President of the International Yellow Cross. Most appeared in his 1996 book *Uranium Projectiles - Severley Maimed Soldiers, Deformed Babies, Dying Children* (Published by Ahriman - Verlag, ISBN: 3-89484-805-7). The book is a documentary record of Depleted Uranium ammunition after-effects, and they were taken between 1993 and 1995. Dr. Gunther also supplied me with additional photographs from his unpublished collection, some of which feature the birth deformities being experienced by Western Gulf war veterans' children. I have asked Dr. Gunther's permission for his pictures to be treated as 'Public Domain' and copyright free. He has agreed and you may reproduce them as you see fit.

Human rights and nuclear facilities

The proposed nuclear development could negatively impact in many areas which affect human rights issues. These impacts are explained below.

Basic services

Basic services are at risk, because international experience shows that, in the USA, states using nuclear power charge about 25% more for their electricity. Our people are already battling to pay the rates being charged today! The PBMR programme will limit the number of jobs in the future, which will reduce the ability of people to pay for services.

Biodiversity

Biodiversity could be threatened, as radiation could mutate life forms, and present new and possibly dangerous forms of plants and animals. Our food growing could be affected over time, especially near Pelindaba and Koeberg.

Children's issues

Children are very vulnerable to leukaemia, one of the key impacts of radiation. Children could be born with physical deformities, which would cause great suffering, both to the children concerned, and their families and friends.

Debt

The money being spent on the PBMR, except for some from USA and UK partners, is our money. Eskom will be importing the major parts of the reactors, increasing the money we owe to the North, as well as having to share profits, if any, with overseas partners. Our people's health could be compromised, and they may have to get into debt to afford medical treatment.

Development

People will be restricted from owning the means of production of energy, as money will be spent on nuclear, which is always more expensive than planned. The subsidies that it requires will mean less money for community power development and ownership. This will also increase Eskom's monopoly, and reduce the chances of our people becoming energy self-sufficient, at an affordable rate.

Economics

The figures already show that the 10 PBMR (1110 MW) will cost at least R40 billion over the proposed forty year life, and leave behind many tons of dangerous radioactive waste, that will need managing for thousands of years. For the same money, we could

Picture of a baby harmed by uranium radiation while still in his mother's womb. The level of radiation was very low, coming from so-called "depleted uranium" ammunition - similar radiation could be released from the PBMR programme.



install over 5000 MW of wind turbines, which would generate more electricity than the PBMR would. Health costs for local communities could rise. Radioactive waste could cost many billions over time.

Energy security

As communities will never own nuclear reactors, and have less money for alternatives, their energy security will be compromised. Electricity will become more expensive, and will not reach many rural or poor people. PBMRs cannot be built in remote rural areas, as the infrastructure does not exist, and is very expensive to install.

Food security

Radiation could change plants and animals, as well as people, over time, with totally unknown consequences. For example, a valuable muthi (medicinal) plant may change, so that it is unable to heal, or food plants may change in such a way that we are harmed by it. No one knows for sure - why take the chance? The costs to government over time will also reduce the funds available for social spending. A mutated plant could pollute the gene pool for the entire species.

Future generations

The waste from mining dumps, fuel transport and manufacture, nuclear power plants, and the eventual used fuel waste, will remain radioactive for thousands of years (See factsheet on waste). Our children, and their children, for at least forty generations, will bear the cost. Our constitution promises to look after the rights of our children, and their children, for many generations. It is abuse to leave these problems for them in the future.

Gender issues

Pregnant women are at risk, as they may give birth to malformed children if they are exposed to radiation - this is because the baby being formed is easily affected by radiation, even in very small doses (see picture and the factsheet on health). Women are also

negatively affected by high prices of nuclear electricity, leading to increased fuelwood use. Firewood collection harms the ability of women to bear children, as carrying heavy loads damages the hip structure.

Globalisation

Eskom has partners from the North, and the North is already dumping radioactive waste in Somalia, Malawi, Zaire, Sudan, Eritrea, Algeria, and Mozambique, killing unprotected workers. Africa is not the North's dumping ground! This is a further example of environmental racism. (See factsheet on the global agenda).

Health - HIV/aids

Radiation harms the immune system, so it can do as much harm as HIV/Aids, probably even more, as it remains dangerous for thousands of years, and will continue to harm us for all that time. People who are weakened by exposure to even small amounts of radiation will fall ill more easily.

Job creation

The safe and clean alternatives to nuclear or coal power, such as wind, wave, solar, biomass, geothermal and micro-hydro, all create many more jobs for people than nuclear. The majority of our people are not nuclear scientists, and will not get jobs - but we can get jobs if we use appropriate and simple technologies. Just because something is simple, does not mean it is inferior; the enlightened countries in the developed world are moving away from nuclear, and towards renewable energy - are we less capable?

Land issues

Land that has been impacted by radiation is unusable for thousands of years, continuing to kill for all that time. Even one accident could have a massive impact. It is impossible to clean up radiation, as it cannot be destroyed, seen, felt, touched or tasted - there would always be left over radiation, which would continue to cause harm.

Literacy

Eskom and NECSA, who want these nuclear reactors and smelter, have not taken the trouble to ensure that people who do not speak English, or who are illiterate, know what is going on. They have even refused to speak to people in some townships! Imposing radiation on our poorer people is further racism.

Mining

Our miners could die from the mining of uranium, and even if it comes from other countries, miners could

still die there. The mine dumps will impact local communities for thousands of years, as the dumps remain radioactive for that time. From radon alone, about 70 people could die every year, for thousands of years, from just one dump.

North / South issues

Eskom's and NECSA's partners are from the North, and will be taking profits if these reactors and the smelter work. Most are companies with a bad record, and have lied to governments in the past. This is again a case of using us as a guinea pig, so if it fails, we would carry the cost and the health risk, not the rich in the North.

Poverty

If we do not get our government to let people own the means of making electricity, then we will forever have to pay for it, and never get the benefits that are possible. The lack of access to safe and clean energy is known worldwide to keep people in a cycle of poverty, The lack of jobs from following the nuclear path will also impact on the poor and unemployed.

Tourism

Pelindaba is very close to the Cradle of Humankind, the World Heritage Site, which will bring many thousands of tourists to South Africa, as well as to the nearby areas. If they know that there is radiation, or if there is only one accident, then the Cradle of Humankind will become a white elephant for tourism.

Violence

This is critical - Eskom and NECSA wish to impose dangerous radiation on us, without us having a share in the decision-making, or in any benefits if they exist. This could harm future generations as well. This kind of environmental violence is unacceptable.

Worker rights

Workers throughout the uranium chain could be exposed to radiation, and could be harmed, now and for future generations, as their unborn children could also be affected.

Nowhere in the world has nuclear power proven to be safe; all nuclear sites result in the local communities being harmed. We must avoid this in South Africa, and halt the PBMR project. We can leapfrog the energy development path from the past into the future, without making the expensive and harmful mistakes made in other countries.

Why radiation cannot be allowed to increase



"Our policy must rest on the solid moral foundation of dedication to the primacy of people and their long-term well being. We have to be on guard against temptations of short-term benefits and pressures from powerful forces at the expense of the long-term interests of all. We cannot afford to bargain away the birthright of future generations."

- Nelson Mandela, opening the 5th session of the World Commission on the Ocean

The number of children and grandchildren with cancer in their bones, with leukaemia in their blood, or with poison in their lungs might seem statistically small to some, in comparison with natural health hazards, but this is not a natural health hazard--and it is not a statistical issue. The loss of even one human life, or the malformation of even one baby--who may be born long after we are gone - should be of concern to us all. Our children and grandchildren are not merely statistics toward which we can be indifferent.

- President Kennedy, June, 1963

Radiation cannot be allowed to increase in our country and the world. When respected leaders show that they are aware of the dangers, we would do well to remember what the objective is here - to supply energy to our people, to improve the quality of their lives, and move away from poverty. Nuclear power will not do that - it will do the opposite, by diverting funds away from those that would satisfy needs, to those that would harm our country, and make profit for a few. That is unacceptable. Having radiation imposed upon us is undemocratic, unnecessary and short sighted.

There is no evidence that there is such a thing as a safe dose of radiation, nor is it proven that a dose received slowly is less dangerous than one which is received quickly. Radiation accumulates, so the speed does not matter. It is like saying that stabbing someone with a knife slowly will not kill them, but doing it quickly will!

Nuclear power radiation lasts for tens of thousands of years - comparisons with medical radiation are inaccurate. Medical radiation generally lasts only a few days or weeks, so the chance of harm is much, much less.

It will cost many millions, if not billions, to look after the radioactive waste for its harmful life. One study in the USA for long term management of radioactive waste is already costing over R80 billion, and this does not include the cost of building the waste facility - this is very difficult, as we cannot be sure that the place will remain stable for tens of thousands of years, which will surely lead to radiation escaping, and affecting future generations.

Our Constitution prevents us from harming future generations. It states that "Everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that-

- * prevent pollution and ecological degradation;
- * promote conservation; and
- * secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

We must apply this law now. Radiation will continue to harm us for generations, with cancers, leukaemia, immune deficiency, genetic damage, and much more. It is our right to protect ourselves and future generations.

Eskom say that there will be about fifty to seventy jobs for the PBMR they plan to build; and that many more jobs could be created, but only if they can make their overseas suppliers move their factories to South Africa. This is highly unlikely.

More jobs would be created using safe, clean, affordable and proven renewable energy technologies, which are already competitive. The International Atomic Energy Association (the world's promoter of nuclear energy) itself says that wind energy will be competitive with coal and nuclear in the near term, between 2005 and 2015, in pure economic terms - excluding all the social and environmental benefits. If these benefits are also taken into account, then wind is already cheaper. During the 1990s the market for wind grew by 24% and for solar by 17%. The market for nuclear energy grew by under 1%.

The USA market for renewable energy alone was greater than US\$6 billion in 2000. 75% were sales from small companies of less than US\$1 million per annum, and 75% of the companies were run by less than 25 people, showing us that ordinary people can create businesses and jobs.

In the USA, renewable energy will create 350 000 jobs by 2010. In the European Union - including losses of jobs in fossil fuel, 500 000 jobs will be created, and a further 350 000 in export of Renewable Energy.¹ There is no reason why we in South Africa cannot do the same.

Both Greenpeace and the EU Wind Energy Association (EWEA) say that at least 40 Gigawatts of wind can be installed by 2010, creating between 190 000 and 320 000 jobs, and 1 200 000 MW will be installed by 2020, creating at least 1.7 million jobs. The Danish wind market grows at 44% annually, and the industry maintains 10 000 sustainable jobs at present.

Also in the EU, wind generated 1.2% of electricity in 1998 - and created 15 000 sustainable jobs - and this is growing!

Nuclear generated 33% of electricity in 1998 - and

supported 38 000 jobs; coal generated 26% of electricity in 1998 - and supported 80 000 jobs; wind generated only 1.2% but yet created 15000 jobs - a much better rate of job creation than either coal or nuclear! If wind was generating as much power as nuclear today, then it would have created 412 500 jobs! Wind has already overtaken jobs in nuclear in 2001!

India has 14 turbine manufacturers - South Africa none. A Zimbabwean windpower manufacturer easily sells everything that they can produce. The USA had zero sales of microturbines in 1998 - this is growing to \$8.5 billion (R85 billion) in 2003 - in only five years!

Wind job creation statistics: 17 job years per MW manufactured, 5 job years per MW installed. The EU says that 1 MW of wind creates 15 to 19 sustainable jobs; Greenpeace says 14 jobs per MW. Even at the lowest possible estimate, instead of only about 70 jobs per PBMR, we could create, safely, 1 540 sustainable jobs, for the same cost.

In 2001, the USA solar industry created 3 800 new jobs, and generated sales of R800 million. So far, this industry has created 20 000 direct jobs, and 150 000 indirect jobs in the USA alone.

With the high solar power available to us in South Africa, we could do much better. European Union PV industry states that they could directly employ 294 000 people by 2010. Astropower, a PV company, is recording growth of 43.7% in business, to US\$49.8 million.

Jobs in Energy Efficiency:

Germany alone had created 100 000 jobs in energy efficiency by the early 1990s. Thermal insulation and replacing old boilers created 200 000 new jobs.

Sacramento in California (USA) have found that saving enough energy to avoid 100MW of generating capacity creates 39 jobs, compared to 15 to 20 jobs created by coal or gas plants.

Let us take the high road, and choose technologies that create many more jobs, for many South Africans, in a worldwide renewable energy market that is growing every year.

¹ All references: *Renewable Energy World*

The mining impacts of the PBMR

In order to run a reactor for one year, to generate electricity, one begins with the mining of 440 000 tons of rock. After the various steps, 33 tons of uranium fuel remain in the end. So, of 440 000 tons of rock, 33 tons of fuel is left over. Just under a twentieth (five percent) of the original material taken from the ground actually goes into the reactor, and 95 percent remains in the mine dumps.

It is uranium mining alone which is responsible for the greatest proportion of the health-related damages of nuclear power.

The operation of a single 1-gigawatt nuclear power plant (the size of the proposed ten PBMR installation), produces in one year 76 fatalities due to the radon alone coming from the tailings (waste). That is based on the information from the International Atomic Energy Association. And that's not just for the year that the energy is produced, but rather, for every year for thousands of years.

So, this one year of energy production results in these fatalities throughout the future - 76 deaths per year for thousands of years.

For one year of a reactor's operation, a further 20 fatalities result from the fact that radium makes its way into the ground water. If we add the 76 fatalities due to the radon coming from the tailings (waste) to these 20 fatalities, that adds up to almost 100 fatalities for one power plant for one year.

About 400 power plants are installed throughout the world. That means that one year of operation of the current atomic industry results in 40 000 deaths per year resulting from uranium mining alone!¹

The B.C. Medical Association (BCMA) has warned

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Thus, instead of one in twenty, about one in five miners would be expected to die of lung cancer because of "permissible" exposures to radioactive radon gas in the mines.²

Communities living near mine dumps are also exposed to extra radiation, and these communities have higher cancer rates than other communities.

We already know that our miners have the highest death rate of all mines in the world. Are we really going to allow Eskom and NECSA to increase these deaths for their own benefit?

The National Union of Mineworkers (partners in the Nuclear Energy Costs the Earth Campaign) agree that we need to move away from a nuclear future, and towards safe and clean alternatives. COSATU also took a strong anti-nuclear stance at their 2000 congress, including calling for the PBMR to be halted.

Why are we allowing the killing to continue?

Why are we allowing the killing to continue?

¹ Peter Bossew, Austria. Physicist, member of the Austrian Ecological Institute for Applied Environmental Research and the Institute for Gamma Ray Measurement, Vienna. (This lecture was drawn up together with Antonia Wenisch, Austria, and held originally in German) *Poison Fire, Sacred Earth. Testimonies, Lectures, Conclusions. The World Uranium Hearing, Salzburg, 1992.*

² *Cost Disadvantages of Expanding the Nuclear Power Industry* by Gordon Edwards, Ph.D. The Canadian Business Review reprint from Volume 9 Number 1 Spring 1982.

The Nuclear Energy Corporation of South Africa (NECSA) wishes to establish a radioactive waste smelter at Pelindaba.

This will be used to melt radioactive metal that is on site, a hangover from the apartheid nuclear weapons programme.

The International Non-proliferation Treaty, designed to limit the spread of nuclear weapons, does not require signatory countries to smelt weapons waste. This waste can safely be encapsulated, and stored above ground.

The smelter, if allowed to go ahead, will emit, as part of its "normal" operation, more than five kilograms of uranium (and more than 260 grams of pure uranium) contamination a year.¹

NECSA are also on record as saying that they wish to "commercialise" the smelter, once they have smelted the waste on site. This is of further concern, as we could end up being a dumping ground for waste from other countries, with unknown releases of radiation as part of the "normal" operation. (See factsheet on the global agenda).

All of this is of great concern, as a single gram of uranium contains fifty million million (not a typo!) radioactive particles, and according to St Andrews University in the USA and others, as little as two of these can cause harm. Hence the worldwide problems with radiation.

Uranium radiation is most harmful if inhaled or ingested - these are the two most likely paths from melting radioactive waste, as air pollution will not only be breathable, but our water and soil will also become contaminated.

NECSA also hope to establish a radioactive fuel plant, to supply Eskom's planned Pebble Bed Modular Nuclear Reactor (PBMR). This plant will also emit unknown quantities of uranium contamination during its "normal" operations.

Depending on whether this is allowed, and Eskom are able to design and build a PBMR (which have so

far been tried and abandoned in Germany, the UK and the USA), it would imply that trucks carrying radioactive material and chemicals will traverse the roads to and from Pelindaba.

Depending on levels of production, this would translate into between 2 to 45 trucks per week carrying either enriched uranium or fuel, and between 6 to 145 trucks per day carrying the various chemicals required for fuel production. These figures are based on information supplied by Eskom - the background information document for the PBMR and fuel plant.

One truck, carrying enriched uranium, for example, would cause a catastrophe if it fell more than nine metres into water - an accident of this nature would leave the area around it uninhabitable for ten's of thousands of years. It must be remembered that radiation can last hundreds of thousands of years, and accumulates. It cannot be seen, felt, tasted nor seen; neither can it be destroyed in any way whatsoever.

Radiation affects all life, without exception - people, plants and animals are all affected, be it with leukaemia, birth defects, mutations, sterility, or many other potential impacts.

The International Commission for Radiological Protection (ICRP) bases its safety issues (as does our National Nuclear Regulator) on the Linear Non-threshold Theory - simply put, this means that there is no such thing as a safe dose of radiation.

Safe and clean alternatives exist for all these plans - sustainable, proven and affordable options that are working elsewhere. It is difficult to see why these plans are being pursued, other than for the possible profit for a few, and to allow radioactive dumping here in South Africa. It must be remembered that the potential impact of such processes is acknowledged worldwide as exceeding 100 kilometres, including Johannesburg and Pretoria.

Why should South Africa become a dump for radioactive waste from the North?

¹ Information supplied by NECSA's consultants.

Radiation

"There is no known tolerance level for radiation."

- R.M. Sievert, a radiologist after whom the radiation measure "Sievert" is named.

Natural radiation exists, but not at the levels we are faced with currently. People-made radiation has increased the amount of radiation we are exposed to. We are not able to cope with these higher levels.

Mining, including the waste, releases radiation all the time, and this increases "background" radiation - natural plus people-made radiation - and it is the joint impact of this that is dangerous.

We all agree that cancer, respiratory illnesses, fertility problems, and leukaemia are all on the rise. If radiation was safe, then why would we need a National Nuclear Regulator? Why would mines and miners be concerned about it?

There is no debate about whether radiation kills, maims, causes mutations (in people, plants and animals), is cumulative (adds up year after year), causes leukaemia (mainly in children), cancers, respiratory illnesses and attacks the immune system (with children, pregnant women and the elderly being the most vulnerable). The only disagreement is about what is legally considered an allowable dose.

There is no such thing as a "safe" dose. The only people who say that a safe dose exists, are those who profit from saying that. The "safe" dose measured by the industry has dropped every few years, until the current "safe" dose is a small fraction of the original "safe" dose. The trend is clear.

Radiation exposure, a known risk factor for cancer, may also significantly increase the risk of other diseases, including heart disease, stroke, pneumonia, and liver problems.¹

As you can see from the above, radiation is a very dangerous thing. Even very small amounts (called a dose) can harm us. Doctors and dentists are aware of this, and wear special clothes when they take an x-ray of our bodies or teeth. The difference between medical radiation and nuclear power radiation, is that most medical radiation lives for a very short time - usually days. The other types can stay in your body until you die, and many years thereafter. Radiation of this kind cannot be burnt or destroyed; it cannot be seen, tasted, smelt, touched or heard.

The other problem is that you and I may choose to go for an x-ray, because we think it may help us get better. Radiation from power plants and smelters do not give us this choice - we are being exposed to this radiation so that other people may make a profit, and we will be harmed without any benefit.

Radiation from a nuclear plant will equal the radiation released by four Chernobyl accidents over a 25 year life! These amounts of radiation are unacceptable. Studies in the USA suggest that the health of 42 million Americans who live downwind and within 80 kilometres of a nuclear plant may be affected by these reactors. The rates of infant deaths dropped dramatically after five US nuclear plants closed.²

No safe dose - no debate!

There is no such thing as a "safe" dose. The only people who say that a safe dose exists, are those who profit from saying that. The "safe" dose measured by the industry has dropped every few years, until the current "safe" dose is a small fraction of the original "safe" dose. The trend is clear.

¹ Radiation Research 1999;152:374-389.

² Nuclear free news - www.nuclear-free.com/english/infant.htm

Eskom is not serious about safe and clean renewable energy. They have spent, so far, about R450 million, which could go up to as much as three billion, for the PBMR demonstration unit alone.

Their own documentation shows that they have spent only R5.5 million on just two of the possible renewable energy sources that we could be using, and will maybe spend up to R2.3 billion. However, there is no guarantee that they will proceed with this.

One of the lies that they spread is that renewable energy is not suitable for "baseload" (basic amount of electricity needed every day and at all times); or that it is "intermittent" (not available all the time); or that it is not suitable for industrial use.

These statements have been proven wrong by many installations around the world. If this is good enough for developed countries, why is it suddenly not suitable in South Africa?

Why are they so keen to push for the untested nuclear power option? Could it be because it will need subsidising, thereby making sure that our government has less money to spend on safe and clean renewable energy? Or is it because they wish to continue with their monopoly of electricity generation, and keep black people out of the market? Is that why they want to sell their two old coal fired power stations, that they have not used for many years, to black people?

Will our communities be able to build, own, install and benefit from nuclear power stations? No, but they could with renewable energy technologies.

The world market for nuclear is growing slowly, at a rate of less than 1% per year. The world market for

renewable energy is growing rapidly. Windpower alone grew 62% in the USA last year, and all targets for renewable energy in Europe were exceeded, with much more being installed than was thought possible.

Eskom's demonstration wind turbine is designed to be dismantled. We ask, why do they need to test something that works perfectly overseas? Is it because they have no intention of using it in the future, once the PBMR is built?

Eskom has also not made it easier for people who wish to generate their own power. It is still very difficult to get access to the grid, and even if you do, the price paid for this good quality electricity is laughable. These are some of the ways that Eskom can keep their monopoly.

Green energies like wind and solar power could play a major role in improving the lives of millions of the world's poorest people, said a report to be handed to world leaders at a summit in Italy recently. If we are serious about poverty alleviation, then we must spend our money on proven

technology which includes our people, rather than unproven technology which excludes most of our people, and presents a danger to all, with no benefit.

The world's largest windfarm (3000 MW) will soon be installed in the USA. This is in addition to a further 200 MW in California and another 260 MW in Nevada, as well as further new wind capacity of 2000 MW - generating more than 50 PBMRs by large windfarms alone!

The price of wind farms will drop by 50% by 2020. The European Union Wind Energy Association has targeted 60 000 MW by wind alone by 2010. This target is already being revised upwards.

Say no to nuclear power - let us say yes to safe and clean power to the people.

Will our communities be able to build, own, install and benefit from nuclear power stations? No, but they could with renewable energy technologies. The world market for nuclear is growing slowly, at a rate of less than 1% per year. The world market for renewable energy is growing rapidly. Windpower alone grew 62% in the USA last year, and all targets for renewable energy in Europe were exceeded, with much more being installed than was thought possible

Safety issues

One study alone found that between 1947 and 1991, there were 1054 accidents, leaks, failures and other incidents in the nuclear industry - averaging one incident about every two weeks!¹ This continues today.

Even Koeberg is not safe - but Eskom want to build the Pebble Bed Modular Nuclear Reactor without a building containing the reactor! They also want to lower the danger zone from the current eight kilometres to 400 metres! Both of these steps are necessary to Eskom, otherwise the PBMR will be too expensive.

An announcement in the US ² (2 November 2001) stipulates that no aircraft may fly within a twenty kilometre radius of a nuclear power facility, or lower than 5 500m above it. At the Koeberg nuclear power station, South Africa's only nuclear power facility, an exclusion zone radius of eight kilometres and a flight height of 600 metres is allowed. Pelindaba is a few minutes from Lanseria Airport.

There is a great deal of evidence that suggests that the hazard from low radiation doses are underestimated, and that the danger lies with internal contamination as well.

The evidence is: (1) geographical clustering of leukaemia around nuclear plant and weapons factories; (2) studies of nuclear workers, showing that those who are (or who only may have been) internally contaminated have higher cancer risks and confer higher risks of leukaemia on their own children; (3) temporal clustering associated with periods of time when large amounts of radioactivity were injected into the environment - Chernobyl in 1986, and atmospheric weapons testing in the 1950s and 1960s.³

"Reactors like Oyster Creek released three, four, five times as much as Three Mile Island and all these radioactive materials drifted across the entire northeastern US. The northeastern US is now suffering this enormous decline in health and the huge rise in insurance rates and medical costs. Governments are

going broke because Medicaid is rising at 28-29 percent per year in many of the states of the northeast and the states cannot afford it. They can't find the money for all the welfare and medical costs."⁴

We must understand the impossibility of 100% containment of the most lethal man-made substances ever created on earth, and it is critical to realize that many releases of man-made nuclear fission products are not categorized as "accidents" at all, but are the result of "normal" operating procedures carried out by, as Vladimir Chernousenko (Scientific Director of the cleanup of Chernobyl) calls it, the "International Nuclear Mafia". These releases fall within the rubric of "permissible levels" as explained by Dr. Ernest Sternglass in his 1982 book, *Secret Fallout, Low-Level Radiation from Hiroshima to Three Mile Island*.

Using data from as early as 1982 to the present, a report says that deregulation in the electric power industry has increased cost cutting at nuclear plants, resulting in less protection. "An accident at a US nuclear power plant could kill more people than were killed by the atomic bomb dropped on Nagasaki," Lochbaum said.⁵ Some of the faults include assumptions in risk assessments that nuclear plants always conform with safety requirements. "Yet each year more than a thousand violations are reported," the report said. Other factors ignored are the aging of plants, reactor pressure vessel failures, plant worker mistakes and health hazards of irradiated fuel.

The International Atomic Energy Agency, the international monitoring body, "expressed some misgivings" about the current direction of safety review for the PBMR. The head of the IAEA, ElBaradei, also "advised caution". The attempts by the German and USA governments to build a PBMR similar to the one that Eskom wish to build did not work - the German one released large amounts of radiation, one week after the Chernobyl disaster. The PBM nuclear reactor is not, and cannot be safe.

1 <http://prop1.org/2000/accidents/facts.html>

2 *Die Burger* - 02/11/01

3 Richard Bramhall, to a Welsh Anti Nuclear Alliance meeting in Chepstow, Wales, 23rd February 2001

4 1992 phone interview with Dr. Ernest Sternglass

5 David Lochbaum, nuclear safety engineer at the Union of Concerned Scientists and author of the report, entitled *Nuclear Plant Risk Studies: Failing the Grade*

Plans for the PBMR could seriously jeopardise tourism industries and waste the substantial investments being made in them for the following reasons:

- (1) Radiation accumulates. This simply means that every year, the amount of radiation increases. If the emissions are 5 kg per annum, after 10 years, there will be 50 kg in the local environment. Even so called "allowable doses" will be exceeded within years. Tourists will not want to visit an area which is unsafe.
- (2) Radiation harms all life. Radiation will affect the people, the wildlife and plant and insect life in a large area. They will mutate, and it is reasonable to assume that their reproductive abilities will also be affected, leading to a reduction in biodiversity over time, hence threatening both the unique Cape flora and the conservation areas being proclaimed in Gauteng.
- (3) A large proportion of tourists, with significant foreign currency to spend, come from Northern countries. Countries like Germany, France, Belgium, Denmark and many others are moving away from nuclear power, and these tourists will be put off by the proximity of dangerous nuclear facilities to these tourist attractions. The facilities will also generate increasing negative publicity for this reason.
- (4) Rare and endangered species have already been shown to be negatively affected elsewhere in the world - the same will happen here.
- (5) There will be an increase in poverty, as people will spend more money on health care, and have less to spend on food, energy and housing.

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- (6) The World Heritage site, the Cradle of Humankind, is only two kilometres away from Pelindaba (the site where they want to manufacture all the fuel for the PBMR's proposed 216 nuclear reactors, and install a radioactive waste unit to melt radioactive metal). Daily emissions of radiation, as well as if an accident takes place, will reach the Cradle in under twenty minutes, and Johannesburg in three hours. The Cradle is Gauteng's premier tourist destination, in a province that struggles to market itself as a tourist destination. Millions of rands are being invested in the area, including the development of the surrounding areas as a protected sanctuary for animals and plants, as well as our indigenous cultural heritage.
- (7) Dinokeng, the last place in Gauteng that has the Big Five animals, as well as other unique biodiversity that attracts tourists to the area, is within the impact zone of the proposed nuclear facilities.
- (8) The World Trade Centre events have also made international tourists wary of potential targets for attack. Easily accessible nuclear facilities constitute such a target, even if such attacks are not probable. Pelindaba and Koeberg are only minutes away from airports, from which planes could be easily diverted for such attacks. South Africa should continue to benefit from her world class tourism facilities, which continue to provide sustainable jobs for our people.

Transport of radioactive materials

If Eskom and NECSA (Nuclear Energy Corporation of South Africa) get their way, then even building the ten new nuclear reactors in addition to Koeberg will result in an increase in trucks transporting highly dangerous material around our country. There will be two trucks carrying radioactive material every week for forty years, and a further seven every week carrying chemicals every week, also for forty years.

At full production, for all the planned reactors, there will be nine trucks every day on our roads carrying nuclear material, and 145 trucks every day carrying chemicals for forty years!

The enriched uranium containers (casks) are designed to withstand a drop of nine metres, and if a cask falls into water as well as dropping more than nine metres, we would have a nuclear catastrophe.¹ Impact into a bridge abutment or falling off a bridge could easily exceed the design limits of the container. It must be made clear that the cask has yet to be built or tested, yet authorisation is being sought for the transport of all this material.

NECSA recently failed to get United States approval for a container it designed and built for medical isotopes. In the United Kingdom, it has been found that at least some radioactivity escapes continuously from the flasks. Even though the flasks are checked and decontaminated at Sellafield, railway staff are still warned not to work close to them for any length of time. Radioactive traces have been found on railway sidings where they are regularly handled. Recently, flasks from Hinckley Point in Somerset were found to be well over the permitted radiation level and others from Germany were so seriously radioactive that they have had to be withdrawn for modification and the traffic suspended.

The more severe an accident, the more likely that radioactive material would be released to the environment. A low speed accident could unseat a valve or damage a seal, releasing radioactive

particulates to the environment. The radioactive material, contaminating the ground, blown about by the wind or spilling into a stream, could lead to many deaths, mostly from cancer, over many years. At the very least, a large area and probably many thousands of people would have to be evacuated.

A fire associated with a truck accident increases the probability that radioactivity will be released. Fires occur in 1.6% of all truck accidents. This means that for the single demonstration reactor alone, we can expect at least seven nuclear accidents and over 110

chemical accidents. This is unacceptable. Diesel burns at 1010 degrees centigrade, but graphite (the material used to make PBMR fuel) burns readily in air at about 800 degrees. This was what spread the radiation so far at the Chernobyl and at the Windscale disasters.

The heat would vaporize some radioactive materials and sweep them up into the air. Persons downwind could inhale radioactive particulates and later develop cancer or genetic effects.

Even if a small percentage of radioactive waste is released from a shipping container, the number of health effects and the impact on a local community could be disastrous. A 1980 study by the Nuclear Regulatory Commission estimates economic consequences in an urban area in the order of \$2 billion.

A more recent study by the Department of Energy (USA) estimates economic costs on the order of \$460 million, and a period greater than a year to clean up the radioactive residue.²

Who would be first on the accident scene? Local fire, police and emergency personnel, who are neither trained nor equipped to cope with emergencies of this magnitude. It is important that fire companies extinguish a fire within a half hour, yet it is often unclear who has authority and responsibility for cleanup and protecting the public health in an emergency.

Further, accidents involving release of radioactivity

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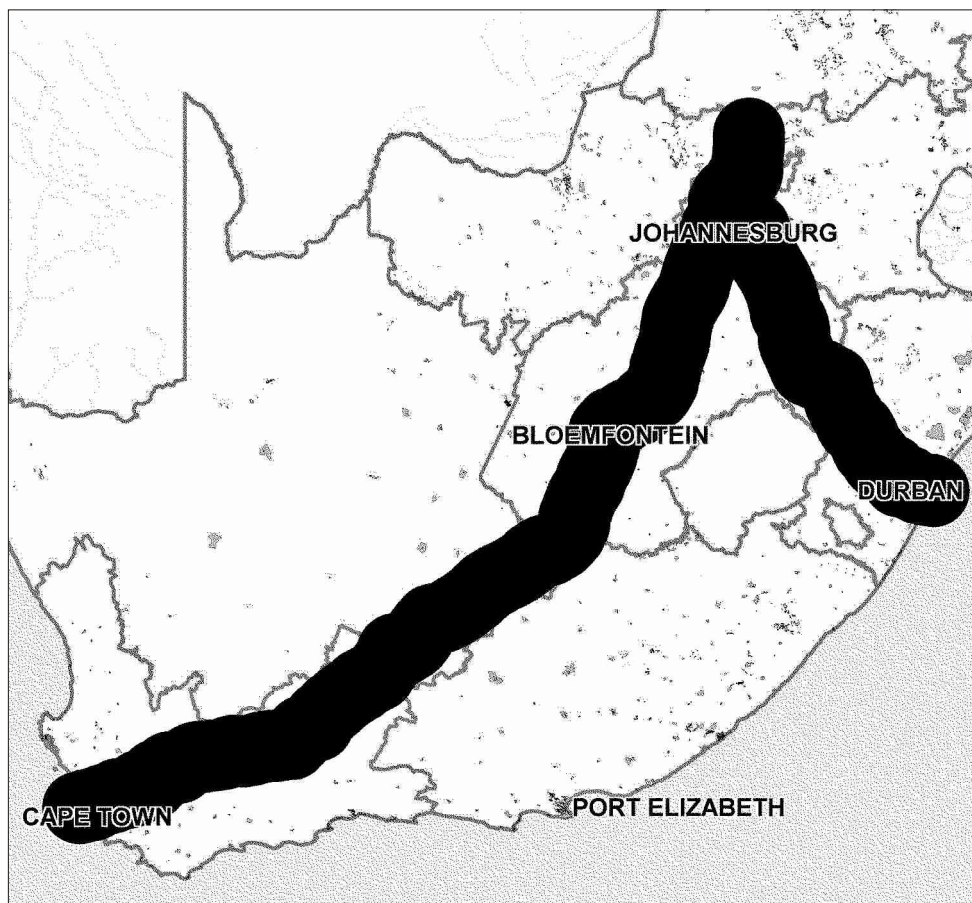
could require hospitals with isolation rooms, local supplies of potassium iodide, and an emergency management plan that includes checking potentially exposed individuals for radiation and treating any cases appropriately.³

A study done by the Department of Energy as part of the 1986 Environmental Assessment for the Yucca Mountain repository site, warns that a scenario involving a high speed impact, long duration fire, and fuel oxidation in a rural area would contaminate a 42 square mile area, require 462 days to clean up, and cost \$620

million. A similar accident in an urban setting would be even worse!

Data from the Department of Transportation reveals that in the last ten years, just under 100 000 accidents released some form of hazardous materials in the US and its territories. These releases caused over \$300 million in damages, over 4000 minor injuries, over 350 major injuries, and over a staggering 100 deaths.⁴

This map shows the area affected by the transport of nuclear material proposed by NECSA and Eskom - people living within the black area are most at risk.



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1 Based on Eskom documentation
2 NIRS
3 Public Citizen
4 Public Citizen

Waste issues around the PBMR

The waste from the PBMR process will include waste from the mining of uranium (tailings); waste from the enrichment of the uranium; items that come into contact with radiation (such as gloves, and clothes); and the fuel itself when it can no longer be used, but is still very dangerous.

All radioactive things can make everything they touch radioactive too, so the amount of waste is very large. In fact, the PBMR will generate ten times more radioactive waste than other reactors that produce the same amount of electricity!

Some of the wastes have lives that require isolation periods of a few 100 000 years. These are, for example, the mine tailings with the main nuclide (thorium-230) having a half-life of 75 000 years. (Half life means that after this time, the radiation drops by only half).

One can assume then that after ten half-lives the activity sinks by one thousandth; and for thorium-230, that would be 750 000 years. There are similar half-lives for certain types of fission products and activation products; they go on up to millions of years, as with neptunium-237, for example.¹

So, a profit is made for a few decades at the most, and then, for hundreds of thousands of years, we are responsible for the waste, and it continues to be extremely dangerous.

There is no safe way or place to handle this waste, especially the waste that is very radioactive. Even the studies for possible sites cost billions of rands, with no success. The Yucca Mountain site, in the USA, has been studied for many years, at a cost of over R80 billion, but has yet not been found to be suitable. It is impossible to predict what will happen to the soil and rocks for thousands of years, so no underground disposal site could ever be safe. Eskom has not included

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So, a profit is made for a few decades at the most, and then, for hundreds of thousands of years, we are responsible for the waste, and it continues to be extremely dangerous.

these costs in their studies. This could mean that future taxpayers could end up paying for the management of all this waste for thousands of years. This is clearly unacceptable.

We must stop producing radioactive waste now, and store what we already have safely encapsulated in ceramics above ground, so that any leakage or emissions can be monitored before they can cause any harm. Eskom and NECSA do not want this approach, as they will have to pay for the monitoring, which will again make the PBMR too expensive.

Communities that live close to minedumps, and waste sites, will be at risk for a long, long time. Why should we be doing this, when there are safe and well proven ways to provide the same electricity, but without the radiation?

The USA Department of Energy has this to say about the only waste site being considered: "A former Department of Energy nuclear waste chief said he has reviewed numerous scientific reports on Yucca Mountain and can find no information that would prove the site is suitable to serve as the nation's nuclear waste repository."²

The best way not to have a waste problem is by not making any radioactive reactors, so we do not have to manage that which is not made at all.

¹ *Poison Fire, Sacred Earth. Testimonies, Lectures, Conclusions. The World Uranium Hearing, Salzburg 1992. Peter Bossew, Austria. Physicist, member of the Austrian Ecological Institute for Applied Environmental Research and the Institute for Gamma Ray Measurement, Vienna. (This lecture was drawn up together with Antonia Wenisch, Austria, and held originally in German)*

² *Las Vegas Sun, January 30, 2002 Pahrump*

The World Summit on Sustainable Development (WSSD) has taken place in Johannesburg, South Africa, during August and September this year.

Many issues that the WSSD process is concerned with are linked to the nuclear development path that has been proposed for South Africa and her people.

A technology with impacts that harm all life, should not be preferred over those technologies that do not have the same level of harm for long periods of time.

Thematic discussions for WSSD 2002

These themes are the broad areas that will be discussed at WSSD 2002. In this factsheet each theme is discussed in terms of its relevance to the proposed reactor and smelter.

Climate change

It is well documented that nuclear power, through its entire chain, from mining to the "management" of radioactive waste, is more CO₂ intensive than renewable energy sources are.

Therefore, nuclear power stations (which have been excluded from the Kyoto Protocol) are not an effective strategy for minimising greenhouse gases.

Nuclear power does not qualify as part of the Kyoto Protocol emissions reduction strategy, so it will not qualify for subsidies, nor will it be accepted as a greenhouse gas offset.

Biological diversity

Radiation has a genetic impact on human, plant and animal diversity, and will impact on generations yet unborn.

Plants around Three Mile Island have mutated; people are harmed. The proof is clear.

Agriculture, land and desertification

Food will be at risk from irradiation, possibly leading to plants becoming mutated and sterile. This could threaten our food security.

Traditional plants could also mutate, causing us to lose our health and heritage.

Land that is irradiated, through accumulation and accident, will be a source of harm for thousands of years, making it unfit for life.

Changing consumption patterns

This is key to the issue. If the wealthy continue to consume energy and resources at the rate they do, there will be none left for others. By investing in both energy efficiency, and safe, clean ways of energy generation, the ability for people to live well will be enhanced, as there is no ongoing impact on scarce resources.

Combating poverty

Poverty is often described as the lack of access to resources. If people have clean air and water, their health improves, as well as their food security. Not having access to land means homelessness, and not being able to provide food for oneself. Mutant plants could have implications for the poor, but of particular concern is the fact that nuclear power is more expensive to the consumer.

Demographic dynamics and sustainability

The movement of people to towns and cities, in an effort to survive, places even more pressure on concentrations of people, and the services infrastructure is unable to cope.

This leads to desperate living conditions. A significant proportion of our population cannot afford electricity today.

Education and public awareness for sustainable development

Less than 3000 people have been reached by the nuclear consultants. There is no information in local languages other than some adverts in Afrikaans, and the consultants have also refused to go to some townships that will be affected by these nuclear plans!

Energy and transport

South Africa has the second most energy intensive economy in the world, second only to Kazakhstan. This means that we use more energy than most of the world to produce what we need, and what we export.

This has implications for global climate change, as it is only a matter of time before we will have to minimise our CO₂ and other greenhouse gas emissions. Nuclear is excluded in the Kyoto Protocol. Transport of nuclear

materials is a problem within South Africa. The trucks carrying nuclear and chemical materials will increase the danger on our roads. At full proposed production, there will be about 33 nuclear trucks and 725 chemical trucks per week for 40 years on our roads.

Finance and trade

The market for nuclear energy is growing at less than 1% per year, while the market for renewable energy technologies is growing at between 25% and 45% per year, with targets being revised upwards all the time.

Global status of biological diversity

Our genetic resources, stemming from our rich natural heritage, are threatened by radiation (See the factsheet: Harm to flora and fauna).

Health and sustainable development

The negative health impacts of nuclear development are felt mostly by poor or previously disadvantaged communities in South Africa.

Radioactive waste sites and radiation pollution result in unsafe and unhealthy air, water and land; as well as damage to communal assets, such as rivers and traditional plants. All this threatens sustainable development.

Information and institutions for decision-making

The right to information is a key step forward in our country. We now have the right to access information held by the state, or any other party, in defence of our human rights, as enshrined in our constitution.

However, local communities, energy activists and antinuclear campaigns are being denied access to information, in a bid to get government approval based on secret and biased reports, such as the second feasibility study - the first was indefensible.

Management of toxic chemicals and hazardous and radioactive wastes

This is a key challenge for South Africa. Our poor communities are still paying the price of such wastes, be it near Vaalputs (a repository for some radioactive waste), or as was experienced at Chloorkop, Umlazi, and many others.

Not creating such waste in the first place, developing clean production, and redesigning products and processes, will go a long way towards addressing the problem.

There is no safe, licensed repository for high level

The negative health impacts of nuclear development are felt mostly by poor or previously disadvantaged communities in South Africa. Radioactive waste sites and radiation pollution result in unsafe and unhealthy air, water and land; as well as damage to communal assets, such as rivers and traditional plants. All this threatens sustainable development.

radioactive waste anywhere in the world, regardless of the fact that over R80 billion has been spent in studying one site alone (Yucca in the USA).

The major problems of radioactive waste are the harm they do to all life, even at very low doses, and the fact that they are harmful for many tens, sometimes hundreds of thousands of years. The world is seeing a decline in both nuclear power, and nuclear weapons. The only safe way to manage the waste we do have, is to encapsulate it in ceramics, and store it above ground, with monitoring.

Oceans and seas

Koeberg generates heat, and impacts on sea life. The PBMR will increase this damage.

This will create problems for fish stocks such as fertility problems and genetic mutations (see the factsheet: Harm to flora and fauna).

We need to be able to protect our seas and oceans, to ensure that the biodiversity is not threatened, and that harvesting of ocean resources is carried out in a sustainable manner, allowing future generations to enjoy the same types of food we do at present.

Protection of the atmosphere

Radiation, from "routine" daily operations at Pelindaba and Koeberg, will impact on air quality. The radiation from Pelindaba, for instance, will reach Johannesburg in about five hours on a normal day, with the air plume reaching many miles, and adding to the already high levels of radiation.

Organisations against a nuclear development path in South Africa



South African Organisations:

Arcatour (SIC)-	Meadowlands
Brits Bankeveld Bewarings Forum	Pretoria
Crocodile Ramble	Muldersdrift
Culterra Pty Ltd	Johannesburg
Development Action Group	Cape Town
Earthlife Africa (Johannesburg)	
Earthlife Africa (Cape Town)	
Earthlife Africa (eThekweni)	
Earthlife Africa (Pietermaritzburg)	
Earthlife Africa (Windhoek)	
EDG	Cape Town
EDM - Environmental Development Monitoring	Mohlatlareng
EJNF - Central Eastern Gauteng	
Environmental Justice Networking Forum	Gauteng
Environmental Justice Networking Forum	National
Environmental Monitoring Group	Cape Town
Eyakho Environmental Group	Johannesburg
Greenbelt Action Group	Roodepoort
groundWork -	Pietermaritzburg
Hartbeespoort Environment & Heritage Association	Groenkloof
HIV/AIDS Link	Vereeniging
Imbali Office Services	Orlando West
Impilo / Bophelo	Meadowlands
K.E.G.G	Johannesburg
Kouga Nuclear Concern Group	
Mmabana Day Care	Orlando West
Munsieville Environmental Task Forum	Johannesburg
New Eden Foundation	Cape Town
Northwest Eco Forum	
Nyakallang Marimba Group	
REACSSA	Meadowlands
Re-baatho	Ekurhuleni
Re-baatho	Diepkloof
Re-baatho	Orlando
SAAV - South Africans Against Vivisection	
Sophumelela Youth Development and Environment Project	Grahamstown
South African Green Revolutionary Council	Witbank
Southern African Association of Youth Clubs	
Southern African Catholic Bishop's Conference	
Soweto Information Centre	Soweto
St. Michaels Youth Group	Soweto
Sustainable Energy Africa	Cape Town
The Green Party of South Africa	
Thuto ke Matla Youth Organisation	Soweto
Vegetarian Society of South Africa	
Vervet Monkey Foundation	Gauteng
Vezukhono Secondary School Eco-club	Gauteng
WESSA - Wildlife and Environment Society of SA	National
Women Against Radiation (WAR)	
Youth Development Forum	Diepsloot
Youth Placement	Meadowlands
Zakheni Environmental Justice Forum	Sebokeng
Zululand Environmental Alliance - ZEAL	KwaZulu-Natal
Labour	
National Union of Mineworkers	
SADC and Africa	
Centre for Total Transformation	Harare
Community Technology Development Trust	Zimbabwe
FONSAG	Botswana
Livanningo	Mozambique
WAAME	Senegal
Zero Regional Environment Organisation	Zimbabwe
International	
Centre for Alternative Technology	Wales
Citizen's Awareness Network	USA
Citizens for Renewable Energy	Canada
Communities United for Responsible Energy	New York
Earthmedia	New York
Ecodefense!	Russia
Endorphin Records	New York
NIRS/ Greenpeace - (Harvey Wasserman) - Columbus, Ohio	USA
Nuclear Information and Resource Service - 6000 members	Washington DC



Safe Energy Communication Council	Washington DC
Shut Down Sizewell Campaign	UK
Sustainable South Bronx	New York
The Radiant Medicine Project	USA
Upsidedown Pictures	New York
World Information Service on Energy (WISE)	Netherlands
World Wildlife Fund (WWF)	Denmark
Taller Ecologista - WISE Rosario	Argentina
Naturschutzbund NÖ	Austria
Naturschutzbund Salzburg	Austria
Naturschutzbund Steiermark	Austria
Friends of The Earth/Brazil	Brazil
WISE-Tarragona-Catalunya	Spain
Ecological Council	Denmark
International Network for Sustainable Energy	Denmark
French Network "Sortir du nucléaire"	France
Réseau	France
Greenpeace	Germany
The Greens Movement of Georgia/Friends of the Earth	Georgia
Anti-Atom-Gruppe an der TU Berlin	Germany
attac Karlsruhe	Germany
B90/The Greens Lahnstein	Germany
Women for Peace	Germany
Maka Ina	Germany
ObjectFarm	Germany
Projekt Neu-Fessenheim	Germany
Robin Wood Bremen	Germany
RSV	Germany
SPD Bundestagsfraktion	Germany
Universität Hamburg	Germany
University Witten/Herdecke	Germany
Urgewald	Germany
VCD Hamburg	Germany
x1000malquer	Germany
X-tausendmal quer	Germany
ZEGG (Center for experimental societal design)	Germany
MIO-ECSDE	Greece
Hungarian Geen Democrats	Hungary
Irish Citizen	Ireland
Amici della Terra	Italy
Plutonium Action Hiroshima	Japan
Women in Europe for a Common Future (WECF) -	Netherlands
WISE Amsterdam	Netherlands
Summit Environmental Youth Organization -	Pakistan
Nuclear Free Philippines Coalition	Philippines
Ecodefense/WISE Russia	Russia
WISE/NIRS-Russia	Russia
Ericsson	South Africa
Center party youth league	Sweden
Swedish Anti Nuclear Movement	Sweden
"Folkkampanjen mot kärnkraft-kärnvapen"	Sweden
Greenpeace Switzerland	Switzerland
University of Lausanne	Switzerland
Birmingham Friends of the Earth	UK
FoE Shepway	UK
Kent Against a Radioactive Environment (KARE)	UK
Ecoclub	Ukraine
Uniresearch Foundation	USA
University of California Los Angeles	USA
Voices Opposed To Environmental Racism	USA
SES-Wales/Cymru	UK
St Volkeren	NL
STAP	NL
St. Windenergie Noord-Nederland	NL
Forum für verantwortbare Anwendung der Wissenschaft	Switzerland
Umweltdachverband	Austria
Gruppo Antinuclear Survia	Argentina
Mundo Limpio	Argentina
FUNAM	Argentina
Corporate Watch	UK
Rising Tide Oxford	UK
Centre pour une Culture de Paix et de Non-violence	France
Überparteiliche Plattform gegen Atomgefahr (PLAGE)	Austria
Arge ja zur Umwelt, nein zur Atomenergie	Austria
Bürgerinitiative Umweltschutz Hamm	Germany
Finnish Association for Nature Conservation	Finland

Hundreds of individual letters of support have already been received.

