

The Ecologist

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Peter Bunyard

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A Question of Oil

I have often thought it astonishing that the costs of electricity generation from such intrinsically incomparable systems as nuclear reactors and fossil fuel fired plants should be so similar. Admittedly the back-end of the plant, consisting of turbines and transmission lines is basically the same, as is the raising of steam through the heating up of water; but there the similarity ends. Just think of the fundamental features of the nuclear fuel cycle; surely there is nothing comparable in fossil fuel electricity generation except for the mining of the material, nor anything of the complexity? Yet *mirabile dictu* the generating costs of all the different systems are all within a few percentage points of each other.

Of course the CEBG unswervingly puts it across that nuclear power is a good bit cheaper, and its latest figures indicate that electricity from nuclear stations cost 0.76 pence per kilowatt-hour compared with 1.23 for coal and 1.43 for oil. But then, among other things the CEBG has conveniently left out its AGRs which it has struggled to get on stream for the past decade. In fact the costs of electricity from those AGRs will most likely be in the range of 1.28 to 1.8 pence per kilowatt-hour, plumb in line with generating costs from coal and oil fired stations.

But I have been thinking about my astonishment at the similarity in generating costs of the different systems and have come to the conclusion that I have been extraordinarily naive: it would be far more astonishing if they should be markedly different. The point is that our industrialised economy runs primarily on oil, and there is virtually no activity which does not have the backing of that ubiquitous fuel. Even the food we consume has come to us at an energy cost of nearly one ton of oil per person per year.

Nor is nuclear power any way exceptional, all the multitude of processes involved in the fuel cycle requiring the backing of fossil fuel energy. Indeed in the United States, where strip-mined coal is comparatively cheap, the enrichment of uranium is carried out using electricity generated from coal-fired power plants. The enrichment plant in Ohio, for example, consumes ten per cent of that state's electricity — more than the entire city of Cleveland.

So much for nuclear powered electricity being clean, and so much for it being an independent source of

energy: oil now governs our standard of living and our future, even coal miners preferring to put petrol in their cars rather than lumps of coal. Nuclear power is more dependent on oil than coal is and when oil goes up to 30 dollars a barrel or more, you can bet your bottom dollar nuclear power will go up to a correspondingly higher rate. Yet for years atomic energy economists have been telling us that when fossil fuel prices go up, nuclear power prices will remain relatively stationary, so that increasingly atomic energy becomes the best buy. Thus in 1973 Len Brookes, economist at the UKAEA, informed us "Fuel accounts for such a small part of the cost of nuclear fuelled electricity that the price of uranium ore would have to go up many times to bring about some percentage increase in the price of electricity produced."

Logic and a modicum of wisdom dictates against such hopes, for why should nuclear power be exempt from rising costs and inflationary trends any more than should cars and, for that matter, hothouse tomatoes? Events too speak louder than the figure jugglings of government economists who in the mid-1970s were suggesting that by 2010 the price of coal would rise three fold compared to a 20 per cent rise for nuclear. How then do they explain that the official costs of nuclear-powered electricity are up 80 per cent on the figure of 0.4 pence per kilowatt hour proposed for 1985?

The International Atomic Energy Agency is a trifle more realistic in its appraisal of nuclear power and in one analysis of the cause of rising costs, it has pinpointed an escalation in the price of uranium. Thus between 1974 and 1977, uranium prices shot up from 39 dollars per kilogram on the world market to 104 dollars, that rise having nothing to do with a drop in the quality of uranium ore. In fact between 1973 and 1976 labour costs in United States uranium mines went up by more than 50 per cent; fuel and electricity costs in the mining operations tripled; the cost of chemicals used in making the fuel for reactors doubled; uranium mill construction costs tripled; furthermore the costs of uranium exploration increased from 2 dollars per pound of uranium between 1966 and 1974 to more than 6 dollars by 1977. According to the IAEA the cost of uranium will either follow inflationary trends or will more likely rise faster because of the need to use lower grade ores.

But if nuclear power costs have been rising at such a pace, why haven't the costs of its electricity generation risen above that of fossil fuel's? The reason, I believe, is that the utilities and industries promoting nuclear energy cannot afford to let the public know its real costs; they rely on hidden subsidies, whether in research and development, in construction of the necessary facilities (including re-processing and enrichment plants) or in special deals with South Africa for procuring cheap Namibian uranium. They then manipulate the figures to ensure that the costs of nuclear electricity generation matches or even betters that of the fossil fuels. That way the public can be bamboozled into thinking that it has a good bargain.

Since the investment of oil is considerable in the construction and operation of each nuclear reactor, we

must surely think very seriously of the time when oil has gone from the ground and we have no such cheap energy source to fall back on. How are we going to build our nuclear power stations? What sort of machines are going to excavate the ground and bring in all the raw materials? And we are not talking of building one or two reactors every ten years; for to take on what oil does for us now we shall require several hundred large nuclear reactors all in operation at the same time, many of them serving no other purpose than to provide energy in order to build more reactors.

Whenever someone tells you nuclear electricity is cheap, and certainly cheaper than coal or oil, don't believe it, they are fudging the figures, and when oil becomes as rare as gold I'll lay a wager, nuclear power stations will be rarer still.

Breeding Distrust

Several items in the news concerning the fast reactor have captured the interest of those keeping a critical eye on the nuclear industry in this country. Almost simultaneously we hear that the reprocessing plant for fast reactor fuel is now officially in operation at Dounreay, and that plutonium is to be shipped by sea from there to Windscale in the form of its nitrate, for manufacture into fast reactor fuel. The other item, tucked away in most newspapers, is of an experiment being set up jointly with the Americans to see how well actinides — plutonium-like substances such as Americium and Ruthenium — are consumed in a fast reactor. The purpose of the exercise, we have been told, is to hasten the decay of such radioactive wastes.

Unlike the rumpus over THORP and the subsequent Windscale Inquiry, public concern over the commissioning of the revamped fast reactor reprocessing plant at Dounreay has been non-existent. We must also remember that THORP, as presented by BNFL, was supposed to have nothing to do with the fast reactor programme, but was considered a convenient way of dealing with spent fuel from thermal reactors. Indeed Justice Parker suggested that if the safest way of dealing with spent thermal oxide fuel was to reprocess it, then the building of a reprocessing plant (at an estimated £600 million) would be a necessary social cost.

At *The Ecologist* we have never been in doubt that the Atomic Energy Authority considers THORP a vital stage in the development of a fast reactor programme. Indeed the Authority has been at great pains in recent months to point out that the liquid metal fast breeder reactor (LMFBR) is a relatively poor breeder of plutonium, and to sustain any kind of fast reactor programme would require another source of plutonium, presumably from thermal reactors. The only way to extract that plutonium is through adequate thermal oxide reprocessing facilities.

On that score, Dr. R.H. Flowers and his colleagues tell us in *Atom* (May 1978) 'We have already noted that when fully optimised an LMFBR can be managed

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to yield a small excess of plutonium. To put this in perspective, the net excess which could be produced per gigawatt (electrical) year in a LMFBR is little more than half the quantity produced in a Pressurised Water Thermal Reactor. This leads to an important conclusion on reprocessing for LMFBR cycles. A growing fast reactor system is likely to face a plutonium shortage, so there will be a strong incentive to reduce the plutonium inventory of the complete fuel cycle, a considerable fraction of which comprises the discharged spent fuel; there will also be an incentive to develop fast reactors which can produce a greater plutonium yield. It follows that, unlike the case of thermal reactor fuel reprocessing, there is a very strong pressure for rapid reprocessing and refabrication of fast reactor fuel."

Since it is plutonium that is required for the fast reactor, there is something of an illogicality in the above statement, for why should thermal oxide fuel — with its higher yield of plutonium — be exempt from the need for a rapid reprocessing and a fast turn-about in the plutonium fuel cycle? It is my hunch that given the publicity over THORP the Atomic Energy Authority want to play down the role of thermal oxide fuel in the fast reactor economy. Instead the Authority is quietly getting on with an entirely new concept in reprocessing technology — that of reprocessing spent fuel in which highly radioactive, short-lived fission products have not been given time to decay. By that means the turn-about time can be hastened and the very poor breeding features of the LMFBR somewhat improved. To give a comparison, the gamma radiation from spent fast reactor fuel cooled for 150 days will be nearly one hundred times more intense than that of PWR spent fuel, cooled for five years.

The *Atom* paper by Flowers and his colleagues is certainly illuminating, for it describes a theoretical system by which spent fuel reprocessing and fuel manufacture can be wholly automated (with intensely radioactive fuel passing through the system the fewer people around the better.) One interesting aspect is the notion of leaving a percentage of fission products — between 0.1 and 0.2 per cent of Ru/Zr/Nb — in the plutonium-uranium oxide mixture comprising the fast reactor fuel pins. The rationale is that one decontamination stage can be left out of the process, presumably with cost savings, and that the high gamma radiation of the mixture will make hijacking of plutonium pretty well impossible.

Could not the joint US/UK experiment of injecting actinide wastes into the fast reactor core fuel be no more or less than a testing stage for using radioactive contaminated fuel in the future? The original idea for letting fission products pass through into plutonium fuel was an American one, Chauncy Starr's, and has since been avidly taken up by Walter Marshall, deputy chairman of the UKAEA. Moreover, the Americans have no prototype fast reactor of their own in operation, and Britain's Dounreay reactor would make an ideal test-bed. At the same time, the UKAEA would probably like to know the trade-off such 'poisoning' of the reactor fuel would be likely to have both on

plutonium breeding and on electricity production: for undoubtedly the more fission products there are the fewer neutrons will be available for maintaining the fission process and for breeding plutonium.

In the meantime the newly commissioned reprocessing plant at Dounreay is based on a conventional system which separates out plutonium and uranium from all contaminants. It is also designed to handle spent fuel that has been adequately cooled to allow short-lived fission products with their very high gamma activity to decay. The final product of the plant is plutonium nitrate, and rather than go to the expense of building a new factory for converting the nitrate compound into oxide, the nitrate is shipped to Windscale where such facilities already exist.

In the United States the transportation of plutonium nitrate from a reprocessing plant on one site to a fuel fabrication plant on another is forbidden. Indeed the unfinished reprocessing plant at Barnwell in North Carolina received a major set-back when the Nuclear Regulatory Commission ruled that it would not be allowed to ship out any plutonium unless that material were first converted from the nitrate to oxide. The operators of the Barnwell reprocessing plant reckoned that to add such an oxide conversion plant would make the whole exercise completely uneconomic.

How is it that we in Britain allow plutonium nitrate to be transported from Dounreay and furthermore that we risk sending it by sea where the chances of shipwreck must be high?

Soon the public will be embroiled in the fast reactor inquiry, and it must do all in its power to ascertain why the authority is able to get away with practices, like the shipping of plutonium nitrate, that outside of France are wholly condemned by the rest of the modern industrialised world. Moreover, the government should make funds fully available to objectors of the fast reactor programme — the amount it would have to spend being no more than the short change of the £2000 million that it will cost to build one demonstration commercial fast reactor.

It might all matter less if nuclear reactors, including fast reactors, were relatively cheap, efficient machines for generating electricity, and if the byproducts of the process were not such devilish substances. But we are being asked to support and pay for machines which seem to fall down on all counts of economy and safety. The biggest and saddest joke of all is the fast reactor whose only virtue, it seems, is that it can consume plutonium and hence will partially eliminate a material which the world would be better off without. But what a preposterous price for getting rid of plutonium, even if a bit of electricity is generated on the way. Justice Parker would probably exonerate such a cost, seeing in it a social benefit for the sake of perpetuating the industrial society. But since the industrial society cannot continue for much longer, it is about time that we put our money elsewhere and into something which really does reap social benefits.

Peter Bunyard

The Scarred Face of Japan

by

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With her insatiable appetite for industrial growth, Japan has turned her back on agriculture. Once self-sufficient, she now imports much of her food. Why did she embark on such a disastrous course? What have been the social and ecological consequences? And where should she go from here?

With the help of Middle East oil Japan has built up a highly competitive manufacturing industry based on worldwide export markets. In return she has been obliged to import, not only raw materials for her factories, but agricultural products, with the result that considerable areas of her agricultural lands — as well as coasts previously supporting a fishing industry — have been turned into industrial sites, covered in factories or contaminated by toxic wastes. The Japanese government was very eager to accelerate this process even at the expense of food production. Among many policies adopted, that of *gentan* (rice-field reduction), is the most notorious. The official view is that the country produces more rice than its population consumes. Based on that assumption the Ministry of Agriculture and Forestry (MAF) considers that the role of Japanese agriculture is not to promote the efficient use of land for further food production, but to use it to strengthen its industrial sector, while relegating agricultural enterprises to a few giant farms. It was this that led to the introduction of *gentan* in 1970. Although the policy met fierce opposition from farmers it nevertheless achieved

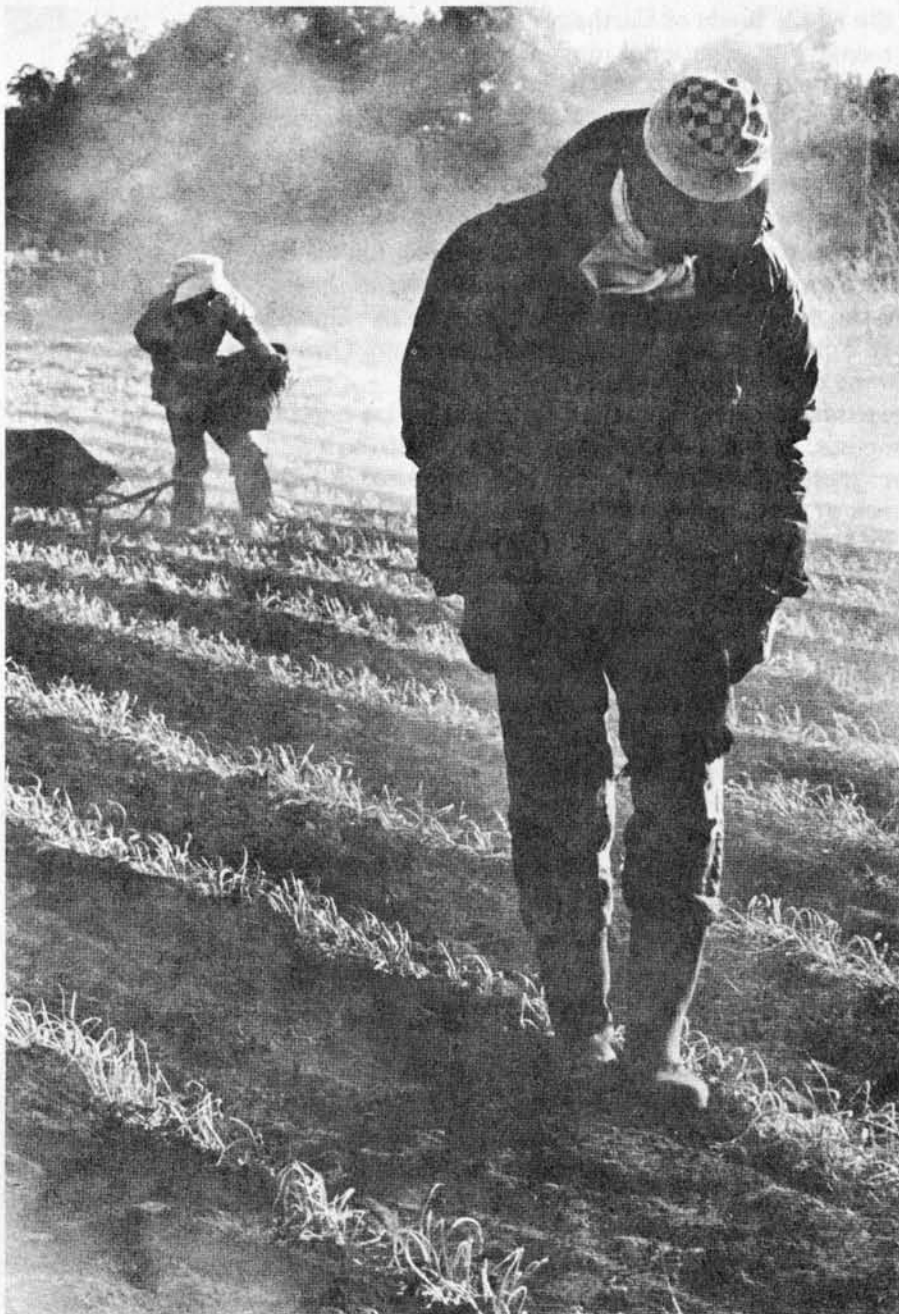
its goal in most cases by paying subsidies to those forced to give up rice growing. Following the first period of *gentan* the MAF proposed a second, even more restrictive period in 1977, whereby it could impose penalties on those farmers who refused to conform.

It is quite obvious that this policy will contribute to the rapid deterioration of the rich arable lands of Japan; even before it started her self-sufficiency rate in crops had begun to decrease drastically during the age of 'miraculous' economic growth. Figure 1 shows this tendency in relation to the situations of other countries.

As we can see while the United States and nearly every country in Europe were increasing their self-sufficiency rates in grain production, Japan incurred a sharp drop, and as a result became one of the biggest food importers in the world.

The Lessons of History

Ancient Greece once supplied industrial products to other Mediterranean countries in exchange for food, and the Roman Empire seized almost the entire farm output



Fukushima Kikujiro

from the fertile lands of Carthage. But as we now know such massive international movements of food destroy both the land that exports it and the country that imports it. Vast quantities of topsoil from the once forested lands of Greece have been washed away, and the present territory of old Carthage, once the granary of Rome, is now half desert. The story is repeated again and again throughout the Mediterranean region. With such historical precedents must we now watch Japan repeat the old mistakes in her dealings with the United States? For Japan now stands where Ancient Greece and Rome once stood.

The extensive and intensive destruction of her mountain forests, paddy fields and sea shores contributes to the progress of industrialization and urbanization. On the back of that destruction the industrial sector prospers by the export of vast quantities of manufactured products to the United States and many other countries, just as Greece once exported weapons to her neighbours. The rationale to justify this fatal policy is that Japan is a *shigen shokoku* — that is a country poor in natural resources, so that it can survive only through export of manufactured products in exchange for importing raw materials and food. Here we come to the crux of the matter — just how poorly endowed is Japan?

The truth is that Japan is not *ashigen shokoku*. The feudal era of Japan under the Tokugawa government (1602-1867) is usually characterized as a dark age when the people suffered severe oppression. While this stereotype view is not altogether wrong, it is certainly one-sided. What is striking about the Tokugawa era is that it supported a population of some thirty million under conditions of almost complete national isolation (*sakoku*). The population at this time was already more than a quarter that of present day Japan, and its density was probably the highest in the world. That the country could be self-supporting in these circumstances can only be explained by the fact that she had enormous ecological resources, and furthermore because her people knew how to conserve and maintain this natural abundance. The total land area of Japan is less than that of France and more than that of the United Kingdom, Italy or West Germany, but eighty per cent of it is covered by mountains, and its population density per unit of inhabitable land in the Tokugawa era, was nearly equal to that in West Germany today, and three times higher than in present day France. (see Table 1).

The key to understanding the enormous ecological capacity of Japan, despite such a seemingly unpromising terrain, lies in the special nature of the water cycle. Japan has an annual precipitation of some 2000 mm per year. This in itself is not phenomenal but, given the sharp gradients of the land, it is almost ideal, producing the most advantageous flow of water to foster mountain forests, croplands and paddy fields, as well as a vast underground network of water. The people of the Tokugawa era used this water flow to its best advantage. They made their paddy fields in terraces on the mountain sides and irrigated them from reservoirs constructed at different elevations. Generally speaking agricultural lands depreciate according to the intensity of their exploitation, but in the case of the paddy fields the opposite was true. They actually improved as the

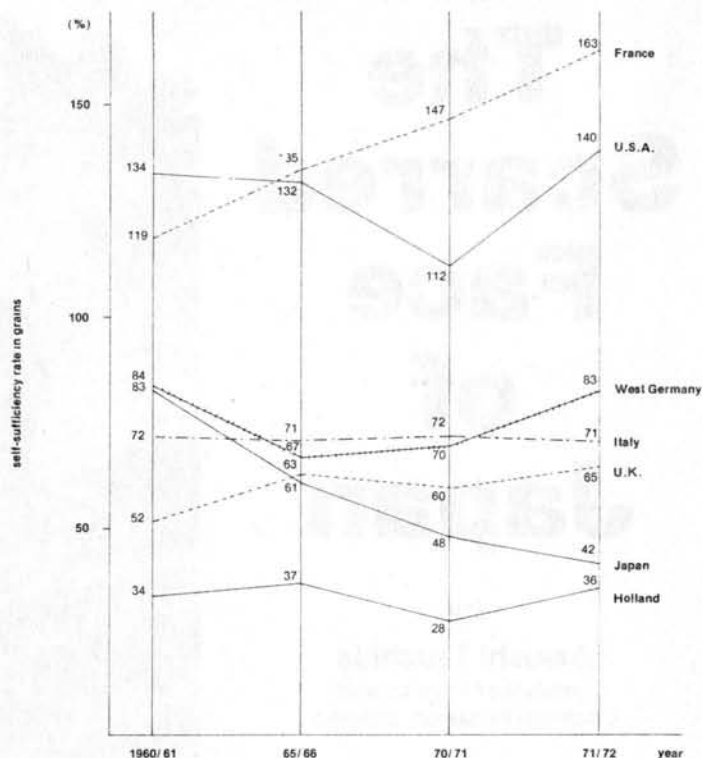


FIGURE 1. International Comparison of the Changing Trends of Self-Sufficiency Rates in Grains

Source: Yomiuri Shimbun Kaisetsu-bu (The Commentary Department of the Yomiuri Newspaper), (eds.), *Ijoh-Kisho to Shokuryo-Kiki no Subete (All about Abnormal Climate and Food Crisis)*, (Tokyo: Kokusai Shogyo Shuppan, 1977), p.200.

irrigation water flowed through and deposited humus-rich sediments on them, while at the same time the outlets from the paddy fields were so constructed that the topsoil could not run out with the departing water.

The development of agriculture on the plains came rather late in the Tokugawa period. Here again water was utilized in a very productive way through a highly advanced system of irrigation. When the rivers were in flood the waters were skillfully guided through a network of low banks, spreading natural compost washed down from the mountain side, across the arable fields, so that they produced rich crops of grain. Furthermore the rivers and ponds were full of fish of many kinds. In the northern part particularly, almost every river, and its tributaries, was filled with salmon in the breeding season, as the fish made their way from the ocean to their spawning grounds.

Village Life under *Sakoku*

The tragedy of the Tokugawa era was that the peasants were deprived of the entire rice crop, which they were forced to yield to the regional governors, who in their turn were subject to the control of the Tokugawa family. Accordingly the peasants had to live on whatever else they could grow. It should be remembered, however, that the Japanese were not originally a rice-eating people. The traditional staples of their diet were taro, barley, buckwheat, beans and various kinds of millet. Intensive cultivation of paddy rice only started in the Tokugawa era, although it had been practised on a small scale from much earlier and was traditionally a cash crop grown for the support of the non-agricultural population. Although the whole of the rice harvest was

forfeit to the Tokugawa and regional governors, everything else the peasants produced was theirs to dispose of as they wished. In fact a plentiful supply of non-rice crops and fish provided the rural people and the coastal villages with a comfortable standard of living. They worked hard, but in between whiles they had their local festivals when highly ritualized plays were performed and the days were studded with songs and colourful merriment. There was also a great eagerness for learning and the literacy rate in Japan at this time was probably among the highest in the world.

Some of the regional governors were men of great ability who developed the arts of irrigation and soil maintenance to an extremely advanced level. They planted trees on the mountains to improve the water-holding capacity of the slopes and to counteract erosion, and they improved the irrigation and flood control systems in the plains. These regional governors were very different from the feudal lords of medieval Europe. In Japan there was no private ownership of land until the Meiji Restoration of 1868. A regional governor had the right to use land and he could own the trees on it, but he did not own the soil beneath the trees, nor the withered branches and leaves which fell from them, nor the grass growing there. The villagers therefore had the right to collect what they liked for their own use, furthermore many mountains and all the sea coasts were communally owned. These shared mountains or *iriai-yama* and sea shores *irihama*, together with *iriumi*, the common sea, were an essential and important feature of the social and economic lives of the people, providing, as they did, security for those without private wealth.

Power for domestic use, as well as for agriculture, was supplied by the numerous water mills constructed along cascades and rivers, for milling corn and regulating the irrigation works. The mills too were often commonly owned and were run by village co-operatives. Firewood was collected from the *iriai-yama* and some of this was turned into charcoal by highly developed burning techniques. Combined with the charcoal burning there developed small iron foundries, called *tatara*, which enabled the people to manufacture hoes, ploughs and other tools which contributed greatly to their efficiency on the farms. These small scale technologies were an important factor in the prosperity and self sufficiency of the village communities.

The Social and Ecological Implications of Modernization

The Meiji Restoration of 1868 and its ramifications brought an end to the two centuries of Japan's isolation. Now western ideas, western knowledge, western industrial expertise together with the complexities of a modern state flooded into the country. Although the effect of this revolutionary change on Japanese culture and society is usually supposed to have been beneficial, it must be recognised that the seeds that eventually led to the ecological deterioration of the country, were sown in the Meiji period. Among these seeds of future ills were the dissolution of the *iriai* and the abandonment of the low bank irrigation systems. The *Chiso Kaisei* (Land Tax Amendment) of 1876 decreed the transfer of the shared mountain areas to either state or private ownership. This amendment also abolished tax payment in kind, so that people who could not pay the land tax in money were obliged to abandon their lands or become the tenants of the new land-owners. Those who were influential thus got a large share of the divided land and became rich, while others suddenly found themselves without the means of survival. The poor, who formerly had at least been able to collect firewood, fallen leaves and grasses from a common mountain were now prohibited access to their traditional sources and became trespassers in their own villages. The immediate social effect was to promote class divisions and bitter rivalry. The ecological consequences were not so immediately obvious, for it was only in the second half of this century that the results of reckless deforestation of the mountains, under private ownership, began to show. Erosion and flooding are now widespread, and the mountain forests that were main-

Until 1868, there was no private ownership of land. A regional governor had the right to use land and to own trees on it. But he did not own the soil beneath the trees, nor the withered branches and leaves which fell from them, nor the grass growing there.

TABLE 1. Population Densities in Several Industrial Countries

country	population (million) (year)	area (1,000 km ²)	population density (number/km ²)	agricultural area (1,000 km ²)	population density per cultivated area (number/km ²)
Japan	111 (1975)	378	298	59	1,850
U.S.A.	203 (1970)	9,363	23	4,269	49
U.K.	56 (1971)	244	229	186	298
Italy	54 (1971)	301	185	175	307
F.R.G.	61 (1970)	249	249	133	459
France	53 (1975)	547	95	324	157

Source: Sorihu Tokei-kyoku (Statistics Department of the Cabinet Bureau), ed., Kokusai Tokei Yoran (The Key Table of International Statistics), pp. 2-5 and pp. 49-50.

tained for years under common ownership have been ruined in less than a century by state and private profiteers.

Much the same disregard for tried and traditional methods was shown in the clauses of the River Act of 1896 whereby the low bank systems were systematically replaced by new high banks. As we have seen the low bank systems were so constructed that the overflow of a flooded river could be guided to downstream areas where debris, high in natural humus from the mountain sides, enriched the farmlands. The newly introduced high banks were based on the idea of complete flood control. But the rivers could never be totally controlled by human beings and the floods never stopped; all too often the higher the banks were, the more devastating the flood damage became. The vicious circle of higher banks and bigger floods has continued to this day.

War, Industry and Misery

Along with the social disintegration of people into antagonistic classes, the Meiji era prompted the development of modern industry, which left the rural areas impoverished. Suddenly the hitherto self-sufficient people were thrust into a commodity — exchange economy; their communal lands denied them, their traditional means of livelihood destroyed. As in every other country in the world, faced with this situation, the people started to drift away from their rural base into the cities where they were employed in industry under harsh, sometimes even slave-like conditions. The newly established military-industrial rulers of Japan were cunning enough to exploit the miseries of the people and channel them into chauvinistic feelings towards other Asian countries. After the colonization of Formosa and Korea in 1895 and 1910 respectively, Japan continuously pursued a policy of aggrandisement through the invasion of China and other Asian countries. It was not until 1945 that Japan abandoned the war policy that had started in the Meiji period.

A Short Period of Sanity

In spite of the negative aspects of modern Japan that we have discussed, there are also some areas where for a time good use was made of natural resources. In the field of electric power, for example, Japan habitually constructed small-scale hydropower stations which took full advantage of the mountainous topography and abundant rivers. Also worth noting are the experiments that were going on during the war and for some while

after it, to make fuel for motor transport by manufacturing pure alcohol from sweet potatoes. The technique of making methane gas from organic wastes was first tried in the 1930s and had some success until it was discontinued at the time of the invasion of China. Experiments were revived in the 1950s, especially among the rural people who saw in it the possibility of emulating the easy life style of their urban neighbours and at the same time increasing the self-sufficiency of the farms. These experiments continued until put paid to by the dawn of the Oil Civilization.

Huge new Dams cause Devastation

The late 1950s brought a complete change to all these positive trends. Only a decade after the war ended gigantic dams for electricity generation or for multiple purposes such as flood control and piped water supplies, became the fashion. In spite of the disastrous examples of the Aswan Low and High Dams in Egypt, industrial circles in Japan rushed headlong into the dam-construction business. Fertile valleys of prime agricultural land were drowned under reservoirs and people in mountain villages were driven from the homes they had inherited from generations of ancestors. Moreover these huge dams stopped the passage of the fish upstream to their spawning grounds, which deprived the riverside villages of their most important means of livelihood. They also made it impossible for the mountain villagers to float their logs down river to the cities. They could not afford to replace this traditional free transport with oil-consuming trucks, and thus they lost another source of income. On top of the enormous social costs of these dams came another unexpected set back — when it was found that many of them were filling with earth and sand. (See Table 2.)

In sum, the dam construction boom brought about the devastation of arable lands, the loss of fisheries, the decline of charcoal burning and the free water transport which was a vital part of the logging industry. Following the social and economic disruption caused by the loss of common lands and *gentan*, it accelerated the inevitable arrival of the profligate, resource — burning and polluting age of oil.

The Gloomy Dawn of the Oil Civilization

In 1960, at the dawn of the Oil Civilization, consumption of oil overtook consumption of domestic coal for the first time. The arrival of cheap Middle East oil was to

TABLE 2. Big Dams Filled up by Earth and Sand in Japan

name of the dam	name of the river	completion date (month, year)	total pondage (1,000 m ³)	accumulated sand total (1,000 m ³)	sand-filled rate (%)
Hiraoka	Tenryu	Jan. 1952	42,425	37,323	87.9
Taifu	Tenryu	Jan. 1936	10,761	8,997	83.6
Oh-i	Kiso	Feb. 1924	29,400	24,233	82.4
Ohara	Shoh	Nov. 1942	11,741	8,923	75.9
Soyama	Shoh	Nov. 1930	33,850	19,794	58.4
Kasagi	Kiso	Mar. 1937	14,121	6,876	48.6
Takaoka	Oyodo	Sep. 1931	12,465	5,590	44.8
Maruyama	Kiso	Apr. 1954	59,350	24,643	41.5
Akiba	Tenryu	Jul. 1958	34,703	14,242	41.0
Jintsu No. 1	Jintsu	Jan. 1954	11,346	4,557	40.1

Source: Asahi Shimbun (Asahi Newspaper), November 4, 1978, p. 1.

totally change the way of life of the whole population. Until the establishment of the Oil Civilization coal had been the principal industrial fuel, while wood and charcoal were extensively used in people's homes. All this changed in the 1960s. Domestic coal became less and less important and was replaced by imported oil and natural gas, which came to dominate the domestic as well as the industrial scene. Due to the rapid distribution of city gas and propane gas all over the country, firewood and charcoal suddenly lost their market value. Industrialists praised the *nenryo kakumei* — the fuel revolution, but for many country people it brought only hardship. Mountain villagers who had earned their living wood cutting and charcoal burning no longer had a means of support. Their sons and daughters, like the children of the rice-growers a generation earlier, were forced to seek work in the cities.

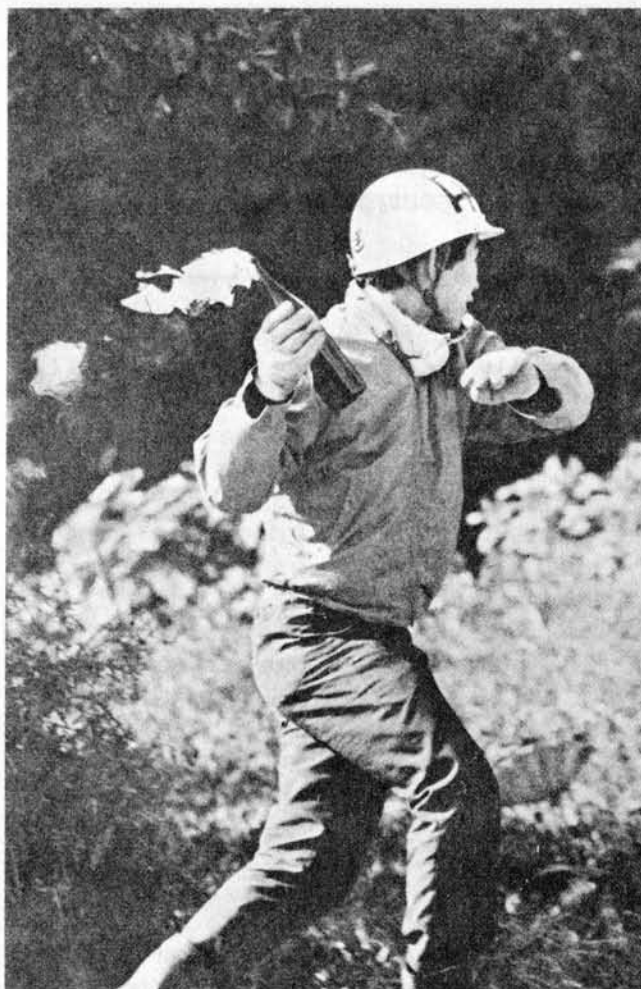
As to agriculture which was once so fruitfully nourished by the low-bank irrigation schemes, its lands enriched with human and livestock manure and domestic wastes, the arrival of the Oil Civilization brought destruction in its wake. The rapid increase in oil-based inputs such as chemical fertilizers, insecticides and herbicides has caused widespread deterioration in the humus content of the soil, and poses a threat to human and animal health. Livestock manure is no longer put back on the land, but is left lying around the farms where it is a pollution threat to the river system.

The threat of pollution is even greater in the urban and industrial centres. Domestic wastes, which in more prudent days were carted back to the farms are no longer valued and are cast into the drainage systems where they are joined by industrial wastes. Water processing plants are inadequate to deal with such quantities and often the effluents are not properly treated, thus the rivers become polluted and in turn carry these toxic wastes down to the sea. The effect of synthetic detergents, especially, has had a fatal impact on the ecocycles of inland water-ways, the sea-shore and even underground water. In a word the eco-systems of Japan's water cycle is in a state of unprecedented crisis.*

Dissatisfaction Leads to Protest

Faced with this situation numerous movements have started up to campaign against industrial pollution and to call a halt to large-scale development projects. Among such movements are both groups and individuals who want to go back to first principles on the land, recognising that the increased use of insecticides and herbicides poses health hazards not only for the farmers using them, but for those who consume their products. The Organic Farming Association of Japan was established in 1971 to propagate the understanding and practice of ecologically sound farming methods. As in other countries with similar movements, the organic farmers are able to sell their wholesome products

*Historically the cities and their surrounding villages had been linked by a barter system under which the villages supplied certain quantities of rice and vegetables in exchange for human wastes. In 1586, Luis Frois, a Jesuit missionary from Portugal who spent the last twenty-four years of his life in Japan, wrote 'While in the west we pay people to remove human excreta from our cities, in Japan it is bought and paid for in rice and money'.



(Above) Protestor at Narita Airport: a reaction against industrialism? (Below) Many farmers no longer have the right to grow rice, a policy which has led to much bitterness.



Farming families were once called 'hyakusho'
— literally 'those with a hundred skills'.
That spirit of self-reliance must be
resurrected.

through shops specialising in organically grown food. Some city dwellers are themselves moving back to the rural areas hoping to re-establish the principles of communally owned land. The same dissatisfaction with the new Oil Civilization is evident in a reawakening of interest in traditional technologies such as methane gas and alcohol fermentation from organic wastes, small scale wind- and water-power schemes, charcoal burning and so on.

More recently a movement has started to campaign for *irihama-ken* (common shore rights) in an attempt to halt the wholesale destruction of the sea shores by public authorities and private enterprises. This is a particularly vital area of concern because Japan has the third longest coastline in the world, next to the Soviet Union and Australia. Generally speaking any coast line ecosystem has a greater productive potential than any other ecosystem, be it mountain, plain or ocean. Moreover the Japanese coast line of some 29,000 km is mostly located in the temperate zone so that its ecological capacity is enormous compared with that of the Soviet coast line, which is next to the Arctic ocean; or the Australian, a considerable part of which is close to the desert. Herein lies one of the reasons why, in spite of her comparatively small land size, Japan is not a *shigen shokoku*, and it is deliberately misleading, therefore, to make the claim that a lack of natural resources justifies the development of a nuclear power industry in the country. Both the land and the seashore of Japan are fertile enough to have kept the country almost self sufficient in food until the 1950s. It was the Old Civilization itself which destroyed these plentiful natural resources. It was the blind preference for industrialization in the 1960s and 70s that replaced the ancient littoral fisheries (including the very fruitful inland-sea fishery in Tokyo Bay and Seto Inland Sea) just as it was the mindless devotion to chemical fertilizers that impoverished the farmlands.

Conclusion

One of the chief characteristics of the oil civilization has been the acceleration of inter-regional and international movement of raw materials. If this process continues unchecked it will result in the catastrophic deterioration of the environment on a global scale. Proponents of economic growth, and hence of the oil civilization, maintain that oil replaces human labour, thus giving people more time for creative activities. This belief has of course proved to be totally wrong. So long as we subscribe to the notion of continual growth so long will the demand for more and better jobs, higher salaries, improved lifestyles and ever more labour saving innovations increase and the dominance of the oil civilization will continue.

To extricate ourselves from this never-ending dilemma we must construct an economy based on self-sufficiency and work co-operation. Such an economy must aim to reduce the volume and frequency of inter-regional and international movement of raw materials to the barest essentials. The means of production must be decentralised to small family concerns or local community operations aiming at self-sufficiency in food and other simple necessities. Only a few items such as salt and iron need be outside the range of such a community or extended family. Subsistence farming on this scale can be considered an extension of home economics. Under such a system only large projects such as building and maintaining the irrigation systems need be undertaken outside the unit, and these would be done by co-operation between the communities.

It is interesting that in Japan a farming family has traditionally been called a *hyakusho* which literally means a family of a hundred skills. A *hyakusho* is not a family that only cultivates the land, but one which also makes and repairs tools, goes fishing and hunting, collects wood, burns charcoal, participates in the construction of a neighbour's house, feeds cattle, keeps accounts, prepares medicinal herbs for the sick, contributes its own performance to the seasonal festivals, studies books of learning and engages in countless other activities that support the community. This is the essence of culture, and only this spirit of *hyakusho* can explain the remarkable success and high literacy rate of the Tokugawa people.

With the spirit of *hyakusho* as our inspiration we should aim to recreate a harmonious self-reliant society. The oil civilization and industrial society teaches people only one or two skills; it treats them as units in a huge bureaucracy and cuts off the organic link between people and their environment. In the post-oil culture that we propose machinery will be replaced by the able and willing labour of the extended family or the community, whose members will have multiple skills and abilities, through the exercise of which each individual will once more be able to realise his or her full potential and live harmoniously with his group and in his environment.

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Factory Farming: a necessary evil?

by Tony Savage

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Factory farming embraces all types of highly intensive farming methods, including arable farming, but in this article I am looking at the subject as it affects farm livestock — their breeding, feeding, grouping, housing and morbidity. It has to be accepted that if we rear farm animals at all, they will be subjected to some form of deprivation and restriction. A herd of grazing cattle are not grazing where they chose, but where the farmer has put them. They are restricted by the fence round the field, they come in when he wants them and go out when he turns them loose and they breed, not to satisfy their natural inclination, but according to the calving index.

Zoo animals in cages or compounds are kept semi-intensively, but if you observe a group of polar bears, with their artificial caves and swimming pools, their environmentally controlled sleeping quarters and so forth, you would probably not class them as being factory farmed.

Aviculturists obtain quite amazing breeding results, often causing birds of totally unrelated species to mate, hatch and rear hybrid chicks. These birds are kept for their entire lives in cages, but one look at their supreme condition will convince you that they are definitely not being fac-

tory farmed in the way we usually understand the term.

At the other end of the scale you may see a small group of turkeys merrily scratching in a grass covered orchard, as free as the wind. The chances are that some investigation would show that their parent stock were kept in cramped conditions — with three square feet of floorspace each — and on a strictly restricted diet, to stop them getting overfat and reducing their egg output. The first eggs would have been hatched long before the turkey hens were 'immunologically mature' and would have been fertilized by artificial insemination. Their offspring in the orchard are, in my opinion, factory farmed.

So there is a vast difference between *farming* and *factory farming* animals and the criteria for deciding which is which are not only those of housing, stocking densities and general welfare, but also the standards under which their parent and grandparent stock are kept. The treatment of the parent stock can have far reaching effects on the progeny. For example stock on restricted diets will throw at least some young suffering from deficiency disease, while immature breeders suffering from insidious diseases

may produce hundreds of young before the clinical signs of the disease manifest themselves.

The Brambell Report

The first real attempt to tackle the problem of factory farming and offer an acceptable solution in the form of minimum standards, was made in the *Brambell Report*, December 1965. Commissioned by the Government, Professor Brambell and his Committee of eight experts, studied all aspects of intensive livestock husbandry for a period of eighteen months. During this time they visited over fifty livestock units throughout the British Isles as well as in Denmark and Holland. They heard evidence from all sections of the livestock industry and finally submitted a Code of Minimum Standards for intensive livestock husbandry.

One would have expected that here was the necessary foundation for setting of standards for factory farm units. Not so — the Ministry of Agriculture, Fisheries and Food, as a result of the *Brambell Report*, brought out their *Agriculture (Miscellaneous Provisions) Act 1968*. When Professor Brambell read this act he commented that it was merely

'a compromise on a compromise'. Many of the minimum standards recommended by Brambell had been cut by half, for example where Brambell recommended one square foot for each six-week-old broiler chicken, the Ministry code gave half a square foot.

To understand just how intolerable are the Ministry's minimum standards (these are only recommendations, not law) let us make a comparison. Ministry Code No 3, Domestic Fowl, August 1971. Stocking density for laying-birds in cages: floorspace — three or more light-weight birds per cage; 8 lbs live-weight per square foot. Now let us see how this compares with the norm for a domestic parrot. A modern parrot cage has a floor area of four square feet (24" x 24"). An African grey parrot has a liveweight of approximately 2lbs, even the large military macaw only weighs 3½ lbs, so that if we applied the Ministry's standards to the parrot we should recommend keeping sixteen parrots in one cage!

Five old Arguments

Why should such atrocious standards prevail? The powers-that-be would have us believe that without them farmers could not produce enough animal products to meet demand; that other systems would use up too much agricultural land and would send prices rocketing; that smaller units could not produce economically and that distribution would be difficult and costly. To these tired old excuses they sanctimoniously add statements like 'better we use these methods than cause a shortage of food for the human race'.

Let us examine these five arguments and see if they are sound. First they claim that we could not produce sufficient to meet demand by methods other than factory farming. This is a load of codswallop. In 1953 there were, in the U.K., seven hundred thousand breeding pigs on one hundred and eighty-five thousand holdings, producing some seven million pigs for slaughter each year — this works out at an average of just over four breeding pigs per holding. By 1976 there were some eight hundred thousand breeding pigs on thirty thousand holdings producing thirteen million pigs for slaughter,

an average of two hundred and seventy breeding pigs per holding. The increased output per sow is due mainly to early weaning practices which means more litters from each sow per year. However if the hundred and eighty-five thousand producers only increased their average from four to eight breeding pigs — (keeping the 1953 level of litters) they could produce fourteen million pigs for slaughter each year. Likewise if only ten per cent of all the farms in the U.K. were to keep a few thousand broiler chickens, they could produce the 350 million birds per year now produced by gigantic factory units. And if every farm kept just two hundred laying birds the national laying flock of 55 million birds could be wholly accommodated in natural conditions.

What about the second line of defence, that other systems would use up too much of our agricultural land? This is without doubt the biggest myth of all. Take the free-range laying system, always the subject of venomous attack by the pro-factory lobby, who throw up their hands in horror at the thought of these birds 'occupying' valuable land. But free-range birds do not 'occupy' land, they share it, with sheep, cattle or crop-rotations and if they are stocked at the right density — a hundred and fifty birds to the acre — they do not impoverish the land, they improve it, aerating, manuring and clearing insects and slugs. A thousand laying birds do not eat as much grass as a single dairy cow on one grazing day.

The only land that free-range birds 'occupy' is the extent of the floor area of their houses. Taking this at two square feet per bird, then the national laying flock of fifty-five million birds would need about 2,600 acres out of the forty-four million acres of agricultural land in the U.K. Compare this with the mammoth battery units with their attendant concrete roadways and aprons, permanently occupying many thousands of acres of farmland. Furthermore free-range poultry houses can be moved around thus greatly reducing the likelihood of disease.

The national broiler flock at present occupies a floor area of 826 acres. If Brambell's minimum standards were applied this would double. It does not seem a high price to pay for three hundred and fifty

million birds per year.

The third argument — that an end to intensive factory farming would cause prices to rocket — seems to be based on an unproven hypothesis. The same argument used to be put forward by the poultry industry when for many years it tried to persuade the housewife to buy white eggs. The producers insisted that brown eggs were difficult to produce and would send up prices. The housewives continued to demand them and today we have plenty of brown eggs with no penalty premium. Furthermore, a recent study by university agricultural economists showed that once a farm gets beyond a three man unit its efficiency drops dramatically, and the cost per unit of production goes up. Obviously if a farmer has a flock of two hundred laying hens or eight breeding sows, the chores of feeding and cleaning are blended in with the rest of the farm routine, often helped by the farmer's wife or one of the employed staff would undertake it along with other duties, so in real terms labour costs are low.

The Costs of Animal Disease

Well then is it true that smaller units could not produce economically? No, if the cost of ill-health is taken into consideration this does not hold water. Small units invariably mean healthier stock and disease costs money. In a 1975 survey it was found that the cost of medication, mortality, vet's fees etc., in the pig industry was in the region of one hundred million pounds a year, or one hundred and twenty pounds per sow. This situation is not improving — it is getting worse, and all investigators agree that the large highly intensive pig units are to blame. Such scourges would be enormously reduced, if not eliminated in a decentralised pig industry.

Although smaller farm units pay more for bought in feeding stuffs, because they do not get the quantity discounts available to feed lot operators, this is offset by the fact that they use a certain amount of home-produced feed, either purpose grown for stock or household scraps and crop wastes like chat potatoes, blown greencrops or by foraging in stubble and on waste ground. What is more the manure is a positive asset, whereas on the mammoth unit it is a disposal liability.

Can the fifth objection be sustained, that distribution would be difficult and expensive? Potatoes, greens, sugar beet, cereals, oil-seeds, hay and straw are mostly decentralised, yet there seems to be no problem in collection or distribution. Nor do farmers seem to encounter much difficulty in moving their livestock about when necessary, as can be seen by a visit to any thriving farm market. This is surely a spurious argument.

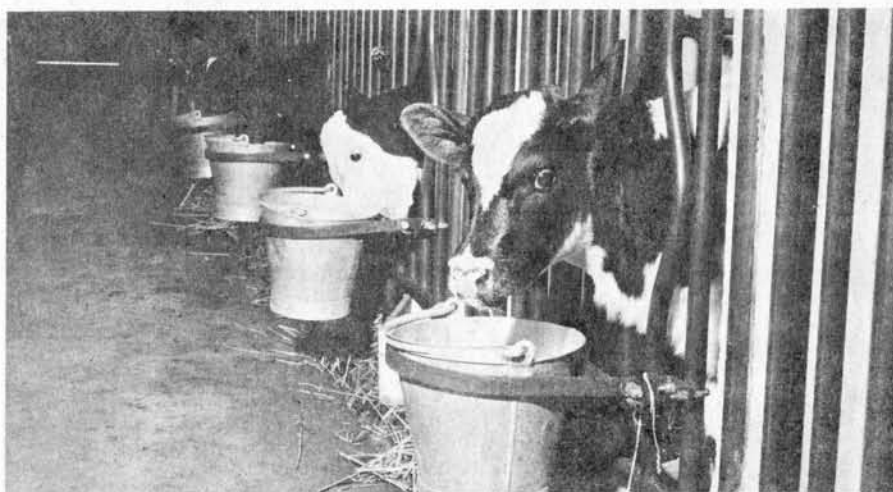
Michigan Disaster

What conclusion can we draw from an examination of these five reasons why factory farming must be sustained? There is no question about it — the livestock industry has got it wrong — and we are all paying for it. We don't want to see a tragedy like the Michigan poisoning case of 1972 when a chemical company inadvertently delivered a fire inhibitor BBP (brominated bi-phenol) instead of an animal feed additive. The BBP was mixed into cattle feeds that were duly delivered to farms throughout the state of Michigan. During late 1972 a number of farmers noticed various deformities in their cattle and reported the matter to the Michigan Department of Agriculture. It was not until 1975 that the authorities took steps to condemn milk and meat from cattle with high levels of BBP in their systems.

By this time some seven million people were showing various levels in their bodies, with symptoms of brain damage, swollen livers, acute arthritis and central nervous system malfunction. American medical experts said that these symptoms would continue for the next fifteen to twenty years with extensive arthritis, cancer, premature ageing and deformed children among the victims.

Hidden Dangers

It would be a mistake to suppose that nothing like that could happen here. There have already been a number of near misses. In 1960 turkey X disease struck suddenly. The cause, aflatoxins in soya beans, was traced within a few months, but not before over a hundred thousand turkeys had died a painful death. We do not know how many affected turkeys were eaten. In 1965 turkey Y disease (T.S.65) attacked turkey



A scene at a calf-rearing unit, showing buckets for feeding, outside the pens.

poults, causing grotesque skeletal defects. No cause was ever found. We do not know if it affected consumers.

Poultry diseases had got so bad by the middle 1970s, that a special Poultry Disease Panel was set up by the Ministry of Agriculture Fisheries and Food. The panel, chaired by Dr. Peter Briggs of the Houghton Poultry Research Station, was given the task of looking at each disease in respect to its importance to the industry now and in the future; the current state of knowledge of the disease; the level of research and the outlook for the future. The panel's first report (MAFF/ADAS/1976/77) covered some sixteen diseases, a number of which are still in the classification 'cause unknown'.

There are around twenty pig diseases that have caused a good deal of concern over the past five years, of these two have come very much to the fore during the last two years, namely pseudo-rabies and streptococcal meningitis. Pseudo-rabies (Aujeszky's disease) is said to be costing the Dutch pig industry from three and a half to four million pounds annually, and although the disease has been known in Holland since 1931 it has only become a major problem since 1970, when the size of the pig herd began to escalate rapidly. The symptoms are 'piglets walking like ducks, adopting a posture like a dog, rapid shallow breathing, salivation and grinding of the teeth. Finally leg paddling, convulsions and death within 36 hours of the first symptom.'

Streptococcal meningitis of pigs has followed from a single outbreak in East Anglia in 1973. The disease has now spread rapidly throughout

England, Scotland and Wales, and thirty-six cases have been reported of humans contracting the disease, most of them working in pig processing plants. Pigs and men are the only known carriers.

Little work has as yet been done concerning the effect of these modern animal diseases on our wildlife, although from time to time various laboratories have isolated domestic poultry diseases in wild birds. Obviously wild animals do not have any vaccine protection and must be at high risk. So it is not only the farm animals in intensive factory farm units whose health is under threat, nor is it only the consumer of products from those animals, it is the whole ecology of our countryside that is threatened by these practices. Added to the hazards of waste pollution we now have a constant bombardment from a whole host of new and unknown pathogens. Sooner or later one such pathogen will make an indelible mark on man or animal or both.

Can we doubt that the time has come for government and the farming industry to admit that factory methods have failed? As a nation we can produce all our needs economically with a decentralised livestock industry. The most urgent matter now is to encourage those three hundred thousand livestock farmers who have gone out of production in the last twenty-five years, to come back into the industry. At the recent Amsterdam Conference on the Welfare of Farm Animals, one eminent speaker suggested that the time had come to say 'Sorry, we got it wrong — now let's put it right'. Can we afford to disagree?



The Twilight of Nuclear Exports

by Norman Gall

Associate of the American Universities Field Staff

How much nuclear power can developing countries use? How much can they pay for? Can the crippled atomic power industries of Europe and the United States survive the fiasco of mammoth export deals to faraway lands that are signed to the beat of drums and cymbals and then become tangled in knots of debts, recriminations, and unfulfilled plans?

The biggest of these deals, with Brazil and Iran, has apparently collapsed. In October 1978, the head of Iran's Atomic Energy Organization announced a virtual cutoff in its ambitious nuclear program that would have meant purchase of some \$50 billion in power plants from German, French, and U.S. suppliers by the year 2000.

And in Brazil, politicians, scientists, engineers, and give govern-

For the rich nations of the Third World, nuclear power has lost its glamour. At home, the industry reels under the impact of lost contracts.

ment agencies are wrangling furiously over the blame for construction mishaps and mushrooming costs that seem to be laying to rest Brazil's giant atomic power deal with West Germany. This deal was announced as the largest transfer of nuclear technology to a developing country, which would have made Brazil an exporter of power plants by the 1990s and given her the techno-

logical base to produce and reprocess nuclear fuels and, therefore, the physical capacity to make nuclear weapons*.

Brazil: Economic Problems

Although the U.S. government vigorously opposes the controversial fuel cycle part of the Brazil-German deal on grounds of nuclear weapons proliferation, the deal is in trouble in Brazil largely on economic grounds. "I don't know the military purposes of the Brazilian nuclear program, but from the economic point of view it is unviable," says Antonio Ermirio de Morass, one of the country's leading industrialists. "I can't see why eight

* Brazil's nuclear power deal with Germany is also explored in my "Atoms for Brazil, Dangers for All," *Foreign Policy and Bulletin of the Atomic Scientists*, June 1976.

nuclear stations should be built while our foreign debt already is \$40 billion and the equivalent of 60 percent of our export earnings are consumed by servicing it. Besides, Brazil has the good luck to possess one of the world's largest hydroelectric potentials that will only become exhausted by the year 2050."

Nuclear Giants in Losing Battle?

On a once-beautiful and secluded beach on the Brazilian coast, strategically located between Rio de Janeiro and Sao Paulo, a losing battle is being waged for the survival of the export prospects of the international nuclear industry. Electrical industry giants such as Siemens, Westinghouse and General Electric say they badly need these export deals. Their home markets have shrunk to almost nothing because of the rising cost of nuclear power and political resistance to the siting of new stations. With a world capacity to produce about 50 new plants annually, the nuclear power industry has been getting orders for only about 10 in recent years.

Angra dos Reis: A Nuclear Battleground

Within view of the thousands of pleasure boats that each week-end ply the turquoise waters around the colonial port and tourist centre of Angra dos Reis, today renamed "Nuclear Capital of Brazil," two atomic power plants are being built side by side in great confusion and controversy. Angra 1, Brazil's first power reactor, is a 629-megawatt (MW) Westinghouse plant that was ordered in 1972, before the oil crisis of the mid-1970s and the cycle of euphoria and depression that since has seized the international nuclear industry. Angra 11, twice as powerful as the Westinghouse reactor, is being supplied by West Germany's Kraftwerk Union (KWU), a Siemens subsidiary, as the first of eight 1,300-MW power stations envisaged in the Brazil-German nuclear deal of 1975.

Angra dos Reis has become a battleground in the fierce struggle for export sales between U.S. and German manufacturers, especially to developing countries where demand for new nuclear plants was wildly overestimated in the early 1970s.

The International Atomic Energy Agency (IAEA) calculated then that by the year 2000 more than half the installed nuclear generating capacity in developing nations would be concentrated in just four countries (Brazil, Iran, India, and Mexico), where only thirteen nations would account for nine-tenths of this demand. But even these limited sales opportunities were exaggerated by extremely loose forecasts of electricity demand, ignorance of costs, shortages of foreign exchange, and failure to take into account other energy sources, such as Brazil's hydropower and Iran's immense gas and coal reserves.

Sited on an Earthquake Fault.

Engineering and geophysical studies by foreign consultants have been leaked to the press that show serious siting and construction problems. It turns out that the Angra site, which was supposed to accommodate 3 power plants, is only 25 kilometers from a geological fault in an area where 3 small seismic disturbances (between 4 and 6 on the Modified Mercalli scale) were recorded over the past 15 years. Intense tropical rains in the same coastal area also produce massive landslides and other forms of erosion that have been aggravated by ongoing construction activity.

"The geological survey started late," says a veteran engineer. *"If it were done sooner, another site probably would have been chosen. When borings were finally drilled it became clear that only one plant would fit on bedrock at Angra, and it would be expensive and difficult to build two more units there. But Furnas (the Brazilian utility in charge of nuclear power) insisted on putting three there. There is an old political feud in the Brazilian government electrical power industry between regional factions from the states of Sao Paulo and Minas Gerais. As a result of this bickering there was a purge of Furnas in 1974-75 that brought in a lot of inexperienced people just as the nuclear program was starting. Right now there are more than 10,000 people working on the Angra site, and nobody knows why. Nobody seems to care because the contractors are working on a cost-plus basis. There is no reason for all those people to be there because the civil construction on Angra 1 (Westinghouse) is 97 percent finished, and the only work going on at Angra 11 (KWU) is the drilling of piles, which*

requires only about 500 people. This is not a construction project. It's a rape. There is no other way of looking at it."

In Deep Trouble

The overall picture of a nuclear program in deep trouble has been borne out by a Parliamentary Investigating Commission (CPI) that began hearings late last October. Much of CPI's time, investigating charges of mismanagement of the nuclear program, has been spent inquiring into why the general contractor for Angra 1, Norberto Odebrecht, was awarded the contract for the first two German reactors "by extension," without competitive bidding. Since winning the Angra 1 contract five years ago, Odebrecht has risen suddenly from obscurity to third place in billings among Brazil's giant constructions companies, earning nearly 40 percent in profits during 1977 on a relatively small capital base. In 1974 the project director for Furnas had reported to his superiors that Odebrecht "has shown neither technical nor financial capacity for executing civil construction at Angra," recommending either revocation of the contract or a change in the management team.

According to testimony at the CPI by the former technical director of Furnas, Fernando Candeias, Odebrecht then signed a technical assistance contract with the German engineering firm Hochtief that was "practically a consortium for the construction of Angra II and III," providing for 50 Hochtief technicians to assume key roles in directing construction during peak activity. The Central Bank had assigned \$25 million to Odebrecht for special training of its technicians in Germany and Brazil. The former Angra project manager for Furnas, Franklin Fernandes Filho, told the *Jornal do Brasil* that both Odebrecht and Hochtief engineers helped him prepare his 1976 report recommending that Odebrecht's Angra I contract be extended, without further bidding, to include Angra II and III.

Because Odebrecht was the prime contractor of the Petrobrás headquarters in Rio de Janeiro at the time President Ernesto Geisel headed the state oil monopoly, and was based in Bahia, where Elétro-

Angra, the nuclear capital of Brazil, is on a site where three earthquakes have been recorded over the last fifteen years.

bras President Antonio Carlos Magalhães previously served as governor, there was speculation about the contractor's political connections.

Construction Difficulties

Candeias told the CPI that the construction difficulties began early. "The National Highway Department (DNER) had promised to build a road to the project, but did not meet its schedule," he said. "There were only two ways to reach Angra I: through a swamp or by barge. Beyond this, Norberto Odebrecht was having financial problems, though they did not reach insolvency." In his 1976 report to Furnas, recommending awarding the Angra II and III contracts to Odebrecht in partnership with two other firms, Candeias foresaw further difficulties in that "the KWU plan for the foundations is not properly studied. Possibly local conditions will force a restudy, which may bring substantial modifications. These circumstances make a contract for fixed unit prices absolutely unadvisable."

Because a second power plant is being built on a site with enough accessible bedrock to accommodate only one reactor, 1,200 huge concrete piles have to be dug and laid more than 200 feet (60 meters) below ground to bedrock to support a platform on which KWU's Angra II station is to be built. The complex construction task has led to delays and cost overruns that have doubled the estimated price of civil construction over the past two years. "They are driving the piles so slowly that if they continue at the present pace they won't begin building the reactor itself for another two or three years," said one engineer. Meanwhile, the excavations for Angra II have produced

earth movement and drainage of ground water from beneath Westinghouse's Angra I, resulting in a moving and tilting of the Angra I turbine generator hills that form a bowl surrounding the beach where the nuclear stations are being built.

Multi-Million Dollar Fire

By October 1977 the confusion was such that, when a \$10 million fire broke out at the Angra I site at lunchtime in a locked laboratory and warehouse, nobody could get in because the man in charge had gone to the beach and taken the keys with him. Fireman rushed to the scene, but could not put out the fire because there was no water in their trucks and because they did not bring with them the wrenches needed to turn on the hydrants nearby. A report of a government investigation, leaked to the newspaper *O Estado de São Paulo*, listed 71 different fires at the Angra site during a five-month period in 1977. After investigation the president of Furnas was fired, along with Furnas' technical director and Angra project manager. After the report was leaked to the press, however, six engineers working for Nuclebrás, the government nuclear energy holding company, were summoned to the headquarters of the political police in Rio de Janeiro and threatened with dismissal if they refused to sign a document vouching for the security precautions at the Angra site.

A lukewarm Government

Although high Brazilian officials have argued passionately that the nuclear program is essential for the survival of the industrial economy of the big cities of southeastern Brazil, the government has acted in some ways as if nuclear energy was not very important at all. In 1976 President Ernesto Geisel announced that Brazil would have to train 10,000 specialized technicians and craftsmen to mount and operate its nuclear power effort. Yet, when three leading Brazilian physicists visited German nuclear installations in September at Bonn's invitation, and were told by their hosts there were vacancies for 40 trainees in Germany, the Brazilian government sent only 4 people. "They only sent medium-level people, such as recently graduated engineers," said

Professor José Goldemberg of the University of São Paulo. "It's interesting that the Germans themselves suggest that they can offer longer and deeper training in nuclear technology if the Brazilian government was interested." Meanwhile, a leading German official told me: "West Germany cannot afford a nuclear accident. Nobody can afford a nuclear accident. This is why we are so afraid of what's happening at the Brazilian construction site."

Nuclear Power Questioned

At the same time Brazilian energy technicians have become increasingly vocal in questioning the value of nuclear power. Mario Behring, former president of Eléctrobras (the government electricity monopoly) and one of the country's leading energy experts, says:

"The nuclear program was based on 1974 estimates of 12 percent annual growth of energy consumption in the Southeast at a cost of \$550 per installed nuclear kilowatt. But we now foresee a slower growth in demand while the cost of the nuclear plants and their fuel has tripled. At these prices it is cheaper to continue to build dams in this region that could produce electricity at half the cost of nuclear energy without spending foreign exchange, since nearly all the equipment is made here."

The most important testimony given by Antonio Carlos Magalhães at that CPI on October 31 was on the future of the nuclear program. He said that the present hydroelectric program for Southeast Brazil was drafted in the early 1960s, when oil still cost \$1.80 per barrel, which only made hydroelectric stations of more than 20 MW economically viable. With the subsequent rise in oil prices, however, smaller hydro plants are cheaper and would increase the region's potential by 30 percent. In answer to a senator's question, Magalhães said that "as a politician I fought for better use of hydro potential. These cheaper dam sites have priority over more expensive power plants, be they prisoner to yesterday's reality." He added that the Brazil-German deal "must be carried out, but I believe all this can be negotiated, renegotiated, as a tactical, technical problem. There is an accord to be fulfilled and of this

accord I cannot speak because it is a government-to-government accord."

Will the Nuclear Program be Revised?

Brazil's only firm commitment under the German nuclear deal is for the purchase of Angra II and III, the two reactors already ordered. During 1978 there was considerable speculation in the energy establishment that the deal might be limited for now to the two plants already purchased. Because Magalhães is an influential adviser to President João Baptista Figueiredo, he left an impression that he may have been telegraphing the intentions of the new government that took office in March 1979. The outgoing government of President Geisel apparently took pains not to contradict that impression. Two weeks after Magalhães' testimony, Minister of Mines and Energy Shigeaki Ueki said he agreed that the nuclear program would have to be revised.

Iran: Did the Shah take the Nuclear Industry for a ride?

Halfway across the world in Iran, other difficulties have been encountered. Since the early 1970s the Shah has been grandly announcing that nuclear power would generate half of Iran's electricity by 1992. Foreign reactor salesmen rushed to the scene in search for orders for the 20 atomic power plants that, according to this scenario, would generate 32,000 MW at a construction cost of \$50 billion. In 1974 the Shah signed a \$4 billion deal for two 1,200-MW plants with KWU, and then ordered two more from France's Framatome, which like KWU had gotten its nuclear technology under license from Westinghouse. In 1977, during his whirlwind dash across Asia, Europe, and the Middle East, President Jimmy Carter stopped for New Year's Eve in Teheran and reached an agreement "in principle" with the Shah for sale of six to eight U.S. reactors, a deal long delayed because of years of haggling over nuclear proliferation safeguards. After another meeting in Paris with President Giscard d'Estaing, the Shah announced that he was "ready" to sign a \$6 billion barter deal for more French nuclear stations. Then a letter of intent was

signed in November 1977 for four more KWU plants, together worth \$11 billion, to be financed on concessionary terms by a group of German banks.

But nuclear industry and its financiers apparently failed to ask questions like these: How many atomic power plants can a country like Iran absorb? How can Iran pay for them? Where can so many nuclear power plants be put in a country of rugged mountains and deserts, subject to severe earthquakes? How many of this \$50 billion in nuclear projects would survive should the Shah be deposed? Or did the Shah, cleverer than many people think, take the nuclear industry and its financiers for a ride?

Earthquakes (Again)

The difficulties soon began to appear. The first two 1,300 MW German reactors, being built at the remote desert site of Bushehr on the Persian Gulf, were being delayed because of the need to protect the plant against the major earthquakes that regularly occur in the area and because of the difficulties of getting imported equipment through Iranian customs. Moreover, transportation of heavy or sensitive equipment across Iran's rough roads is difficult and dangerous. Inland sites for nuclear stations are hard to find because Iran's arid and mountainous terrain contains only a few, small rivers. Their waters must be used for agriculture rather than for cooling nuclear power plants. So these plants must be sited either on the earthquake-prone desert coast of the Persian Gulf to the south, or along the mountainous coast of the Caspian Sea to the north, which presents logistical and transportation difficulties. Payment for these plants was to begin only after they were completed and began operation in the mid-to-late 1980s, when mountains of debts would be coming due as well.

The revolution in Iran may spell the end of the nation's nuclear energy ambitions. Even before he was deposed, the Shah's lavish arms and nuclear equipment purchases were abruptly cut back in order to pay for strengthened social programs and large pay increases for civil servants to quiet political discontent. The head of the Atomic

"Angra isn't a construction project. It's a rape. There's no other word for it".

Energy Organization was fired and placed under house arrest as part of a general housecleaning of Iran's nuclear establishment. The new AEO president, Ahmed Sotoodehnia told *The Washington Post*:

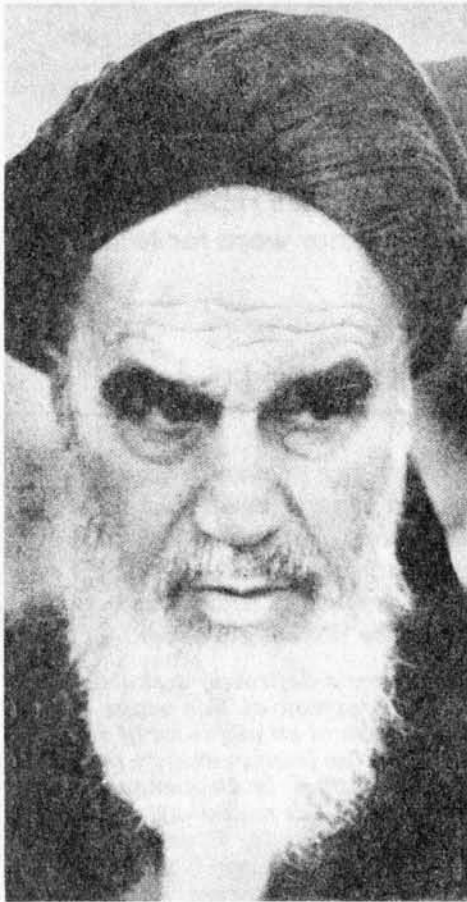
"There's definitely a slowdown in the program at this stage of the game, and an awful lot of rethinking of the Iranian energy program. The capital intensiveness of the program has made lots of difficulties. Because we have pulled a lot of capital from the Government — this was a top priority program — the other sectors weren't at ease to see that this project gets so much capital and so much free hand. All these things have created an atmosphere of unrest."

Coal and Gas Reserves

Referring to Iran's enormous coal and gas reserves, the AEO chief said laconically: "We do have enough fossil fuel at present." While suspending future nuclear plant orders beyond the four already under construction, Iran now plans, as a stopgap measure, to drill more gas wells in new reservoirs and build gas-fired thermoelectric plants. In addition, Iran has enough high-quality coal reserves to mine eight million tons annually for the next four or five centuries.

Second Thoughts

Similar second thoughts are surfacing in Brazil. According to recent estimates, atomic power now is three times as expensive per installed kilowatt in Brazil as hydroelectric stations. Not only have Brazilian engineers developed great skill in carrying forward what has become the world's largest hydropower program, but the introduction of a new technology high-voltage direct-current transmission, now makes available the immense hydraulic potential of the



Since the revolution overthrowing the Shah, all plans for nuclear power plants in Iran have been cancelled, including two contracts for plants already under construction. The Shah saw nuclear power as a cornerstone of Iran's industrial development, and at one time twenty-three reactors were planned, although by early this year that number had dropped to four.

The head of Iran's Atomic Energy Organisation, Fereidun Sahabi, said the contracts with France and Germany were being cancelled for "political, economic, social, human and technical reasons." The German-built plant is said to be eighty per cent completed, though recent reports in *Nuclear News* suggest that only ten per cent of the reactor has been built. The plant has already cost 2.87 billion dollars and the final price-tag is expected to reach 7 billion dollars. One reason given by the revolutionary government for the cancellation of the German contract was that paying interest on the money due to the Kraftwerk Union would be 'un-Islamic'.

The Government has made it quite clear that it does not wish to depend on foreign expertise and technology for its energy supplies. Instead it argues that Iran's vast oil, gas and coal supplies will be sufficient to meet the country's need at a third of the cost of a nuclear programme. As for the now moribund German plant, an Iranian scientist (formerly in favour of nuclear power) has prepared designs illustrating how the cooling towers could be converted into grain silos.

Sources: *Nature*, August 1979 and
Not Man Apart, July/August 1979

Amazon basin without the costly power losses that previously penalized transportation of electricity over long distances. So Brazil now is thinking twice about nuclear power and meanwhile, taking a relaxed view of delays in its reactor program. Ueki told *Der Spiegel*: "We really aren't in much of a hurry with the nuclear reactors, since they will be supplying only a small part of our energy needs."

Will the German Deal be renegotiated?

In late September 1978 a "confidential" French newsletter, *Defense et Diplomatie*, reported that the Brazil-German nuclear deal would be renegotiated. Brazil might purchase only the two reactors already ordered, while the Germans would be freed of their undertaking to supply Brazil with enrichment and reprocessing facilities. Although high Brazilian and German officials immediately denied the story, West Germany's Secretary of State for Research and Technology, Hans-Hilger Haunschile, the man responsible for nuclear exports, had already told a Brazilian journalist that Germany would not feel bound to sell fuel cycle technology to Brazil if Brazil did not purchase the eight

KWU reactors envisaged in the 1975 deal.

If Germany does rescind its commitment to export enrichment and reprocessing technology to Brazil, this would be an inadvertent vindication of the nonproliferation policies of the Carter administration, which made serious diplomatic blunders in dealing with Brazil and Germany in 1978. Before Jimmy Carter took office in January 1977, France and Germany agreed not to make any new deals for export of reprocessing plants "until further notice."

The Brazil-German agreement was grandiosely and desperately conceived as a way of keeping the German nuclear industry and its 13,000 jobs intact while equipping Brazil with a wide range of nuclear technology and supplying a large share of her electricity needs by 1990. Westinghouse was at an advanced stage of negotiations for sale of Angra II and III to Brazil until Luis Claudio Magalhães, then president of Furnas, came back to Rio de Janeiro empty-handed after flying to Washington in June 1974 to sign contracts with the U.S. Atomic Energy Commission for supplies of enriched uranium for the two plants. He had been told with

great embarrassment by Abraham Friedman, then the AEC's international director and now the science attache at the U.S. Embassy in Bonn, that the contract could not be signed immediately for technical reasons: amendment of the 1972 nuclear cooperation agreement between the two countries to provide for larger shipments of enriched fuel. Friedman promised that the new agreement would be ready in a few days. But then the AEC suspended all new enrichment contracts because it had been inundated by orders exceeding its enrichment capacity by government and utilities seeking to take advantage of low uranium prices while they lasted. Shortly after the Furnas president returned to Brazil intensive negotiations began with West Germany. The new president of Furnas, Licinio Seabra, told the CPI that by September 15, 1974 the Ministry of Mines and Energy had advised Furnas that Angra II and III would be acquired as part of a big deal with Germany, "which made Furnas suspend its work on engineering specifications and designs." Ironically, now the United States has excess enrichment capacity because many of the nuclear plants ordered in 1973-74 were never built.

Fallout

With the curtailment of the nuclear programs of Brazil and Iran, West Germany's nuclear industry must rely increasingly on its domestic atomic power program, which is in deep trouble. Although Germany's 1973 energy plan called for nuclear power to generate 45 percent of her electricity supply by 1985, this target was cut by half a year ago under pressure from citizens' groups that have nearly paralyzed nuclear construction. Under this pressure the Social Democratic government restored priority to coal-fired plants to generate electricity, agreeing to new nuclear construction only where coal cannot do the job. Meanwhile, KWU officials complain that citizens' lawsuits have tied up about \$10 billion new nuclear investments, and that licensing and appeal procedures for new plants in Germany can take five years before construction begins. West Germany has 14 nuclear stations completed, though 2 of them are not working yet because licensing has been delayed by litigation. Eight more plants are under construction, while work on three others has been stopped by court order and three more are awaiting construction permits. These new plants will bring Germany well above its lowered 1985 nuclear generating goal of 24,000 MW. So very few more stations are expected to be ordered in coming years.

The U.S. nuclear industry is in somewhat better shape because the two main reactor manufacturers, Westinghouse and General Electric, have a substantial backlog of past orders to be filled and derive considerable revenue from maintenance and retrofitting of equipment. However, the only new orders for power plants received by Westinghouse over the past two years were two from South Korea in 1978. Business has been even worse recently for General Electric which, according to industry rumors, may leave the nuclear power field entirely if there is no improvement by the early 1980s. By then the excess capacity problem could be staggering for both companies, since each can produce almost as many power plants annually as the rest of the world's reactor manufacturing combined. In the mid-1970s they

together could produce four times as many high technology components as turbine-generators and reactor pressure vessels as the U.S. domestic market required. U.S. sales have dropped to virtually nothing since then because of escalating costs and political controversy over nuclear power.

Lavish Promises

Apart from licensing delays and problems of siting and construction, the nuclear industry has been attacked by critics for being unable to deliver on lavish promises to utilities that ordered larger and larger power plants on the assurance that the unit costs of nuclear generation would be cheaper and cheaper. In a 1978 book, *Light Water: How the Nuclear Dream Dissolved* (Basic Books, \$10), Irvin C. Bupp of the Harvard Business School and Jean-Claude Derian of the Sorbonne argue that the industry exaggerated its ability to translate new engineering designs into cheaper nuclear power, encountering unexpected difficulties in building atomic plants to larger and larger scale.

"The sales pitch of the 1960s and early 1970s about the 'cheapness' of nuclear power was based more on engineering designs and computer printouts than on historic operation experience," says Bupp.

Waste Problems

The U.S. Inter-Agency Review Group on Radioactive Waste Management in October 1978 issued its draft report to the President, predicting that it will take the industry from 15 to 20 years to master the problems of safely disposing of nuclear fuel waste. The ecological lobbies in both Germany and the United States have obtained passage of state legislation making further licensing of nuclear power plants dependent on solving the waste disposal problem. To jump this hurdle Germany recently made a deal to send its spent fuels to France for reprocessing. But the French, who are more advanced than anyone else in commercial reprocessing technology, have only managed to send isolated batches of nuclear waste through their huge new plant, designed like an oil refinery, that is supposed to separate

plutonium to be sent back to power plants to be burned as fuel. While the plutonium is viewed by the industry as an energy resource and as a way of reducing the size of the waste disposal problem, it also is a highly dangerous poison that is subject to transportation hazards and to clandestine diversion for use as the raw material for nuclear weapons. Countries without their own fossil fuel resources, such as France, Germany, Italy, Japan, and Korea, are pressing for adoption of large-scale reprocessing as a way of economizing fuel and maximizing the advantages of nuclear electricity generating.

The Future

The number of countries trying to adapt civilian nuclear power to military purposes may shrink as the cost rises and the economic justification of nuclear power diminishes relative to other energy sources. Only countries like India and Argentina, which have developed their own nuclear programs doggedly for more than a quarter-century and have large teams of trained people, show signs of being able to withstand international economic and political pressures to restrict the use of atomic power. In most countries the economic and organizational burdens of a rush into nuclear power may be decisive.

The developing countries that embarked on ambitious nuclear power programs in the late 1960s and early 1970s were governed by authoritarian regimes of one kind or another: Iran, Brazil, Spain, South Korea, South Africa, Taiwan, the Philippines, and Pakistan. In Brazil, Iran, and Spain the curtailment of nuclear power construction seems to be associated with an ongoing process of political liberalization, while South Korea, essentially unchanged politically, is maintaining its announced goal of building 45 atomic power plants by the year 2000. All these nations protest that they will not use their nuclear power programs to produce atomic weapons. But these affirmations are met with skepticism by other countries, especially their neighbors.

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Cancer and Inflation

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Industry claims that the introduction of stricter controls on chemical hazards would fuel inflation. But what about the costs of NOT regulating these hazards — the compensation claims, the hospital bills, the welfare payments — and above all the delayed costs of an increase in the rate of cancers and birth defects? Their price-tag is far higher than any short-term costs that would be incurred.

Cancer is a complex set of diseases which affects one in every four Americans, and kills one in five. Last year's cancer fatalities of about 400,000 are about eight times as many as the total number of US casualties in all the Korean and Viet Nam war years combined. Cancer is not a disease of degeneration or ageing. There is little or no evidence that viruses play a significant role in the causation of human cancer. Similarly, genetic factors are unlikely to be important determinants of human susceptibility to cancer. Cancer affects all ages and is an expression of past exposures to carcinogens in air, water, food, drugs, other consumer products, and the workplace.

Our overall ability to treat and cure cancer has not materially improved over the past few decades. With the exception of Hodgkins disease, prostate cancer, and some other relatively rare cancers (such as choriocarcinoma and Wilm's tumor), the odds of a cure for the major cancer killers are now just about as bad as they were two to three decades ago (Table 1). This is the case despite the billions of dollars spent on researching a cure for cancer; despite the high priorities for cancer research created by the 1971 National Cancer Act (which have been and continue to be directed towards curing rather than preventing cancer); and despite the optimistic, contrary assurances of the American Cancer Society.

The Increasing Incidence of Cancer

Cancer is now the only major killing disease whose incidence is on the increase. In 1900, the crude cancer death rate was 64 per 100,000 of the population, accounting for 4 percent of all deaths. By 1976, the crude cancer death rate had reached 176 per 100,000, accounting for 20 percent of all deaths. While to some extent, this increase in cancer mortality reflects

increased longevity, there has also been a real major increase. Standardized cancer death rates, adjusted for age and based on the total U.S. population, show an overall and progressive increase of about 11 percent from 1933 to 1970. This increase has been even more striking over the last decade (Table 2), and cannot be accounted for by smoking (Table 3). The actual probability at today's death rates of a person born in 1979 getting cancer by the age of eighty five is 27 percent for both men and women, in contrast to about 20 percent for a person born in 1950.

The Causes of Cancer

Evidence for the environmental causes of cancer is provided by a constellation of scientific findings. These include: the striking increase in overall cancer death rates in this century; the still more striking increase in death rates for certain "high risk" population subgroups, such as workers in asbestos or petrochemical industries, pre-menopausal women who have been subjected to repeated mammography, and post-menopausal women who have been administered oestrogen replacement therapy for prolonged periods; the major international geographical variations (in some instances by as much as 2000 percent) in specific organ cancer rates which have largely disappeared over the course of one or two generations following population migration from high to low cancer areas; the clustering of excess overall cancer rates and organ specific cancer rates in men and women living in heavily industrialized U.S. states (Table 4), particularly in those counties with a high concentration of petrochemical and certain metallic and non-metallic mining and processing industries; and the experimental demonstration of the carcinogenic effects of a wide range of chemicals, particularly synthetic organics.

Occupational Hazards

Environmental factors incriminated as causes of human cancer encompass a wide range of influences including background and man-made radiation; naturally-occurring plant, fungal, and chemical carcinogens; smoking; and industrial chemical carcinogens contaminating air, water, food, consumer products, and the workplace. Smoking is known to be associated with up to 80,000 deaths from lung cancer annually, quite apart from cancers at other sites including bladder, pancreas, and larynx. However, all the major epidemiological studies demonstrating the association between lung cancer and smoking have failed to take occupational exposures into account. It is also known that smoking synergizes the effects of various occupational carcinogens, such as asbestos and uranium. Additionally, the incidence of lung cancer in non-smokers, now about 20,000 per annum, has steadily increased over the last two decades. As indicated in the January 1979 Surgeon General's *Report on Smoking and Health*, over-emphasis on smoking has diverted attention from other important occupational causes of lung cancer.

Food and Cancer

Much has been made of the relationship between modern eating habits (particularly high caloric intake,

Table 1 Five-Year Survival Rates for Cancer* (Whites)
5-Year Relative Survival Rates %

Type of Cancer	Sex	1960-1963	1970-1973
Lung	M	8	9
	F	12	13
Breast	F	63	66
Cervix	F	60	62
Uterus (Body)	F	75	78
Prostate	M	49	57
Colon	M	40	46
	F	45	49
Stomach	M	10	12
	F	13	12
Hodgkin's disease	M	34	62
	F	52	59
Childhood leukemia*	M	5	23
	F	4	33

Source: M.H. Myers, NCI, May, 1979.

* These data are composite of results from three participants in the SEER programme: Connecticut Tumor Registry; Registry of the University of Iowa; and Registry of the Charity Hospital of New Orleans. Results reflect rates with a standard error of less than 5%. It should be noted that these 5-year survival rates do not reflect the possibility of late recurrences, such as those that are now being seen with Hodgkin's Disease.

Table 2 Changes in Standardized Cancer Incidence (for Some Major Sites) from 1970 to 1975

Cancer Site	Annual Percentage Changes in Incidence Rates, 1970-1975*			
	WM†	BM	WF	BF
Lung	1.0	0.7	8.5	11.6
Bladder	2.4	8.2	3.2	10.0
Rectum	0.3	4.5	2.3	9.9
Colon	0.8	4.9	1.0	4.9
Melanoma (skin)	6.0	36.6†		
Cervix			-6.5	-6.1
Uterus			9.0	12.0
Breast			2.3	8.9
All sites	0.9	2.3	2.2	6.1

Source: NCI, Third National Cancer Survey, 1969-1971, and Cancer Surveillance Epidemiology and End Results (SEER) Programme.

* The 1975 standardized overall cancer incidence rate (per 100,000) is 359.8 for white males; 413.2 for black males; 299.8 for white females; and 329.1 for black females.

†WM = white male; BM = black male; WF = white female; BF = black female

†Estimate unreliable as based on small number of cases.

Table 3 Changes in Cancer Incidence Rates from 1970 to 1975

Group	Average Percent Increase in Incidence Rates, 1970-1975			
	Cancers of All Sites		Cancers of All Sites except Lung	
	Annual	5-Year	Annual	5-Year
White male	0.9	4.7	0.9	4.6
Black male	2.3	11.9	2.7	14.3
White female	2.2	11.6	1.8	10.2
Black female	6.1	34.6	5.7	32.2

Source: As for Table 1.7 NCI, Third National Cancer Survey, 1969-1971; SEER Programme; and statement of M.A. Schneiderman before the U.S. Department of Labor, Occupational Safety and Health Administration, OSHA Docket 090, April 4, 1978.

high consumption of animal fats, and low consumption of grain and fiber) and the twentieth century cancer epidemic. On the basis of indirect evidence, it has been reasonably suggested that a low fiber, high fat diet increases the risk of colon and possibly other cancers, including breast cancer. However, the epidemiological case against fat is not at all strong, as there are populations that have high fat intake and little bowel cancer, and no case-control studies have yet identified fat as a risk factor. The apparent carcinogenic effects of a high fat diet, however, may well reflect an increased intake of a wide range of carcinogenic contaminants (accidental food additives) in animal fats, such as chlorinated hydrocarbon pesticides, which are still ubiquitous.

The Synthetic Invasion

Since the advent of the petrochemical era in the 1930s, a vast array of new synthetic organic chemicals have been introduced into commerce, generally in the absence of testing for carcinogenic and other chronic toxic effects on humans and the environment. By 1976, total US production of synthetic organic chemicals had reached 300 billion pounds per annum, from levels of about 1 billion pounds in 1940 (Figure 1). Currently, about seven hundred new chemicals are being introduced into commerce each year. In this connection, it must be appreciated that the property of carcinogenicity is relatively rare, and can be practically and economically detected by animal tests which are highly predictive of human effects. Of the less than one thousand chemicals which have shown to be carcinogenic, most belong to special subclasses (such as chlorinated olefins, alkyl halides, and aromatic amines) widely used by industry.

There is now substantial evidence incriminating the role of industrial chemicals as major causes of cancer. Recent confirmation of this was provided by a 1978 Health, Education and Welfare (HEW) report, *"Estimates of the Fraction of Cancer in the United States Related to Occupational Factors"*, prepared by ten leading experts in the National Cancer Institute, the National Institute of Environmental Health Sciences, the National Institute for Occupational Safety and Health, and the International Agency for Research on Cancer. The report conservatively estimates (with detailed epidemiological and statistical evidence) that up to about 38 percent of total cancer mortality over the

next three decades will be associated with asbestos, and five other "high-exposure" carcinogens (arsenic, benzene, chromium, nickel, oxides and petroleum fractions).

This report clearly underestimates the impact of occupational carcinogens. First, these estimates exclude the effects of radiation, and a wide range of other known occupational carcinogens. Second, these estimates fail to consider the effects of occupational carcinogens on the general community, due to their discharge or escape from industrial plants into the outside air, water, and hazardous waste disposal sites. Third, it is premature to assume that the effects of more recently introduced industrial chemicals can be gauged through current cancer rates. Fourth, the majority of epidemiological studies so far undertaken in the workplace, have been in larger industries which are likely to be less hazardous than the more numerous small plants manufacturing, handling or processing carcinogenic chemicals under even more poorly controlled conditions. Fifth, the duration of follow-up in most epidemiological studies on carcinogenic exposures in industry have been four times less than the necessary life-time observations period, and subsequently are likely to minimize the degree of risk.

Recognized Costs

Total direct costs of treatment for an individual cancer patient were estimated by HEW in 1971 to range between \$5,000 and \$30,000. Indirect costs are often much greater still, including loss of earnings from premature disability, besides insurance and death charges. Total national costs from cancer, both direct and indirect, were estimated by HEW in 1971 to be about \$15 billion annually. Projections for 1979 are in the region of \$30 billion.

Externalized Costs

In addition to the recognized costs of cancer, there are a wide range of incremental costs which have generally been discounted or poorly perceived. While no attempts have yet been made to describe and quantify the total externalized costs of cancer, it is clear that they are substantially in excess of recognized costs, as illustrated by the following few (far from comprehensive) examples.

In attempts to estimate the extent and potential costs

Table 4 Comparison of Cancer Death Rates: New Jersey, Wyoming, and North Carolina, White Females*

Cancer Death Rates	State			Excess Rate for New Jersey (%)	
	New Jersey	Wyoming	North Carolina	Wyoming	North Carolina
Overall	147.9	109.1	107.0	36	38
Lung	7.2	4.4	4.5	64	60
Bladder	2.9	1.6	2.1	81	38
Leukaemia	5.7	4.8	5.6	19	20
Colon and rectum	21.7	12.4	10.9	71	99
Pancreas	6.3	5.1	5.2	24	21
Breast	30.6	21.1	19.3	45	59

Source: Based on T.J. Mason and F.W. McKay, "U.S. Cancer Mortality by County, 1950-1969," DHEW Publication (NIH) 74-615, Washington, D.C., 1973.

* Age-adjusted annual mortality rate per 100,000 population.

of exposure of workers to occupational carcinogens, the National Institute of Occupational Safety and Health (NIOSH) undertook a Survey from 1972 to 1974, covering nearly 5,000 plants and close to one million workers (the results of which were published in 1977, in a document entitled, *The Right to Know*). The survey found that one in every four workers, nearly 22 million, are likely to be exposed to OSHA-regulated substances that can cause disease or death. The survey also found that up to 40-50 million Americans may have been exposed to an OSHA-regulated carcinogen or other toxic substance during their lifetimes.

In addition to knowing which workers have been exposed to what carcinogen, the NIOSH document stated that "there is currently no effective mechanism for locating workers and notification". The extent and potential costs of exposure of workers to carcinogens were also spelled out:-

"As many as 880,000 American workers, or one percent of the current labor force of 84 million persons currently face full or part-time exposure to carcinogens regulated by the Occupational Safety and Health Act."

"One in every four American workers (approximately 21 million) may be exposed on either a full or part-time basis to OSHA-regulated hazardous substances. Upwards of 40 to 50 million persons or 23% of the general population in the United States may have had exposure to one or more of OSHA-regulated carcinogens or hazardous substances during their working lifetime."

"The aggregate annual costs of physical examinations for workers currently exposed to carcinogens on either a full or part-time basis are estimated to be about \$230 million. The actual amount would depend on particular examination costs and the degree of worker participation."

"The annual costs to society of monitoring workers with either full or part-time exposures to all OSHA-regulated hazardous substances including carcinogens could range between \$675 million and \$2 billion."

"Even when consideration is limited to carcinogens, substantial costs (of surveillance) are involved. The total cost associated with workers currently exposed to OSHA-regulated carcinogens full-time is around \$434 million. The cost for both full and part-time workers is nearly \$8.5 billion. We believe that any worker exposed to a carcinogen for four or more hours a day should receive follow-up care."

Real Costs Underestimated

The \$8.5 billion surveillance costs (Table 5) are substantial underestimates, as they exclude the following:

1. Costs of surveillance for the very much greater number of workers currently exposed to occupational carcinogens still unregulated by OSHA.
2. Costs of surveillance of workers exposed in the past to OSHA-regulated carcinogens.
3. Costs of surveillance of workers exposed in the past to carcinogens still not regulated by OSHA.
4. Additional employer liability or compensation costs resulting from the discovery of compensable

cancer during surveillance and examination.

5. Entitlements under various federal and state programs.

6. Recovery for damages under possible third-party legal actions.

7. Recovery for damages under legal actions brought by the progeny or on behalf of the progeny of women exposed to occupational carcinogens during pregnancy,

8. Costs for the cases of community cancer and other diseases, such as birth defects, arising in the general public from spillover of occupational carcinogens from industry into the air, water, and soil of adjacent communities.

Industry represents a heterogenous array of interests. Such diversity is replaced by a common front of intransigence when it comes to proposed regulation of toxic and carcinogenic chemicals.



Earl Dotter (OSHA)

There are no available estimates of the projected figures for cost items 1 through 8. They are, however, clearly substantially in excess of the NIOSH estimate of \$8.5 billion.

Low Compensation

The current low level of workmen's compensation payments to workers who have contracted occupational cancer not only results in externalization of industry's costs, but also masks the full extent of the national costs of cancer. State compensation systems have abjectly failed to deal with occupational health problems, particularly for diseases with long latency such as cancer. Workmen's compensation laws vary from state to state only in their degree of inequity. Theoretically, these laws are based on an implied trade-off in which workers surrender their rights to sue their employer, in exchange for the guarantee of adequate compensation in a non-adversarial process. The courts have almost consistently upheld the legality of the denial of right to sue, but have generally failed to maintain the right to a non-contested adequate compensation.

Impossibly heavy burdens are placed on workers or their heirs to demonstrate unequivocally causal and exclusive relationships between their cancers or other diseases and prior occupational exposures to carcinogenic and toxic agents. Workers are obliged to hire a lawyer on a contingency basis (most lawyers are reluctant to accept such cases because of the poor chances of success and minimal nature of awards) to represent them before compensation boards which are often both unsympathetic and poorly informed. State compensation systems further make no provisions for identification and medical examination of retired or active workers previously exposed to carcinogens, but who are not yet clinically ill.

Recent surveys by the Department of Labor have shown that the average length of time from onset of disability to the first disability payment is one year for a disease claim, compared to two months for an injury case; that 60% of disease cases which were eventually compensated were contested, compared to 10% of injury awards; the probability of litigation approaches 90% for serious diseases; 55% of disease claims are settled by compromise and release agreements, compared with 16% of injury cases; the total compensation payment for permanent occupational disease is less than \$10,000, compared to \$23,400 for similar injury cases; compensation for death caused by occupational disease averages \$3,500, compared to \$57,500 for an injury case; foreign countries settle proportionately more disease claims than do the U.S. (in the case of Sweden the disparity is about twelve fold); and the claims determination process in most foreign countries is in the hands of a disinterested party, in contrast with the U.S.

Will Compensation Costs be Internalized?

An important recent development in attempts to reform the inequities of current workers state compensation systems, which would help to internalize some of the costs of occupational cancer, has been the introduction of S.3060 by the Senate Human Resources sub-

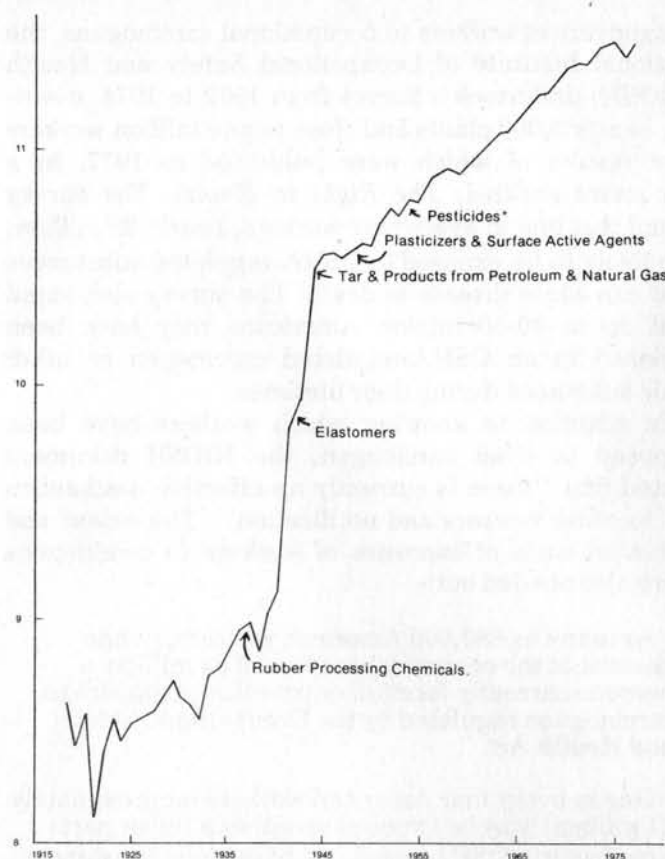


Figure 1
Source: *Production of Synthetic Organic Chemicals in the U.S. from 1918 to 1976.*

committee on labor. This bill is designed to provide comprehensive reform of compensation programs, and to impose uniform national guidelines, while allowing a reasonable degree of autonomy at the state level. Industry has reacted critically. The Alliance of American Insurers testified that the bill would impose "further liberalization of benefits without curtailing the abuses — (and that it would) explode costs and create administrative chaos". John F. Burton, chairman of the 1972 National Commission on State Workers Compensation Laws, however, testified on behalf of the bill, expressing the view that "for the first time a workers compensation bill had been introduced in Congress that deserves to be enacted".

Third Party Suits

Third party suits represent another major externalized cost of failure to regulate, whose numbers have burgeoned in the past few years. As the causal relationship between past exposure and delayed onset of cancer has become increasingly appreciated, the courts have recently come to apply the doctrine of "strict liability", and the prospects of success in third party suits is now increasing. It seems likely that the recent disclosure of the asbestos "Pentagon Papers" will have a favorable impact on the over 1000 asbestos-related lawsuits, totalling over \$1 billion now before the courts. (While large adverse judgments may act as an incentive to manufacturers to produce carcinogen-free products, and to be more candid and explicit if they persist in manufacturing carcinogenic products, the financial impact of out-of-court settlements is blunted by current IRS law, allowing the carrying forward of such costs for tax purposes.)

Recent Compensation Suits: the Tip of the Iceberg

Another category of externalized costs are suits against company doctors for medical malpractice, based on failure to warn of medical findings that would have otherwise allowed workers to limit further exposure. In illustration, are the ten lawsuits totalling over \$50 million against Kent Wise, former physician to a Johns Manville plant in Pittsburgh, California, on the grounds that he deliberately withheld information from workers on x-ray evidence of asbestos-induced lung disease. Such professional malpractice lawsuits in all probability, will also be filed in the future against company-employed engineers, chemists, and industrial hygienists for failure to protect workers and to inform them of occupational hazards.

Product liability suits, filed by consumers who have developed cancer, or other toxic effects, from consumer products, particularly drugs, represent a further externalized cost. Good examples are the \$100 million damage suit, and a \$1 billion class action for punitive damages filed in 1976 by three Long Island mothers against a score of major pharmaceutical companies and five physicians, and a similar class action suit against the University of Chicago for having prescribed DES to pregnant women in the early 1950's, without warning that it had been known to be carcinogenic over a decade earlier.

The class action lawsuit totalling \$2 billion by Love Canal residents against Hooker Chemical Company is a harbinger of events to come, and an inkling of the massively inflationary costs of failure to regulate. Apart from being dispossessed from their homes, these residents have suffered a wide range of adverse effects of which miscarriages and congenital malformations have been so far most clearly recognized. While an excess of breast cancer and leukemias have also been reported, their epidemiological status appears as yet undefined. It is estimated that the Love Canal area is contaminated with nearly 4,000 tons of trichlorophenol, contaminated with about 150 pounds of the highly potent carcinogen tetradoxin.

EPA estimates that there are approximately thirty thousand sites, such as municipal landfills and disused mines, all over the country which have been improperly used for disposal of hazardous and carcinogenic wastes, and that potential public health problems have been identified so far in about 100 of these. What percentage of these thirty thousand sites will turn out to be Love Canals and at what cost to the nation is yet to be determined.

Community cancer suits represent an as yet unexplored legal initiative for internalizing costs of the development of cancer from exposure to carcinogenic chemicals by residents living in the vicinity of petrochemical plants from discharge or escape of toxic and carcinogenic chemicals from inside the plant to the outside community. Apart from epidemiological evidence of clustering of excess cancers in heavily industrialized countries, there is now a significant body of monitoring data on levels of industrial carcinogens in the adjacent community air. Illustrative are the 2.8 ppm levels of vinyl chloride monitored in June 1977 by NIOSH in an elementary school in Saugus, California, which is located across the road from Keysor Century

Table 5 Estimated Costs of Surveillance for Workers Currently Exposed to OSHA-Regulated Carcinogens

	Workers Currently Exposed to OSHA Regulated Carcinogens Full Time	Workers Currently Exposed to OSHA Regulated Carcinogens Full Time or Part Time
Number of Workers	44,000	880,000
Obtain Addresses	\$ 18,000	\$ 352,000
Compose Letters	3,000	3,000
Print and Mail	66,000	1,320,000
Hotline	50,000	990,000
Conferences	200,000	200,000
Surveillance	423,280,000	8,465,600,000
TOTAL COSTS	\$423,617,000	\$8,468,465,000
Approximate years	37	37
Approximate Annual Cost	11,000,000	229,000,000

Source: *The Right to Know: Practical Problems and Policy Issues Arising from Exposure to Hazardous Chemical and Physical Agents in the Workplace*. NIOSH, July 1977.

Corporation which manufactures PVC and phonograph records. (The occupational standard for VC is 1 ppm.)

An additional major category of costs reflects the consideration that many carcinogenic chemicals pose other toxic effects, notably teratogenic and mutagenic. This introduces a calculus of externalized costs, the dimensions of which have not yet even been barely considered.

Industry's Track Record on Regulation

Industry, like labor, represent a heterogeneous array of interests and objectives. Such diversity, however, tends to be replaced by a common front of intransigence in response to the proposed regulation of toxic carcinogenic chemicals. A complex of interrelated factors seems involved in this posture. These include the near-automatic rejection of federal controls, without a parallel rejection of tax subsidies and other forms of corporate protectionism; preoccupation with short-term marketing interests, often in conflict with the needs for hazard controls, rather than consideration of long-term economic growth; excessive reliance on narrowly based, self interested recommendations of in-house marketing and scientific staff and their consultants on problems of health and safety; and a tendency to wait for health and safety problems to arise which are then dealt with defensively, rather than developing anticipatory strategies based on long-term considerations.

Industry has failed to adequately comprehend the magnitude of health and safety problems entailed in the manufacture and handling of hazardous chemicals. Accumulating information on carcinogenic and other toxic hazards in the workplace has not been paralleled by development of technological innovation to control these hazards. Indeed, industry has insisted that attempts at regulation are stifling technological innovation.* Industry has also failed to comprehend (or has discounted) the enormous costs to society of cancer and other diseases resulting from the unregulated or poorly regulated use of toxic and carcinogenic che-

*For a good analysis of this problem, see N. Ashford *et al*; *The Implications of Health, Safety and Environmental Regulations for Technological Change*. US Department of Commerce, 1979.

micals. Self interest apart, industry is not alone in this failure of comprehension which must also be shared with government and the public. Such failure, coupled with historic imbalances reflecting industrial dominance of decision-making with regard to its own products and processes, appear to be the major determinants of current industry policies. In analyzing industry policies and problems of constraints in their data, these considerations appear preferable to alternate simplistic theories based exclusively on machiavellianism.

Past Strategies

In support of the *status quo*, industry has evolved a complex set of strategies to use individually or in concert to meet the needs of any particular circumstance. Their essence is to minimize the reality of risks due to a particular product or process, to maximize the social benefits of the product or process, and to exaggerate the costs and difficulty of regulation. These strategies are sometimes presented frankly as industry positions. However, they often come from industry-front organizations and quasi-professional "scientific" or "educational" associations (such as the Nutrition Foundation and the Council on Agricultural Science and Technology), or from academic consultants as "professional" viewpoints, often with no hint as to their special relationship with industry. The elements of these strategies include:

□ *Minimizing Risks*, as illustrated by the Quebec Asbestos Mining Association's position that asbestosis is a reflection of past working conditions which have improved so dramatically that the industry is now safe, or again in the claims of industry's front-organizations that there is no risk in exposure to 'relatively low levels' of carcinogenic chemicals:

□ *Blaming the Victim*, witness the attempt by the American Industrial Health Council to ascribe occupational cancer to smoking, poor diet and individual hyper-susceptibility rather than exposure to occupational carcinogens:

□ *Using Propaganda*, as illustrated by the successful, but grossly misleading, media assault on the public by the Calorie Control Council, in response to the proposed Federal Drug Administration (FDA) ban on saccharin, and the self-serving Monsanto advertising campaign, reassuring the public of the safety of synthetic chemicals and the high degree of responsibility of the industry (positions at variance with Monsanto's record on various chemical products, such as acrylonitrile Cycle Safe bottles which were marketed prior to completion of carcinogenicity testing):

□ *Diversionary Tactics*, such as insistence on degrees of scientific precision and legal definition that cannot possibly be met in toxicological or epidemiological studies, often coupled with rejection of carcinogenicity test data in animals, and demands for long-term prospective human studies over the next few decades pending the results of which (it is claimed) regulatory action should be deferred:

□ *Influencing Policy*, powerful, well-focused and well-financed industry lobbyists and the National Chamber of Commerce network represent a national force which can be instantly galvanized to subvert the legislative and regulatory process, both in the promulgation and implementation of standards without adequate balanc-

ing pressures — other than those that can be mustered on behalf of the confused or apathetic public or work-force by the limited resources of public interest groups and organized labor:

□ *Exhausting the Agencies*, once an agency has decided to regulate, or been obliged to regulate in response to concerns of labor or public interest groups, industry generally resorts to legal action, insisting on a protracted case-by-case re-examination of fundamental principles of toxicology and carcinogenesis, while at the same time claiming trade secrecy on related questions of alternate non-carcinogenic products and processes:

□ *Flight of the Multinationals*, with increasing national concern for occupational health and environmental considerations, US industry with multinational connections has embarked on the large scale export of hazardous products to 'runaway' shops in lesser developed countries such as Mexico, Brazil and Taiwan, where cheap and unorganized labor is ample and where there are virtually no regulatory controls, (see *The Ecologist*, May-June 1979).

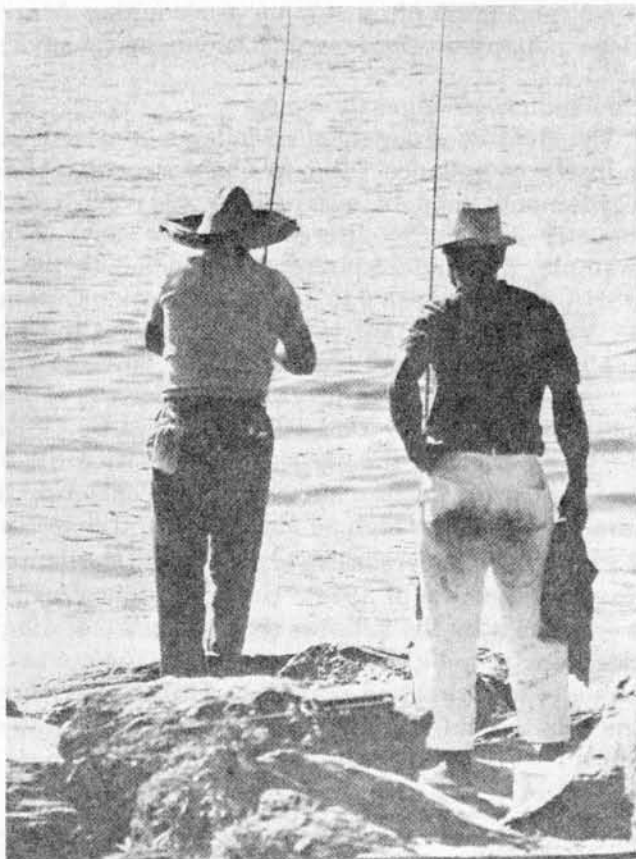
US Government Policies for Regulation

In March, 1978, President Carter issued an executive order, requiring regulatory agencies to develop economic analyses of all major proposed standards, with particular attention to their impact on business. The order was promptly endorsed by the U.S. Chamber of Commerce. Since then, the Administration has imposed increasing restrictions on health and environmental regulations, particularly through the Regulatory Analysis Review Group of the Council on Wage and Price Stability (COWPS). As an agent of the President, COWPS is now pitted against the regulatory agencies in their discharge of policies laid down by Congress.

As OSHA was concluding a review of comments on its "generic" cancer policy, COWPS issued a report in October, 1978, sharply critical of the proposal on both economic and scientific grounds. COWPS, which draws freely on affected industries for staff, cited the economic impact analysis prepared for the American Industrial Health Council (and admitted by COWPS to be "seriously flawed") as its authority for stating that the total costs of the proposed regulation will be inflationary. These cost estimates were developed in a 1978 report by Foster D. Snell Inc., a division of Booz, Allen & Hamilton (whose earlier cost analyses on meeting the "no detectable level" vinyl chloride occupational standard were shown to be grossly exaggerated). The study claimed that the cost of controlling suspect carcinogens could range between \$9 billion and \$88 billion in capital investment, and between \$6 billion and \$36 billion in annual operating expenses. However, Joseph Califano, Secretary of Health, Education and Welfare, in his 1978 address to the national AFL-CIO conference on occupational health, commented:

"It is in my judgment, myopic to argue that programs to protect workers are inflationary — if we do not count in our calculations what those programs buy: safety, health, and often greater productivity."

COWPS was equally critical of the OSHA benefits analysis for its failure to address the cost-benefit question on a carcinogen-by-carcinogen basis, and for failing to determine incremental benefits over and above those



The River Hudson (above), thoroughly polluted by industrial PCBs. (Right) New Jersey, pollution capital of the East Coast.



achievable by alternate methods of regulation. This criticism was buttressed by reference to the October 1978 decision of the 5th Circuit Court, overturning the benzene standard on grounds including economic feasibility, and cost-benefit considerations. COWPS was also critical for OSHA for disregarding potency and risk assessment in their essential classification of chemicals into carcinogens and non-carcinogens.

On October 24, 1978, President Carter announced his new anti-inflation program, concluding that inflation is the nation's Number One problem, and that prompt remedial action, including across-the-board austerity measures, must be taken immediately. However, the program embodies budgetary cuts, which are likely to increase unemployment, and further restrictions on regulations designed to protect workers and the environment. The new measures, moreover, fail to protect consumers from runaway price increases in the four basic necessities of life — food, energy, housing, and medical care — those areas where inflation hits hardest.

Important Constitutional Issues Raised

The new administration initiatives raise important constitutional and legal issues, particularly as they appear to represent direct executive usurpation of legislative authority. (This usurpation is over and above the personnel ceilings imposed by the administration which have prevented agencies from functioning adequately within approved budgetary limits.) Regulatory responsibilities have been created by Congressional Acts to implement specific programs under specific legislation.

The Occupational Safety and Health Act, for example, mandates "safe and healthful working conditions", without reference to economic and technical feasibility or cost-benefit considerations. The intervention of the White House staff in the regulatory process, in the name of fighting inflation, does not appear authorized by statute.

Constitutional and legal issues aside, there are serious problems and flaws inherent in the administration's approach to regulation from myopic and narrowly defined cost-benefit perspectives.

First, most cost-benefit analyses do not adequately reflect the economic and other costs of deregulation or failure to regulate in terms of disease and death, and environmental degradation. This is especially so in view of the substantial uncertainties inherent in quantitative risk assessment or costing, as are illustrated by the 10 million-fold range in current estimates of the carcinogenic hazards of saccharin (Table 6). Additional uncertainties in such costings are created by the likelihood of synergisms and multiple exposures which are in general unpredictable. Quantitative risk assessment is a premature science fostered by pressures to express public health hazards, particularly those inferred from animal test data, in simplistic economic terms. Additional costings, based on medical treatment, and income or productivity losses, seem inadequate or inappropriate estimates for pain and suffering, and loss of life. While the recognized annual costs of cancer are in the region of \$30 billion, there are still a wider range of

larger and currently unrecognized and externalized costs.

As the burden of environmentally-induced cancer and disease has progressively increased, total national health expenditures have soared from \$30 billion in 1960 to \$185 billion by 1978. Health care costs in 1978 were roughly nine percent of the G.N.P. and \$55 billion more than the defense budget. HEW Secretary Califano has recently pointed out that of the \$48 billion federal expenditures on health care in 1978, fully 96 percent was directed to treatment, and only 4 percent (under \$2 billion) was spent on disease prevention programs. Health care leads the nation's inflationary spiral, and has been growing at the rate of 15 percent or more for the last five years. The contrast between runaway health care spending and the resistance of the administration, besides industry, to invest in environmental health protection is striking.

Apart from recognized health care costs, there are a wide range of related costs that can no longer be externalized. As recently pointed out by Paul Samuelson, conventional estimates on the impact of regulation on economic growth and the Gross National Product are meaningless, unless —

"We adjust for any such "bads" that escape the G.N.P. statistician whenever society is both failing to prevent pollution and failing to make power (or water or air or cotton) users pay for the full costs of the damage they do. (Once we make these adjustments), we see that the net economic welfare grows more slowly than (conventionally measured) G.N.P."

What is Real Cost?

Second, there are also problems in evaluating the cost of regulation. Compliance strategies involve large degrees of uncertainty, and generally ignore treatment of positive externalities arising from innovation associated with add-on devices, or alternative technologies, including product or process substitution. (A good example of economic product substitution in the early 1960s in small business is the substitution of toluene for benzene as a solvent in glues, which virtually eliminated occupational leukemia in the shoe-making industry in northern Italy.) Compliance may achieve substantial economies by recovering and recycling valuable chemicals, otherwise lost as air and water pollutants. Cost analyses also rarely reflect the creation of new pollution control industries. According to a November, 1978 report, prepared for the Environmental Protection Agency (EPA) by Arthur D. Little, the air and water pollution control industry (manufacturing equipment, instruments and biochemicals for pollution control from industrial plants, and for municipal solid waste recycling plants) had record sales of \$1.8 billion in 1977, accounting for about 36,000 jobs. These new industries are growing about twice as fast as the rest of the U.S. industry, and are projected to grow even faster over the next decade. Another important consideration is the fact that industry has a virtual monopoly on data needed to assess costs of compliance. Industry estimates on the cost of regulation are often exaggerated, sometimes by several orders of magnitude. OSHA and COWPS do not have adequate resources to scrutinize such alleged

costs, and must often rely on a consulting firm with close industry ties for economic and technical advice.

How Industry Fudges the Books

The clear need for detailed independent scrutiny of industry compliance estimates and economic impact assessments (and of analyses by COWPS based on industry claims) is afforded by the vinyl chloride example. The industry strongly objected to the 1974 OSHA proposal for a 0 to 1 ppm occupational standard for VC on the grounds that it was beyond their compliance capability and too expensive. To bolster these claims, contracts were given by the Society of Plastic Industries to Arthur D. Little, Inc., and by OSHA to Foster D. Snell for the purpose of estimating the economic impact of the new standard. The consulting firms predicted costs as high as \$90 billion and losses up to 2.2 million jobs (persuasive arguments in the depressed economic climate of 1974). However, these estimates were shown by the subsequent experience of the plastics industry to be gross distortions. In spite of massive industry lobbying and pressures, OSHA stood firm on the new 1 ppm standard, which was promulgated on April 1, 1975.

The low level of compensation payments to workers who have contracted occupational cancer not only externalises industry's costs but also masks the full extent of the national cancer bill.

Table 6 Estimated Human Risks from Saccharin Ingestion of 0.12 g/day

Method of high- to low-dose extrapolation	Lifetime cases/ million exposed	Cases per 50 million/yr.
Rat dose adjusted to human dose by surface area rule		
Single-hit model (Hoel, 1977)	1,200	840
Multi-stage model (with quadratic term) (Hoel, 1977)	5	3.5
Multi-hit model (Scientific Committee of the Food Safety Council, 1978)	0.001	0.0007
Mantel-Bryan probit model (Brown, 1978)	450	315
Rat dose adjusted to human dose by mg/kg/day equivalence		
Single-hit model (Saccharin and Its Salts, 1977)	210	147
Multi-hit model (Scientific Committee of the Food Safety Council, 1978)	0.001	0.0007
Mantel-Bryan probit model (Brown, 1978)	21	14.7
Rat dose adjusted to human dose by mg/kg/lifetime equivalence		
Single-hit model (Brown, 1977)	5,200	3,640
Multi-hit model (Scientific Committee of the Food Safety Council, 1978)	0.001	0.0007
Mantel-Bryan probit model (Brown, 1978)	4,200	2,940

Source: "Saccharin: Technical Assessment of Risks and Benefits" Report No. 1, Committee for a Study on Saccharin and Food Safety Policy, NAS Institute of Medicine, November, 1978.

Within one year, the VC/PVC manufacturing industry had successfully met the new standard, and without any major economic dislocation. B.F. Goodrich, one of the industry giants, redesigned its manufacturing technology to enclose VC manufacturing and handling processes and plug possible sources of leaks. Additionally, a "stripping" process was developed to reduce levels of the unreacted VC monomer in the PVC resin and to decrease VC loss in the process (and thus reduce contamination of the surrounding community, besides reducing worker exposure). The initial capital costs of compliance were only \$34 million. Contrary to the estimates of the consulting firms, B.F. Goodrich found that the new clean-up technology actually cut labor costs and could be profitably leased. (In spite of this, B.F. Goodrich increased the price of its PVC products in 1976, claiming higher production costs and blaming these on regulatory standards.)

The experience of Union Carbide is similar. In late 1975, an official expressed surprise as to how unexpectedly easy it had been for his company to comply with the 1 ppm standard. However, earlier company reports had documented the economic advantages of compliance through recovering and recycling VC which would have otherwise been lost to the general environment. Currently, the VC/PVC industry is enjoying an unprecedented boom. Quite apart from the distortions in estimates on the economic impact of compliance, they ignore the major costs to the industry from losses of VC gas, with resulting air pollution of the plant and adjacent community. They also ignore or discount the major costs to society, both direct and indirect, from failure to regulate, with resulting VC-induced disease. Finally, these estimates do not reflect the emergence of a small and booming industry manufacturing the monitoring equipment now required to meet OSHA regulations.

Do We Need Industry's Products?

Compliance costs are generally estimated on the implicit and self-serving assumption that a particular product is socially beneficial, even in the absence of supporting evidence or even in the presence of contrary evidence. Such assumptions cannot be substantiated for a wide range of carcinogenic products, such as saccharin whose main usage is by adolescents and whose efficacy in the treatment of diabetes and obesity has never been documented in the scientific literature. Aldrin/Dieldrin are among other examples of high carcinogenic products, that have produced widespread environmental contamination, for which the manufacturer (Shell Chemical Co.) was unable to produce evidence of efficacy in the 1973 EPA cancellation hearings, as the major target insect population is resistant to these pesticides.

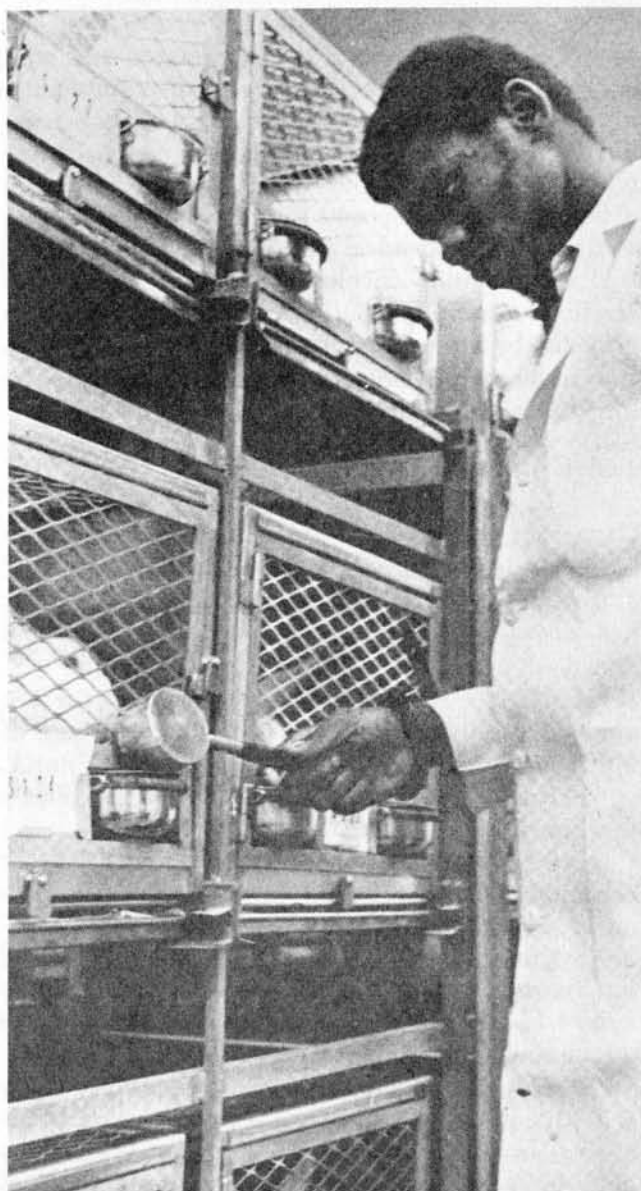
Is Testing Such a Major Financial Burden?

The costs of carcinogenicity tests are often cited by industry as a heavy and unjustified compliance expense, particularly on the grounds that too many new chemicals are being introduced into commerce each year to be handled by conventional animal testing and that the cost of such testing would be prohibitive. In fact, less than seven hundred new chemicals are intro-

duced each year. There is every reason to believe that current facilities could be expanded to cope without excessive strain with this number of chemicals. There are large potential facilities at the National Laboratories, such as Oak Ridge, Tenn., and Argonne, Ill., besides a large facility at the National Center for Toxicological Research, Arkansas. In addition, the bioassay program (under the new leadership of the National Toxicological Program) is planning to substantially increase its testing program to handle larger numbers of chemicals.

With regard to expense, the annual costs of testing one chemical for carcinogenicity in groups of fifty mice

Industry has a virtual monopoly on the data needed to assess costs. Its estimates are often exaggerated and in some cases the books have been cooked.



FDA

Is the cost of testing new chemicals as high as industry claims?

and rats of each sex at two dose levels is about \$200,000. Properly conducted carcinogenicity tests also provide information on a wide range of other chronic toxic effects, including testicular damage (leading to sterility), central nervous system damage (leading to paralysis or behavioural changes), and damage to the liver (leading to cirrhosis). The \$140 million costs for testing seven hundred chemicals would be unlikely to result in substantial increases in production and retail product costs. Such testing costs are about 0.2 percent of the 1976 \$76 billion gross sales of the chemical industry. The costs of testing should be further contrasted with the far greater costs of failure to test and regulate.

It may be noted that a 1972 Congressional report contrasted the then \$215 million total federal effort in environmental health with the \$83 billion value of products regulated in 1970 by one agency alone, the FDA. By 1978, total expenditures in carcinogenesis were still under \$200 million, which are trivial compared to the overall costs of preventable cancer and a national health care budget of about \$185 billion.

Finally, cost benefit analyses raise important questions of equity. The penalties of failure to regulate carcinogens are usually long delayed and impact on different sets of people than those who profit from the manufacture or processing of the carcinogen and who resist bearing the immediate cost of compliance (recognizing also that much of these costs could be distributed through tax write-offs and price pass-throughs). It would seem reasonable to require that the interests of a worker exposed to hazardous conditions and a consumer exposed to hazardous consumer products (both generally involuntarily and unwittingly) should receive substantially more protection than is now afforded by the regulatory process, and still more than that envisaged by regulation further attenuated in the name of fighting inflation.

Conclusion

1. Cancer is the only major killing disease whose incidence is increasing. In spite of massive funding and research, our ability to treat and cure cancer has not materially improved over the past few decades.
2. While the recognized annual costs of cancer are about \$30 billion, there are a still wider range of much greater and growing externalized costs, which have hitherto been discounted or poorly perceived.
3. Cancer is an expression of long past exposure to carcinogens in air, water, food, consumer products, including drugs, and the workplace. Synthetic organ chemicals, constitute a major class of environmental and occupational carcinogens, the extent of whose future impact has not yet been adequately appreciated.
4. With increasing realization of the invalidity of its scientific data base and with the emergence of independent scientists and qualified agency leadership, industry is shifting the arena of debate from science in regulatory agencies to economics in Congress and before the courts. Industry emphasis

is also shifting from the denial of risk from hazardous products and processes to demands for acceptance of poorly disclosed risks (by workers and consumers) on the basis of cost-benefit considerations. In this, they are powerfully supported by the new anti-inflationary policies of the administration.

5. Industry and Administration cost-benefit analyses are of limited validity. The reasons for this include uncertainties in estimates of costs and benefits; reliance on self-serving industry estimates on costs; failure to take into account a complex of factors including long-term economies that can be often achieved by regulation; the vigorous growth of new anti-pollution industries; the existence of economic alternative technologies, including product and process substitution; the lack of any social benefits from many hazardous products requiring regulation; and the inflationary impact of failure to regulate in terms of substantial externalized costs which hitherto have been largely discounted.
6. The only effective cancer prevention lobby is embodied in a few public interest and consumer groups and some elements of organized labor. The medical and scientific professions have been largely indifferent to the needs for carcinogen regulation. The American Cancer Society has in general been hostile or indifferent to legislative or regulatory moves in this direction.
7. The likelihood of future success in the regulation of toxic and carcinogenic chemicals in air, water, food, consumer products, and the workplace would seem to be dependent on the recognition by Congress and the Administration of the inflationary impact of failure to regulate toxic and carcinogenic chemicals. Equally critical are needs for such recognition at the level of state government.
8. The electorate must rank cancer prevention (quite apart from other preventable disease induced by toxic environmental agents) at least as high as inflation on the next political ticket of their local and state representatives, Congressman, and President.

ENVIRONMENTAL POLLUTION MANAGEMENT

This bi-monthly European journal is the leading journal in English, which deals comprehensively with all aspects of pollution control — liquids, solids, air and noise. As such it is essential reading for all who are concerned with the effects of man's activities on the environment. The annual subscription is £12.50 (£4.00 extra for Air Mail delivery) and a sample copy will be sent free on application to the publishers:

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Peter Hussey



The Ecology Party Conference 1979

The Ecology Party has decided to set up a national headquarters to provide the facilities necessary for the party to become a significant force in British politics. The decision was taken at a recent conference in Keele, attended by just over 200 members.

The proposal to establish a London office has been a controversial issue within the party for some time, but was approved at the conference with remarkably little acrimony. Many activists remain convinced that the decision will inevitably lead to the creation of an inert, bureaucratic organization, manipulated from the centre, but the majority were swayed by the persuasive case put by David Fleming, the party's press officer. Admitting that Eco had as yet made little political impact, he told delegates that they were faced with a simple choice between "whether we are to take an effective part in the politics of the nation, or whether we should be satisfied with a worthy non-polluting leisure activity for a tiny minority of aware middle class people". Without an efficient, national office, the party would be doomed to the latter, he argued.

Superficially, the debate appeared to be a parochial dispute over internal administration, but was in fact symptomatic of a profound identity crisis currently afflicting the party. The schism is between those who see the Ecology Party as "a commando unit" intent on storming the barricades of centralist power in order to seize the controls, and those who view it as a working model of an alternative society, seeking change through radical community politics. Advocates of the latter strategy harboured a positive antipathy towards the proposed office, which they saw as incompatible with their vision of

the Ecology Party as a loose, informal network of autonomous branches. The conference decision is, in effect, a compromise between the two extremes, opting into national politics as a vital complement to branch and community activities.

A similar conflict between the demands of efficiency and the precepts of ecology arose over a proposal to elect a formally designated 'Party Leader'. A leader was necessary, suggested outgoing Chairman Jonathan Tyler, to act as a national focus, and to personify the party for the benefit of the media. Tyler was at pains to stress the differences between the role envisaged, and the hierarchical system traditionally implied by 'leadership', but enough delegates remained unconvinced by this somewhat specious distinction to ensure that the proposal was narrowly defeated.

Much of the remainder of the conference was taken up with debates concerning party policy. The discussions centred around papers prepared by working parties, and succeeded in being both vapid and inconclusive. The difficulties facing the Ecology Party in its attempt to refine ecological ideas into detailed policies are exacerbated by the existence of two different factions within the party. The 'idealists' as the tag implies, are concerned to inject a measure of idealism and vision into contemporary politics, an ambition which is constantly frustrated by the 'realists', who insist that eco-policy should be both immediately practicable, and tailored to the present whims of the electorate. The divisions between the two groups are accentuated by a tendency on the part of the 'realists' to reduce the

message of ecology to a simplistic mix of environmental protection and resource conservation.

The contrast between the two factions was vividly highlighted during the defence debate, when the conference was unable to agree on even the first principles of a defence policy. Delegates who put the case for pulling out the war system "as an act of faith", were left rather bemused when a member of the party's National Council outlined his support for the concept of deterrence. His assertion that "our security depends on nuclear weapons and our readiness to use them", with the implicit paranoia about "the communist threat" found little support, but served to underline the extent to which the Ecology Party has yet to achieve unity at a fundamental philosophical and moral level. The conference was eventually left with no option but to refer the defence paper, together with the three other policy papers, back to the working parties for further revision.

Following this débâcle, many members are now questioning whether the attempt to achieve consensus on a detailed manifesto of eco-policies is a chimera the Ecology Party would be well advised not to waste too much energy pursuing. One alternative being canvassed is for the party to concentrate on promoting a broad statement of ecological intent, while accepting a healthy diversity of opinion on exactly what policies will be required to effect the transition to an ecological future. Another view holds that any attempt to formulate detailed blueprints is both misguided and presumptuous, since an ecological society can only be created from the bottom upwards not imposed from above.

The conference was generally agreed to have been one of the most tedious and gruelling experiences any ecologist has ever been subjected to. For Ecology Party conferences to become almost indistinguishable from those of other parties is perhaps one badge of political maturity that should not be advertised too widely. Nevertheless, one important conclusion can be abstracted from the morass of rhetoric and procedural manoeuvring: the wholehearted commitment to national politics, and the decision to establish a London headquarters may well turn out to be a watershed in the party's development, and assuming the party manages to raise the necessary funds to get the office off the ground, its future success seems assured. Its upward progress would surely be faster still if it first managed to achieve a greater degree of ideological unity.

Peter Frings

Goldsmith: What made you start Men of the Trees?

Baker: I had news that an ecological survey was being undertaken in the Sahara, to the North of the Gold Coast, and I learnt that the local tribesmen had been forced by increased desertification to retreat to a small triangle of land, the last remaining patch of forest in the area. There was desert behind them for a thousand miles, and desert to either side of them for a thousand miles; the chiefs had forbidden marriage and the women refused to bear children because the end of the forest was in sight.

At the time, I was Assistant Conservator of Forests in Kenya and I was determined that the Kenyans should never have to suffer such an appalling social and ecological disaster. The solution, as I saw it, lay in planting trees, but the trouble was that the government had very little money to spend on reafforestation. I realised that if the project was to have any chance of success, I had to enlist the co-operation of the local people, in particular the Morans, the young warriors. But how? the answer was through a dance. In Kenya, everything starts with a dance, so I went to the local elders and I said, 'You have a dance when the beans are planted, another when the corn is reaped, what about a dance of the trees for tree planting?' 'Trees? That's Sharia Mungo. That's God's business. They just grow'. 'Yes', I said, 'but if you destroy all your parent trees, your mother trees, you don't give Mungo a chance. We will have a dance in three weeks time. I will offer a prize of a fatted bullock for the best turned out warrior, and a necklace of their favourite beads for the most beautiful damsel. I shall choose the winning dancer, assisted by a committee of twelve chiefs.'

They liked the idea, and three weeks later three thousand people turned up for the first Dance of the Trees. That was the day that I called for volunteers who would promise before the High God to plant so many trees each year and to take care of trees everywhere. The movement gradually grew until tribes who were suspicious or hostile began to exchange hospitality because they were all Men of the Trees. The name



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ion. Would you accept that?

Baker: Yes. You can gauge a country's wealth, its real wealth, by its tree cover. In spite of our beautiful parks, Britain is only 6.5 per cent wooded, whilst France is 26 per cent wooded, Germany 28 per cent and Sweden 57 per cent. We are almost at the bottom of the list: there is only one country worse than ourselves and that is Ireland. A country's very poor that doesn't have trees. Look at the Sahara: the desert is spreading along a two thousand mile front, in some cases to a depth of thirty miles in one year. It is becoming poverty-stricken. People who have lived for generations on what the forest yields are now having cut down the forest to make way for cash crops, forced to retreat before the oncoming desert.

Goldsmith: In Africa do you think it is possible to develop, in the Western sense of the term, without causing deforestation and other forms of environmental degradation?

Baker: No.

Goldsmith: Do you think people are going to face this fact?

Baker: It is difficult.

Goldsmith: In this country, what percentage of the land area do you think should be reafforested?

Baker: The minimum for safety is one third of the total land area. I think what is happening to the elms must be alerting the whole country to the necessity of trees, of the need for more trees. The elm has the largest leaf surface of any tree in Britain. If you defoliate a large elm and put the leaves together edge to edge, they would cover ten acres. So naturally, the first tree to suffer from air pollution was the elm and, of course, when an elm is suffering from fatigue it is subject to attack by disease: the elm bark beetle, the carrier of the elm fungus, comes along and the tree succumbs.

I look at it this way. If a person is living a normal life and not abusing themselves — not smoking too much, not eating too much, not drinking too much — but living normally and eating the right food — they will be fit and well. It is only

A Man of the Trees

An indefatigable champion of forests, Richard St. Barbe Baker has travelled worldwide persuading governments and people of the value of trees. He has battled on behalf of the Redwoods of California and planted trees in the Sahara in an attempt to halt the encroaching desert. Recently he visited Cornwall. Edward Goldsmith talks to him . . .

started as a nickname really because we were always planting trees.

Goldsmith: Do you agree that poverty in the Third World is not simply deprivation of material goods? People are poor not because they are short of electric toothbrushes, they are poor because there are more and more people living on land that looks increasingly like the surface of the moon, devastated through deforestation and soil eros-

when they start abusing themselves that they are prone to attack by disease. It is the same with trees.

The next tree to go (the next tree with the largest leaf surface after the elm) is probably the beech: after that the sycamore: and so on. Finally it will be Man's turn. We forget that we owe our existence to the presence of trees and as far as forest cover goes, we have never been in such a vulnerable position as we are today. The only answer is to plant more trees — to plant for our lives.

Goldsmith: If we were to grow trees on a third of the land in this country, we would have to use up a good deal of agricultural land: don't we need that land to feed our population?

Baker: If you want to double your supplies of food, then you should devote twenty-two per cent of your farm to trees, to strategically planted shelter belts. We found in Alberta that if we devoted twenty-two per cent of a quarter section, that's 160 acres, to trees we could double the crop output. Trees create microclimates, reduce the speed of the wind, lift the water table and increase the population of worms. Darwin revealed all there was to be known about worms, but he didn't tell us how to harness them. If the farmers only knew how to harness worms, they could double their crops. Trees provide the answer.

Goldsmith: I can see that this could be so in Alberta, where the winds sweeping across the Prairies are obviously more destructive, but do you know of any research which shows the effects of tree cover on crops in Britain?

Baker: If it works in Alberta, it would probably work much better here.

Goldsmith: What techniques are available today for replanting trees in the arid tropics?

Baker: I have had a good deal of experience of this over the last twenty years. The first thing is to get the voluntary co-operation of the local people. In Morocco, we were able to employ nearly 80,000 people, 40,000 of them planting trees and making roads through the new forests. In Algeria we used what has been

"The first tree to suffer from air pollution was the elm. Next to go is the beech: after that the sycamore. Finally it will be Man's turn . . ."

called the 'bulkhead system' for replanting. We threw up little banks all along the mountain side and planted fruit trees — apricots and figs — on them, with cereals in between if the slope was gentle enough. If it wasn't, then we stuck to trees, all Mediterranean species. The first planting party goes along and digs the holes, the next wave brings up the little trees, and the last wave puts them in the holes. Then the tankers come and spray the line.

Goldsmith: What do they spray?

Baker: Oil mulch from the Esso petrol refineries. It stabilises the dunes and draws down the heat. This lifts the water from underneath the ground and the water comes up in steam, leaving the salt behind in the soil. It is like growing trees with underheat, as in a nursery. After one week you see a shoot of about one inch long: a week later it will be two inches or so; and in eighteen months will have grown to fifteen feet.

We have worked out that the economic rotation of a plantation of Eucalyptus is six years or six and a half at the most. But a single Eucalyptus tree, 45 feet high, will transpire 82 gallons of water a day onto the earth. In this way, a microclimate is created in which one can grow food.

The effect of the black mulch is to draw down the heat; that sends up a wall of heat which in turn drives the rain-bearing winds from the sea to a height where they come down as dew or rain at night.

Goldsmith: If the optimum commercial rotation for Eucalyptus trees is six and a half years, what would be the optimum rotation for an oak tree in Britain?

Baker: Well, for hedgerow oaks,



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which are grown very fast for special purposes, they would be ready after about 150 years or so. To get the best value out of an oak, however, you want height not girth. If you plant them in conjunction with beech, you can get a return of five pounds per acre on a 320 year rotation for oaks with three crops of beech.

This is actually being done on the Lichtenstein estate in Germany. Here the acorns are planted in lines six feet apart and after twenty years, swathes are cut at right angles to those lines, leaving one stem every six feet. Then the oaks are underplanted with beech. You have to give the oak twenty years start over the beech because the beech will soon suppress the oak: the beech is a shade bearer, the oak a light demander, so you have to crop the beech after a hundred years. This has to be quite a careful operation as the south-east stem of the oak mustn't be exposed to the morning sun — when the oak sap freezes on a frosty night, a rapid thaw fractures the cells and you get a 'frost shape' which ruins the timber.

Thinning is done by a supervisor, his assistant and a student. They watch the pattern of the shade on the forest floor and they are very careful not to let in too much light, otherwise

"Wheat has been grown continuously for a hundred years at Rothamsted. The secret is that the fields are surrounded by trees."

grass would grow and take away from the wood increment. This is done year after year, and if the supervisor dies, then his assistant takes over and a new student is taken on. Thus, there is absolute continuity of management. You get three crops of beech and after 320 years, the whole forest is felled. The land is used for agriculture the next time round, and the foresters move on to other land that needs building up.

I divide agricultural land into seven grades and forest land into seven grades, the last three agricultural grades overlapping with the first three of forestry. By planting the lower quality forest land you can raise its grade and transform it into agricultural land. The only category you can't transform into farmland is that land which would be sand dunes if it were deforested.

Goldsmith: If you treat land in this way, then theoretically it should last forever?

Baker: Yes, forestry is forever.

Goldsmith: They talk about Grades One, Two, Three and Four of agricultural land in Britain. Grade One is land that grows wheat indefinitely, and there is only 2.8 per cent of our land in that category.

Baker: Talking about growing wheat indefinitely, there is a field at Rothamsted Research Station which has grown wheat continuously for a hundred years. But the secret is that the field is surrounded by trees. It has great oaks around it and the roots of the oak go down to a great depth, tapping many minerals. When the leaves have served their function (carbon assimilation and wood formation) they fall to earth with just the right proportion of trace elements needed for plant food, animal food and tree food. The worms come up and take the leaves down overnight.



Katherine James

"If the Forestry Commission cannot take a long-term view, how can you expect the private landlord to do so?"

ready happened in the Californian Redwood forests, where these huge machines are used to do the felling. The ticking-over of the engine causes the ground to vibrate and a pan is formed about ten inches below the surface. I doubt whether the roots of the young Redwoods will be able to penetrate this pan, so they are likely to have a very short life span — twenty to forty years as opposed to two thousand years.

Goldsmith: Isn't it usual in modern forestry to clear the site completely after felling the trees — to remove the understory as well. Is this also a harmful practice?

Baker: In my opinion, there should be no clear-cutting at all. Felling should be by selection of the best stems, the mature trees, or by a group selection method where a cluster of trees is removed to enable the surrounding trees to regenerate the land. Planting should be a last resort. Good forestry, good silviculture allows for natural regeneration and planting should only be done in the case of emergency, or on fresh land.

Goldsmith: Why do you the British Forestry Commission continue to make use of such obviously unsound practices?

Baker: Forestry departments all over the world are now being run according to the dictates of economics, and Britain's Forestry Commission is no exception. Silviculture is being prostituted for short-term economic gain: it has increasingly become a question of money, machines and manpower — in that order. The Forestry Commission has to satisfy the Treasury and its policy of planting quick-growing conifers for pulp is designed for that purpose. But if the Forestry Commission cannot take a long term view, how can you expect private landlords to do so?

Goldsmith: What is the effect of planting pine trees generation after generation. Does this lead to soil deterioration?

Baker: Obviously. The hair-roots of the pine are furnished with a little sheath of acid, whose object is to enable the root to get a hold in a rock. If you have root competition between pines, the acid starts killing off the competitor's roots and an acid pan is formed in the soil. If you are foolish enough to plant a second crop of pines on the same soil, the roots only go down about two-thirds of their normal depth because they fight shy of this acid pan. If you are crazy enough to have a third crop of pines, the roots will only go down five inches or so and the trees blow over in the first storm.

Goldsmith: How about the litter produced by these conifers?

Baker: It is acid. Nothing else will grow and it is not good habitat for wildlife.

Goldsmith: Do you think the big machines used in modern forestry affect the soil adversely?

Baker: Heavy machines tend to form a hard pan in the soil. This has al-

Goldsmith: You played a considerable role in the fight to save the Redwoods in California, didn't you?

Baker: Yes, I first saw them in 1930. In those days, they were talking about preserving individual trees in memory of some great American or cause. I was thinking in terms of retaining a micro-climate in which these trees could survive, and I felt we needed at least 9,000 acres in one block to achieve this.

These Redwoods play a vital ecological rôle, filtering out the coast mists through what is called 'horizontal precipitation'. A big Redwood will ordinarily transpire about 500 gallons a day into the air through its leaves: when the sea mists come drifting over the forest, they hit this wall or transpired moisture — and down comes rain. If there are no Redwoods, the coast mists simply peter out over the desert.

I set to work to conserve 12,000 acres in one block. It took me nine years to create sufficient interest to raise the money to buy the forest back from the concessionaires, but in 1939 people at last began to sit up and take notice. For every dollar we raised, the State of California put up a dollar, and eventually Men of the Trees was able to hand over 12,000 acres to be preserved as a State Park.

Goldsmith: You were in California battling on behalf of the Redwoods quite recently, weren't you?

Baker: Yes, last year. I was called over to do an independent report on the National Redwood Park which had been taken over by Ladybird Johnson with much speechifying. You would have thought from the television interviews and radio broadcasts that they were never going to cut down another Redwood. How wrong you would have been! They have been felling on the edge of the National Park and on private land adjoining it, so much so that it had become questionable whether the National Park was still viable.

I managed to get my report out in time for an enquiry into the state of the Redwoods at the Sierra Club. I did some research in the library next door in case I was needed, and about halfway through the Attorney General came out and said, 'Are you



Katherine James

"If he had spoken out against the lumber industry, he would have lost his job overnight."

'Twenty to forty years, sir.' 'Am I hearing you correctly? Would you repeat that Professor?' 'Twenty to forty years, sir.'

Afterwards the Professor came over to me, very apologetically. He knew I would not have approved of his testimony: those trees have a natural lifespan of 1500 to 2000 years, during which they are fulfilling vital ecological functions. But I knew what would have happened if he had spoken otherwise, if he had taken on the big lumber kings and the lumber industry. He would have lost his job overnight.

Goldsmith: What country is making the greatest effort to reafforest its land?

Baker: China. I have been told by a geographer who recently returned from China that 32 million people are permanently employed by the government for reforestation. Even white collar workers put on their oldest clothes over the weekend and help the peasant farmers to plant trees. At school, the children vie with each other to see who can plant the most trees. All in all, they have increased tree cover from 7 per cent to 28 per cent. I am very proud that Men of the Trees sent seed out to China forty-seven years ago. I like to think that millions of the trees that have been planted were raised from the seeds we supplied.

Goldsmith: One final question, do you think that people are more receptive than they used to be to the message you have been preaching for the last seventy years?

Baker: Yes indeed. Young people today are deeply concerned about trees and the future of Mankind. They feel these things intensely — and that inspires me with great hope.

Dr. Baker: Are you responsible for this report?' I said that I was and he replied, 'Thank you, sir. Now we can act.'

He didn't say what he was going to do, but when I got to Washington I learnt that he had declared a moratorium on all felling until the whole issue came before Congress. Later I gave evidence at the Congressional hearings.

Goldsmith: Can you tell us a little more about the Sierra Club hearings? They were rather hectic, weren't they?

Baker: Two hundred truckers and loggers drove down to San Francisco to demand that felling should be permitted in the National Park. They had placards with the slogan 'No More Parks' and they had made effigies, cruel effigies, of Ladybird Johnson. They crowded into the hearing, filling up the court and shouting in unison 'No More Parks!'

I was slipped in through a side door in the press gallery. There was only one seat left. Quite early on, the Chairman of the Inquiry, a congressman, called on a Professor of Forestry to testify. During cross-examination, he asked: 'Professor, what did you say was the economic rotation of the coast Redwood?'



Books

Dark Roads Ahead

RESOURCE TRENDS AND POPULATION POLICY: A TIME FOR REASSESSMENT, by Lester Brown; THE DISPOSSESSED OF THE EARTH: LAND REFORM AND SUSTAINABLE DEVELOPMENT, by Erik Eckholm; KNOWLEDGE AND POWER: THE GLOBAL RESEARCH AND DEVELOPMENT BUDGET, by Colin Norman. Worldwatch Papers 29-31. Available from *The Ecologist*, £1 each.

The Worldwatch Institute continues to monitor the world's developing environmental crisis. The latest batch of three papers adopts widely differing perspectives: population policy; the case for land reform as a precondition for ecologically sound development; and the consequences of the culture-bound priorities of most scientific-research expenditure.

In Worldwatch Paper 29, Lester Brown gives an update on world population trends. At the beginning of this year, more than 4,000 million human beings were alive and looking for subsistence. As this number continues to increase, so the planet reaches the limits of its carrying capacity. Global life-support systems are showing signs of strain under this mounting load: after years of overfishing, the yield of oceanic fisheries is remaining constant despite increased investment, which means that yield per capita is on the downturn; the trend in the per capita yield of mutton and wool indicates the decline in grassland production; the plight of the world's forests is now entering the realm of common

knowledge; and the shrinkage in cropland area can no longer be met by increases in yield per acre, which augurs a diminution in cereal output in the years to come.

Lester Brown outlines a programme for population stabilisation by the year 2015. He is cautiously optimistic that this can be achieved, at a level of 6,000 million, by means of a gradual reduction in birth rate rather than a catastrophic increase in death rate. There are already signs that even countries which formerly were aggressively pro-natalist are revising their attitudes; Brazil is a case in point.

In Worldwatch Paper 30, Erik Eckholm addresses the effect of inequitable land distribution on ecological stability. This may take many forms: tenant smallholders with no security of tenure are unlikely to feel concern for the long-term fertility of the land they work; landless labourers seeking a living from the soil will clear forest, till marginal land, overgraze pasture and move on when the consequences make themselves felt.

More generally, there is little to be said for development and aid programmes whose benefits do not reach the poorest and, even where such programmes recognise the needs of the landless rather than of some undefined "small farmer", exploitative power structures can still frustrate well-meaning planners' intentions. In Ethiopia, for example, Swedish aid to enhance crop output in a region of oppressive tenancy conditions was deliberately concentrated on the poor tenants rather than being allocated to the landlords for redistribution. In one sense, this policy succeeded: the tenants' crop yields did improve. However, the landlords, seeing the benefits of modern technology, promptly evicted tenants in large numbers and began buying tractors; for those tenants who remained, the rent was increased from one third of their harvest to one half. Land prices doubled, and any chance that a tenant could buy the land on which he spent his labour vanished; output continued to rise, and the landlords reaped the benefits.

Eckholm's conclusion is clear: "Those serious about eliminating hunger have no choice but to involve themselves in the acrimonious politics of social change."

Colin Norman's point in World-

watch Paper 31 is that research and development expenditures, even those of Third World nations, are allocated according to developed-world priorities. What those priorities are is gloomy enough: the largest chunk of the Federal R & D budget in the United States (60 per cent) goes on military and space research; and as for industrial research, the general state of affairs there is made fairly plain by a recent pronouncement of the vice-president of the Ford Motor Company, complaining that Federal regulations had forced his company to spend 43 per cent of its R & D funds on fuel economy and emissions control. As Colin Norman drily notes, he didn't say what accounted for the other 57 per cent.

Trivial and misdirected as much Western R & D is, the fact remains that Third World countries with few facilities for research are dependent on Western technology, and those without even the means of evaluating different technologies are cripplingly dependent. On this basis, there is a case for further development of research facilities outside the industrialised world. More importantly, though, there is a need, in this field as in so many others, for priorities that correspond to the requirements of the eighties rather than, as is presently the case, the fifties and sixties.

Bernard Gilbert

Idle Dreams

THE BIOSPHERE AND POLITICS, G.Khozin, Progress Publishers £1.25. THE SPRING OF CIVILISATION by Ian J.Hackett. Campaign for Earth Federation 30p. ECONOMIC POWER by D.A.Simmons, Gemini Books £1.40.

Three blurred visions. The first is to be welcomed in so far as it reflects genuine concern and real action over environmental degradation in the USSR. Most readers, however, will see it only as a joyless communist tract which uses the ecological problems of the West as a pretext for bourgeois-bashing. Pollution, it

claims, is an effect of capitalism and can only be cured by changing the socio-economic structure of society. Socialist industry pollutes not. Not half it doesn't. That nuclear disaster in the Urals was certainly not caused by 'capitalist profiteering'.

It's possible that G.Khozin is indeed a Russian E.Goldsmith but is forced by the system to camouflage his warnings about Soviet industrial policies, and present them as a denunciation of the USA and its allies. More likely he is a party hack commissioned to use 'ecology' in the propaganda war much as the word 'peace' has been misused by the invaders of Czechoslovakia. To this end he claims that Marx and Engels were the first ecologists with Lenin their environmentally-aware mouthpiece. Searching the latter's Collected Works the best quotation he can find to support this risible contention is in Volume 32: "If we are to safeguard our oil reserves, we must see that the scientific and technical regulations are observed".

As described here Russia's own ecological initiatives are pretty elementary, and often read like the script of Ninotchka: "In 1973 alone 1,700 purification complexes were commissioned in the Soviet Union. They process over 13 million cubic metres of water every 24 hours". Nevertheless the book does make two valid points. One is that environmental protection is easier to enforce under the Soviet system than under democracy — but that, of course, is because the system is a dictatorship, not because it is socialist. The second point is that ecological co-operation between East and West is highly desirable. Mr.Hackett's wistful and in many ways appealing vision is an Earth community divided into about 1000 mini-states, based where possible on separate cultural identities, under a Federal World Government located in Malta. States will have a fair degree of local autonomy but the world government will wield all military power and have very extensive economic authority. For example it will have the right and the duty to tax the successful states in order to develop the poor ones.

Such a solution is justified in this book by Mr.Hackett's summary of world history in the first chapter. This convincingly demonstrates that

war is inherent in the 'nations system', and that as the nations get bigger the wars get worse. He also shows why the UNO, despite its intentions, is powerless to guarantee peace. Much of this is salutary — our present dangers are all too real and the relative security of the last three decades all too false.

But how is Mr. Hackett's Federation to be achieved? What will persuade the USSR, for example, to devolve into 55 autonomous little countries and reduce the Kremlin to the status of the recently proposed Scottish assembly? What will change the hearts and minds of the power-hungry rulers and would-be rulers of any of the existing UN members? 'The Spring of Civilisation' suggests that if some small country, like Malta, commits itself to the principle of world federation, others will follow suit and a notional world government will be formed. As the movement gathers momentum, the notional government would gain credibility — and power...

Well, maybe, but nothing in Mr.Hackett's view of history and current affairs supports the idea that today's rulers will behave so obligingly. And the thought also occurs that the military and economic powers of the world government would be almost impossible to control democratically. Malta would become a super-Kremlin all too easily.

The third vision also has an appealing side but again provides no convincing route to its accomplishment. D.A.Simmons's analysis of big business in Britain is so one-sided as totally to overlook the existence of the labour party and the trade union movement. His UK is controlled by a tiny clique of aristocratic, ex-public-school, tax-evading, Tory businessmen; no one else has any voice. Rubbish, of course, but not Marxist rubbish, for he roundly condemns the communist way too.

But the author is on firmer ground when he considers the relative efficiency and social merits of large and small-to-medium companies. He shows that firms with under 500 employees tend to be happier, more responsible, more efficient than the giants, and that towns which largely rely on one or two big employers are less prosperous and contented than

those with a multiplicity of small employers. He also explodes some of the claims about economies of scale in mass production.

'Economic Power' calls for a Poujardiste, small-is-beautiful revolution with companies of 50 to 500 people making up an increasing proportion of the GNP. However, apart from nationalisation, breakup, and re-sale of the giants, the book's only real suggestion as to how this is to be achieved is to ask and encourage as many people as possible to start up their own little companies as soon as possible — on the grounds that each successful venture will take away a little business from a big one. Readers may like to take this advice but should not expect the directors of ICI and Shell to lose much sleep on that account.

Victor Gordon

Marginal self sufficiency

SUBSISTENCE FARMING IN ROMAN ITALY by Joan M. Frayn. Centaur Press, £8.50.

Subsistence Farming in Roman Italy is principally aimed at historians and classicists, for whom it gives valuable and fascinating insights into a neglected corner of Roman life. But Dr. Frayn's portrait of the ancient Italian peasant will interest most students of agrarian history, provided they can take in their stride a few untranslated quotations from classical authors. The Roman ruling class was concerned with the peasants chiefly as fodder for the Republican and early Imperial armies; they are mentioned in Latin literature mainly in (premature) complaints over their disappearance, or in highly idealized descriptions of the simple life as dreamed about by urban poets; modern historians have concentrated on those more conspicuous but less typical aspects of Roman agriculture, the *villa* and the *latifundium*. Dr. Frayn brings to life the forgotten men at the bottom of the rural economic scale, and shows how they were able to scratch a tolerable living from their tiny plots of marginal land. The secret lay partly in the exploitation of the wild resources of forest, marsh and mountain; partly

in the acceptance of a diet in which the staples were bread and sheep's-milk cheese, and meat was a rare luxury.

As so often in studies of "primitive" peoples, one's admiration is evoked by the ingenuity with which local conditions and materials were enlisted to meet almost every basic need. No resource, however humble, was wasted — dead leaves and bracken were collected for compost, brambles could be woven into baskets, a reed, surprisingly, could serve as a kitchen knife. Self-sufficiency was almost total: iron and salt were virtually the only imports, and the former was less essential than might be expected, for many items of farm equipment could be home-made out of wood — even shovels, hay-forks and ploughs. There is an excellent chapter on the baking of bread: how rarely do historians concern themselves with the real fundamentals of life!

Dr. Frayn draws evidence not merely from the literary sources, but also from archaeology and from the modern Italian scene. As she points out, "In many parts of Italy . . . one may still find conditions of agricultural work and local communications almost unaltered since Roman times or even earlier." Politically, too, there are parallels with the present day: the Mediterranean small farmer seems to be a perennial problem for central governments in the area. But this book can also provide insights into the predicament of modern Third World peasants. The impact of the money-economy, for instance: "Before the introduction of a monetary system the small farmer, accustomed to borrow grain in time of scarcity from a more fortunate neighbour, would have repaid in kind at the next harvest. Now he must pay in cash and with interest. The price of the borrowed grain would be fixed in the time of scarcity, not at the harvest. Under such conditions a peasant farmer is always at a disadvantage." As in ancient Italy, so in modern India or Latin America: the wonder is that peasant agriculture survives at all. Perhaps it endures in the face of all natural and man-made obstacles because it is the only practical system for making long-term use of the agricultural potential of marginal land — or rather that high proportion

of the earth's surface (over 80 per cent of Italy, for example, by Dr. Frayn's reckoning) which agribusinessmen ancient and modern have always dismissed as marginal.

Nicholas Gould

The Breath of Life

WORLD WITHOUT TREES by Robert Lamb. Wildwood House, £4.95

Robert Lamb has chosen an important subject for his book. Whether through the attentions of Chestnut Blight, Oak Wilt, Lethal Yellowing, or any of the other debilitating tree diseases; as a result of irresponsible logging, or as a victim of the pressure for land for tillage, grazing or habitation, the world's tree cover — and particularly its natural forest — is steadily shrinking. There seems little likelihood now that the tropical forests will survive much beyond the end of the century: the benefits they afford as gene banks, habitats for animal species, and lungs of the planet will be lost, and there is more than a faint possibility that the consequences will extend not only to the desertification of South America but also to major climatic modification.

The loss of tropical forest reflects the aspirations of Third World elites to Western-style industrialisation; equally, it indicates the insatiable demand for tree products in the industrialised countries themselves, who find it preferable to invest in tropical forestry and import timber rather than maintain commercial forests themselves: in this they not only tolerate tree loss at home, but effectively export deforestation. This seems even more profligate when it is understood that, generally, less than ten per cent of virgin tropical forest that is cleared in commercial operations actually ends up in a finished product; the balance is burnt as waste.

World Without Trees offers a competent and thorough account of the relation between trees and their environment. The mechanism by which Dutch Elm Disease kills its victims is lucidly discussed; a spirited defence of hedgerows is made; the rape of Amazonia is documented

and its lessons drawn; there is a history of North America's forests, including an appraisal of suspicions that U.S. forestry services are more indulgent to commercial timber interests than sound husbandry would countenance; the pressures for deforestation on the one hand and the environmental services provided by trees on the other are carefully catalogued.

The inclusion of more anecdotal material ensures that the book isn't a worthy but dull read. In particular, anyone curious about our native sick man of the tree world, the elm, can discover such diverse information as the factors accounting for its wide distribution, despite its relative uselessness as firewood or building material (among other things, that elm leaves provided a valuable source of animal fodder in late summer when other sources were unavailable and, more recently, elm wood was prized for coffin making), the nature and properties of slippery elm (an extract of elm bark which may be infused to make a tea with emollient properties for the throat) and the curious distinction of Alexander Grant, a Scottish Parliamentarian who died in 1794. His distinction is that, in the last decade of his life, he planted more trees on his estates than the Forestry Commission has planted anywhere in the entire fifty years of its existence.

The future of the world's trees is an important subject, and the definitive work remains to be written; meanwhile, Mr. Lamb's book can be read with much profit and pleasure.

Bernard Gilbert

A Family Environment

THE QUALITY OF LIFE: The Peckham approach to Human Ethology. Innes M. Pearse M.D. Scottish Academic Press £6.50

The "built" environment is fashioned by people. Its pattern and use determine the quality of life; but how it affects the people who inhabit it and grow up in it, is too often not closely considered by those who plan and design — witness tower blocks and urban degeneration. But the built environment is a major part of the habitat of all populations, the

growth, the differentiation of powers and the general development of which, follow from the creation of a new family.

These are biological processes which occur spontaneously and unfold according to their natural disposition. As they integrate with their surroundings their growth and development is not driven from without but is inherent — even when its members are inhibited or frustrated by their surroundings. When the process works well it leads to good health in both the family complex and the individual. This indicates the direction in which an enquiry into the nature of health must turn.

Lately, Thomas McKeown, Birmingham Professor of Community Medicine has identified three "determinants" of health. They are nutrition, environment and behaviour. We are accustomed to thinking that a Health Centre is for the cure and care of ill health. This was not the view of the initiators of the Peckham Experiment (1926-1950). Their pioneer Health Centre was a means by which the leisure environment of a thousand or so local families was modified. Behaviour springing from inherent disposition was allowed to take its own course within these modified circumstances. Thus two of Professor McKeown's determinants of health — environment and behaviour — were central to the experiment's endeavours. The third was not neglected. Foods for optimum nutrition were made available, particularly in relation to pregnancy.

Knowledge is not only an important constituent of any environment, it is also a major influence on behaviour. In the Peckham Centre biological knowledge was diffused by consultation between biologists and individual families. After undergoing full physical examinations the family periodically met the biologists for further consultation. The constant exchange of information brought into perspective the social implications of starting and raising a family — both for the subjects of the experiment and for the biologists. The many phases of development — pregnancy; infancy; the adjustment to an ever wider environment by the child; and the differentiation of the child's, and indeed the family's, powers, were brought into focus.

Knowledge which justly perceives the developing potential of people and their families can be used to enhance the quality of their lives. Ideally the environment should provide for extension and exercise of the individual's abilities. Too often the information needed to provide the best environment is not sought, it was, however, the object of the experiment at Peckham.

An enquiry into how a representative sample of families, in its relation with its leisure circumstances, can favour the health of its members requires both a technique and certain assumptions or hypotheses. The technique and to some extent the assumptions on which the Peckham experiment was based are set out in Dr. Pearse's posthumous work. There have been previous reports of the Peckham findings in *The Peckham Experiment* by Pearse and Crocker in 1943 and *Science Synthesis and Sanity* in 1965. In her new book Dr. Pearse further expounds the techniques employed.

Dr. Pearse, one of the two partners who initiated the experiment, held that the quality of life is not to be measured, weighed or numbered. She believed that it derives from the spontaneous inherent ability of the living to develop in their environment. Although difficult to analyse, the quality of life is recognisable, just as beauty is recognisable. Dr. Pearse's conviction was that life in families and communities requires to be understood, not only by knitting up the threads which we have unravelled from the fabric of life, but by recognising and cherishing the quality and potential of that fabric.

Kenneth Barlow

Other Books Received

The Sisterhood of Man, Kathleen Newland, W.W. Norton \$3.95.

Kathleen Newland will be known to readers of *Worldwatch* Papers as a champion of women's rights. In her new book she examines the social implications of twentieth century women, not only in the West but in the Third World. Unlike those ecologists for whom the ideal of the extended family necessarily involves

the return of women to their traditional role as home-makers, Ms Newland campaigns without reservation for the relentless extension of the present trend; she will not be satisfied until women play an equal part in every walk of life, and particularly in world politics. While most women will probably applaud her stance, one may perhaps be forgiven for asking whether this aim is altogether sensible in view of the present forecast of galloping worldwide unemployment.

The Land of England, Dorothy Hartley, Macdonald and Jane's £6.95.

At a time when the preoccupation of everyone from the US President to the chap with a power-assisted bicycle, centres on the question of future energy sources, the fascination of discovering how our ancestors survived without any power but that generated by their own labour, and if they were lucky a horse and an ox, has taken on a new dimension. *The Land of England* is full of delights and surprises; it is not a history book but a detailed description of how people lived and worked and ate and played; how they paid their debts or avoided paying their taxes in the green and forested land that was medieval England. Copiously illustrated. Don't miss it.

Laurel's Kitchen. A handbook for Vegetarian Cookery and Nutrition, Laurel Robertson, Carol Flinders and Bronwen Godfrey, Routledge and Kegan Paul, £12.50. Paperback £7.95.

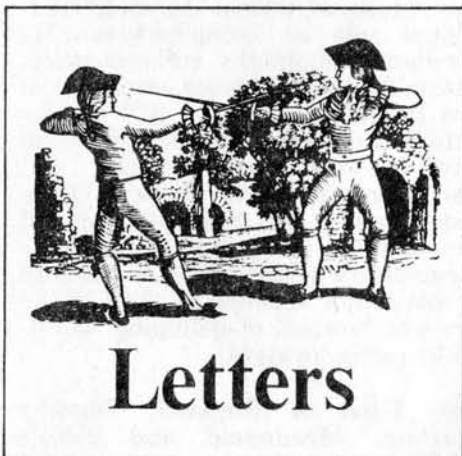
There is no shortage of cookery books for vegetarians. The importance of this one (from America) is the emphasis it puts on getting the nutritional balance right. It's a large volume bursting with recipes, charts, tables, lists and advice galore. Unless you are madly enthusiastic you might find it just the least bit daunting.

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Humanists and Ecologists

Dear Sirs,

The obvious comment on the repeated criticism of humanism in the ecological press is that the humanism in question is largely imaginary. Thus the form of humanism attacked in David Ehrenfeld's book *The Arrogance of Humanism* is far from the form of humanism held by most people who call themselves humanists, and the view of humanism offered by Catherine Roberts in her review (*The Ecologist*, August 1979,) — and in her pamphlet *The Three Faces of Humanism* [Tract 14] — is far from the state of humanism as it actually exists. Of course anyone can use any word in any sense, but for people who use words to clarify rather than confuse ideas humanism means no more than a basic allegiance to our fellow human beings in this species, as opposed to a prior allegiance either to God or to other divine or supernatural beings, and to an ultimate allegiance either to any other species or to life or nature in general.

What Dr. Roberts calls Anthropocentric humanism is what she attacks most strongly and what is also attacked by Ehrenfeld, but in any case they are both wrong to suggest that it is the prevailing form of humanism.

Biocentric humanism is what is supported by Ehrenfeld — and by Henryk Skolimowski. It is a semi-religious view of humanity seen from the perspective of evolution or the universe, which is held by some humanists [especially scientists], but is rejected by most humanists because it introduces — or re-introduces — irrational elements of vitalism and teleology which confuse the issues and obscure the facts.

Theocentric humanism is what is supported by Roberts — and by Albert Schweitzer and Teilhard de Chardin and E.F. Schumacher. It is a religious view of humanity seen from the perspective of God or a divine equivalent, which was held by the original humanists of the Renaissance, but is now held mainly by modernist Christians or Jews, and is rejected by almost all humanists because it introduces — or re-introduces — irrational elements of theism and worship which are felt to be the opposite of humanism.

The form of humanism held by most humanists today is neither anthropocentric [in Robert's narrow sense] nor biocentric [except perhaps in Julian Huxley's broader sense], and it is certainly not theocentric [in any sense]. We say that man is the measure of all things, but only for man; that man is part of nature, but our part; and that man is a religious animal, but also an irreligious and anti-religious animal. We avoid dogmatic scientism and materialism on one side, and dogmatic theism and idealism on the other. Our humanism is a combination of the atheism, secularism, rationalism, and ethicism developed in the freethought movement during the late nineteenth and early twentieth centuries. It has much in common with ecology, and it is common in the ecological movement. If this debate is going to continue, it should be based on real issues and real facts rather than unreal ones.

Yours faithfully,
Nicholas Walter,
New Humanist,
London N. 1.

Who's Fudging?

Dear Sirs,

Colin Sweet's piece on Nuclear Costs (May-June 1979) scarcely justifies a rebuttal, but in case the artifice of presenting figures uncorrected for inflation and calculated on dissimilar bases has misled your readers, the following facts may prove helpful.

Comparative electricity generating costs presented to Parliament by the CEEGB have always been standard accountancy figures for current operating costs, including allowance for capital recovery. They relate to coal, oil and nuclear stations of similar age and give some guide to the current benefits of past investment. In order to take account of the fact that future costs of reprocessing and waste disposal for nuclear fuels were not all captured in these figures, the basis of calculation was changed in 1976. Each year's figures are in different current money values.

My figures published in *Electrical Review* [March 7th 1979] relate to the expected costs of new power stations built to operate in the mid-1980s expressed in January 1977 pounds sterling. Contrary to Sweet's assertion they do include allowance for waste disposal, the cost of capital and decommissioning and this was clearly stated. The CEEGB figures cited by Sweet relating to Portskewett will have been in March 1979 pounds sterling and differ little from mine when inflation is allowed for. Similarly, the Torness figure is in 1978 pounds sterling and contains elements other than straight capital cost which totally invalidate Sweet's comparison.

The fuel costs in Energy Commission Paper No. 6 were in constant January 1977 pounds sterling unlike the annual CEEGB figures cited by Sweet, the basis of

which has changed anyway [see above]. They relate to a different fuel with a higher burn up and lower processing costs per unit of energy output.

We need both coal and nuclear fuelled power stations for the future but, unless coal prices can be cut in real terms, nuclear will remain the preferred option for base load power generation.

Yours faithfully,
P.M.S. Jones,
Head, Economics and Programmes
Branch, U.K.A.E.A.
11 Charles II Street,
London.

A Pest on Your Chemicals!

Dear Sirs,

I have no formal agricultural credentials; only a lot of reading and thinking and a very strong feeling for the Earth. On this basis I must protest strongly against any advocacy of Integrated Pest Management as I understand it from the presentation in the book review *The Least is best Pesticide Strategy* [*New Ecologist*, April, 1979].

IPM is like "humane" traps and other half-measures. It allows one to go on farming badly instead of learning to return to the soil nourishment in proportion to that removed; to go on running enormous "farms" and using much mechanization and centralization and all the other agribusiness practices you at *The Ecologist* generally deplore. In other words it still considers certain life as "pests" instead of teaching farmers to seek the reasons why they have so many "pests", weeds etc. and what is making their crops so vulnerable.

It perpetuates the old system — just tidying it up a little. It also perpetuates the chemical industries, which are still "needed" to produce the fertilizers and the biological control materials [sterilizers of males, etc.] and the pesticides. And it spawns a new class of farmer who depends on the IPM consultants instead of himself. Let's not have employment at such a cost! This is parasitic employment! The only "simple" solution is to learn that whatever appears to be a "pest" is so because man made it so and to change the man-made environment to one of multi-cropping, mulching, cover-cropping, integration with the seasons and surrounding vegetation and type of soil one has, and allowing full freedom to the birds and other creatures of the countryside. To reduce farm size, return to the hardier seeds instead of hybrids and other un-robust modern types — and so on. In my opinion IPM is not an improvement! It is only a patch on the same old inner-tube, another bondage to the farmer. Do not be fooled by it!

Yours faithfully,
Sheila M. Weaver,
Vancouver,
Canada.

Classified

PERSONAL

IMTFE - J / A9 : "The right of belligerency of the state will not be recognized." Tokyo, 3 May 1947.

IMTFE - J d. 1. 11. 1948 in effect confirms and universalizes A9. Since when therefore the conventional concept Sovereignty has no longer had validity. Wherefore since then *all* 'sovereign state' Armed Forces in effect have been, and are, *illegitimate!*

Hollander age 59 reckons approach along these lines to offer the most effective available means of halting the criminal ongoing arms-race. He seeks contact with post-graduate students or more senior academics who specifically are interested in any of the following:

The Pact of Paris (Kellogg - Briand Pact) d. 27.8.1928.

The Japanese Constitution's Article 9 (A9) d. 3.5.1947.

The Judgment of the Tokyo Tribunal (IMTFE - J) d. 1.11.1948.

The San Francisco Peace Treaty with Japan d. 8.9.1951.

Martin Knottenbelt, 's Lands Werf 84, 3063 GC Rotterdam, NL.

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