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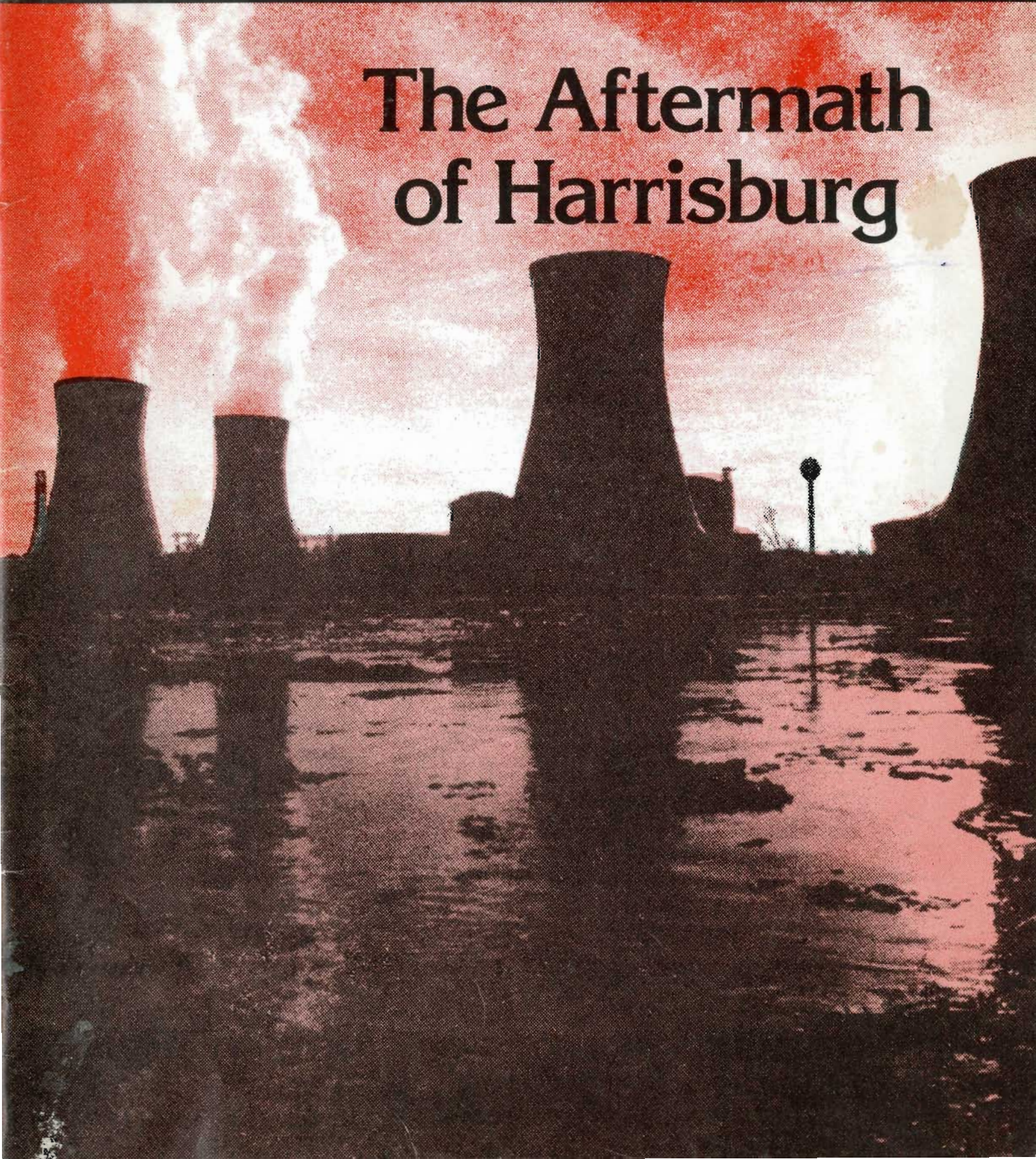
Journal of the Post Industrial Age

No.3

May~June 1979

70p

## The Aftermath of Harrisburg





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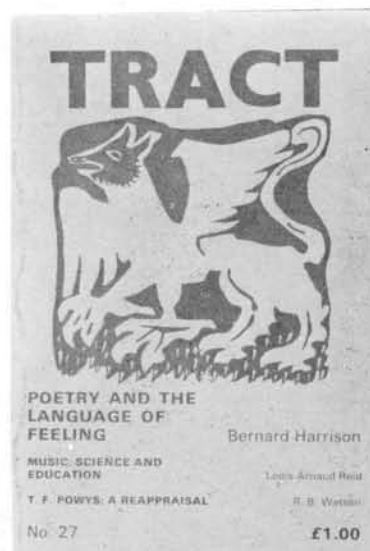
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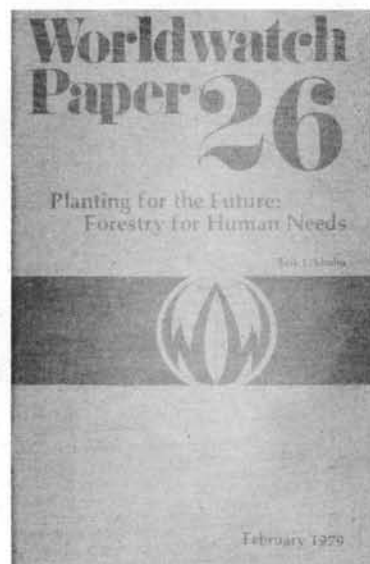
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Note: While every care is taken with manuscripts submitted for publication, the Editors cannot guarantee to return those not accepted. Articles published in The Ecologist do not necessarily express the views of the Editors.

Published by Edward Goldsmith, Ecosystems Ltd, 73 Molesworth Street, Wadebridge, Cornwall PL27 7DS, UK.

Editors: Edward Goldsmith, Nicholas Hildyard.

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Advertising: Maria Parsons  
73 Molesworth Street,  
Wadebridge,  
Cornwall.  
Tel: 020-881-2996

Printed by: Penwell Ltd  
Parkwood, Callington  
Cornwall.





## The Steady State Economy

A few of our more enlightened scientists and economists have rightly accepted that economic growth is now neither feasible (except in the very short-term) nor desirable. Rather than allow growth to come to a halt by itself, we should seek instead purposefully to achieve a 'Steady State Economy' (Daley) or an 'Equilibrium Society' (Meadows). In such a society births would equal deaths and investment would equal depreciation — which means that there would be neither demographic nor economic growth.

This is indeed a very necessary first step, but is it sufficient? Can our social and physical environment support, except in the very short-term, our present population, living at its present level of consumption? I am quite convinced that it cannot.

If some, indeed most people, continue to think that it can, and that it would thereby suffice to freeze population and economic activity at the present level to achieve a 'steady-state' or sustainable society, it is largely, I think, that they have overlooked two very important factors.

The first is that problems that have up till recently been local in character are rapidly becoming global. This means that they can no longer be exported, because there is nowhere left to export them to. When pollution was a local problem we could put up high chimneys and send it all off to Scandinavia. When population was a local problem, we could colonise the empty lands across the oceans and consign to them all our surplus people. All this we cannot do for very much longer and this means that our own environment, not that of other people, will soon have to sustain the full impact of our destructive activities.

The second is that the impact of these activities is *cumulative* over and above the rate of natural biospheric recovery. If the impact of these activities over a given period is greater than the environment can sustain, the latter will deteriorate and its ability to support the impact of our activities over the succeeding period will be correspondingly reduced *even if the extent of these activities does not increase*.

In other words the gap between the impact of our activities and the environment's ability to support it must systematically increase even in a stationary economy. Hence the biospheric cost of our activities

must go on increasing.

As a result the material compensations, technological expedients and institutional services that a stationary GNP can provide *must meet with diminishing returns*.

People in general will want more material benefits as a compensation for the cumulative deterioration of their physical environment.

Farmers will require more fertilizers to compensate for the diminishing fertility of their land resulting from the cumulative effects of overcropping and overgrazing and for its diminished capacity to generate its own nitrogen as a result of the cumulative over-use of fertilizers. They will require ever more pesticides to compensate for the growing pest problems resulting from cumulative ecological disruption and growing resistance among insects and other pests to the pesticides used for their 'control'.

We shall require more hospitals to cater for the growing number of cancer cases and the growing incidence of congenital disease caused by the cumulative exposure of our population to the carcinogens and mutagens in the food they eat, the water they drink and the air they breathe. We shall require more institutions to cater for the growing hordes of criminals, delinquents, vandals, baby-bashers, wife-batterers, alcoholics and drug-addicts, generated by the cumulative disintegration of our social structures under the cumulative impact of industrial activities. We shall also require ever more material resources which can only be obtained by further cumulatively depleting the world's dwindling stocks.

Such trends, needless to say, can only lead to price increases and, in a stationary economy, to reduce levels of consumption that, on the basis of current values and expectations are unlikely to be accepted. This will render it correspondingly more difficult to maintain the stationary economy in the face of international competition. Thus, if a foreign competitor introduces a new labour saving device, the micro-processor for instance, economic survival only seems possible if everyone follows suit. But this, among other things, can only lead to increased unemployment unless once more the economy is allowed to expand. It might be argued that unemployment benefits can be increased. But then, in the long run, these can only be financed by increasing economic growth.

What then can we do? There is no solution other than to reduce per capita GNP to that level which the environment can support over a long period. It is only once this has been achieved that the deterioration of our social and physical environment will cease, that the strategies employed for dealing with our problems will no longer meet with diminishing returns and that the need for further increasing the scale on which they are applied will be less apparent. This of course will mean achieving both negative demographic growth



and negative economic growth or, to put it less inelegantly, demographic and economic contraction.

It is not suggested a contracting economy is likely to be easier to manage than a stationary one, only that the problems involved in the latter case can only increase whereas in the former case they must eventually solve themselves. Indeed once the level of economic activity is reduced to that which the social environment can absorb, the manufacture and distribution of goods and services rather than occurring within a separate and self-contained sphere of human activity — the economy — can occur instead as an integral part of social activities, subjected thereby to the control of the social system as a whole. Polanyi (see *Our Obsolete Market Mentality*, *The Ecologist* July 1974) has shown that this was the case in all traditional societies, a separate economic sphere only appearing with the disintegration of society, largely under the impact of an over-developed market economy.

Once economic activities are brought once again under social-control, attitudes are likely to change very dramatically. Economic motivations are likely to be replaced by social ones as is also the case in traditional societies where goods are produced and distributed not to maximise the return on any factor of production but to feed oneself and one's family, satisfy social obligations and achieve social prestige.

Once peoples' pre-occupations become social rather than economic, the main motive-force for further economic expansion thereby disappears.

The objection normally raised to the idea of economic contraction is that it would reduce our ability to feed our massive population. People seem to think that industry feeds people. The opposite of course is true. The more economic growth we have, the more key resources such as labour, land and water must be diverted from agriculture to industrial use, the more, in the long run, must production fall. In many arid parts of the world where water availability is a limiting factor on food production (South California, and many parts of India) further industrial growth can even today only be achieved at the cost of reducing current food production.

What is more, industrial growth only provides more food for the population of industrial countries because manufactured goods can be sold to non-industrial countries *in exchange for their food*. Industry is thereby not a means of producing food but of exporting food shortages from industrial to non-industrial countries. If we take these two considerations into account it becomes clear that taking the world as a whole, the number of people we can feed is, if anything, *inversely* rather than *directly* proportionate to per capita GNP.

It must be noted that no government or International agency has to my knowledge, yet commissioned a study of Economic Contraction. It probably has not occurred to them that this might even occur — let alone that it might provide the only solution to the worsening problems that face us today.

Edward Goldsmith

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# Exporting Hazardous Industries

by Barry Castleman

**Multinational corporations faced with rigid worker health controls in the United States are solving their problems by moving to Third World countries where government regulations are lax and people ignorant of potential risks can be cheaply recruited.**



In the next decade the export of hazards from the US to the Third World is likely to increase. Just as in the past banning of unsafe consumer goods, foods, drugs and pesticides led to their export to poorer countries, similarly today US pollution control and occupational health standards may soon lead to the wholesale exodus of major manufacturing industries. As firms seek to overcome the heavy costs of implementing regulations and meeting standards imposed by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) while still continuing to sell their products in the US, the alternative offered by countries without restrictive controls must look increasingly attractive.

In many of the most polluting and hazardous industries existing plants are already very old and incapable of being made safe; to meet modern standards they need to be redesigned and rebuilt. Faced with this reality some manufacturers prefer to invest outside the US rather than stay where they are and meet tough regulations. What is certain is that the economy of hazard export is emerging as a driving force in new plant investment and that this is a prospect with grave implications for the future. The poverty and ignorance that exist in many developing countries make them particularly vulnerable to exploitation by the multinationals who own the majority of the foreign companies manufacturing hazardous materials for the US market. It may well be that government directed

efforts to implement environmental controls will need in future to incorporate measures to prevent the mere displacement and export of the killer industries to countries where there is little or no protection under the law, either for the workers or for communities threatened by pollution from plants set up in their traditional homelands.

Asbestos, pesticides and benzidine dyes are three industries that face increasingly rigorous standards of workplace safety which have resulted in alternatives to home production being sought in a variety of ways.

## **Asbestos textiles**

Occupational and environmental exposure to asbestos in this century has been the cause of a monumental tragedy whose full extent is not yet known. In the U.S. the number of people now living who worked with asbestos and will someday develop cancer as a result has been conservatively estimated at four hundred thousand. In the past eight years the asbestos industry has faced increasing regulations to control conditions of work and pollution of the atmosphere. These show no sign of abating, following as they do a steadily growing body of knowledge about the effects and the prevalence of "low-level exposure".

Historically asbestos manufacturing has been carried out in industrial nations and the US has been a world leader, but as the industrial nations impose increasingly costly controls some of the manufacturing



companies are declining; five years ago the National Institute for Occupational Safety and Health (NIOSH) noted that the US asbestos textile industry faced mounting competition from imports:

'Foreign facilities, which may be owned by domestic companies typically have a competitive advantage over domestic producers since they do not have to pay for environmental controls capable of meeting OSHA standards . . . . .'

As early as 1935 the risks were being recognised and asbestos manufacturing companies were being forced to pay very high rates for workers' compensation insurance; some private insurers were already refusing to sell life insurance to asbestos workers as long ago as 1918.

In his book *Expendable Americans* (Viking Press, NY 1974) P. Brodeur describes an extremely hazardous asbestos insulation plant that was moved from New Jersey to Texas in 1954. Follow up of former plant workers in New Jersey showed that an excessive incidence of fatal lung cancer had occurred in men employed there for a month or less. By 1965 it was established that cancer rates among asbestos workers were extremely high. Members of workers' families, and those living close to asbestos plants were also dying of cancer.

In June 1972 OSHA issued standards that were to be met by all asbestos-product manufacturers by June 1976 — in other words the companies were given four years to lower the asbestos dust levels in their plants from five million to two million fibers per cubic meter of air, but long before that date was reached OSHA realised that the new standard was not stringent enough and in 1975 it was lowered to five hundred thousand and then in 1976 to one hundred thousand fibers per cubic meter. Even this level is acknowledged to involve a risk of cancer and new standards are certain to be imposed. As a result the asbestos industry commissioned its own consultant report which concluded that even at the 1975 level of five hundred thousand fibers per cubic centimeter, some segments of the industry could not survive the competition from foreign manufacturers operating in countries where regulations did not apply.

Penetration of the US asbestos friction products industry (brake linings etc.) was also predicted if the OSHA standards were to be implemented. The report showed that significant imports were already being made from Korea. Increasingly manufacturing companies had to give up or get into an area where less rigid controls enabled them to produce at a competitive level.

Before 1970 over ninety-nine per cent of US asbestos textile imports came from Canada, Europe and Japan, but as the regulations governing workers health and environmental pollution have increased so have the imports from countries untroubled by increasingly severe standards, Mexico, Taiwan and Brazil. In 1973 Amatex, a firm based in Norristown Pennsylvania, closed an asbestos yarn mill only six years after it had opened and concentrated its operations on its asbestos textile plants in Agua Prieta, a small town just across the Mexican border from Douglas, Arizona, and Ciudad Juarez across the border from Texas. By 1975 this

company was producing nearly a quarter of all asbestos textiles imported to the US. The asbestos fiber used in these mills comes from Canada, there are no asbestos mines in Mexico. Workers are paid the minimum wage and there are virtually no regulations to protect them from the hazards of asbestos dust. A prominent industrial health specialist, Dr. William Johnson and a reporter from the *Arizona Daily Star* visited the plant at Agua Prieta in 1977. They saw part of the interior of the plant and gave the following account of conditions:

Asbestos waste clings to the fence that encloses the brick plant and is strewn across the dirt road behind the plant, where children walk to school.

Inside machinery that weaves yarn into industrial fabric is caked with asbestos waste and the floor is covered with debris. Workers in part of the factory do not wear respirators that could reduce their exposure to asbestos dust.

The newspaper story was reprinted in Spanish in Agua Prieta and subsequently the workers at the plant called for an investigation. As a result of the inquiry they must now wear protective clothing over their own and leave it at the plant, so that their families will not be endangered, but none of the workers have left their jobs and no more complaints have been made, presumably because the Union, known for its alliance with management, has threatened to dismiss any workers who make trouble. Since publication of the newspaper article the exterior of the plant and its surrounds have been cleaned up, but according to Dr. Johnson this has been a purely cosmetic operation; clumps of asbestos fibre can still be seen on the road behind the plant and clinging to the shrubs in nearby lots.

Also in 1977 a Texas television team visited the Juarez plant of the same company. A worker whose identity was concealed, said he had not been warned that he could develop a fatal disease from breathing asbestos dust. He described the plant as having no pollution control and no provision was made by management for workers to have functioning respiratory protection or a change of clothes for work. Dust levels in the plant were not monitored. In its US plants Amatex had been required to monitor fibre levels in the working area at least twice a year. Given an opportunity to refute allegations of carelessness in a television interview the President of Amatex steadfastly refused to appear. In Mexico regulations on workers' health have general provisions that workplaces using suffocating or toxic substances must display posters warning workers of the dangers to which they are exposed, and they must provide protective clothing. However the fine for failing to observe these minimal regulations is no more than a thousand pesos (less than fifty dollars). By contrast in the State of California the fines for violation of the Occupational Carcinogens Control Act of 1976 is a thousand dollars for a first failure and five thousand for repeated violations. Companies with diminishing profits and unable to find the money required to meet the stringent standards of OSHA or the consequent fines for failure have only two options. To manufacture outside the regulating countries or to close down.

Taiwan and South Korea have been replacing Japan as sources of asbestos textiles for the US. The plant in



Taiwan and one of the plants in South Korea are owned by Japanese firms, and the importer who ships the greater part of the imports from Taiwan to the US is the Japanese global trading company Mitsui. These asbestos textiles appear to be largely made from Canadian asbestos fibre. There are no mines in Taiwan or Korea, but there are few if any health regulations for asbestos workers either.

By making hazardous work economically attractive and by making workers suffer pay cuts in exchange for improved working conditions the law undermines all efforts to improve working conditions in the asbestos industry. Management has the choice of taking steps to protect workers or paying them extra for losing their health, and presumably does whichever costs less. The worker has little choice but to accept the company's terms or look elsewhere for a job.

#### **Arsenic and refined copper from primary smelters**

In January 1975 OSHA proposed lowering the workplace limit for airborne arsenic exposure from five hundred micrograms per cubic meter of air to four micrograms per cubic meter. In the light of mounting reports of the carcinogenicity of inorganic arsenic NIOSH recommended to OSHA that they should change this to a standard of only two micrograms per cubic meter. Arsenic is present in copper ores and a few copper smelters are designed to recover arsenic trioxide (white arsenic) as a by-product from high-arsenic ores. The only US producer of arsenic is Asarco's copper smelter in Tacoma, Washington. At hearings following the OSHA proposals Asarco's representatives said they could not achieve the proposed four microgram limit for less than fifteen million dollars a year, and would therefore have to close the plant, unless OSHA accepted a less rigid standard. Eventually OSHA issued a ten microgram limit and Asarco are asking them to approve the use of respirators where other controls are 'unfeasible'. The Tacoma smelter is also a major source of community exposure to arsenic air pollution, and the application of improved arsenic air pollution controls could also put the firm to considerable expense. Researchers and epidemiologists at the National Cancer Institute believe that arsenic air pollution is a contributing cause to high lung cancer rates in those US counties where copper, lead and zinc smelting is carried out. Community exposure to inorganic arsenic at Tacoma is within an order of magnitude of the limit proposed by OSHA for the workplace, and high urinary arsenic levels in children who live near the smelter have been reported. Soils for miles around non-ferrous smelters are ruined permanently from years of being rained on with metallic pollutants and road dust and playgrounds are likewise contaminated. It is likely that before 1980 EPA will promulgate rules requiring best available technology for the control of arsenic air pollution from smelters.

Two thirds of the copper produced at Tacoma is in fact made from ore mined in southwestern US and scrap. This ore is low in arsenic and Asarco could alleviate many of its most pressing problems by using more low-arsenic raw materials. However this would have the effect of selectively exporting the production

of arsenic by-products to copper smelters in non-regulating countries. The remaining sources of raw materials processed at Tacoma are high-arsenic copper ore concentrates from the Philippines and Peru, the latter coming from a marginal mining venture owned by Asarco. This being so Asarco may indeed be pleased to divert some of its arsenic business to Mexico. It already part owns a copper smelter in San Luis Potosi which has for long exported arsenic trioxide to the US and is the sole source of arsenic trioxide in Mexico. It is designed to handle high-arsenic raw materials and its output could be increased without any expansion of copper capacity if the plant receives 'dirtier' raw materials in the future than it has in the past. It could process residues from US smelters and high-arsenic ore concentrates from Peru, to produce more arsenic for the US market. There may be similar shifts in other manufacturing firms seeking to escape OSHA regulations. Companies manufacturing pesticides, herbicides, wood-preservatives and soda-lime to glass, are all users of arsenic. Although imports have steadily declined in recent years domestic demand for arsenic, especially for making pesticides, is expected to increase, with the US continuing to consume roughly half the total world consumption.

#### **Pesticides**

The US pesticide industry is a two and a half billion dollars-a-year business and is growing rapidly despite increased costs for pre-market research and a decline in the number of firms still developing new products. The industry produces a billion pounds of pesticides per year for use in the States and another six hundred million pounds for export. The global market for these chemicals is a seven-billion-dollars-a-year business. During the last twenty years the Agency for International Development (AID) has financed the export of over five hundred million dollars worth of pesticide chemicals. In 1975 AID was sued by a coalition of environmental groups and as a result it announced in 1977 that it would no longer sponsor the export of pesticides banned in the US for health or environmental reasons. A year later it announced that its basic pesticide policy would be reversed; less money would be given to developing countries to buy US pesticides and AID would seek to end the indiscriminate use of pesticides which had given rise, among other tragedies, to the incorrect application of malathion to crops in Pakistan that caused five deaths and illness in nearly three thousand people.

The manufacture of pesticides by US firms has generally been carried out in the States, but as more cases of cancer, sterility and diseases of the central nervous system among chemical workers come to light there is much unease in the industry and widely used products find themselves on the banned list.

The pesticide *kepone* was manufactured in Virginia for Allied Chemical Corporation by Life Science Products Company and was sold to banana growers in Latin America, Africa and Asia. This pesticide has caused sterility and apparently permanent nervous disorders among seventy-five Life Science employees; has severely polluted the James River and wreaked havoc on the local seafood industry. Allied and Life





Well protected in the US — but in the Third World, output is valued higher than workers' safety.

Science were indicted for over a thousand violations of federal water pollution control laws and criminal charges were filed against Life Science owners. Astronomical fines were imposed and Allied set up an eight million dollar fund to clean up James River. But the damage was already virtually irreparable. Another pesticide *leptophos* was manufactured until 1976 by Velsicol Chemical Company in Texas. Originally granted a tolerance by EPA for residues on tomatoes and lettuce EPA later warned that it intended to withdraw the licence following publication of an article about water buffalo deaths and human injuries associated with the use of the pesticide in Egypt. When Velsicol appealed against the decision EPA appointed a panel of experts to review the matter. The panel inquired whether any of Velsicol's own employees, engaged in the manufacture of *leptophos*, were showing any sign of nerve diseases. The company met that challenge by attempting to withdraw its appeal however the investigation was followed through and serious nerve damage was discovered among Velsicol's workers. The revocation of *leptophos* tolerances in November 1976 caused consternation in Mexico where the pesticide was used on tomatoes grown for export to the US.

Kepon and *Leptophos* subsequently ceased to be produced and OSHA announced that a general practice standard for all pesticides would be issued, but the overall effect of AID's declared policy of not exporting pesticides that are banned in the US and EPA's stricter controls will have the effect of sending the manufacturing companies to developing nations where they can carry on with the production of these

chemicals without the stringent and costly controls encountered at home.

#### **Benzidine dyes**

The manufacture of dyes from benzidine has been banned in a number of countries including Sweden, England, Italy, Japan and Switzerland due to the extremely high rate of cancer of the bladder observed in benzidine workers since the turn of the century. A retrospective study of benzidine dye-workers at an Allied Chemicals plant showed that by the time of follow-up twenty-two per cent had developed bladder cancer. In Italy thirteen families of dead and sick workers recently charged a dye plant's management with multiple manslaughter claiming that 132 workers had died from confirmed or suspected bladder cancer during the past twenty years. Three plant owners, the general manager and the company doctor were jailed for terms of from three to six years.

Benzidine dyes are now only made in the US by a single small firm called Fabricolor, but until recently three quarters of all benzidine dyes made there were manufactured by Allied Chemical or GAF. After these companies ceased to produce the dye some of their customers may have gone to Fabricolor, but it is clear that some textile, paper and leather firms turned to foreign sources. US imports of three benzidine dyes formerly supplied by Allied rose five-fold in 1976 and continues to grow. The reason for Allied and GAF's withdrawal from the market is not hard to find. Regulations governing the production of this most hazardous of dyes means that manufacturers will be required to provide lifetime medical follow-up for every worker.



The US has therefore almost ceased to manufacture the dyes which are now imported from Romania, Poland, India and France. But the industries that use the imported dyes pose a similar threat to workers. The benzidine dyes manufactured by Allied contained less than twenty parts per million of free benzidine (the unconverted benzidine remaining in the dyes); dyes from other countries have been analysed as having five hundred ppm free benzidine content. In England the manufacture of benzidine stopped in the sixties, but both the dyes and imported textiles coloured with benzidine dyes are imported largely from South Korea. In Italy the chemical industry has introduced a range of alternatives for cottons but these are more expensive than the dyes they replace and little is yet known about their toxicology. Until viable alternatives can be found it seems inevitable that benzidine dye production will increase in other countries that make cotton goods for export to industrial nations.

### **The Steel industry**

Steelmaking is a highly polluting industry. Making coal into coke for blast furnaces is one of the most polluting steel-making processes. It has been well documented that coke-oven workers incur excessive rates of lung and kidney cancer. In October 1976 OSHA issued a standard for occupational exposure to coke oven emissions. The estimated annual cost to the steel industry to comply with the standard was between two hundred million and one billion dollars, and the industry immediately went to court to challenge the standard. Already in 1973 the supply of coke had been curtailed by the inability of producers to meet environmental standards, however, because of the high price and poor quality of imported coke, the fragility of the material and its tendency to powdering in transit and the fact that both deposits of coking coal and markets for the coke are abundant in the US it is unlikely that there will be any long term trend towards importing more from abroad. There might be more favourable conditions for exporting the production of coke to non-regulating countries from other industrial nations where coke is now made from imported coal.

In Japan the high density of polluting industries has already led to pollution export. Several years ago Kawasaki Steel attempted to expand production at its steel mill in the polluted city of Chiba. Faced with opposition from local citizens Kawasaki decided to press for a new blast furnace in Chiba and built a sintering plant to serve it in Mindanao, in the Philippines. The sintering plant converts iron ore dusts from Australia and Brazil to larger iron pellets in a process using coke and limestone. This product is shipped to the blast furnaces in Chiba. Pollutants from the process include trace element impurities from the ore as well as fine iron oxide dust and gases which are predominantly oxides of sulphur and nitrogen. A Kawasaki pamphlet indicates that particulate emissions from parts of the process are controlled by cyclone collectors, and there are no controls for the gases. It is well known that cyclone collectors are not the most effective means for particulate control, though their removal of large particles is economically attractive from the standpoint of product recovery. More efficient

means of particulate control are more expensive than cyclones and unlike cyclones are efficient in controlling the very small respirable - sized particles that are the real threat to health.

A Manila newspaper responded favourably when the agreement between Kawasaki and the Philippine government was negotiated:

This is a case of a 'dirty' industry that can no longer be located in Japan because of pollution concerns. But the Philippine authorities have no objection to its installation in the under-polluted southern island.

Fifteen hundred families were reported to have been moved to make way for this plant and its six kilometer 'pollution zone'. The farmers and fishermen displaced by the Company were not hired to construct the plant because they were considered too unskilled and uneducated. The plant employs from six to seven hundred workers.

Asbestos, pesticides, benzidine dyes and steel are examples of a much longer list of hazardous and polluting substances that are increasingly expensive to manufacture in those countries that have powerful regulating bodies — others are vinyl chlorides and mercury and lead and zinc smelting.

### **What should be done about hazard export?**

Clearly all nations need to develop expertise in toxic substance control and equally clearly all those employed in hazardous work have the right to know what risks they face and what they can do to minimize the hazard. Every worker should have the opportunity to reject hazardous employment before jeopardizing his health or that of his family and before becoming economically dependent on the job. Unfortunately few countries have so far set up regulatory agencies with sufficient resources, expertise and authority to provide much protection to workers and communities from the dangers of operating plants. Obviously there is urgent need for worldwide co-operation. A hazard export information service, run by a respected international organization could do a great deal to disseminate current knowledge about health risks; to appraise industrial project plans; to keep track of the hazard export industries round the world and to monitor the movements of consumer goods, food, drugs and pesticides, which are banned in their country of origin.

The fundamental objection to worldwide control of export hazard made by those whose interests may lie in the opposite direction is that poor people may be better off *with* hazardous factories and goods than they would be without them. It is of the utmost importance to respect the right of people and their governments to choose what is best for them and to recognise that in some cases they will accept recognised mortal risks with full knowledge and with full justification. It would seem to follow that all that needs to be done to justify hazard export is to ensure from the outset that all parties involved are told, and are able to understand, what is at stake. Once this is done hazard export is supposedly a legitimate way of distributing the world's hazards to places where they are 'needed'.

This line of reasoning rests on the assumption that the recipients of hazard export would be fully informed and that they would be able to fully appreciate the nature



of the hazards — given the complexity of the question and the time lag that exists between the initiation of tests and the publicising of data, both assumptions are highly questionable. And there are other disturbing questions raised by the notion that hazard export, with informed consent, is a legitimate way to do business. For example, what's at stake may be the capacity of the environment to continue to bring forth food that is not poisoned, and a starving man might accept a polluting factory even at great peril to future generations of man and other living things. He could hardly be blamed for that, but can the same be said for those who wish to profit from his misery to the extent that they will offer him no better a bargain for putting food into his mouth?

The long term prospects, following this line of reasoning, are ominous. Industrial nations are increasingly confronted with discoveries that existing technologies are far more hazardous to workers and the environment than was ever imagined. If industry is to develop innovative solutions to these problems, if banks are to finance a new generation of technologies, something will have to be done to make the exporting of current technology hazards less attractive. Worldwide the pollution and worker health hazard problems posed by asbestos, benzidine, mercury and the like are largely determined by price. As long as hazardous processes can operate without the expense of controls, their products will be cheap to manufacture and will

remain competitive with other products made by safer processes. Demand for the hazardously-manufactured product will remain high rather than declining in favour of safer alternatives. Inevitably the resulting pollution and worker disease will be concentrated in the poorer hazard-importing nations — it will not be evenly distributed throughout the world.

The moral and medical arguments for worldwide standards to protect humans from toxic substances are persuasive, but they pale before the bleak alternatives to hazardous work in much of the world today. The establishment of international standards is a lofty goal, but it will not be within reach until a serious widespread effort is made to turn away from historic dependence on discredited technologies. The growing awareness of the need for clean, simple technologies, appropriate for local needs and capabilities, offers hope that models for development will arise that discriminate against polluting hazardous industries to the greatest possible extent.

#### Acknowledgement

A final, referenced version of Barry Castleman's report will appear in the *International Journal of Health Services* later this year.

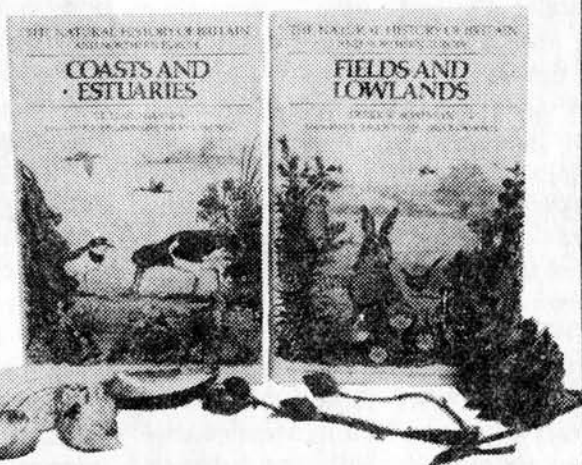
The author would like to hear from any readers who know of any cases of hazard export and asks them to contact him at: Box 230A Valley Road, Knoxville, Maryland 21758, USA.

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# First in, First out?

## Will Britain pioneer the post-industrial future?

**Once the workshop of the world, Britain is now scarcely able to compete with other manufacturing countries. Economic growth is no longer a feasible goal. Will the World's first industrial nation be the first to deindustrialise?**

This is an essay in utopian thought. Some will recoil in disdain or embarrassment. But 'utopian' does not mean the merely fanciful or fantastic, the sketching of an impossible dream. Properly understood, as in the utopias of Thomas More, Francis Bacon, or William Morris, it means the stating of goals or objectives which are utopian only in the sense that the specific mechanisms or routes taking us from 'here' to 'there' are not investigated. It does not mean that the goals are incapable of realization — that, after all, would be a poor sort of exercise in the human sciences. "Certainly the model is more vast and high than can possibly be imitated in all things", wrote Bacon's editor Rawley in his introduction to the *New Atlantis*; "notwithstanding most things therein are within men's power to effect".

What does it mean to speak of Britain becoming a post-industrial society? It must, at the very least, mean a future which in some crucial respects breaks with the present pattern of industrial societies. All industrial societies tend towards certain ends. They are large-scale, hierarchical, centralized, mechanized, bureaucratically-governed, and based on specialization and the

technical division of labour. A post-industrial society worthy of the name would not necessarily dispense with all these features; but it would tend towards different ends. It would move towards small-scale organization, towards more autonomous units, towards structures of work and authority in which individuals recover the use of skills previously alienated to the machines and the professional hierarchies. It would mean also a fundamental re-direction of goals and values. Industrial societies live by material growth and expansion. It is this feature — what one might call the Promethean or Baconian impulse — which distinguishes industrial culture from that of all other societies known to the world. Post-industrial society certainly does not disown science and technology, the motor of that expansiveness. But it acknowledges limits — material and moral — to the Promethean impulse; and it gears itself towards a world in which growth is considered primarily in qualitative rather than quantitative terms.

All this is easily said, of course; and it would be utopian in the rightly pejorative sense of the term simply to preach, to call for a new social pattern and a new set of values without indicating why these things "are within men's power to effect". I want to argue that the post-industrial pattern is now on the agenda of most industrial societies. Whether it likes it or not, the industrial world is reaching a position where further development along classic industrial lines is becoming increasingly difficult, costly, and dangerous. A post-industrial society

may not be to everyone's liking, but it may be a necessity for future survival.

More to the point, Britain may be uniquely placed to find a way out of the predicament of the industrial societies. Britain is the first and oldest industrial nation in the world. That in itself might lead one to think that, having lived the longest through the experience, she would be the likeliest candidate to undertake the next step of social evolution. Such exercises in the 'logic of history' are generally spurious — societies can and do get stuck in particular ecological niches — but in Britain's case the thought is supported by more solid considerations. For a number of reasons the oldest industrial nation restrained and modified the industrial impulse right from the start, preserving within itself values and patterns of social life that kept alive certain pre-industrial traditions. One consequence of this, the stuff of present day anxieties and public debate, was Britain's subsequent poor economic performance and loss of industrial pre-eminence in the world, after what in retrospect must seem a remarkably short time. But the other side of that inheritance needs stressing as well. It means that as the industrial pattern of development becomes increasingly bankrupt, a society that has preserved and cherished other values and ways of life, may be able to move into a post-industrial future with far less disturbance and dislocation than is likely in the case of those societies which more full-bloodedly embraced the industrial way of life.



Lastly by way of introduction, and so as not to be thought unduly eccentric, perhaps I may quote in support the similar sentiments of a very varied range of commentators on the current British predicament:

'Your real problem is that you were the first of the great industrialised nations, and so things happen here first. You are living out the concern for some more leisurely relationship with industrial life that other people have been discussing for fifty years or more.'

*Professor J.K. Galbraith,  
Harvard University*

'The country that brought us the industrial revolution brings us now perhaps the post-industrial world.'

*Professor Peter Stansky,  
Stanford University*

'It seems likely to this visitor that the world's developed countries will be emulating Britain within a decade or less . . . When the next round of industrialization — which will emphasise durability, quality, and community-level systems — arrives, you will more quickly recognize how well matched its demands are to your national strengths.'

*Professor Robert Socolow,  
American physicist*

'Britain started the industrial revolution; other nations followed. Despite thirty years on the wrong road, it's not too late for us to lead the world into the post-industrial society.'

*E.G. Wood, Centre for Innovation  
and Productivity,  
Sheffield Polytechnic*

'We, who live in the first industrial country, are now among the first to arrive at the next great turning point in history. We should take heart. In our intuitive wisdom, we are already laying the foundations for the post-industrial future . . .'

*James Robertson, author of  
Profit or People? The Sane  
Alternative, etc.*

'We led the world up to the industrial revolution and we must lead it down again to a calmer, uncompetitive state.'

*Professor Graham Hills,  
Southampton University*

### **The illusions of industrial progress**

These are all very fine sentiments, it may be said; and wouldn't we all like "a calmer, uncompetitive state", a caring society respecting both the natural environment and

the quality of individual life. But these things cannot be yet. They are the sweets of economic growth and greater productivity. To abandon the effort to restore economic expansion would be to consign Britain to a state of wartime austerity and authoritarian control. The industrial cycle still has its course to run before we can usher in the post-industrial utopia. However galling we may find its regimen, however inhumane and unethical, we must suffer it to the end because only in this way can we eventually throw off its yoke. As Keynes warned long ago in his essay of 1930, *Economic Possibilities for Our Grandchildren*, "for at least another hundred years we must pretend to ourselves and to everyone that fair is foul and foul is fair; for foul is useful and fair is not. Avarice and usury and precaution must be our gods for a little longer still. For only they can lead us out of the tunnel of economic necessity into daylight"'.

The familiarity of this objection should not blind us to its strength, or to the fervour with which it is held. It squares both with the received philosophy as well as the common sense of the times. So, before proceeding with the particular discussion of Britain as a post-industrial society, some cautionary remarks are in order on the religion of industrialism, and especially on its central tenet, the necessity of continuous economic growth.

Surprising as it may sound, the economic and social indicators widely used for measuring industrial growth cannot tell us whether there has been any *real* growth in economic or social welfare as a result of the adoption of the industrial system. The reasons for this strange situation are pretty well-known by now, and can be briefly stated.

### **GNP: A poor guide to welfare**

The first point is this, the standard measure of economic growth is growth of Gross National Product (GNP) *per capita*. GNP is the aggregate of all goods and services transacted in the formal market economy, for cash, together with the goods and services provided by public bodies out of taxes (the 'grants economy'). But in this totting-up process there is a curious

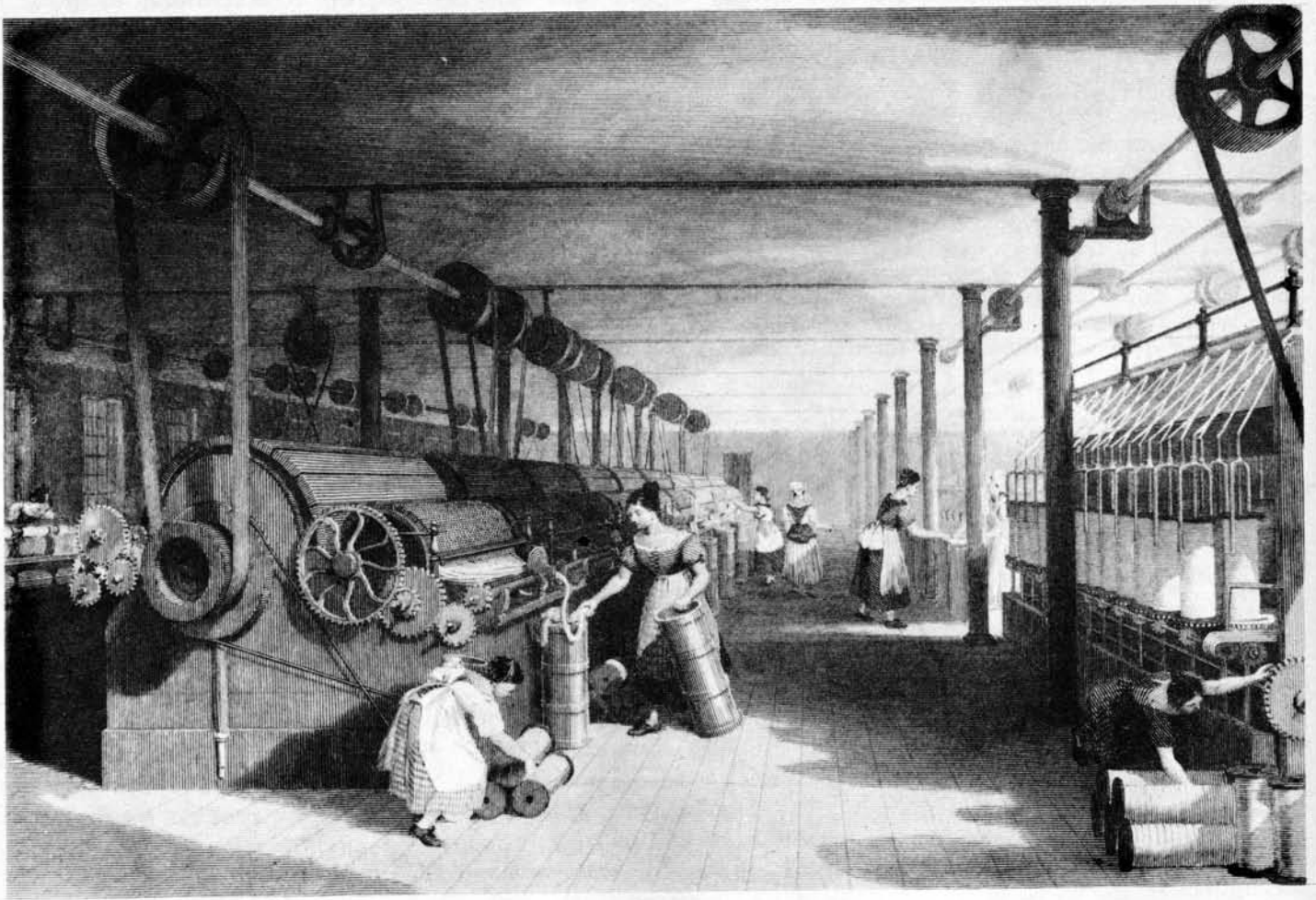
quirk of accounting (curious, that is, to anyone but an economist). If, say, a firm produces plastic macintoshes and in the process fouls up the nearby river with chemical wastes, *both* the proceeds from the sale of plastic macintoshes *and* the cash paid out (whether by the firm or the government) for clearing up the pollution are counted as additions to GNP. Put rather more technically, what the economists call the 'externalities' (or 'external diseconomies') of economic activities are added to the national product rather than, as might seem sensible, deducted from it.

The implications of this are clear. Much of what counts as economic growth — how much is anyone's guess — is in fact defensive, compensatory, or reparative expenditure. We cannot tell, from increases in GNP *per capita*, whether or by how much such increases mean an actual increase in economic welfare. The situation can quite plausibly be presented as one in which industrialism takes away with one hand what it gives with the other. Industrial society, as it develops, produces a growing cornucopia of good things: but the costs — material and social — of doing so grow too, so that we cannot be sure that the even point has not been reached or surpassed, leaving us with the worst of the bargain the more we continue the current pattern.

The second point was incisively made half a century ago by the economist A.C. Pigou, when he observed that if a widowed vicar paid his house-keeper a weekly wage for her work, this was an addition to the national income; if he married her, it became a subtraction. This is a fundamental point. GNP counts as 'productive' only those activities involving cash transactions, whether in the market or the grants economy. Activities outside this sector — in the home, in voluntary work or in barter relationships — are deemed 'unproductive' and not included in GNP.

We can allow, once again, the technical difficulties of measuring the value of work undertaken in the 'informal economy' of home, community, and friendship. But this should surely not deceive us into accepting the extraordinary and elaborate sleight-of-hand played





An industrial nation still clinging to pre-industrial values?

upon us. Indices which tell us that we are healthier, or better educated, or better cared-for, because there are now more hospitals, schools, or social workers, simply cannot be taken at face value. The fact that a service is offered by a paid professional worker within the formal economy clearly does not mean that it is necessarily better than that previously performed within the informal economy of the family or community. Indeed much of the growth in services in this century can be seen as a process of substitution, caused mainly by the decline of the household. Services previously performed in the home or community, which were unpaid and so 'unproductive', have now had to be performed by the paid professionalized agencies of the market or state. This substitution is recorded as very large increases in GNP; but whether or not this also means a net increase in welfare is clearly very open to question.

I hope it is clear by now that these remarks are not a digression but an absolutely central part of my argument. You cannot reasonably expect people to take the post-industrial

idea seriously until you make them aware of the weak conceptual foundations on which the industrial idea rests. Most people accept that there are various things wrong with industrialism, but these are seen as the necessary and bearable costs of the tremendous improvement in the standard of living for the mass of the population. The system rests, in other words, on a utilitarian philosophy and a utilitarian calculus — Bentham's 'felicific calculus'. But what if we show that the pains outweigh the pleasures? Or, more modestly, that there is no real way of measuring the costs and benefits of industrialism, so that what we are told are necessary evils — bigness, bureaucracy, alienation — may really be an intolerably high price to pay for benefits which turn out to be illusory, and which can be manufactured by an accounting exercise? We have seen that GNP, as an index of national prosperity, overestimates the degree of that prosperity by adding goods and bads together on the same side of the balance sheet. At the same time it underestimates the contribution of activities in those spheres of society

which it formally refuses to acknowledge, and which indeed are constantly invaded and undermined by the industrial principle enshrined in GNP. We cannot, from this kind of social accounting, conclude that industrialism has unequivocally brought with it greater welfare or happiness.

At the very least, therefore, the options for Britain are far more open than the current public debates about her future allow us to think. Even if there were no other reasons for looking forward to a post-industrial society, we might wish to promote its values and social forms simply as a matter of choice, as a means of leading more satisfying and fulfilling lives. In doing this we could see that we were acting perfectly rationally, indeed quite in accord with the ruthless cost-benefit analysis. For as Michael Marien has said, "only after encountering the extreme of material abundance for some, at the cost of insecurity, alienation, loss of pride in work, soil depletion, air and water pollution, and the fragmentation of family and community, can we begin to recognise the values that have



been lost and seek to give them a proper place in our accounting of progress and well-being."

### **The Case for a Post-Industrial Transition**

Industrial societies may or may not be reaching the end of their line of development. Personally I see no reason why they shouldn't carry on as they are, absorbing more and more of the world into the industrial system and creating a 'hyper-industrial' world society. In history as in politics it is often the short-run that counts; and in the short run the power lies with the big battalions — the super-powers and the multinational corporations — who presumably wish to keep things going along current lines, only more so.

The trouble is that by then it may be too late to change. And I think there are sufficient problems, of sufficient scope, to make us feel that we should be thinking about those changes now, and trying to implement them, rather than waiting for the system to collapse in — probably — international war. Let me briefly list some of the problems.

As far as the physical limits to the industrial system are concerned, it is probably unhelpful here to rehearse all the arguments and calculations. But I have seen no convincing case to suggest that the energy sources on which the system rests will not either run out within the reasonably foreseeable future or become so difficult and costly to get as to outweigh the benefits gained from them. At the very least the dependence of some societies on others more fortunately endowed with natural resources will create political strains of unnerving dimensions.

Similarly with the social limits to further industrial growth. These have been admirably discussed in a recent book by Fred Hirsch (*The Social Limits To Growth*). The picture he paints there of a future society still striving for growth is bleak and unattractive enough to put off any but the most dogmatic 'growthmen'. Hirsch projects a rat-like society locked in an intense competitive struggle for goods and services, especially of the non-material kind such as privacy, quietness, space, unspoilt countryside, creative and satisfying work.

The Ecologist Vol. 9 No. 3 June 1979

These are goods — termed by Hirsch 'positional' — which are always scarce, since their attainment depends upon others being denied them (cars are wonderful when few own them, but when everyone has one it is quicker to go by bicycle). The game is one in which the stakes are constantly being upped, and everyone is running like mad simply to maintain the position they've already reached. It is a situation in which the normal institutional controls exercised through such agencies as schools, trade unions, and political parties, are most likely to prove insufficient. The prospect held out is of a society in the Hobbesian state of the war of all against all, held together, if at all, by a grimly authoritarian sovereign.

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### **"Anti-industrial values have shown themselves again and again in the course of recent history . . ."**

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At the same time as these limits are being discovered and discussed, other institutional arrangements of classic industrial society seem to have become otiose or destructive of their original purpose. Parliamentary government, even in those countries such as Britain with the longest tradition of it, has everywhere given way to prime-ministerial or presidential government, with a key role played by unelected civil servants, experts, and shadowy pressure groups. The large-scale organization has begun to show that the diseconomies of scale might more than offset the economies of scale, with a system that stifles creativity and encourages careerism, and which deprives increasing sections of the workforce of the skill and autonomy needed to find satisfaction in work. Health, welfare, and educational systems expand, but both the motive behind their expansion, and their success, become questionable: seemingly having more to do with social control, disguised unemployment, or professional aggrandizement than with the creation of a healthier or better-educated population.

### **Britain as a prime candidate for change**

These problems hold of course for all industrial societies. Why then might Britain be in a better position to meet the challenge? Paradoxically her very weakness and demoralization at the moment might be part of the answer. From being the strongest industrial power in the world Britain has become one of the weakest, lacking particularly the great empire which once provided her best markets. Britain seems to have the least zest currently for engaging in heroic industrial exploits. But this means that she should be in a much more receptive state, psychologically, for contemplating a move to a post-industrial society. The populations of other, more successful, industrial societies are still tasting the wonderful apple of growth, and may be disinclined to leave off eating its heady fruit. They are not (with the possible exception of the United States) likely to be attracted at the moment to a society committed to a 'steady state' economy, work-sharing on a part-time basis, modest incomes across the board, and a good deal of the material and cultural basis of life being provided by all of us in our own homes, allotment gardens, and 'Black-and-Decker-ed' workshops.

Britain's receptivity to such a future society does not turn only, or even mainly, on her present weakness. It is not, in other words, a matter of accepting second-best because we cannot achieve the best. Britain's receptivity to such a pattern seems to me to derive from a much longer-standing tradition, nurtured by deep historical and cultural roots. I have already suggested that the Industrial Revolution remained imperfectly developed in the country of its birth. After thirty or forty years of dizzying manufacturing success in the first half of the nineteenth century, the country seemed to revert to a pre-industrial pattern of commerce more suited to the national temperament. From about 1870, as Britain's share of world trade in manufactures declined and her competitive position worsened, she changed, in Michael Fores' words, "from being the workshop of the world to being the service agency of the world". Britain became the world's banker



While their fathers made money . . .

and shipper — a role in which she had already become pre-eminent in the eighteenth century, before the Industrial Revolution turned her towards manufacturing as well. The service sector has remained strong throughout this century, always in surplus on current account (compared with manufacturing which has had a surplus in only nine out of the last one hundred and seventy seven years), and accounting over the past century for about forty per cent of Britain's overseas earnings.

I don't want to make the mistake of identifying manufacturing with 'the industrial society' and services with 'the post-industrial society'. Nor do I want to suggest that Britain can find her way to the post-industrial society by running down her manufacturing industry and going all out for services. As Dr. Gershuny has shown, the era of service expansion itself seems to be coming to an end, with rising labour costs and increasing mechanization of shops, offices, schools, hospitals, and other service organizations. People are either preferring or being forced to do things for themselves. The point I want to make is rather different. The culture and the temperament that preferred services to manu-

facturing is, I would argue, closer to post-industrial values than to industrial. It values human skills over machines, people over things, small organizations over large ones. In some of the more modern manifestations of the service sector — tourism, music, radio and television programmes, health and educational services — the aesthetic, humanist, and environmentalist aspects reveal themselves even more clearly.

#### No industrial spirit

The 'pre-industrial' and even anti-industrial values have shown themselves in Britain again and again in the course of her recent history. There is the well-recorded fact that the children of the great nineteenth century manufacturing families — the Arkwrights, Boultons, Strutts, Wilkinsons, Wedgwoods, Courtaulds — all hurried to escape the manufacturing label, and enrolled in the professions, public service, or the City instead. What is perhaps even more significant is that their parents pressed them to do so as well. Everyone wanted to be a gentleman, few players. The consequences were already apparent by the last quarter of the nineteenth century. British manu-

facturing then began its long downhill slide from its position of supremacy. From the 1870s we also begin to hear the litany of complaints, now so familiar, about Britain's backwardness in technical education, the lack of entrepreneurial ambition, the preference of the best brains for the professions and public service rather than for manufacturing industry.

Things don't seem to have changed very much since. A recent discussion paper from the Department of Industry, *Industry, Education and Management*, showed that the proportion of graduates going into manufacturing had dropped to an all-time low of 26 per cent. Even more worrying from their point of view was the steep decline in the number of science and technology graduates going into manufacturing. Moreover the demand for science and technology places at universities continues to be static, while that for arts and social science subjects goes on rising. Add to this that the quality of students entering to read technological subjects is significantly lower than that for all other subjects, and the Department of Industry's disquiet is understandable. All this when both the quantity and quality of industrial management, backed by





... the children of the great industrialists hurried to escape the manufacturing label.

social esteem, continues to increase in most other industrial societies.

I'm not for a moment suggesting that Britain is already a post-industrial society, nor that there is going to be any easy or inevitable transition to it. The forces of industrialism are still very strong, as the closure of every small shop or small business, or the relentless displacement of human workers by advanced technology, demonstrates almost daily. If the move were made to a plutonium economy those forces might get even stronger, at least for a while. What I'm saying is that of all the industrial countries, Britain by virtue of her history, culture, and social structure, is best poised to move out of the industrial age. Polls continue to show the persistence of attitudes and values, from top to bottom of the population, which place the satisfactions of particular social relationships and particular styles of life over economic ambition and careerism. When a recent *New Society* poll aroused anxiety because it seemed to confirm the imminent departure of the Protestant work ethic among British people, Ralf Dahrendorf sensibly remarked that "the desire to 'live a pleasant life' rather than 'work as much as one can for as much

money as one can get' is a source of strength, not of weakness in Britain".

#### Decadence or Revival?

These attitudes could, of course, be read simply as the symptoms of decline and decadence: Britain as Athens to America's Rome, or Britain playing out the years of a faded imperial power like Venice or Spain in the seventeenth century. And they could indeed portend decadence, if they are not used as the springboard of conscious social policy to bring about at least the beginnings of a post-industrial state. Exhortations to 'get manufacturing industry going again', or attempts to bribe students to do science and engineering, seem to me beside the point — not to mention going against the forces of history and the grain of the national culture. What we need to do is to strengthen the new growth points of the society, not prop up the old decrepit structures. There is the prospect here of a society in which, matched with the appropriate technology, human skills can once more be encouraged in the context of a locally-based household economy. A good deal more of our food could be grown, and dependence on imports cut.

We could do a lot more of our own repair and maintenance of goods, and perhaps even a lot more of the repair and maintenance of people, in a household economy. Both of these would reduce our dependence on specialized service professionals.

Some work, and some specialization, will still clearly be needed in the formal economy of wages, big technology, and big plants. But it need involve only a fraction of the work-time now spent. Automation, especially that involving micro-processors, could be more wholeheartedly prosecuted when 'unemployment' ceases to be a stigma and a threat. We would all be 'semi-employed' in the formal economy. This would leave us time to attend to production within the informal household economy, which could also be the basis of many of the activities of child rearing, education, and social welfare. We do indeed need bigness as well as smallness, but the relationship between the two could be decisively changed in favour of the latter.

Utopian? Yes, maybe. But I go along with Oscar Wilde: "A map of the world that does not contain Utopia is not worth even glancing at."

# The Great Nitrite Scandal

by Ross Hume Hall

**Food manufacturers insist on the necessity of nitrites to control botulism. Even though nitrite is converted into a potent carcinogen in the human gut, the food giants deny it presents any health hazard.**

Let us imagine the year is 1779 and we live in France, subjects of King Louis XVI. The King (at that time 25 years of age) is preoccupied with two problems, keeping the Dukes and Comtes in line and keeping a restless population under control. He calls in a consultant, a reputed seer and asks, "What is the future of the Monarchy?"

The consultant could tell the King that the outlook is bleak, the Dukes and Comtes exploit the population viciously and the people blame him. The King and his advisors would probably reject the consultant's unwelcome conclusion and, in fact, the consultant might well lose his head.

Or, the consultant, knowing Kings, Dukes and Comtes like to have their own beliefs reflected, could say that the Dukes and Comtes fulfil their role with technical competence, paying careful attention to the people's welfare. As a consequence, he says the population just loves the King. The King, highly pleased, would decide his policies need not be changed. The consultant, on leaving the palace, is immediately offered a retainer to Le Comte de Major Foudes at 10,000 ducats per annum.

Neither advice is satisfactory. First, the future of the monarchy in 1779 was mixed. Although Louis and many of his Dukes and Comtes lost their heads 14 years later in the revolution that sliced through France, a few countries 200 years later still honour their monarchs.

Second, the consultant, if he remained objective, should have pointed out how the people were being exploited and, worse, their

muttering was growing louder. His best advice to the King would have been: "Circumstances are changing, you cannot continue using your old approaches, your old policies. You, the Dukes and Comtes will have to make some changes, difficult for you now, but in the long run, everyone will benefit."

## A Modern Analogy

Let us extend this historical vignette to the present food system and consider another three-cornered acerbic relationship. Just as the French citizens were locked into their political structure, modern consumers are locked into the commercial food system. Like the French citizens who began to object to the quality of their governing, consumers are now more than ever questioning the quality of their nourishment.

It is not the food enterprises, however, to whom citizens vigorously complain, rather it is to their government. For in assuming ultimate authority for quality, it bears the brunt of citizen concern. Moreover, the government not only regulates quality, it defines quality in the first place.

Just as Louis and his citizens drifted apart in their definition of quality of governing, a gap is widening between the government's definition of food quality and consumer's conviction of what quality should be. Louis' end came about because, with his thoughts and practices centered on past successes of French royalty, he lacked sensitivity to his subjects changing perception of how they should be governed. We pursue this analogy

because it stresses the necessity for a government to keep up with changing circumstances and when it doesn't, how it can frustrate the citizenry with its rigidity.

How does this relate to the quality of your food? Much of the argument over food quality results from changing perception of quality. Like Louis' ideas of Kingship, we find the government's perception dragging, because it is rooted in the nineteenth century definition of food contamination and chemical adulteration. The pure food and drug laws of this century did much to regulate filth, insect wings, rat droppings, microbes. We applaud this tightened control, but in dealing with chemical adulteration the government's record falls short of what the public has the right to expect.

Its approach to regulating chemicals in the food has been whether the food poisons you today or tomorrow. The public's perception of safety has advanced far beyond this nineteenth century attitude. It now expects, not to be poisoned 20 years hence (e.g. the cancer process may take 20 or more years after initiation). Although government regulatory agencies have a scientific base (not really adequate) on which to make decisions about immediate toxic effects, they have been caught in the 1970s without any approach on which to protect the public from the long term effects of food poisoning.

There is a second aspect to food quality — nourishment. Quality of nutrition until recently has received practically no attention from government regulators, a legacy of their almost total preoccupation with



contamination and chemical adulteration. The public, on the other hand, has long believed that the food they buy should provide quality nourishment. It is becoming ever less certain that this is the case.

### The Nitrite Issue

Why should there be a controversy over nitrite? After all, use of nitrite-containing salt for preserving meat predates the Roman period. For many people it was a matter of surviving the long winters, or sea voyages. As European societies evolved, the art of curing meat blossomed into production of a wide spectrum of hams, corned beef, sausages, bacon and, what today we call luncheon meats. All these processes use nitrite to turn the meat bright red, to give it flavour and to inhibit bacterial growth, particularly botulinal bacteria that form an extremely dangerous toxin. Although modern society provides a year-round supply of fresh meat, cured meats have become so popular that some 12 billion dollars worth is sold every year. Close to 60 percent of every pig slaughtered is cured.

The technique of curing hasn't changed since the Romans. The meat is soaked in a salt brine containing sugar, nitrite, nitrate, phosphate and sometimes ascorbic acid (vitamin C). The meat was once soaked up to three months in order that the pickling solution reach the innermost parts. Hams today are pickled within 1-4 days by pumping the solution through the arteries of the carcass. Frankfurters are made by emulsifying meat, fat, chemical additives, with the pickling solution and then forcing the emulsion into casings which are cooked.

With such a history of satisfied customers, it would seem almost sacrilegious to question the validity of the curing process, yet questions are being raised as to the long-term safety of cured meats.

### Nitrites and Cancer

The key ingredient in the pickling process is nitrite, added as sodium nitrite. Thus, there was a great deal of apprehension among meat industry officials when, in 1956, scientists found nitrosamines, which can be formed from nitrite (see Box), to be carcinogenic. Subsequently, it was found that nitrite reacts with substances in the cured meat to

### Nitrite, Nitrate and Nitrosamines . . .

Both nitrate and nitrite are added to pickling solutions and meats as preservatives. Although the controversy centres around nitrite, nitrate converts to nitrite — and both end up as nitrosamines when eaten.

NITRATE	bacteria in food and in human gut	NITRITE	reaction with amines present in all food	NITROSAMINES
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The power of nitrite to cause cancers is disputed. No one, however, questions the carcinogenicity of nitrosamines — which is akin to admitting a bullet can kill, whilst denying that a gun can.

form nitrosamines. In addition, the human stomach turns out to be an excellent chemical reaction vessel because the nitrite of cured meats reacts with substances from either the meat itself or other foods to form more of the deadly nitrosamines.

This revelation sparked consumer groups to request the government ban nitrite. After many years the Food and Drug Administration (FDA) (U.S.) and Health Protection Branch (Canada) responded by ordering manufacturers to reduce the level of nitrite in cured meat products to 200 ppm. The level, decided in agreement with the industry, was still high enough to achieve industry goals of: 1) imparting a bright red colour, 2) contributing to the taste and 3) inhibiting the growth of botulinal spores.

One can challenge all three of their reasons. The bright pinkish-red colour results from a reaction between the nitrite and the components of the flesh. Strictly cosmetic, it hardly is a valid reason. The contribution to taste also is questionable because it's the salt that dominates. The government regulatory agencies in terms of the botulism menace were quite generous in their allowance of the cancer-causing nitrite. W. Lijinsky, Frederick Cancer Research, pointed out that with good manufacturing practice nitrite-control of botulism could be achieved at one tenth the government approved level (20 ppm).

These agencies, however, mindful of a certain degree of sloppiness in the industry, opted for the higher levels.

### To Ban or Not to Ban

One might ask why nitrites weren't banned in the U.S. under the

Delaney Clause, which forbids the use of any additive that causes cancer. Two reasons: It seems that the use of nitrite in cured meat was thought by FDA to have received prior sanction as a preservative in the early 1920s which exempted it from the Delaney Clause. Second, nitrite itself was not believed to cause cancer, even though it is virtually impossible for it to pass through one's digestive tract, without forming the dangerous nitrosamines. This fact didn't sway legal hair-splitters.

The notion of prior sanction brings to mind the French King's long standing belief in absolution — the King's actions, whatever they might be, were the law. Louis XVI, when the going got rough, tried to fall back on his sanction, but found it didn't persuade the public, who by this time said, to hell with prior sanctions and demanded the King face the problem at hand.

In any event, the argument over the use and misuse of nitrite continued for over 20 years with no resolution until August, 1978. At that time the results of a study commissioned by FDA and carried out by Paul Newberne, Massachusetts Institute of Technology (MIT) were announced. Nitrite by itself is carcinogenic.

The government could no more ignore that finding than a macho bull could ignore a red flag. If the Delaney Clause applied, FDA by law, was compelled to ban nitrite immediately.

The Newberne study did indeed galvanize the government into action, but not the way consumer groups had hoped. Joseph Califano, Secretary, Health Education and Welfare, the parent of FDA, stepped

in and insisted that the matter be handed over to the Justice Department to sort out whether the Delaney Clause or prior sanction applied.

The need for legal opinion seemed somewhat mystifying. Gilbert Goldhammer, on the staff of the House Operations Subcommittee on Intergovernmental Relations pointed out that nitrite was never prior sanctioned as a preservative, but only as a colour fixative. In this case, nitrite would clearly fall under the Delaney Clause. FDA, clinging desperately to the prior sanction, disputed Goldhammer, saying that the 1920 lawmakers clearly intended to sanction nitrite as a preservative.

Not only is FDA involved, but the U.S. Department of Agriculture (USDA) has a clear responsibility because of its jurisdiction over meat. But, it too found a convenient prior sanction. Although USDA acknowledged nitrite is poisonous, they defined it as a non-adulterant. An adulterant under the Federal Meat Inspection Act, like application of the Delaney Clause, requires an automatic ban. USDA however, does not hesitate to define nitrosamines as adulterants. In applying the terms of The Meat Inspection Act, USDA cracks down on all bacon manufacturers who allow nitrosamine (formed during manufacture) above a bureaucratically determined level.

It seems USDA views its jurisdiction as ending the instant the bacon is chewed. The nitrosamines formed in the digestive system from the nitrites/nitrates added to bacon fail to fit any bureaucratic niche, and hence escape regulation. In effect, we have legal carcinogens and illegal ones. We wonder if your body tissues can tell the difference?

If USDA had any qualms about the silliness of its position, they were dispelled when U.S. District Judge G.A. Gesell, upheld the prior sanction for nitrite. USDA's position had been challenged by a Ralph Nader affiliated group, Public Citizen, on the distinction Goldhammer had pointed out. Judge Gesell refused to get into scientific subtleties and, in effect, said a prior sanction is a prior sanction.

#### A Legal Bog

Until the announcement of the

Newberne results, the nitrite argument was proceeding so leisurely that it looked like use of nitrite in food was safe for another 2,000 years. Thus, one can only marvel at the speed at which government authorities ensnared the nitrite issue in legal tape. Twenty-two years of accumulated scientific evidence capped by the Newberne study thoroughly documented the health hazards of adding nitrite to foods. But, the agencies timidly refused to act because of the industry's contention that without nitrite-cured meats could not be protected from botulism. The industry claimed they would have to shut down a large part of the cured-meat production if a ban was declared.

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**"Nitrite doesn't prevent botulism, it merely retards it. The fuss is all about a brief extension of the shelf life of cured meat."**

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The force of that argument came through loudly in the declaration of Canada's Monique Begin, Minister of Health and Welfare. In response to the Newberne results, she announced "On the basis of a benefit to risk assessment, I have concluded that the elimination of nitrite would not be warranted." She did add that nitrite and nitrate would be phased out if a safe and effective substitute became available.

In the meantime faith of the Canadian authorities in nitrite was demonstrated when they allowed Canadian cheese manufacturers to start adding nitrite, a hitherto prohibited use. In the U.S. nitrite is banned from cheese.

The benefits Begin referred to were the jobs and economic worth of the cured meat industry which are real enough. These benefits also weighed heavily on USDA and FDA, but unlike in Canada, which lacks such rules, the Meat Inspection Act and the Delaney Clause were forcing a decision unfavourable to the cured-meat industry. Hence, the haste in Washington to bind the

nitrite issue in legal tape so strong neither law could extricate it.

You may wonder what ever happened to the risk of cancer and other possible health hazards. Somewhere in this legal bog the public interest seems to have been sucked right out of sight.

#### The Defence of Nitrite

The meat industry, led by its trade association, The American Meat Institute (AMI) reacted swiftly and strongly to the Newberne study and the threat of possible government action. They claimed 400-600 cured meat products would vanish, tens of thousands of jobs would be jeopardized and millions of frankfurterless consumers would be angry with the government.

They attacked the threatened ban with two arguments. First, they reemphasized that without nitrite they could not control botulism in cured meats. The botulinal organism can exist as spores which are extremely hard to kill. According to AMI, in order to ensure that all spores are eliminated, the meat would have to be cooked into a shapeless unappealing pulp. The added nitrite retards the germination of the spores causing production of fatal toxin.

The toxin would be destroyed if the meat were cooked by the consumer, but many luncheon meats are eaten cold. AMI for the past 22 years has insisted that it has found no alternative technique to controlling botulism.

Second, AMI attacked the Newberne study as both incompetent and irrelevant. Richard Lyng, president, cited an FDA audit done during the progress of the Newberne experiments, which pointed up faulty laboratory practice. Lyng insisted that such faults invalidated the results. But, the defects turned out to be minor and an independent review by other scientists didn't agree. They concluded that the experimental work was first rate.

Having struck out that one, Lyng turned to Newberne's conclusions and here he got some support because not all scientists could agree on the significance to humans of Newberne's rat experiments.

A scientist-Congressman, James Martin, together with William Wampler, introduced a bill in Congress to block any possibility



of a nitrite ban. Martin, wearing his scientific hat (Ph.D. in chemistry) declared the conclusion, that nitrite is a carcinogen, invalid because no proportionality existed at the low levels humans would be exposed to. He calculated that a person would have to eat 1586 pounds of bacon a day to get the equivalent amount of nitrite the experimental rats received. Further, he claimed that banning nitrite would remove only 2.1 percent of daily human exposure to nitrite — the rest not being subject to government control.

Martin's last statement was based on a study by Steven Tannenbaum of MIT who had shown nitrite is produced naturally in the lower bowel by bacterial action. In addition, Tannenbaum and Robert Bruce, University of Toronto, had shown that the nitrite produced this way reacted with amines\* in the faeces to produce the daily nitrosamines. Tannenbaum and Martin contended that dietary nitrites were insignificant in amount, in comparison to what one's own bowels generate. Hence, they both concluded banning nitrite in meat would not change one's risk of contracting cancer.

Tannenbaum calculated the adult daily exposure to nitrite as a food additive is three percent compared to 15 percent generated in the saliva, and 82 percent generated in the bowels.

### The Anus is not the Mouth

This argument deserves careful scrutiny. The position that dietary nitrite is insignificant in comparison to other sources shows up another flaw common to those who argue from analytical data. Indeed, one can make accurate measurements of nitrite and nitrosamines in sausages or human bowels. Science, however, cannot extend this precision to the interpretation of one's susceptibility to cancer. Thus, Martin and Tannenbaum, in making their judgements, moved from a set of precise analytical numbers into the imprecise and hazy realm of predicting cancer risk.

Such conclusions confuse the lay person who doesn't realize the little strategem being played out under the guise of scientific objectivity.

Another large hole in their argu-

ment is the fact — rather obvious — that the top end of your alimentary tract is somewhat different from the bottom. One cannot assume that dietary nitrites and nitrosamines introduced in the mouth, regardless of quantity, present a lesser risk than those produced in the bowel. To suggest that the dietary nitrites/nitrosamines are insignificant in terms of cancer risk is totally unsupported by any scientific experiment.

Induction of cancer by chemicals is like a black box into which you put something and a result comes out. We know it happens, but the how and why are totally obscure. For example, if we all generate nitrite in the bowel, why doesn't everyone succumb to cancer? Obviously protective mechanisms exist and only when one's native defences are overwhelmed does a tumor start. Having established that nitrites/nitrosamines are cancer producing, should we deliberately increase the risk of overwhelming the body's defences with additional nitrite in the diet?

### Casting Aspersions

In 1779, French citizens were saying we need to be governed, but do we have to be governed so badly. In 1979, consumers are saying we need to eat, but do we have to be slowly poisoned in the process?

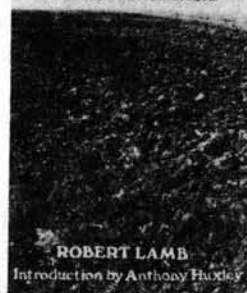
There are those who deny that we are being poisoned. The Council for Agricultural Science and Technology (CAST), a body of university scientists generally supportive of existing agricultural and food policies, stated that there is no evidence that any human cancer has resulted from nitrosamines in food.

The CAST statement, a frequently heard sentiment clings to fallacious logic designed to muddy the issue. On its face, the statement is correct, but when a body of scientists pronounces such, the implication to the lay public is that nitrosamines and/or nitrite as used in the meat industry are not harmful to humans.

Has CAST ever put 1,000 humans in cages for 30 years and fed them nitrosamines/ nitrite - containing food? Without having done an experiment, these scientists draw, what to the public seems is a scientific conclusion.

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\* Amines are normal constituents of most foods.

The correct statement is that we don't know, but in view of the fact that nitrosamines/nitrite cause cancer in laboratory animals, we would suspect that humans are susceptible. If a substance causes cancer in animals, it will do so in humans.

### Chemical Innocence

The CAST statement strongly reinforces the outdated policy that a substance used in food manufacture has to be proven guilty beyond reasonable doubt before it is removed. Moreover, the burden rests on those who would question the safety to prove a substance is unsafe.

FDA is put in the position of having to build a scientific case, a slow and tedious task. The Newberne study which it commissioned took over three years, cost five hundred thousand dollars and as we note, lacked unshakable authority. The fact is, any experiment concerned with food safety can be challenged, because the scientific methodology by its nature is not precise.

The policy should be reversed and the burden placed on the users to prove their additives safe. This policy from the consumer's point of view seems eminently superior, but it faces a historical handicap. Before the food and drug laws began to tighten the screws on adulteration, the food industry had incorporated literally thousands of additives into its manufacturing practices. In their desire to interfere as little as possible, legislators granted exceptions, grandfather clauses, such as prior sanction for nitrite. The legislators assumed that if a substance was already being used in food, it must be harmless.

Nitrite is only one of thousands of additives that fall into some kind of grandfatherly category. Few of the rest have received any attention at all. And, of those that have, as each has been investigated in depth, doubts about its safety arise.

### Botulism Everywhere?

How real is the threat of botulism, a threat that has effectively paralyzed government decision makers as if they had the disease itself? The bacteria *Clostridium botulinum*, lives in the soil. Part of

its life cycle is spent as a spore, a tiny robust particle resistant to heat. The spores adhere to dust particles and thus float everywhere including food factories. Since factory hygiene plays a critical role, contamination is erratic. In a study of 684 bacon samples, for example, 30 were found to be contaminated with germinated spores.

The spores, if conditions are favourable, germinate into a colony of mature bacteria which make a toxin. It is the toxin that is so dangerous, killing about one third of the people who are stricken. Cases of botulism are so rare, however that when they do happen, they make headlines. One reason is that the toxin is very unstable to normal cooking temperatures.

The spores germinate very slowly, especially when held at refrigerated temperatures. Bacon deliberately contaminated with a large excess of spores and held at summer temperature (81°F) did not become toxic until after 10 days. If the bacon had been held in the refrigerator, the time would have been much longer.

Nitrite doesn't prevent germination of the spores, it merely retards them. So what the fuss is all about is a brief extension of the shelf life of cured-meat products.

In reaching for what it considers the holy grail, unlimited shelf life, the cured-meat industry seems to be trying to copy the breakfast cereal and canned vegetable industries, whose products last for decades.

What seems to have been forgotten in this issue is that consumers possess some intelligence. They know how to refrigerate meat and they don't plan to keep it for very long. Consumers would be receptive to being given throw-away dates.

The industry, however, is less concerned about how long the consumer keeps the meat, it wants extended shelf-life for its own purposes. There has been a steady shift away from small local plants to a few central plants dominated by transcontinental corporate giants. One cost of these complex distribution systems is the excessive time required to deliver products to the consumer.

### Corporate Lethargy

Does a small child willingly seek

an alternative to its security blanket? No matter how tattered, he or she clings to it. Nitrite seems to provide a needed security blanket. Witness the statement from AMI.

"Sodium nitrite is absolutely unique — it injects colour, flavor, and is a preservative." Without nitrite, the statement continues, the commercial success of frankfurters and similar meat products would be jeopardized. The statement cited a taste panel that concluded frankfurters prepared without nitrites had a poor flavour and, moreover, this off-flavour was detected within one day of manufacture.

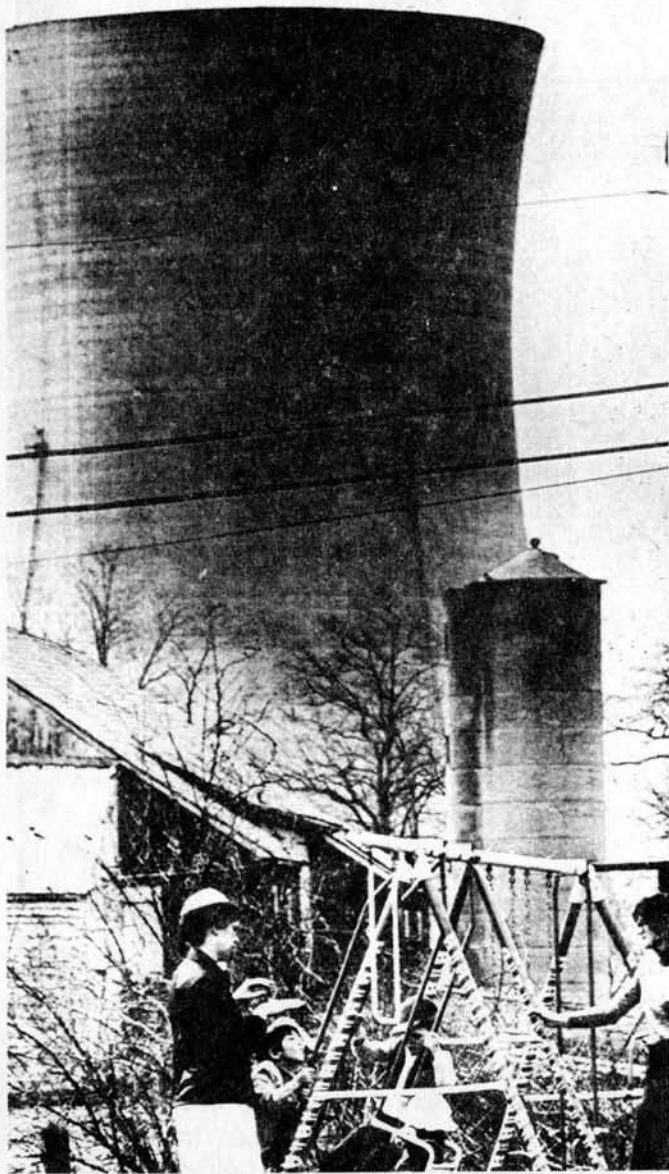
This statement underscores a faith which, however, does not bear up to fact. There are now companies, small ones, that successfully sell tasty nitrite-free products. When given the opportunity consumers seem to prefer them. A local producer in Iowa claims to have captured 90 per cent of the market in its area with a nitrite-free bacon.

Nevertheless, the big producers cling to their nitrite and have made essentially no attempt to research alternatives. In spite of \$12 billion a year in sales, AMI, the industry trade group, has funded only \$80,000 a year for nitrite research. In terms of the cost of scientific research, that paltry sum wouldn't even feed Newberne's rats.

Industry, under pressure, now seems to be stepping up its research, but it is all directed towards finding that magic replacement for nitrite. In capitulating to the industry definition of the problem, C.T. Foreman, Assistant Secretary of Agriculture announced that nitrite won't be banned until an acceptable substitute is found. USDA will add one million dollars to the search for a nitrite substitute.

One notes that all this maneuvering is designed to avoid disturbing an established mode of processing and distributing a food product. Nitrite inhibits *C. botulinum* because it is a poison. Will a nitrite substitute be any less of a poison?





# Living on a Knife-Edge -

## The Aftermath of Harrisburg

by Peter Bunyard

**Why was the Three Mile Island nuclear plant rushed into service? How was the accident there caused? And has it sounded the death knell for the nuclear industry?**

The nuclear accident at Three Mile Island may not have been the worst reactor accident ever. In all probability the Windscale fire of 1957 and the resultant escape of tens of thousands of curies of radioactive gases far surpassed the discharges from TMI, while as meltdowns go, that at the Enrico Fermi fast breeder reactor near Detroit, may have got closer to the classic China syndrome, in which a large blob of molten core burns its way — uncheckable — through the reinforced concrete containment structure and down into the earth below.

But times have changed. In the 1950s and 60s nuclear technology and its high priests were sacrosanct, and in the climate of the cold war the public was far less likely to dispute what it was told. If a medical authority proclaimed that the radiation releases were harmless, then harmless they were deemed to be; few complained that no government team was set up to investigate in depth the medical aftermath of Windscale. Today, people want to know what is happening to them, and they want the truth: not cover ups.

### A Sequence of Accidents

The accident at TMI has been well described by Lee Torrey in *New Scientist* and Jim Harding in *Friends The Ecologist* Vol. 9 No. 3 June 1979

of the Earth's *Not Man Apart*. Between 3 and 4 o'clock in the morning, with the reactor nearly at full power, a 6000 horsepower pump for feeding water to the secondary cooling system failed, followed afterwards by an auxiliary feedwater pump. With both pumps out the turbine tripped, so that the reactor, although still generating heat at full power, was no longer generating electricity. So far just two seconds had passed. With the secondary cooling system gone, the coolant flowing through the reactor core in the primary system began to heat up above the 580°F operating temperature and in four seconds the primary loop pressure had risen several hundred pounds per square inch above normal. A few seconds later the reactor automatically 'scrammed' with control rods dropping into the reactor core. So far so good; the reactor had behaved as it should in an emergency situation.

A bare fifteen seconds after the initial pump failure the primary loop temperature was still rising above 600°F, while the pressure had dropped to below 2,200 pounds per square inch (psi). When the reactor pressure had fallen to 1,600 psi the emergency core cooling system switched on, and high pressure boronated water was blasted into the core.

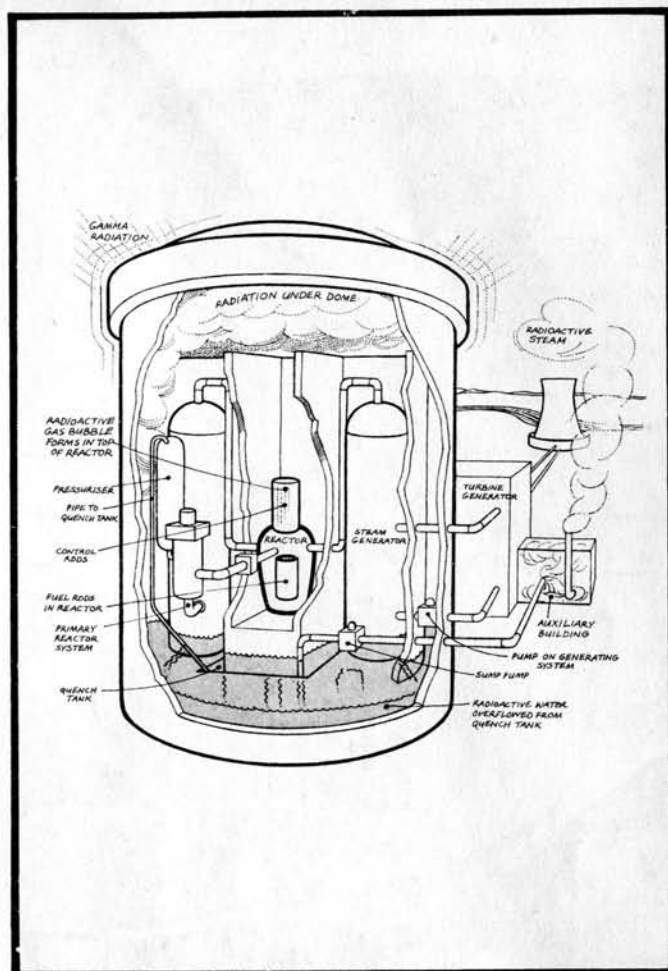
To counterbalance the influx of emergency cooling

water, a pressuriser allows excess pressure to bleed off. At TMI the valve on the pressuriser, set to close at 2,200 psi remained stuck open and not only did steam and water spew out into a quench tank below the reactor but water inside the reactor flashed into steam, creating 'voids'. The operators were faced with an incomprehensible situation. On the one hand the controls indicated a possible 'blowdown' with loss of coolant from the core, on the other a pressure indicator in the pressuriser showed rising pressure and triggered off the opening of bleed valves, releasing for the first time small amounts of radioactive vapour. At that point the pressure indicators went off scale and the only information fed to the operators on the computer print-out was a string of question marks.

### Near Melt-Down

The emergency core cooling system serves to keep the core covered when there is loss of coolant from the primary system, but its excessive use is risky in that it can overpressurise the core and rupture fuel rods. The operator, probably with the fear of overpressurisation in mind, shut down one of the emergency cooling systems. A minute and a half later, just six minutes after the initial pump failure, the coolant flashed to steam and the pressure dropped to 1,350 psi. Bathed in 'voids' rather than water, the reactor core heated up instantly because of continuing radioactive decay. Temperatures as high as 2,700°F may have been attained in the core, sufficient to rupture fuel rods and release their contents. Another 600°F and the heat would have been sufficient to initiate a full blooded core meltdown. From the *New Scientist* account, the situation within the reactor was 'heads I win, tails you lose'. Water is vital for cooling and for sustaining the pressure, but once the core heats up to above 2,700°F, the addition of water to the reactor can bring about autocatalytic hot fuel cladding/water reactions which evolve more heat and will release hydrogen. Whether the operator saved the day by pulling out the emergency core cooling system, so preventing further autocatalysis, or whether he brought about even more damage through exposing the reactor core, has become one of the controversies in the reactor post-mortem.

It was at this stage, eight minutes from zero, that the operators discovered that valves in the auxiliary feed-water pumps had been left in the closed position as a consequence of a routine maintenance drill some two weeks before. The valves were opened and a few seconds later the steam generator pressure began to recover. That was followed by the pressuriser level indicators coming back on scale. The operator then tripped out the second emergency core cooling system but changed his mind a minute later. Meanwhile steam voids in the primary coolant system were making the primary coolant pumps splutter and at 5.15 am the two primary coolant pumps had to be tripped manually to prevent them burning out; half an hour later the auxiliary feedwater pumps were shut down for the same reason. By 7 a.m. some of the core was exposed, clear of water, and a partial meltdown occurred, causing the core temperature to soar to temperatures approaching 3,600°F — "high enough theoretically" reports Torrey in *New Scientist*, "to trigger core collapse and possibly



Stewart Lowdon

a massive meltdown."

According to Darrell Eisenhut, Deputy Commissioner of the NRC, the computer measuring temperatures at the top of the reactor, befuddled like its counterpart on the pressuriser, began printing out question marks — a sign that the computer had failed, the thermocouple had failed or the fuel rods were failing. "It is everyone's belief," he exclaimed "that the fuel rods were failing".

Because of the faulty pressuriser valve, water and steam continued to blow out into the quench tank, until it had reached capacity, and its rupture disc blew off as intended. At this point water spilled out into the reactor basement, triggering off a sump pump which began to shift the spill to a tank outside the containment structure. Two hours later the auxiliary tank was filled to capacity and relief valves opened, venting radioactive steam. Two technicians, caught unawares, picked up at least three rads each, of radiation. Meanwhile radioactive steam in the containment dome escaped through extractor fans into the atmosphere and drifted northwards over Harrisburg.

### Radiation Vented

Just before 7.00 a.m. an on-site emergency was declared and a general emergency at 11.00. Nevertheless Metropolitan Edison, the company that owns Three Mile Island, continued to issue bland, pacifying statements. "When we say general emergency", said Jack Herbine, vice president of the utility, "it does not mean that an emergency exists. There was nothing that was catastrophic or unplanned for." Later he remarked that "as soon as we found that there was the



slightest chance of radiation, we stopped venting into the air." In fact by 11.00 a.m., radiation levels were measured at three millirems per hour just 500 yards offsite; and as high as 50 millirems per hour in the wind. Since average background radiation amounts to little more than 100 millirems per year, a person standing offsite would be exposed to as much radiation in one day from TMI as he would get naturally in a year. Meanwhile the NRC was making somewhat more truthful statements than Met-Ed, and admitted that venting of radioactive gases would continue for several days.

A major item in the news in the first few days following disclosure of the accident was the build up of a large 1,800 cubic feet gas bubble above the reactor core. The danger was that hydrogen from the radiolytic breakdown of water would form either a flammable or even explosive mixture with oxygen. As it happened the hydrogen concentration crept up to some 2.6 per cent nearly three days after the original accident, only a couple of per cent below the risk of fire. The bubble also represented another hazard, in that if the operators cooled the reactor too quickly, or allowed the pressure to fall further, the bubble would increase in size, thus exposing more core and the likelihood of further meltdown.

Obviously no-one within the nuclear industry seems to have predicted the risk of a bubble of that dimension, nor the creation of so much hydrogen, consequently the reactor lacked any proper contingency for dealing with the problem. It also transpired that one small hydrogen explosion had already occurred in the reactor at the beginning of the incident. News about the explosion caused some acrimony between the NRC and Met-Ed, moreover it led to increasing doubts about the truthfulness of any public statements on the state of the reactor. The NRC claimed that the explosion occurred early on Wednesday, the day of the accident, while Met-Ed put the time of the explosion at 2 p.m. the day after. Both the NRC and Met-Ed agreed that the blast would have been wholly contained within the reactor structure.

### Evacuation

With no clear, established technique of dealing with the bubble, and with the threat of an explosion hanging over the plant, Joseph Hendrie, NRC chairman, considered the possibility of evacuating all residents in a wedge-shaped area 10 to 20 miles downwind of the plant. "It may turn out to be a prudent, precautionary measure", he said. "We wouldn't at all wait for a demonstrated disaster." Meanwhile State Governor, Richard Thornburgh, who had first reacted to the accident by proclaiming that no one was in danger, now recommended that all pregnant women as well as children under five living within a five mile radius of the plant should be evacuated.

However on Friday evening, technicians at TMI managed to reduce the bubble in size by increasing the flow rate of cooling water through the reactor. It was a critical situation with no one sure of the outcome. Frank von Hippel, a member of the American Physical Society's special study team on Rasmussen's reactor safety study exclaimed later, "*I believe there was a*

*40 per cent chance of a core explosion, divided fifty fifty into small and large events. The small event would have resulted in major offsite exposure and permanent land contamination. The large event would have been a full-scale nuclear meltdown.*"

### Cost of Clean-up

The cost of dealing with the crippled reactor will undoubtedly run into millions. According to Robert Bernero, Assistant Director of Materials Safety Standards, it will be at least one month before anyone gets inside the containment dome to assess the damage, and he reckoned on four years or more to clear up the mess, including extracting the ruptured fuel rods. It may well be that the crane used to extract fuel rods above the reactor core will also have melted down. Whether the reactor will be worth salvaging at the end of the clean-up operation is anyone's guess. The chances are that it will be cheaper to build a new one.

### Why was TMI Hurried into Service

The TMI reactor had been in operation for barely three months before the incident on March 28. Some people, including Mark Widoff, the State Consumer Advocate, have been questioning whether the unit 2 reactor was not rushed into service in order to gain state funds. In Pennsylvania, public utilities are entitled to a reasonable return on their investments through the rates they charge their customers. Metropolitan Edison first asked for a rate increase of 45 million dollars in June 1977, but with the reactor not yet working one year later, the State Public Utility Commission granted a rate 'hike' of only 2.5 million dollars. Immediately the utility asked for a rate increase of 81 million dollars — again on the basis that the reactor would soon be on stream. If nine months go by without a decision the rate hike request automatically goes through. The utility commission happened to grant Met-Ed 49 million dollars on Thursday March 29 — just one day after the incident, and precisely on the nine month deadline. In addition by getting the plant into operation on the day preceding the end of the year, Met-Ed qualified for depreciation of the facility against federal income taxes for the entire 1978. The savings amounted to some 3.3 million dollars. Whether financial considerations jeopardised safety considerations at the plant has now become something of an issue, especially since customers are being called upon to pay for the disaster. Mark Widoff expects the NRC to look closely at the possibility that the plant was rushed through the final stages. "I can't make any accusation, but it's a question that deserves further investigation."

### Closing Down Similar Reactors

The hard work comes now. Those investigating the skittle-like course of events and the extent of the damage caused both inside and outside the reactor will have to decide how close TMI was to major disaster; their investigation will hardly be made easier by the extremely high levels of radiation now to be found inside the reactor vessel and inside the containment dome. Initial assessments indicate that radiation inside the containment dome reached some 30,000 rems per hour, or a factor of 3000 higher than it should

be. If the investigators discover, and publicly admit their discovery, that the reactor was a hair-breadth away from an explosion or complete core meltdown, that surely will raise soul searching questions about the implications of continuing with such Light Water Reactors in the United States.

The US Nuclear Regulatory Commission, having been called in to control the crippled reactor, and with the mammoth task of unravelling what went wrong and why, initially decided that Babcock and Wilcox PWRs of similar design to the Three Mile Island installation, could be left in operation. Having called for the shutdown of five reactors because an essential feed pipe was of insufficient strength to withstand potential earthquakes it was clearly embarrassing to have to shut another eight reactors of the TMI type. Later, however, the commission changed its mind. One reason for reversing the decision, said Harold Denton, a safety expert with the NRC, was the realisation that mechanical malfunctions played as great a part in generating the crisis as did human error. The assumption seemed to be that human error could be more easily eradicated than mechanical error.

#### **Prior Knowledge of Faults**

As the body which gives operating licences and is supposedly overseeing the safety of reactors, the NRC's innocence in the TMI affair will certainly be challenged. Information is already emerging that the NRC knew of inherent defects in the Babcock and Wilcox reactors but preferred to overlook them in the conviction that malfunctions would not threaten overall safety. Hearings on the TMI incident are now taking place in Washington, and during one session the NRC admitted that valve failures of precisely the kind which happened at Harrisburg had occurred some 150 times previously during 'transients' in which power surges put the pressure up and cause blow-outs through a pressuriser valve. Transients are relatively common phenomena in such reactors and Denton admitted that valves stick on average once every fifty times they are used. That means each valve is likely to stick four times a year.

The Union of Concerned Scientists has continued its watchdog activities since publishing *The Nugget File* (see page 110), and Dr. Robert Pollard, a nuclear safety engineer whom the Union gained when he left the NRC, has revealed that the NRC has been sitting on reports from its own inspectors. As recently as January one NRC inspector, J.S. Creswell, reported that he had found 'corelifting' at the Davis-Besse reactor during cooling, the net result of which could be to hinder the movement of control rods used to shut off the reactor. The same inspector also mentioned one incident at a Babcock and Wilcox plant during which there was 'extreme difficulty in controlling the plant'.

In the same group of documents Pollard also came across a description written by a Babcock and Wilcox official of an incident in March 1978 at the Rancho Seco plant. On that occasion the plant's instruments began reading conditions incorrectly and 'the integrated control system' responded to erroneous input signals rather than to actual plant conditions 'resulting in a rapid cooldown of the reactor cooling system.'

Pollard claimed that such rapid cooldown could have caused a hydrogen bubble similar to that which threatened the Three Mile Island reactor. And how simply the incident began. Apparently while trying to change a bulb in the control panel at the Rancho Seco plant, a technician dropped it in the works and caused a minor shorting out. Subsequently Babcock and Wilcox officials pointed out 'the need for a close look at operator training and emergency operating procedures . . .' Pollard wonders how you train operators to respond to instruments that are reading incorrectly.

#### **False Reading Common**

False readings seem to be a perennial problem in reactor operation. At one of the hearings on Harrisburg, Carl Michelson, a senior nuclear safety expert of the Tennessee Valley Authority, told how he had sent a 30-page analysis to Babcock and Wilcox in which he described how a reactor operator could take the wrong corrective actions in response to false signals. Moreover Michelson referred to the likelihood of an operator switching off the emergency core cooling system during a crisis because of information received from the pressuriser. "A full pressuriser may not always be a good indication of a high water level in the reactor coolant system", reported the nuclear safety expert. It was a prophesy of Harrisburg where the operator did switch off the emergency core cooling-systems because of signals received about pressure levels in the pressuriser. Some safety experts believe that such switching off may have contributed greatly to the extent of the damage to the reactor core. In reply to his report Michelson received a letter from the manufacturers that made no sense to him.

#### **Psychological Problems**

One of the most horrifying aspects of the incident was its psychological effect on those living within a few miles of the reactor. The notion that the reactor works quietly, churning out megawatts is false for a start. The Garnish family live opposite the plant on the other side of the Susquehanna river. According to them trouble at the plant is always preceded by a loud gush of steam from a blast blowoff valve. They even timed the episode on Wednesday March 28 to 3.53 a.m. "The windows rattled. It was enough to shake us right out of bed". On asking Met-Ed what was going on, the company told Mr. Garnish it had men investigating. "What if radiation tests are positive?" Garnish asked. "We'll cross that bridge when we get to it", he was told.

Despite their proximity to the reactor, the Garnishes decided to sit it out and not voluntarily evacuate themselves. Perhaps they really believed Governor Thornburgh when he announced that radiation levels were '*not dangerous to normally healthy people*'. Nevertheless the tension of waiting was agonising, especially when news of a potential explosion was declared. Others who left feel exceedingly apprehensive about returning permanently. One family that had been growing its own vegetables, decided to give the garden a miss for the rest of the year.

Overall the horror of the episode manifested itself in a variety of ways. Some people rushed off to buy guns



and ammunition, the gun stores doing up to ten times their normal business. One shop-owner who 'had been too busy to leave' reported that 'people are concerned, but they don't know what about. They can't comprehend radiation. They can't see it. I think people are turning their fears to things they can comprehend, like looters, burglars, or going hungry'. As for food, business in some stores shot right up. One store selling military-style concentrated rations did 1,700 dollars worth of business in a couple of days compared to 25 dollars a week under normal circumstances. "One fellow came in and bought 26 cases and said he was coming for more", said one shop owner.

At the Hamilton Health Centre, Dr Samuel Clayton described how people were streaming in with complaints about chest, stomach and back pains and shortness of breath. "What they are suffering from is an overdose of tension and fear — the cumulative effect of non-stop worry about whether they and their families will be consumed in a nuclear holocaust".

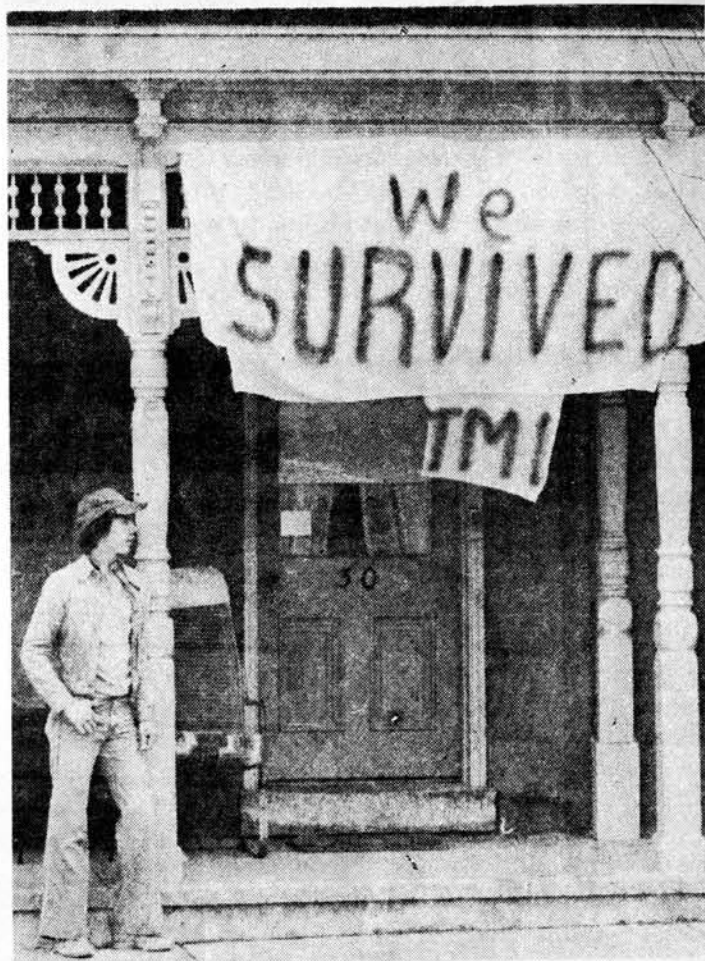
Said another doctor: "A typical reaction from a patient is 'My God, what's going to happen? The thing's going to blow up. Should I go? Shouldn't I go?'" One man proclaimed that he felt like a jackass leaving, "But I'd rather be a jackass and leave than be sorry I stayed".

Just as disturbing as the nail-biting reactions of adults living within the vicinity of the reactor are the reports of children's reactions. A great many of those questioned showed a cool cynicism about the world that had been created around them. Thus Joyce Eggington of the *Observer* tells how one girl, aged 12, sees no point in worrying about the dangers of nuclear power "because everything gives you cancer today — candy, gasoline fumes, even the chemicals they put in bread." And another child was not afraid of cancer because "anybody can get it, not just old people. I am not afraid of it because if the radiation gives me cancer it will take 20 years to develop and by then they will probably have a cure for it." The myth that technology will solve our problems, including those of degenerative disease, clearly dies hard.

### Reassessing Risks

Nuclear power has lost its innocence. The basis of its existence is increasingly challenged on both sides of the Atlantic. No more does the public implicitly believe officials who tell it that nuclear power is 'cheap, clean and safe'. In that respect the accident at Three Mile Island has strongly reinforced suspicions about nuclear power. Whereas Windscale, for example, was a primitive air-cooled military reactor with scant safety devices, and the Enrico Fermi reactor a one-off sodium-cooled breeder at the forefront of technology, the same excuses cannot be entertained for the TMI reactor. Indeed TMI is a standardised civilian Light Water Reactor, bristling with safety systems and subject to a host of stringent operating regulations. TMI is also one of the reactor types investigated in depth by Professor Norman Rasmussen and associates in their famous reactor safety study, and such reactors have been officially given a clean bill of health, with the probabilities of serious accidents considered so low as to be negligible. The chances of a core meltdown in a

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LWR reactor have been assessed by Rasmussen as one in one hundred thousand.

Harrisburg has even perturbed Professor Rasmussen and he is already talking of having to look again at probabilities. As it happens, the Union of Concerned Scientists, seems to be much closer to the mark in assessing risk (See *The New Ecologist*, Nov/Dec 1978).

### How many Deaths?

Nevertheless Met-Ed has stuck to its guns and continues to maintain that there will be no deaths as a result of the accident. Initially their claim was echoed by Joseph Califano, Secretary of the Department of Health, Education and Welfare. But US Government estimates of radiation releases since the accident have continually risen. First they were put at 1800 person-rem; then 3500 person-rem; and latest estimates have reached 5300 person-rem. The chances are that even higher releases will be admitted.

Curiously the official estimate of the number of deaths from cancer incurred by such releases remains close to zero. Statistically only one death is predicted, although Califano has acknowledged that there might be ten cancers and a handful of genetic effects among the two million inhabitants in a fifty mile radius from the plant.

But no one really knows how much radiation was released, nor how much each individual absorbed. Even radiation biologists cannot agree on the damage per dose received. Professor J. Rotblat, Emeritus Professor of Physics at St. Bartholomew's Hospital, estimated at least one hundred and twenty cancers on the basis of the first official figures given of radiation releases. He will surely be increasing several fold the

expectation of death by cancer among the local population.

Undoubtedly people have lost faith in what they are told by the experts and just because no one was killed outright that does not diminish the fear generated by the accident. Of course officials know that any cancers caused by the accident will be hard, if not impossible, to detect amongst the half million or so cancer deaths each year in the United States.

Clearly the accident was far worse than was admitted during those frantic first five days. The public feels that it was grossly deceived about the full seriousness of the situation, and moreover that if mass evacuation had been suddenly called for, it would have resulted in total chaos.

#### **Incident Predicted?**

One remarkable coincidence was the publication back in August 1978 of *Meltdown: Tomorrow's Disaster at TMI*, a fictitious account in which the reactor not only suffered a meltdown but also containment-bursting explosions. Curiously, the author, Larry Arnold, starts his story on March 28th, the day of the real accident, although Arnold's meltdown was set for Christmas.

*The Harrisburg Monthly Magazine*, in which the story was published, is government-funded, and furious officials of Met-Ed set out to curtail the funds by complaining to the Susquehanna Employment and Training Corporation, which had awarded support under a one year contract. Indeed Walter Creitz, President of the Utility, remarked that the original article was "sensational reading, not true, a horrible article and distorted". After a temporary hold-up the grievance was passed over, and in its November issue *The Harrisburg* reported that Met-Ed intended to hold an emergency drill at the TMI site. "During the upcoming drills," said the press release, "there will be no attempt to organise or drill the local citizens. The practice drill will exercise the in-plant crews and test off-site communications systems." When asked about the emergency drill, Creitz admitted that "anything humans make isn't perfectly safe", but concluded that "nuclear's going to go forward". How galling for him that TMI unit 2 has been so ungloriously shut down, perhaps never to be used again.

#### **The Cost of Nuclear Power**

Escalating costs have become the bugbear of nuclear plant construction. The Three Mile Island reactor originally cost 780 million dollars, and repairs after the accident may amount to as much as one billion dollars. The Price-Anderson Act, bought in during the 1960s in order to promote nuclear power, insures nuclear power plants to a maximum of 560 million dollars, with the Federal Government paying about 140 million dollars and private insurance companies the rest. There is thus a deficit of several hundred million dollars which must be found if TMI is to be resurrected. Indeed users of the utility are already expecting a twenty per cent or more increase in the cost of their electricity.

#### **Will the Nuclear Industry Survive?**

Because of Harrisburg, the New York State Power Authority is abandoning its plans to build a 1200 megawatt reactor in Cemento. In fact estimated costs

of the reactor have risen seventy-six per cent from 1.3 billion dollars to 3.1 billion dollars since June 1977.

Such cancellations, together with long delays in the construction of nuclear plants, have led to nuclear power making a far smaller contribution to electricity generation than was anticipated from orders in the early 1970s. Overall there are some seventy-seven nuclear plants in the United States, of which some dozen have now been closed on orders from the NRC. At best, then, nuclear power is contributing some twelve per cent to electricity generation and just a few per cent to total energy use. Undoubtedly the Harrisburg incident is the last straw for the beleaguered nuclear industry. Because of action taken by environmentalists against nuclear installations, safety requirements have been continually upgraded and a significant proportion of the construction cost is in improving materials and in trying to achieve fail-safe operating systems with multiple back-up devices. Responding to the trauma of Harrisburg, President Carter has stressed that further safety requirements will now have to be considered. That means greater delays in construction, higher costs and dwindling competitiveness between nuclear and other sources of power.

Carter is in a fix. He needs nuclear power as an important ingredient in his energy plan. Indeed with some areas like Chicago dependent, to the tune of fifty per cent, on nuclear power for their electricity, how can anyone possibly throw the switches on such plants, especially now that the summer is coming and with it America's apparently unrestrainable need for air conditioners? Carter has therefore told the nation that nuclear power is essential, and that if there is any cutting back to be done it must be in reducing oil imports. His message is clear: the United States needs nuclear power to survive as an industrial nation.

But against Carter stand a growing number of Americans. The massive May Rally against nuclear power in Washington, the Seabrook sit-in last year, and now a poll showing that two-thirds of Americans would gladly do without nuclear power even though that means cutting back on energy consumption, are clear signs of growing disenchantment with nuclear power. It is the same story in Europe. A referendum in Austria, in which fifty-one per cent of the electorate voted against nuclear power, has been followed by other anti-nuclear successes. In Denmark a recent opinion poll revealed that sixty per cent of those questioned were anti-nuclear, and in Holland the figure was as high as seventy per cent.

No longer can Americans trust their experts, and like children peering through the crumbling facade of parental authority, they are suffering the consequences of that psychological trauma. "We were told lies," they claimed at Harrisburg and they weren't far from the truth. If the authorities continue to force nuclear power down the throats of an unwilling public, then increasingly repressive measures will have to be taken to hold society together. A big accident again and all Hell could break loose.

Surely the lesson of Harrisburg is obvious. We cannot afford nuclear power: it costs too much, its wastes cannot be contained, its safety defies prediction and it undermines society.



# Green Crosses

There was a rather embarrassed silence at the other end of the telephone when Odile Faull told a french friend how many votes her husband, Jeremy, polled in the North Cornwall parliamentary election, where he stood as a candidate for the Ecology Party. Clearly the friend didn't know quite how to react: should he congratulate or commiserate?

"Four hundred and forty-two votes?"

"Yes! Didn't he do well!"

"That's marvellous," their friend replied with obvious relief. "How many voters were there? Was it a municipal election?"

"Fifty-five thousand. But no, it was the general election."

Another embarrassed silence.

By French standards, such a result would have been disappointing. In the French legislative elections in March 1978, for instance, ecologists gained 2.2 per cent of the national vote, and average! some six per cent in the seats they contested. But Britain's Ecology Party was fighting a very different political battle and the ground was certainly not to its advantage. Small parties are still something of a novelty in Britain and, without proportional representation, voters are reluctant to cast traditional political allegiances to the wind and throw their lot in with a party that has little or no chance of winning a seat.

On that score, for the Ecology Party to have netted over forty thousand votes in the fifty-three seats contested is no mean feat. The more so in an election that saw one of the biggest swings to a major party since the war and where, consequently, sympathy votes were few and far between. The electorate seemed convinced that this was a 'make-or-break' election — its last chance to choose between full-blooded socialism and a free-enterprise economy. Tactical voting was the order of the day and it was the small parties that lost out. Tories voted to keep the reds out of the bed, if not out of the bedroom; Labour supporters voted to keep 'that woman' out; and Liberals voted to prevent either of the major



Members of the National Executive at Eco's press conference.

parties from having a majority.

"People weren't voting for anything positive," comments David Fleming, press officer of the Ecology Party. "They were simply voting *against* one or other of the established parties. In that sense Britain has become a negative democracy — rule by whoever is disliked least. If people had been prepared to vote *positively* — for new ideas and new solutions — the Ecology Party would undoubtedly have achieved a phenomenal success. If we'd had as many votes as we had expressions of goodwill, then we'd probably be forming the next government."

In fact the Ecology Party's success is best judged by its performance against other minor parties rather than by its performance against the big battalions. Overall the party achieved an average of 1.6 per cent of the votes cast in the fifty-three seats it contested, whilst the National Front — with over thirty years political experience and heavy financial backing — only netted 1.3 per cent of the votes cast in the three hundred odd seats it fought. Indeed Eco trounced the National Front in seventeen out of the twenty-three seats where both parties had candidates.

It was successes of this kind that caught the eye of the media. That the Ecology Party had the organisation to field fifty-three candidates was impressive but that it distinguished itself so well against the National Front clearly meant that it had won its colours and attained political

maturity. Indeed it was significant that at the press conference held to launch the party's election campaign, the fifty or so journalists who attended were hardly interested in the party's attitude to such stock environmental issues as conservation and spent most of their time questioning Eco's policies on such thorny political problems as race, unemployment, Northern Ireland and agriculture.

Jonathan Porritt, Vice-Chairman of the party, sees the election in terms of a three lane motorway. "In the right-hand lane, there's a flashy little number full of people shouting rather loudly about individual freedom and driven with some panache by the unsmiling Woman in Blue. The vehicle is instantly recognisable as a Selsdon Convertible, not seen on the roads since 1970.

"Swaying along in the left-hand lane, its once bright red now peeling and faded, a clumsy old pantech-nicon advertises 'free fares for all'. Firing unevenly on diluted egalitarianism, its progress is clearly impeded by the fierce struggles that break out from time to time amongst the passengers, much to the anguish of the reassuringly dignified driver.

"Lagging some way behind in the middle lane, there's a peculiar orange contraption, made up of various odds and ends from the breaker's yard, backfiring noisily, and liable to veer over to the Left or Right without any warning. As far as one can see, it doesn't seem to have

a driver at all.

"And then down there by the side of the road as this cavalcade hurtles past, there's a bunch of rather earnest looking individuals some leaning against their green bicycles, shouting at the top of their lead-polluted lungs, 'Stop, you're going the wrong way!' and pointing somewhat forlornly in a totally different direction."

The 'unsmiling Woman in Blue' may have won this race to the House, but Eco's message clearly has appeal. Four thousand membership applications were received in the week following the Party's political broadcast on radio and television, and they are still flooding in. As the *Daily Telegraph* put it: 'It could be folly to dismiss as a bunch of well-intentioned cranks any party which fielded fifty-three candidates in its first General Election, even if they did all lose their deposits. The Ecology Party must be one of the fastest emerging political forces in the West.' Politically, it seems, the Ecologists have finally arrived.

Nicholas Hildyard

A Canvasser's view

## Is a Wink as good as a Vote?

"There's not much you can do now, but if you like you can go down to the polling station and stand there smiling at people and taking down their names and addresses if they want to help us — otherwise just pretend to write down their polling number..."

With these instructions I left Jonathan Porritt's house and trotted off along sunny Hamilton Terrace to the Church hall. I'd only heard about the Ecology party a week or so before, but with rosette and ECO badges pinned strategically on my person, I chatted in happy mood to the tellers for the other parties, and found that despite political differences there was great camaraderie.

There was, if anything, even greater camaraderie with the prospective voters. One very Tory lady walked up to me and poked me in the stomach. I doubled up and listened, indeed, I didn't have much choice.

"We've got to keep the others out, this time," she told me winking knowingly, "but get yourselves established, and next time round, who knows?"

The next to come my way was the Hampstead liberal type. She ap-

proached, grinning and giving the thumbs up sign, "Don't tell the others," she whispered theatrically, and she too winked as she tiptoed out of sight. Should I have winked back, I wondered? Was this some ECO code sign?

Soon afterwards a fiercely serious young man in a beard walked up the path. My first thought was that he was obviously a committed socialist, but I must have been wrong because, without looking at me, he strode past, raised his clenched fist and muttered the words "Rock on". Minutes later he strode out again and once again raised his fist while looking at no one in particular. "One more blow for freedom!" he said, and left to join the Hampstead Liberal.

Some people are of course committed to one party or another and often they walk right past the tellers without passing the time of day; but a large proportion seem to be 'floating voters' and 'don't knows'. At least one in seven at a guess, and they manage to look undecided even as they study the list of candidates. One man approached me and told me he had been out of the country for some years, and although he had come to the polling booth he didn't really think he would be casting a vote, because he didn't think much of any of the parties. Twenty minutes later he had voted Ecology and expressed a desire to help the party, going so far as to say that he quite fancied becoming a candidate himself.

A smiling middle-aged man stopped beside me. "How many votes do you think your chap will get?" he asked, "I've got a bet on you to get at least 400. You've got all the votes from our house, that's five." He won his bet easily, by over two hundred votes.

As a couple approached I heard the wife saying "I don't know... Ecology I suppose." Her husband obviously wasn't persuaded, but he did tell me that he had been impressed by the canvasser who came to his house and stayed for an hour even when he knew the chap's vote was going to someone else.

"I thought your party's broadcast was marvellous," said the Conservative teller. "If I was thirty years younger I'd vote for you. There ought to be an ecological system for disposing of the voting cards." A policeman who came by for a chat agreed. "It's a pity people don't take Ecology more seriously," he said, "The pollution in the streets is terrible."

Before I left the teller for one of the other parties beckoned me into a corner and whispered "Don't tell anyone, will you, but I voted for your lot!"

R. Shorter

## Quiet Radicals

By now ecologists have grown accustomed to established politicians stealing their clothes and turning them into rags — be it President Giscard sporting an oak leaf as his electoral symbol whilst commissioning yet more nuclear power stations along the Rhine, or the Prime Minister of Japan describing Narita as an 'environmental airport'. Rare indeed is the party that adopts the ecological message lock, stock and barrel — without consideration for quick electoral gains.

The Italian Radical Party is an exception to that general rule. A well-established party — with four members in the Italian parliament — its conversion to the ecological cause has been a gradual one, so much so that many of its two thousand members may not yet realise just how far the party has gone over to the Greens.

Although small, the party exerts considerable influence in the often confused world of Italian coalition politics. In part the Radicals' strength lies in their refusal to partake in the increasingly sterile and irrelevant arguments that separate the Left and the Right, from both of which, says Emma Bonino, one of the party's leading figures, the Radicals are increasingly isolated.

Instead the party is concerned with the more serious issues of political decentralisation, federalism, and the preservation of cultural diversity. Significantly the party has been extremely active in defending the rights of such groups as the Sardinians and the inhabitants of the Val di Fassa in the Trentino to preserve their customs and teach their respective languages in local schools.

The party has also been concerned with civil liberties, including womens' rights, and it has fought hard to obtain legislation to permit divorce and abortion. Another of its concerns is 'La Caccia', the large-scale massacre of song-birds that takes place in Italy every year.

More recently, the Radicals have taken up the nuclear issue. Emma Bonino was a member of the Parliamentary Commission on Nuclear Power. Totally unimpressed by the arguments used the pro-nuclear experts who testified at the hearings, she became determined that the Radical Party should throw its weight behind the anti-nuclear lobby.

Decentralisation, cultural diversity, federalism, civil liberties, birth control, preservation of wildlife and a passionate opposition to the development of nuclear power — these are some of the main ingred-



ients of any ecological policy, and it was inevitable that, sooner or later, a party with such concerns would come into contact with the Green Movement in the rest of Europe. Its first contact was in July 1977 when Marco Panella, the Party's leader, met Brice Lalonde, one of France's best known eco-politicians. The following year Panella attended a meeting of Ecoropa, the European Group for Ecological Action, in Geneva. Since then both Emma Bonino and Marco Panella have joined Ecoropa and regularly attend its meetings. They have also established a branch of Friends of the Earth in Italy.

Particularly interesting is the Radical Party's concern with direct government. The Italian constitution makes possible three different means whereby ordinary citizens can influence legislation directly. The first is the 'popular initiative', whereby parliament must debate a specific issue if fifty thousand people sign a petition asking it to do so. The second is the regional referendum, the procedure for which varies from region to region, but in general about thirty thousand signatures, obtained within a three month period, are sufficient to force the Regional Parliament to organise a referendum on a specific issue.

Finally, there is the national referendum which must be organised at the request of five hundred thousand citizens, whose signatures must also be obtained within a three month period.

The Radical Party makes full use of the three very valuable tools. This year, due to the party's energy and initiative, no fewer than eight referenda are in the offing, including one on 'La Caccia' and another on nuclear power. Emma Bonino is quite confident that the Italian people will vote 'ecologically' on both these issues.

*Edward Goldsmith*

## Election Results

### SOUTH WEST

**BATH** (Don Grimes) 1082 (2.2%) **Beat National Front**  
**BODMIN** (Chris Retallack) 465 (0.9%) **Beat National Front**  
**BOURNEMOUTH E.** (Jacky Dempsey) 523 (1.3%)  
**BRISTOL N.E.** (Gundula Dorey) 469 (1.25%) **Beat National Front**  
**BRISTOL W.** (John Ingham) 1154 (2.7%) **Beat National Front**  
**CHIPPENHAM** (Bert Pettit) 521 (0.87%)  
**CORNWALL N.** (Jeremy Faull) 442 (0.9%) **Beat National Front**  
**DEVIZES** (Ray Burcham) 713 (1.1%)  
**DEVON N.** (Tony Whittaker) 729 (1.1%) **Beat National Front**  
**EXETER** (Peter Frings) 1053 (1.9%)  
**GLOUCESTERSHIRE S.** (David Kerridge) 695 (1.0%)  
**HONITON** (Hilary Bacon) 1423 (2.0%)  
**LYMINGTON & CHRISTCHURCH** (Jim Keeling) 975 (2.2%)  
**ST. IVES** (Howard Hoptrough) 427 (1.0%)  
**SOMERSET N.** (Richard Carder) 1254 (1.6%)  
**TAUNTON** (Geoffrey Garbett) 1403 (2.6%)  
**TORBAY** (David Abrahams) 1161 (1.75%) **Beat National Front**  
**WESTBURY** (Sally Rodwell) 554 (0.9%)

### LEEDS AREA

**BARKSTON ASH** (David Corry) 1829 (2.5%)  
**BATLEY & MORLEY** (Clive Lord) 460 (1.0%)  
**KEIGHLEY** (Joyce Wade) 208 (0.47%) **Beaten by National Front**  
**LEEDS E.** (Anne Hill) 206 (0.4%)  
**LEEDS N.E.** (Sara Parkin) 813 (2.0%)  
**LEEDS N.W.** (Keith Rushworth) 847 (1.7%)  
**PUDSEY** (Peter Lewenz) 340 (0.6%)  
**RIPON** (Alastair Laurence) 781 (1.85%)  
**SHIPLEY** (David Pedley) 486 (1.0%)

### LONDON AREA

**BECKENHAM** (Biff Vernon) 762 (1.75%) **Beat National Front**  
**BRENTFORD & ISLEWORTH** (Irene Coates) 454 (0.8%) **Beaten by National Front**  
**CHINGFORD** (Steve Lambert) 649 (1.5%) **Beaten by National Front**  
**DULWICH** (David Smart) 468 (1.1%) **Beaten by National Front**  
**HENDON S.** (Geoffrey Syer) 563 (1.5%) **Beat National Front**  
**ISLINGTON C.** (Adrian Williams) 310 (1.2%) **Beaten by National Front**

**KENSINGTON** (Nicholas Albery) 698 (2.06%) **Beat National Front**  
**ST. MARYLEBONE** (Johnathan Porritt) 691 (2.8%) **Beat National Front**  
**HITCHIN** (Brian Goodale) 911 (1.45%) **Beat National Front**  
**READING S.** (Peter Dunn) 700 (1.2%)

### MIDLANDS

**BIRMINGHAM EDGBASTON** (Jonathan Tyler) 852 (1.8%)  
**LOUGHBOROUGH** (David Whitebread) 595 (0.98%) **Beat National Front**  
**WARWICK & LEAMINGTON** (Peter Sizer) 905 (1.36%)  
**WORCESTER** (John Davenport) 707 (1.2%)  
**WORCESTERSHIRE S.** (Guy Woodford) 1722 (2.8%)

### SOUTH EAST

**BRIGHTON PAVILION** (John Beale) 638 (1.5%) **Beat National Front**  
**CHICHESTER** (Nick Bagnall) 656 (1.2%)  
**GILLINGHAM** (Colin Fry) 501 (1.0%) **Beaten by National Front**  
**RYE** (Anne Rix) 1267 (2.2%) **Beat National Front**

### WALES

**BEDWELLYTY** (Peter Rout) 556 (1.4%)  
**PEMBROKE** (Brian Kingzett) 694 (1.1%)

### THE NORTH

**ALTRINCHAM & SALE** (Cicely Marsh) 796 (1.4%)  
**CROSBY** (Peter Hussey) 1489 (2.4%)

### EAST ANGLIA

**LOWESTOFT** (Tim Pye) 435 (0.65%)  
**NORWICH N.** (George Hannah) 334 (0.94%) **Beat National Front**

### SCOTLAND

**EDINBURGH S.** (Stewart Biggar) 552 (1.3%)

### Percentage Votes by Region

South West	1.5 per cent
Leeds	1.3 per cent
London	1.6 per cent
Midlands	1.6 per cent
South East	1.5 per cent
Elsewhere	1.3 per cent
Overall	1.5 per cent

The National Front stood in 24 seats against ECO and were beaten in 17 seats.

# Nuclear Costs – Are the Authorities fudging the books?

Last year, in an article in *The New Ecologist* entitled "The Hidden Costs of Nuclear Power", Colin Sweet wrote a critical review of the official figures on the cost of nuclear power, and argued that the real costs were much higher than either the CEBG or the AEA admitted. Since then the situation has changed in important aspects and both the CEBG and the AEA have dramatically revised their costs . . .

Compared with the figure given in Parliament for 1977/78 of 0.69p per KWhr for nuclear, (which was designed to show that nuclear was much cheaper than coal or oil fired power stations) both the AEA and CEBG have conceded that the real costs have risen much more rapidly than their figures reveal. In a Conference at the Polytechnic of the South Bank in November 1978, Dr Peter Jones, Head of the AEA's Economics and Programming Division, gave a figure for AGR Stations of 1.28p per KWhr. This still undervalued the actual costs for AGR output in the power station now being built. Dr Jones gave the construction cost for AGR's at £450/KW whereas the cost given by the South of Scotland Electricity Board for its Torness AGR Station is £650/KW. Moreover, Jones did not include the cost of capital or the R & D cost or waste disposal. If these were added, the revised figure would come well into the range of 1.5 - 1.8p/KWhr, that I gave as the likely cost in my evidence at the Windscale Inquiry.

The AEA latest costing was first published in an article by Jones in

the *Electrical Review* of March 7th 1979. A few days later, this was unexpectedly upstaged by the CEBG, at a public seminar in Cwmbran which had been called by the Gwent County Council to debate the CEBG's application for planning permission to build a new AGR station at Portskewett on the Severn Estuary. Pressed by local councillors as to the cost of the proposed station, Mr. P.G. Holbrook of the CEBG stated that the cost of the AGR output would be 1.8p per KWhr. This admitted high cost is surprising because it means: (a) that the CEBG is moving towards giving the real cost of the expensive technology that it is buying; and (b) that it is diverging publicly for the first time from the AEA. Thus the monolithic misrepresentation of nuclear power as the cheap option, which has been unceasingly pursued for fifteen years, appears to be ended. It is a development that I welcome, and it is without question the result of the pressure which the critics of nuclear power have exerted.

Of course, both authorities continue to assert that nuclear is cheaper than coal fired stations, but their argument is somewhat threadbare because they have to assume figures for the price of coal which are not those of the National Coal Board. Indeed, their tenuous position is revealed in a document of the Energy Commission (Paper No 6) which compares coal costs with nuclear costs. Figure I gives the Commission's forward projection for the prices of coal and nuclear fuels.

It can be seen that while coal prices are assumed in the first case to increase at the rate of 3 per cent per year, the nuclear prices are virtually stationary. Why? That assumption seems even more curious when we look at the rise in prices in the nuclear fuel cycle of existing nuclear power stations. They are as follows:

	1973/4	1975/6	1977/8
Fuel costs (including fuel handling)	0.116	0.282	0.505
(CEGB statistical yearbook 1977/78)			

Why does the CEBG not project this trend forward to the year 2000 in the same way as it projects other energy data? The answer is, I think obvious. The CEBG is currently searching the country for new sites for nuclear stations that it hopes it will get permission to build in the next few years. Local opinion, as at Portskewett, is increasingly sensitive and requires to be convinced that there is a need for a fifth nuclear station on the Severn Estuary. Significantly, at the Cwmbran Seminar, where several hundred people attended, the CEBG failed to show that there was need for the station and also that there would be economic benefit from replacing coal fired stations by nuclear ones. If there is no economic benefit from building a station, there can be no case. The reason is that there is no need to build nuclear stations. There is no shortage of energy at present and there will be no run down of fossil fuels for the U.K. for at least fifteen years, during which time we can diversify from coal as a base fuel and develop alternative energy supplies. Given the admitted risks (and those not admitted by the nuclear establishment) of nuclear power, why take such risks if there are no economic gains? The demonstration that the economic case of the CEBG/AEA does not stand up thus destroys their public credibility. It is important to make it.

Colin Sweet

Figure I.

		1985	1995	2010
Coal	Max			
	p/therm	15.2	20.2	40.0
Nuclear	Min			
	p/therm	9.6	10.3	11.8
	AGR			
	p/KWhr	0.400	0.441	0.503

Source: Energy Commission Paper No. 6



# BEYOND THE GREEN REVOLUTION

The Ecology and Politics of Global Agricultural Development

by Kenneth A. Dahlberg, Western Michigan University

*Beyond the Green Revolution* assesses the history, current uses, and future prospects of Western agricultural technology in underdeveloped areas. The author's method of "contextual analysis" provides a perceptive evaluation of the complex issues which determine world agricultural policies. His profoundly humanistic conviction is that the resolution of these issues can only be achieved by understanding *real* people, plants, technologies, and groups, within the context of their specific and evolving environments. 270 pp., illus., 1979, \$17.95 (\$21.54/£11.31 outside US)

# INTEGRATED PEST MANAGEMENT

edited by J. Lawrence Apple, North Carolina State University at Raleigh  
and Ray F. Smith, University of California at Berkeley

"Implementation of the concept of integrated pest management has and will continue to have a great impact on all people. The food supplies of the world are and will continue to be dependent on the management systems discussed in this book. I therefore recommend it to anyone involved with agriculture or forestry."

—Glenn A. Snow, *American Scientist*

Presenting contributions from the fields of plant pathology, entomology and weed science, this volume includes overviews of economic and international planning of pest management, and detailed studies of integrated pest management programs for tobacco, cotton, deciduous fruits, and forest crops. 214 pp., illus., 1976, \$25.00 (\$30.00/£15.75 outside US)

# PEST MANAGEMENT PROGRAMS FOR DECIDUOUS TREE FRUITS AND NUTS

edited by David J. Boethal, Louisiana State University, Shreveport  
and Raymond D. Eikenbary, Oklahoma State University, Stillwater

This volume presents the current status of pest management programs (IPM) in orchard ecosystems. Topics covered include a unique review of historical backgrounds and current IPM technology for almonds and walnuts, the development of programs for pecan weevil and other pecan pests, and case studies conducted in Oregon pear orchards and Pennsylvania apple orchards. This volume will serve as a diverse reference text for both the advanced student and field agriculturist. approx. 300 pp., 1979, \$29.50 (\$35.40/£18.59 outside US)

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## Books

### A Treeless Waste?

**PLANTING FOR THE FUTURE:** Forestry for Human Needs, by Erik Eckholm, *Worldwatch* Paper 26, available from The Ecologist. £1.00.

In ecological terms, the continuing decline in the world's tree and forest cover incurs heavy costs. Among the more spectacular are soil erosion and irreversible deterioration, the siltation of water courses and flooding. To take one example, the floods which in Autumn 1978 devastated West Bengal and Uttar Pradesh, resulting in 2000 deaths and the loss of crops valued at 750 million dollars, have their origins in the tree-denuded slopes of Nepal and northern India. The Third World suffers most of the forest loss presently occurring, and so feels the consequences most acutely.

Fully one third of the world's population depends on firewood for cooking and heating. Scarcity may mean a rise in prices to the point where it costs more to heat the cooking pot than to fill it; or, for a family which attempts to meet its fuel needs from scattered trees throughout the countryside, it may mean days of searching and gathering each week. Where no firewood can be obtained, the alternative is to burn dung, which could more fruitfully be used as a fertiliser; the World suffers most of the forest loss presently occurring, and so agriculture will be such as to reduce food production in Nepal by a million tons a year, and Nepal's present food production each year is no more than four million tons.

This by no means exhausts the consequences of forest and tree loss. Meteorologists, for example, are beginning to express concern

about the impact on atmospheric carbon-dioxide levels; conservationists worry about the threat to plant and animal species which are adapted to forest habitats; economists have come to realise that timber scarcity fuels inflation; and development planners find that their housing programmes are stunted by lack of the basic building material, wood.

In the latest *Worldwatch* paper, Erik Eckholm analyses the causes of forest depletion and examines possible remedies. He emphasises that the problem cannot be resolved by forestry reforms alone. Any attempt to expand — or even hold constant — the area given over to forest must contend with the pressure for land on which to subsist. To reduce this pressure demands effective population control and also, in many cases, a more equitable distribution of land: in a cash-crop economy, where the best land is given over to production for export, those who need a plot for cultivation and pasture to graze their animals will not shrink from forest clearance, even though the first rains may wash away the crops they plant and the soil which was to support them.

Turning to forestry itself, Eckholm argues the case for a community-based approach. Traditionally, foresters in poor countries have concerned themselves with large-scale timber exploitation for industrial and urban use and for export. This has left untouched the needs of the rural majority, who, not surprisingly, have felt no compunction in poaching wood from forest reserves or letting their animals nibble nursery plantations out of existence. Without the cooperation of local people, no forest-renewal plan can work: sabotage is all too easy. If, on the other hand, their energies were to be mobilised in the cause of tree planting, remarkable progress could be made. Such cooperation can only be secured by ensuring that those who do the work also gain the benefits, and this is the basis of community agriculture: a village evaluates its own forestry needs, decides how best to meet them, and undertakes the responsibility for implementing these plans. The role of professional foresters is to arouse the enthusiasm of poor

farmers for whom long-term ecological benefits have little force, and to advise the villagers not only on tree planting and husbandry but also on related matters such as the best use of their remaining land for cultivation and grazing, and modifications to woodstoves so as to make more efficient use of fuel. In principle, rural communities would learn, through the practice of village forestry, how to solve problems for themselves and so to create better lives and to be more self-reliant.

In practice, the success stories of forest regeneration have combined self-help with strong direction by central government, but successes there are. According to recent claims, China has increased its tree cover from 5% of the total land area in 1949 to 12.7% in 1978, an increase of 72 million hectares — and this in a country which in 1948 was written off as an ecological disaster area by one distinguished conservationist ('Millions will die . . .'). South Korea has made a recovery from the brink of disaster that is even more rapid: it began in the early seventies. On a more modest scale, the Indian state of Gujarat demonstrates the remarkable degree of cooperation which social forestry can generate. Although tree cover in Gujarat is the worst of almost anywhere in the world, and the need for wood is correspondingly desperate, there is no attempt to keep poachers out of new plantations, which are bounded by a trench or a row of cacti rather than secure fencing; despite this, loss through theft is slight.

Since the publication of this *Worldwatch* paper, the importance of its subject matter has been underlined by the tropical ecologist Dr Craig MacFarland, who predicts that by the year 2000 the world's tropical moist forest will have all but disappeared. Plainly the situation is serious, but Eckholm is at pains to point out that it is not hopeless: the examples of China, South Korea, and Gujarat show what can be done by adopting an appropriate approach and creating the institutional structures to implement it. What is required in the next twenty years, if the planet is not to be rendered a treeless waste, is the exercise of human ingenuity and determination.

*Bernard Gilbert*



**APPROPRIATE TECHNOLOGY** — Technology with a Human Face, P.D. Dunn Macmillan £6.95, paperback £2.50. **STEPPING STONES**: Appropriate technology and beyond, edited by Lane de Moll and Gigi Coe. Marion Boyars £4.95.

Nobody should write a book without a good reason. This is particularly true in the ecology movement, which must rate as one of the most immobile 'movements' of all time. By reading and writing enough books and journals, we can fool ourselves that we are making progress while in fact we are not just standing still — we are *sitting* still. Action, not words, is what will bring results. In J.K. Galbraith's words: "I want to change things. I want to see things happen. I don't just want to talk about them." So in considering two newly published books on Appropriate Technology I am strongly influenced by the likelihood of their leading to effective action. For readers who do not share my tolerance, let me outline the works in question:

*Appropriate Technology: Technology with a Human Face*, describes itself as a comprehensive introduction to the theory and practice of appropriate technology and its application to developing countries. The description is accurate. The book's emphasis is on the theoretical: no blueprints are given for constructing A.T. devices, but as a primer giving the whys, wherefores and basic principles of appropriate and intermediate technology it can hardly be faulted. It might almost have been designed as an undergraduate text. The book covers the politics and background of appropriate technology; food, agriculture, agricultural engineering; water and health; energy; services — medicine, building and transport; small industries in rural areas; education, training, research and development. The technical information is impeccable, as one would expect from an author who is Professor of Engineering Science at Reading University and Chairman of the I.T.D.G. Power Panel. Both technical and political points are put

across in an engaging, jargon-free style and the importance of practice is stressed throughout. In fact, the Galbraith quotation above was borrowed from the head of Professor Dunn's final chapter, entitled 'Getting Started'.

In contrast, *Stepping Stones: Appropriate Technology and Beyond* is not for the activist. It is an anthology of gems and snippets from the 'alternative' press collected by Lane de Moll and Gigi Coe. The thirty-nine articles range from 'The Soil and Health' by Sir Albert Howard to the classic 'Buddhist Economics' by E.F. Schumacher. There are contributions from Ivan Illich, John Todd, Amory Lovins, Richard Gregg, Howard T. Odum, Leopold Kohr . . . but none of them is new. Only the last five pieces were written specially for this book and they are by no means the best five. There is more than a hint of the coffee table, but the generally high quality of the snippets collected makes this book a temptation to the 'armchair alternative' in all of us.

If you intend to get involved in appropriate technology, there is no doubt that Professor Dunn's book will be a useful supplement to more specialised textbooks and practical handbooks. Otherwise I suggest that the best use for either of these books is as a gift for less enlightened friends and relatives.

D.S. Warren

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### Good and Bad Advice

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**YOUR OWN DAIRY COW**, Patricia Cleveland-Peck. Thorsons Publishers Ltd. £4.50, £2.75 paperback. **SHEEPKEEPING ON A SMALL SCALE**, Edward Hart. Thorsons Publishers Ltd. £3.50, £1.95 paperback. **LET'S GROW FOOD**, David Wickers and John Tuey. Julian Friedmann, £4.00 cased, £1.95 paperback.

The two most recent titles from Thorsons Self-sufficient living series are certainly among the best in this fast growing industry of teaching the uninitiated how to realise their dreams of self-sufficiency. It cannot be emphasised too often, however, that no amount of reading can substi-

tute for learning by experience, and the best advice to anyone contemplating taking on livestock is to go and work on a farm and discover what this really entails in terms of work, commitment, skill and money. Books can then be regarded as very useful supplementary guides, which will confirm your experience and answer your questions. If you are thinking about a house cow or a few sheep then here are the nearly ideal companions to your apprenticeship. Both are at pains to point out the problems and pitfalls that may beset you; they are practical and sensible and easy to follow, and since Patricia Cleveland-Peck evidently loves cows and Edward Hart is obviously happy when surrounded by his 'gentle creatures' they both convey a warm and almost irresistible enthusiasm for their subjects. So if you are at the stage of wondering whether self-sufficiency is for you or feel uncertain about branching out into livestock, these books can help. Buy them and read them and then please go out and try the real thing before you make your decision.

My only quarrel with Patricia Cleveland-Peck is that she does, in common with other recent books on small scale dairying, include a paragraph telling you how to milk — don't be taken in; she knows you can't acquire this skill from a book and she rightly advises you to learn how to do it before submitting your cow to the discomfort of your trials and errors. That apart this is a splendidly comprehensive and lucid account based on practical experience. The advantages and suitability of different breeds is discussed; management of the cow and of the land she occupies; breeding; health and dairy processes are fully covered and the book includes a list of useful addresses.

Edward Hart has been shepherding and writing about sheep for many years and communicates his own delight in this biblical pursuit in every line of his book, but he knows that it is not easy to keep even a small flock in good shape on the same piece of land year in and year out. Ideally grassland where sheep are kept should also be grazed by cattle or horses which will eat the coarse grasses that the more selective sheep will leave. This does

mean, I'm afraid, that they are not suitable for keeping on an extended garden or a little orchard, and I feel that the author should have made this clear. Nowhere in this otherwise excellent book does he commit himself by suggesting how much, or how little land, he believes the self-sufficiency shepherd should have, or what acreage per ewe he regards as adequate. For the rest the book covers all you will need, to consolidate the experience you have prudently acquired by spending some months working with a shepherd.

*Let's Grow Food* is a book written for children although it does not make this clear on the cover and it would be possible for the unwary to thumb through it in a bookshop and spend his money before this dawned on him. Does it matter? Well yes, I think it does, because to my mind it is a book that you would not want to buy for either an adult or a child. It is unacceptable for the adult beginner because of the patronising tone and the feeble jokes (it never rains indoors unless your roof leaks) which make it a bore, while much more seriously it is totally inappropriate for children because of the sort of information it includes, to wit: 'Pesticides are either in the form of dry powder . . . in ready made aerosols . . . or as liquids which must be diluted and applied in a spray gun'. There is no hint to the child reader that the use of such noxious substances is dangerous and unnecessary; no suggestion that their use is controversial; no advice about alternative methods of pest control and inevitably, since the authors are evidently unaware of it themselves, there is no attempt to explain ecological balance, no whisper of doubt about the moral argument against pesticides. In spite of what may be good in it, this book must be condemned. I'm not sure that a gardening book specially for children is necessary — a child with common sense and a desire to grow will learn most from trial and error, and if he's really enthusiastic about looking things up, let him turn to the old masters, Lawrence Hills and John Seymour, who will teach him right and set him on his way with a proper reverence and respect for the land he is going to till.

Ruth Lumley-Smith

## Authors in this issue

### Krishan Kumar

is Senior Lecturer in Sociology at the University of Kent, and author of *Prophecy and Progress*, published recently by Penguins. His article was first read at the 1978 meeting of the British Association for the Advancement of Science.

### Barry Castleman

is an environmental consultant. He has been involved in research on hazardous industries since 1974.

### Ross Hume Hall

has conducted extensive research on the effects of contemporary technology on the quality of nutrition. In 1974, he published *Food for Nought, the decline of Nutrition* (Harper and Row).

### Colin Sweet

is Senior Lecturer in Economics at the Polytechnic of the South Bank. He gave evidence at the Windscale Inquiry.



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## Nuclear Nuggets

THE NUGGET FILE collected by Dr. Robert Pollard. Published by Union of Concerned Scientists Cambridge, Mass. \$4.95.

Escaping radioactive steam, a hydrogen bubble fit to burst, pregnant women leaving in droves, and all because someone left a valve closed in the emergency cooling system at the Three Mile Island nuclear reactor some ten miles from the town of Harrisburg in Pennsylvania.

"Just human error" was the kind of remark we heard over our radios from top people at the US nuclear regulatory commission (NRC) and only when the main crisis, or at least the fear of an explosion and core meltdown was over, did we get any admission that the reactor itself might have some inherent weaknesses in design.

Barely one week before Harrisburg Nicholas Hildyard gave me *The Nugget File\** to read and comment on. We owe the origin of this slim volume to Dr Stephen H. Hanauer, a senior official with the NRC, part of whose job was to analyse standard reports on the safety and operation of US nuclear reactors. Over the past ten years Dr Hanauer had access to a mass of material and rather than lose track of the more choice accounts of faulty operation and misadventures at reactors, he made a separate file — The Nugget File.

There, but for the Freedom of Information Act the story might have ended. That act gives American citizens the right of access to any information concerning their's and the public's welfare. The civilian use of nuclear power falls into such a category, and consequently the Union of Concerned Scientists urged the NRC to turn over to them all data and studies on nuclear safety problems. There was a mass of material to go through, and the NRC played the game by releasing only such information as had been asked for. Then came a break: on one set of documents written by Dr Hanauer was a 'buckslip' indicating that documents and memoranda had been directed to another office.



On the buckslip was the handwritten message "This one is too good to pass", and, in the corner, a notation referring to The Nugget File.

Over the telephone Dr Hanauer confirmed that the file existed and the UCS resorted once again to the Freedom of Information Act to have the file's contents made public. At first the NRC balked, offering instead a full list of the titles and dates of the documents in the file. The UCS were far from satisfied and following increased public pressure, the WRC felt obliged to have the whole file copied and placed in the public document room.

The UCS asked one of its members, Dr Robert Pollard, previously a reactor safety engineer with the NRC, to abstract the best 'nuggets' and make comments. The result is a brief account of more than fifty incidents at American reactors, some of them extraordinarily bizarre. To understand the implications of the reports would require intimate knowledge of nuclear engineering, in particular of light water reactors. I must admit I have wondered at times whether those engaged in criticising the safety aspects of nuclear reactors, such as emergency core cooling systems and their efficacy in preventing core meltdown in case of a loss of coolant accident, might not have been exaggerating the dangers. There have been a host of accidents at reactors — of the sort that Hanauer recorded in his Nugget File — yet none (and of course I speak before Harrisburg) resulted in a radioactive cloud or in the immediate deaths of scores of the public. *Prima facie* it seemed that nuclear reactors could take a lot of beating without anything horrendous happening, other than frantic sleepless nights for reactor physicists and engineers. In fact, *The Nugget File* makes it clear that each incident was a potential Harrisburg.

*The Nugget File* is an alarming catalogue of faulty design, of shoddy construction, of poor engineering, of bad maintenance and of human error. A typical example is an incident at the San Onofre Unit 1 at San Clemente, California in early 1968. Initially a fire broke out in electrical cables while the reactor was operating at power, the fire being caused by 'thermal overload-

ing . . . in an area of restricted ventilation'. The damaged cables were replaced and the reactor returned to service. After bringing the reactor to power, the control room operator took it upon himself to overlook control rod position indicator lights because his operating experience prior to the fire had told him that the indication system was at fault. Nearly three weeks later a computer analysis indicated that the indication system was correct and the control rod was fully inserted, contrary to what the operator believed. The reactor was shut down and it was discovered that the wires to the control rod drive mechanism had been reversed after the fire. If that control rod had been suddenly withdrawn from the core, there could have been a dangerous surge in power.

Shortly after another fire broke out in the cable trays, and the Atomic Energy Commission commented that the 'occurrences' were caused through "inadequate system check-out, non-adherence to plant operating procedures, failure to recognise an abnormal condition, toleration of a spuriously operating system over an extended period of time, inadequate attention to plant operating parameters and inadequacies in component design, layout and material selection."

In Britain we heard of improvisations at the Hinkley Point new AGR reactor when a cooling water pipe burst and the station superintendent and his staff fitted a fire hose into the ruptured end, (See *The New Ecologist*, March/April 1978). They were commended for their action by the CEBG. But not all improvisations meet with official approval. At an unidentified reactor in the States a pump for the reactor cooling system was moved to a different position, which necessitated cutting through a suction line. In order to keep shielding water covering spent fuel, capsules and other radioactive material, a 'regulation' basketball, wrapped in tape to increase its diameter, was inserted into the suction pipe and inflated.

"Work was in progress when the basketball plug was forced through the pipe and out the open end by the water static head pressure (a force of about 500 pounds). Fourteen

thousand gallons of water spilled into the basement in approximately five minutes. The reactor pool water level dropped to the level of the suction line and the canal level dropped in excess of six feet to the top of the second gate section. Meanwhile the radiation dose rate at the top of the water increased by a factor of about 130 to 2 rems/hr.

"If the second gate had been removed as planned, the water would have dropped to a level just above the spent fuel stored in the canal. Since the pneumatic seals were deflated, the water level could have dropped further leaving only the bottom one-third of the fuel covered. An additional inch and a half of water in the basement would have caused short circuits in the power supply to the two pool water emergency recirculation pumps."

If it all sounds rather alarming, perhaps even more disturbing is the AEC's rather mild admonishments and the lack of any real disciplinary action. *The Nugget File* thus records: "The corrective action: a more conventional seal . . . to be substituted for the basketball . . . Where the risk of fuel melting and personnel safety are involved, consultation with knowledgeable people should be made prior to questionable operation."

Other 'nuggets' tell of plugged drains and leaking roofs leading to electrical failures in important reactor safety systems; of operators lacking confidence in the signals they receive in the control room; of safety components left inoperable for a year or more; of unexpected 'common mode failures'. Again in 1968, at the Connecticut Yankee Haddam Neck plant, when diesel generators were brought in to pump essential cooling water around the reactor after a loss of offsite power, all three generators failed, even though expectations were that such an occurrence was well nigh impossible.

"When the offsite power loss occurred the diesels started as designed. However, when the operator intentionally (and properly) attempted to reduce load on the diesel generators by stopping an electrically-driven pump, two of the three diesels also tripped (i.e. disconnected) for reasons as yet un-

explained. The remaining diesel immediately succumbed to the overload..."

The AEC comments "obviously there was at least one other potential fault which could involve all three generators. It did and summarily negated our original conclusions that all faults had been considered."

Wiring errors preventing control rods from functioning properly is a common cause of problems in reactors, and even the use of a 6 amp fuse instead of a 10 amp fuse can lead to a reactor automatically scrambling because of a blown fuse, as happened at the Nine Mile Point Unit 1 reactor in New York State.

In another incident, at two Zion units at Illinois, in August 1974,

Westinghouse issued a revised though "incorrect wiring diagram that resulted in the correct wiring diagram being changed to reflect the incorrect as-built circuit". Consequently a low steam pressure detector, which would indicate a break in a main steam line, did not function properly: moreover the malfunction remained undetected for more than one year after operating licenses were issued.

Reading through *The Nugget File*, the overall picture is of incredible oversights, and far too often of trivial events, like blown fuses, leading to major operation failures. For the non-nuclear engineer most of the accounts are heavy-going and more or less incomprehensible with the result that one might easily overlook

the significance of Dr Hanauer's collection. Clearly nuclear reactors are extremely complicated devices, not because of any inherent complexity in the fission process, but because of the safety systems necessary to ensure that control of the reactor can be maintained at all times. Their very complexity seems to be their downfall, and events like 'common mode' failures indicate only too vividly that man cannot eliminate all potential dangers. Dr Hanauer himself wrote "Some day we all will wake up". Harrisburg will certainly have disturbed the slumber of the American public and in particular of the NRC.

Peter Bunyard

## Other Books Received

Projects in Conservation, D.I. Williams and D. Anglesea, Wayland £2.95.

This is an excellent handbook for those whose concern for the environment goes beyond sitting and wailing in the comfort of their armchairs. The authors recognise the devastation caused by increasing pollution and set about explaining what can be done about it. Some of their chapters are controversial — planning and constructing a nature trail may not seem to all ecologically minded readers the ideal way to conserve the countryside — but on the whole the contents is very good. Presumably written primarily for school children, the authors are both teachers, it would also be a good buy for amenity or conservation groups whose members need guidelines to encourage them to make their own contribution to cleaning up the polluted environment.

Global Employment and Economic Justice: The Policy Challenge, Kathleen Newland, Worldwatch Paper 28, available from *The Ecologist*, £1.00.

To expect a panacea for the world's mounting unemployment

and underemployment from Kathleen Newland would be too much. What she gives us, in forty pages of measured, uncluttered Worldwatch prose, is an overview of the present situation both inside and outside the industrial nations; a warning on the difficulty of obtaining comparable unemployment figures for different countries, or any meaningful figures at all in some cases; a discussion of likely prospects for the future if nothing is done (the demographic bulge is about to do its worst), and a sensible suggestion: that, in the Third World, efforts to provide new employment should concentrate not on urban manufacturing jobs but on labour-intensive occupations for the rural poor.

Encounters with Nature, Leslie Brown, Oxford University Press £6.50.

Here is a book to savour and relax with. When the horrors and the problems of our industrial scene depress you beyond words, take this book off the shelf and lose yourself in it. Leslie Brown's encounters are the golden moments of his life-long involvement with wild creatures the world over. Eagles, badgers, otters and many others come to life in these personal reminiscences. The author's capacity for wonder is undimmed and his enthusiasm unblunted; he communicates his delight unerringly. 'Maybe, one day, I shall meet a big whale face to

face; and it will grin at me and be curious, as I am told they do.' Illustrated by Doris Tischler with pleasing pencil drawings.

Investigating Animal Abundance, Michael Begon, Edward Arnold £3.95.

Sub-titled *Capture-recapture for biologists*, this is a book for the professional concerned with the future of the world's wildlife population. The rightness or otherwise of interfering and manipulating other species for mankind's advantage (or supposedly its own) will continue to spark violent argument among conservationists. But however strong the conviction may be that man has already done damage enough in the space we share with other animal and plant life, it is probably necessary to be able to measure what is happening to wildlife populations. This book attempts to explain the mathematical techniques employed in terms that can be understood by researchers and students in the field.

The Earthquake Handbook, Peter Verney, Paddington Press, £5.50.

Is exactly what its title suggests. A book all about earthquakes; their genesis, their history and what can be done to avoid them. If you are thinking of going to an earthquake-prone area take it with you among the birdbooks and the maps and the guides.



# Classified

## PERSONAL

I AM SLOWLY and with sadness becoming more aware of my environment. I wish to become more selfsufficient. I need help. I am an engineer; currently an experienced social worker; bed sitting, and divorced. I wish to know people, courses, communities, through which I might get better at living in tune with nature. I am not a con man, nor as presumptuous as this advert sounds. Just desperate. Please help. I cannot stray far from South Wales because of my son, otherwise I am mobile. Box Number 132.

ASTROLOGER offers accurate analysis of birth charts, interpretation of future trends and comparison of charts. For details send S.A.E. to Nicholas Campion, 5 Carol Street, London NW1.

RAPPORT is the intelligent person's introduction service. Whatever your age, location or preferences, enrich your quality of life immeasurably with RAPPORT — and rediscover the joy of living. Special introductory rates this month for men over 45. S.a.e. for details to RAPPORT, P.O. Box 94, Oxford.

PROFESSIONAL Journalist with specialist knowledge of the environment and its attendant problems will undertake research projects, write reports and help authors organise their work for publication. Write to Box No. 133.

## FOR SALE

ANYONE wishing to join the Ecologist Group in Withiel Valley (5 miles from Wadebridge) COTTAGE AND A FEW ACRES FOR SALE — delightful situation. Ideal, though not necessary condition of sale would be if purchaser wanted to join small co-operative farm venture. Contact Peter Bunyard, The Ecologist, 73 Molesworth St., Wadebridge or telephone 020 883 205.

## MISCELLANEOUS

### ECOLOGICAL LAND BONDS

Join with others to create ecological settlements where people can live economically, and consume less of the Earth's resources. Enjoy farming weekends and help set up alternative work opportunities for yourself. Participate full or part-time. New solar heated housing will be built for members when planning permission can be obtained. Ecological Land Bonds are Index-linked, secured on the land, and you can enjoy the benefit of your investment. Please send £1 for prospectus and application form, or £4 to include one year's news, to: Ecological Life Style Ltd., 11 Lodge End, Radlett, Herts.

WINDGENERATOR — Winco Model 1222 — 12 volt heavy duty including 10ft. tower, heavy duty battery and six fluorescent lighting sets. Price £250. Butterwell, Davidstow, Camelford, Cornwall. Telephone: Otterham Station 307.

TWO PEOPLE WANTED to join us on organic dairy farm. Suit following skills: garden/greenhouse, woodland management, machinery, building maintenance. We offer board and lodging with use of above facilities in return for part-time farm work. Send SAE for details to H. Fullerton and P. Condon, Troed-y-Rhiw, Gwynfe Road, Llandeilo, Dyfed, Wales.

HAVE YOU EVER THOUGHT why there's a difference between the way you think and the way you vote? People are beginning to come to terms with this dilemma by joining the Ecology Party, 26(F) Main Road, Kempsey, Worcester.

## BOOKS & PUBLICATIONS:

THE COMING AGE: the magazine of the primordial matriarchal tradition of the one Goddess — a faith that moves to the rhythm of the spheres. 35p. 40 St. John St., Oxford.

DIRECTORY OF ALTERNATIVE COMMUNITIES lists many such groups, £1.50 (cash with order please) from The Teachers (MG3), 18 Garth Road, Bangor, N. Wales.

## SITUATIONS VACANT

KILWORTHY HOUSE TRUST is an independent Therapeutic Community for 20 teenagers with social, emotional and learning difficulties. We require an adult with experience and/or qualifications in organic gardening. Experience in special schools for residential social work an advantage but not essential. Applicants join 17 adult members (13 resident). This post is residential and requires commitment. For further information phone Tavistock 2610.

## FORTHCOMING EVENTS

3rd POLGOOTH FAYRE — August 10th, 11th and 12th 1979. Three days of fun and laughter, on a beautiful site 2 miles from the sea, between St. Austell and Mevagissey in mid-Cornwall. For more information contact Polgooth Fayer Association, "Lorrimore", Cross Park Terrace, Mevagissey, Cornwall.

SELF SUFFICIENCY '79 — The new outdoor show you mustn't miss . . . on Saturday, 23rd June 1979 from 11 a.m. to 6 p.m. in Rogate, Hants. Speakers include: John Seymour, Patrick Rivers, Katie Thear, Lawrence Hills, Cherry Hills. Organised by The East Hampshire Self-Sufficiency Group, Secretary Alec Fry, Heather Cottage, Warren Road, Liss Forest, Hants. Tel. Liss 3832.

INTERNATIONAL Conference on Climate and History, 8-14 July 1979 at the Climate Research Unit, School of Environmental Sciences University of East Anglia, Norwich, NR4 7TJ. The conference is being sponsored by the World Meteorological Organization, the Environment Programme, the American Meteorological Society, the Royal Historical Society and others.

## CLASSIFIED ADVERTISEMENTS MUST BE PREPAID.

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# BOTH THESE SPECIES ARE FIGHTING FOR SURVIVAL. WHICH SIDE ARE YOU ON?



This year could be the turning point in the sad history of whales and whaling.

The International Whaling Commission meets in London this July and for the first time ever, three nations have put down motions for the abolition of commercial whaling.

The I.W.C. was set up to safeguard for future generations "the great natural resources represented by whale stocks." But the indiscriminate hunting of many whale populations has continued unabated. There has been an estimated 97% reduction in the numbers of Blue and Bowhead Whales since records began.

This year Friends of the Earth will be mounting its biggest ever campaign to stop the slaughter of the whales.

We shall be at the I.W.C. meeting, putting heavy pressure on the delegates to vote for an immediate moratorium on all commercial whaling.

We shall also organise, with other environmental groups, a major national demonstration in Trafalgar Square on July 8th, publish a book on whales and

whaling, and campaign for a ban on the import of Sperm Whale products into Britain.

To campaign effectively, we need money now. Please, be a friend to the whales and give generously.

Friends of the Earth, 9 Poland St., London W1V 3DG. 01-434 1684. Please make all cheques payable to Friends of the Earth and mark all correspondence "Whale Appeal." Thank you.

Name \_\_\_\_\_

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£2 ☐ £3 ☐ £5 ☐ £10 ☐ £25 ☐ Other ☐

Please send me FOE's publication list (free) ☐

I would like to join FOE. Please send details ☐



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