# The Abuse of Nuclear Power

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I have been asked to present a paper [1] with the title "The Abuse of Nuclear Power" but this title can, of course, be read in many different ways. The threat of nuclear attack by one country on another would obviously be the abuse of nuclear power. The development of nuclear weapons by any additional country would today be regarded as an abuse of nuclear power because it could provoke another country to do the same thing and lead to further proliferation of nuclear weapons. Abuse of nuclear power could mean terrorists attempting to steal plutonium to make a crude nuclear weapon or to contaminate the environment as an act of blackmail. Abuse of nuclear power could also mean the careless use of nuclear materials leading to contamination of the environment or unjustified hazard to employees or to the population. Finally, the abuse of nuclear power can just as much refer to the uninformed and misleading attacks to which the nuclear industry is frequently subject.

The whole history of mankind since the start of civilization has been influenced by the continued search for greater power. The introduction of oxen for ploughing and riding the horse as an alternative to walking; the use of fire to keep us warm and the water-wheel to augment the strength of the human arm. The use of coal to make iron and the introduction of the steam engine for pumping water and powering the railways. The introduction of the motor car and the aeroplane. All these steps gave more power to man's elbow, raised his standard of living and made it possible, for example, for Britain to support ten times the population that it could support before the industrial revolution.

The reason that mankind has become the dominant species on earth is because he is the most adaptable to his environment. He has been able to change most rapidly to changing circumstances and he has been able to use to his advantage changes and opportunities as they occurred. But evolution in nature is very slow and on the timescale of industrial development mankind is still very conservative indeed. He is acutely suspicious of what he does not understand and is very resistant to any change in a period of his own individual lifespan.

Throughout history all change has been resisted – the Luddites, the bitter opposition to the building of the railways by the environmentalists who, three generations later are arguing that they should be subsidised to prevent them from being closed down, the man with the red flag walking in front of the motor car. If only the Ancient Britons had been able to write, I am sure we would have written evidence of the Ban the Wheel Marches held at Stonehenge. But all change has advantage and disadvantage. It has always been possible to point to some aspect of the past and compare it with some unsatisfactory aspect of today. But the overall balance of these changes over the years has been overwhelmingly

in man's favour. The good old days were a myth. Did the happy peasants of the Middle Ages have conveniently small families to prevent the population exceeding the capacity of rural Britain to support them? Did they suddenly have large families in the cruel days of the industrial revolution to provide cheap labour for their beloved employers? Did they suddenly discover the attractions of sex? We must accept that in the good old days they died quietly, one at a time, of disease, cold and starvation and that this is still happening in the underdeveloped parts of the world today.

As man got access to more power, he did things in a bigger way. The train superseded stagecoach, the factory superseded the village forge. Accidents also got bigger because a stagecoach going over a cliff could only kill about six people, whereas a train accident could kill over a hundred and an accident to a single aircraft can now kill over 300.

The promise, and the problem, of nuclear power is that it is not only one more step along the path that mankind has been following since civilization began, it is also a fairly big step. Each step in the past frightened people at the time, and this step, brought vividly to everyone's attention by it being introduced by the dropping of the atomic bomb on Hiroshima, has frightened correspondingly more.

Let us then look at nuclear energy as another source of power put at the disposal of mankind, which, as with all other inventions, can be used for good or ill, used or abused. Without the wheel we would not have had tanks, mobile guns, railways or the motor car. Without chemistry we would not have had bombs, shells, drugs for our hospitals or fertilizers. Without nuclear physics we would not have had the atomic bomb, plutonium or the availability of virtually limitless power to support us when our precious reserves of oil and gas have been squandered, squandered in a way that will cause bitter resentment by future generations. Let us look then at the various aspects of the use and abuse of nuclear power.

We may or may not regret the invention of the atomic bomb but we must accept that it is a reality. It has been developed independently by the United States, Russia, the United Kingdom, France, China, India and probably Israel.

More important still is the fact that many countries have the scientific, engineering and technological skill to develop nuclear weapons or peaceful nuclear power programmes themselves. Furthermore, they will be more likely to do so if they are denied nuclear power by the countries that have it today. There is no way that this knowledge, which is now world wide, can be univented. This is a fact and we must learn to live with it.

The problem of proliferation of nuclear weapons is in my view far and away the most worrying aspect of nuclear power. Governments, responsible or irresponsible, depending upon your point of view have the possibility of obtaining weapons of devastating power. The solution to this problem is political and international. It will not go away by banning the construction of nuclear power stations.

Great progress has been made through the International Atomic Energy Agency, and the Non-Proliferation Treaty has been signed and ratified by an encouraging number of countries. The British Government has, I think, done everything it can to support the IAEA in this initiative and should continue to do so. Achieving the maximum degree of acceptance of the Non-Proliferation Treaty remains in my view the most important political objective in nuclear power. The Non-Proliferation Treaty may not be perfect but it is a major step in the right direction.

**Actual and expected deaths UK Atomic Energy Authority and British Nuclear Fuel Limited male employees and pensioners 1962/1974**

| Cause of Death | Employees | | Pensioners under 65 | | Pensioners + 65 | | Total | | Ratio: Actual/ Expected |
|---|---|---|---|---|---|---|---|---|---|
| | Actual | Expected | Actual | Expected | Actual | Expected | Actual | Expected | |
| ALL CAUSES | 1653 | 2411 | 273 | 158 | 804 | 1083 | 2730 | 3652 | .75 |
| ALL NEOPLASMS | 447 | 558 | 71 | 42 | 212 | 258 | 730 | 858 | .85 |
| Leukaemia | 8 | 17 | 1 | 0.85 | 2 | 4.9 | 11 | 23 | .48 |
| Lymphatic System less Leukaemia | 18 | 27 | 2 | 1.3 | 6 | 6 | 26 | 34 | .76 |
| Ca Bone | 3 | 3.2 | 0 | 0.15 | 1 | 0.8 | 4 | 4.2 | .95 |
| Ca Lung | 172 | 277 | 33 | 20 | 86 | 109 | 291 | 406 | .72 |
| CIRCULATORY SYSTEM | 903 | 1050 | 149 | 72 | 445 | 529 | 1497 | 1651 | .91 |
| Ischaemic Heart Disease | 701 | 809 | 91 | 51 | 274 | 321 | 1066 | 1181 | .90 |
| Cerebro Vascular Disease | 95 | 175 | 27 | 11 | 97 | 123 | 219 | 309 | .71 |
| RESPIRATORY SYSTEM | 73 | 242 | 24 | 17 | 76 | 177 | 173 | 437 | .40 |
| DIGESTIVE SYSTEM | 42 | 62 | 3 | 3.6 | 20 | 25 | 65 | 90 | .72 |
| GENITO URINARY SYSTEM | 14 | 32 | 2 | 1.5 | 10 | 14 | 26 | 47 | .55 |
| ACCIDENTS, VIOLENCE | 129 | 174 | 9 | 5.4 | 15 | 18 | 153 | 197 | .78 |
| Road Traffic | 66 | 61 | 3 | 1.6 | 2 | 6.2 | 71 | 68 | 1.04 |

I believe the world has less to fear from nuclear terrorists. Certainly the efforts of Drs. Wilbridge and Taylor have provided a great deal of information which might just give the necessary encouragement to terrorists contemplating some nuclear outrage. I am, for this reason, of the view that the commissioning of their report was a serious error of judgement by the Ford Foundation. But in spite of what has been written I remain of the opinion that committing an act of nuclear terrorism would be one of the most difficult ways of achieving the terrorists' objectives.

We must accept, I suppose, that at some time in the future there will somewhere be an attempt at nuclear terrorism. But I am confident that it will fail for the reason that the achievement of the terrorists' objectives will be very much more difficult than they have anticipated.

It is unfortunate that we have so much terrorism in this world and that we have got to take all the steps we do to ensure that it does not succeed in the nuclear field. But the nuclear industry is a responsible industry and the governments that control it in their respective countries are increasingly insistent that adequate precautions are taken. Certainly in Britain I am satisfied that the precautions we are taking today are adequate for the circumstances of today.

The nuclear industry in the UK acts from the point of view of buying and selling its services as a commercial company. The more sensitive parts of it, such as the factory at Windscale, are, however, from the point of view of security still treated as if they were defence establishments. The careful selection of staff, the fences, the design of the plutonium vaults and the arming of the security guards are all carried out to the instructions of the Government Security Services. It is these Government Security Services which ultimate carry the responsibility for determining the level of security and defence employed on establishments such as Windscale.

I said I was satisfied with the precautions we are taking at the present time. I think what is very much more important is that the Government Security Services are satisfied at the precautions which are being taken today.

Even the critics of nuclear power admit that the situation today is not too unsatisfactory and they direct their main criticism at the situation that might apply towards the end of the century when our nuclear programme will be perhaps ten times larger than it is as the present time. They contend that with the very much larger movements of plutonium and the increases in the amounts of radioactivity being processed, the situation could get out of control.

I would be the first to agree that the plants that we have at our disposal today will not be satisfactory for the requirements of 25 years hence, but I would contend that in this period of time we will improve our processes in line with the requirements placed upon them and that the situation at the end of the century will not be worse, but if anything will be better than the situation that we have today.

The last subject I would like to turn to in this address is the abuse of nuclear power by our critics, particularly in relation to the hazards from plutonium, the health of nuclear employees and the possible damage to the health of the public at large.

The discussion about plutonium is far more emotive than rational. It has been said that plutonium was named after the god of the devil; that is untrue; it was named after the

**Illustration of high standardized mortality rates from Registrar-General's Decennial Supplement published in 1971**

| | Actual | Expected | Standard Mortality Rate (100 = norm) | |
|---|---|---|---|---|
| Coal face workers | 420 | 12 | 3500 | Pneumoconiosis occupational |
| Furnacemen – glass and ceramics | 18 | 1 | 1800 | Pneumoconiosis occupational |
| Moulders and core-makers – foundry | 24 | 5 | 480 | Pneumoconiosis occupational |
| Constructional engineers, riggers | 177 | 27 | 656 | Accidents other than road vehicle and in the home |
| Railway lengthmen and labourers | 223 | 33 | 676 | Accidents other than road vehicle and in the home |
| Operators of earth moving and other construction machinery | 115 | 29 | 397 | Accidents other than road vehicle and in the home |
| Fishermen | 48 | 10 | 480 | Accidents other than road vehicle and in the home |
| Window cleaners, office cleaners | 84 | 34 | 247 | Accidents other than road vehicle and in the home |
| Drivers, motormen, firement – railway | 122 | 53 | 230 | Accidents other than road vehicle and in the home |
| Publicans, innkeepers | 25 | 10 | 250 | Diabetes |
| | 370 | 174 | 213 | Vascular lesions of central nervous system |
| | 63 | 26 | 242 | Other myocardial degeneration |
| | 121 | 56 | 216 | Hypertension |
| | 38 | 15 | 253 | Ulcer of duodenum |

**Illustration of high-standardized mortality rates from Registrar-General's Decennial Supplement published in 1971**

| | Actual | Expected | Standard Mortality Rate (100 = norm) | |
|---|---|---|---|---|
| Company directors | 94 | 3 | 3133 | Motor vehicle accidents |
| | 77 | 4 | 1925 | Suicide |
| | 254 | 47 | 540 | Malignant neoplasms |
| Medical practitioners | 21 | 6 | 350 | Cirrhosis of liver |
| | 26 | 10 | 260 | Accidents in home |
| Stevedores, dock labourers | 136 | 66 | 206 | Pneumonia |
| | 389 | 177 | 220 | Bronchitis |
| | 118 | 44 | 268 | Other accidents |
| Deck and engine room ratings, barge and boatmen | 80 | 38 | 211 | Malignant neoplasm stomach |
| | 264 | 124 | 213 | Malignant neoplasm lung bronchus |
| | 21 | 8 | 262 | Chronic endocarditis |
| | 22 | 11 | 200 | Other myocardial degeneration |
| | 69 | 31 | 223 | Pneumonia |
| Upholsterers and related workers | 12 | 6 | 200 | Leukaemia aleukaemia |
| Textile fabrics and related products makers and examiners | 7 | 3 | 233 | Leukaemia aleukaemia |
| | 19 | 8 | 238 | Chronic rheumatic heart disease |
| | 219 | 129 | 270 | Coronary disease, agina |

outermost planet of the solar system. It has been said that plutonium is the most toxic material known to man; that is untrue. It is certainly a nasty material to handle and this gives rise to major problems in the design of plutonium plants. But it has nothing like the toxicity of some of the poisons of the spiders and other insects, and it is not significantly worse than the toxicity of many chemicals.

It has been said that a piece of plutonium the size of an orange is sufficient to kill the population of the British Isles. That is about as sensible a statement or as relevant as saying that one road tanker of liquid chlorine has enough poison to kill everybody in Europe; or, for that matter, saying that the air in this assembly room would, if injected into the veins of the public, kill everybody in the world. All these statements would be near enough true if the population were stupid enough to allow someone to inject just the right amount of material in question into the critical organ of the body.

From the point of view of eating or drinking, plutonium is less toxic than many chemicals in quite widespread use. The particular hazard from plutonium is inhalation of plutonium dust into the lung, where less than a milligram can cause lung cancer. But the issue is not whether plutonium can cause lung cancer, we know it can, but then many materials can cause lung cancer. The real issue is whether plutonium does cause lung cancer.

But before I come to diseases of the lung, which is a very wide subject, could I just mention the disease leukaemia. Leukaemia has been associated with atomic energy; whenever there is a leukaemia death in any atomic energy establishment there is a national outcry with the implication that another person has been killed by plutonium or by radiation. But have any of these people who write about leukaemia deaths and atomic energy actually studied the statistics? Our leukaemia statistics are no worse, in fact they are somewhat better, than the population at large.

But, if we look at the Registrar-General's Decennial Supplement where the statistics for all industries in this country are analysed and look to see which industries have got the highest leukaemia rate, what do we find? At double the national average – upholsterers and related workers, and just over double the national average – workers in textile fabrics and related products.

Do we really believe that upholstery causes leukaemia? It's possible, but I believe unlikely. Before meaningful conclusions can be drawn there must be some reason why we should suspect that a particular substance or a particular industry should cause a particular disease and also have sound statistical evidence to back up the case.

Anybody who has taken the trouble to study the Registrar-General's report will rapidly come to the conclusion that small variations from the national average for the death rate for individual diseases is meaningless. But in some cases the divergences are so large that they are meaningful and indicate the relative health or otherwise of different industries.

Let us look then at the list of really high figures and see where the high death rates do occur. Let us use the Registrar General's basis and take 100 as representing the national average. Let us look at pneumoconiosis:

| | |
|---|---|
| Coal face workers | 3,500 |
| Furnacemen – glass and ceramics | 1,800 |
| Moulders and coremakers | 480 |

Let us look at accident statistics:

| | |
|---|---|
| Construction engineers, riggers | 656 |
| Railway lengthmen and labourers | 676 |
| Operators of earth moving and other construction machinery | 397 |

The list is endless: one could be excused for thinking that one could prove almost anything. But I think an objective study of the statistics would convince anybody that the skilled industries have a better life expectancy and a lower death rate than the unskilled industries, and particularly the dirty unskilled industries. I think this evidence is irrefutable from the study of the Registrar-General's statistics. I know you can quote back at me the figures for Company Directors – road accidents, 3,133; suicide, 1,925 – but the general conclusion is irrefutable.

So what about atomic energy? Yes, certainly there is plutonium and certainly there is radiation. But atomic energy is a skilled industry; it's an industry of laboratories, clean chemical plants and the highest quality of light engineering.

If one compares the statistics of atomic energy workers with people doing the same type of work in other industries, in other words, laboratory work, chemical plants where the conditions are clean and hygienic and the highest quality of light engineering, we find that the statistics are remarkably similar.

Atomic energy is one of the best of industries to work in, a clean industry with good working conditions; an interesting industry where the employees take an interest in their work and, just as important, they take an interest in themselves and, perhaps encouraged by the Works doctors, look after their own health. Our health statistics are good and I think better than any other industry producing the energy we require.

To those of our critics who argue against atomic energy on health grounds I would say to them "What alternative do you recommend and what statistics can you produce to show that your solution would give a better outcome than atomic energy? "

Attacks on atomic energy by people who have not studied the facts, who have not taken the trouble to look at the statistics are to my mind abusing atomic energy. They are also doing a national disservice. I am willing at any time to discuss the facts, our records, what we are doing, what discharges we make to the environment and compare the effect of nuclear power with that of any other solution to the world's energy needs that people may seriously propose as an alternative.

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[1] The paper was given at the conference on "Nuclear Power and the Public Interest – The Implication for Business", which was organized by the Financial Times and held in London in July 1976.