Published on Friday, April 15, 2005 by the Australian

Nuclear Power is the Problem, Not a Solution

by Helen Caldicott

There is a huge propaganda push by the nuclear industry to justify nuclear power as a panacea for the reduction of global-warming gases.

In fact Leslie Kemeny on these pages two weeks ago (HES, March 30) suggested that courses on nuclear science and engineering be included in tertiary level institutions in Australia.

I agree. But I would suggest that all the relevant facts be taught to students. Mandatory courses in medical schools should embrace the short and long-term biological, genetic and medical dangers associated with the nuclear fuel cycle. Business students should examine the true costs associated with the production of nuclear power. Engineering students should become familiar with the profound problems associated with the storage of long-lived radioactive waste, the human fallibilities that have created the most serious nuclear accidents in history and the ongoing history of near-misses and near-meltdowns in the industry.

At present there are 442 nuclear reactors in operation around the world. If, as the nuclear industry suggests, nuclear power were to replace fossil fuels on a large scale, it would be necessary to build 2000 large, 1000-megawatt reactors. Considering that no new nuclear plant has been ordered in the US since 1978, this proposal is less than practical. Furthermore, even if we decided today to replace all fossil-fuel-generated electricity with nuclear power, there would only be enough economically viable uranium to fuel the reactors for three to four years.

The true economies of the nuclear industry are never fully accounted for. The cost of uranium enrichment is subsidised by the US government. The true cost of the industry's liability in the case of an accident in the US is estimated to be $US560billion ($726billion), but the industry pays only $US9.1billion - 98per cent of the insurance liability is covered by the US federal government. The cost of decommissioning all the existing US nuclear reactors is estimated to be $US33billion. These costs - plus the enormous expense involved in the storage of radioactive waste for a quarter of a million years - are not now included in the economic assessments of nuclear electricity.

It is said that nuclear power is emission-free. The truth is very different.

In the US, where much of the world's uranium is enriched, including Australia's, the enrichment facility at Paducah, Kentucky, requires the electrical output of two 1000-megawatt coal-fired plants, which emit large quantities of carbon dioxide, the gas responsible for 50per cent of global warming.

Also, this enrichment facility and another at Portsmouth, Ohio, release from leaky pipes 93per cent of the chlorofluorocarbon gas emitted yearly in the US. The production and release of CFC gas is now banned internationally by the Montreal Protocol because it is the main culprit responsible for stratospheric ozone depletion. But CFC is also a global warmer, 10,000 to 20,000 times more potent than carbon dioxide.

In fact, the nuclear fuel cycle utilises large quantities of fossil fuel at all of its stages - the mining and milling of uranium, the construction of the nuclear reactor and cooling towers, robotic decommissioning of the intensely radioactive reactor at the end of its 20 to 40-year operating lifetime, and transportation and long-term storage of massive quantities of radioactive waste.

In summary, nuclear power produces, according to a 2004 study by Jan Willem Storm van Leeuwen and Philip Smith, only three times fewer greenhouse gases than modern natural-gas power stations.

Contrary to the nuclear industry's propaganda, nuclear power is therefore not green and it is certainly not clean. Nuclear reactors consistently release millions of curies of radioactive isotopes into the air

and water each year. These releases are unregulated because the nuclear industry considers these particular radioactive elements to be biologically inconsequential. This is not so.

These unregulated isotopes include the noble gases krypton, xenon and argon, which are fat-soluble and if inhaled by persons living near a nuclear reactor, are absorbed through the lungs, migrating to the fatty tissues of the body, including the abdominal fat pad and upper thighs, near the reproductive organs. These radioactive elements, which emit high-energy gamma radiation, can mutate the genes in the eggs and sperm and cause genetic disease.

Tritium, another biologically significant gas, is also routinely emitted from nuclear reactors. Tritium is composed of three atoms of hydrogen, which combine with oxygen, forming radioactive water, which is absorbed through the skin, lungs and digestive system. It is incorporated into the DNA molecule, where it is mutagenic.

The dire subject of massive quantities of radioactive waste accruing at the 442 nuclear reactors across the world is also rarely, if ever, addressed by the nuclear industry. Each typical 1000-megawatt nuclear reactor manufactures 33tonnes of thermally hot, intensely radioactive waste per year.

Already more than 80,000 tonnes of highly radioactive waste sits in cooling pools next to the 103 US nuclear power plants, awaiting transportation to a storage facility yet to be found. This dangerous material will be an attractive target for terrorist sabotage as it travels through 39 states on roads and railway lines for the next 25 years.

But the long-term storage of radioactive waste continues to pose a problem. The US Congress in 1987 chose Yucca Mountain in Nevada, 150km northwest of Las Vegas, as a repository for America's high-level waste. But Yucca Mountain has subsequently been found to be unsuitable for the long-term storage of high-level waste because it is a volcanic mountain made of permeable pumice stone and it is transected by 32 earthquake faults. Last week a congressional committee discovered fabricated data about water infiltration and cask corrosion in Yucca Mountain that had been produced by personnel in the US Geological Survey. These startling revelations, according to most experts, have almost disqualified Yucca Mountain as a waste repository, meaning that the US now has nowhere to deposit its expanding nuclear waste inventory.

To make matters worse, a study released last week by the National Academy of Sciences shows that the cooling pools at nuclear reactors, which store 10 to 30 times more radioactive material than that contained in the reactor core, are subject to catastrophic attacks by terrorists, which could unleash an inferno and release massive quantities of deadly radiation -- significantly worse than the radiation released by Chernobyl, according to some scientists.

This vulnerable high-level nuclear waste contained in the cooling pools at 103 nuclear power plants in the US includes hundreds of radioactive elements that have different biological impacts in the human body, the most important being cancer and genetic diseases.

The incubation time for cancer is five to 50 years following exposure to radiation. It is important to note that children, old people and immuno-compromised individuals are many times more sensitive to the malignant effects of radiation than other people.

I will describe four of the most dangerous elements made in nuclear power plants.

Iodine 131, which was released at the nuclear accidents at Sellafield in Britain, Chernobyl in Ukraine and Three Mile Island in the US, is radioactive for only six weeks and it bio-concentrates in leafy vegetables and milk. When it enters the human body via the gut and the lung, it migrates to the thyroid gland in the neck, where it can later induce thyroid cancer. In Belarus more than 2000 children have had their thyroids removed for thyroid cancer, a situation never before recorded in pediatric literature.

Strontium 90 lasts for 600 years. As a calcium analogue, it concentrates in cow and goat milk. It accumulates in the human breast during lactation, and in bone, where it can later induce breast cancer, bone cancer and leukemia.

Cesium 137, which also lasts for 600 years, concentrates in the food chain, particularly meat. On entering the human body, it locates in muscle, where it can induce a malignant muscle cancer called a sarcoma.

Plutonium 239, one of the most dangerous elements known to humans, is so toxic that one-millionth of a gram is carcinogenic. More than 200kg is made annually in each 1000-megawatt nuclear power plant. Plutonium is handled like iron in the body, and is therefore stored in the liver, where it causes liver cancer, and in the bone, where it can induce bone cancer and blood malignancies. On inhalation it causes lung cancer. It also crosses the placenta, where, like the drug thalidomide, it can cause severe congenital deformities. Plutonium has a predisposition for the testicle, where it can cause testicular cancer and induce genetic diseases in future generations. Plutonium lasts for 500,000 years, living on to induce cancer and genetic diseases in future generations of plants, animals and humans.

Plutonium is also the fuel for nuclear weapons -- only 5kg is necessary to make a bomb and each reactor makes more than 200kg per year. Therefore any country with a nuclear power plant can theoretically manufacture 40 bombs a year.

Because nuclear power leaves a toxic legacy to all future generations, because it produces global warming gases, because it is far more expensive than any other form of electricity generation, and because it can trigger proliferation of nuclear weapons, these topics need urgently to be introduced into the tertiary educational system of Australia, which is host to 30 per cent to 40 per cent of the world's richest uranium.

Helen Caldicott is an anti-nuclear campaigner and founder and president of the Nuclear Policy Research Institute, which warns of the danger of nuclear energy.