

The 'Faustian Bargain' of Nuclear Energy

On three consecutive days of early June this year there were reports in the British press of (i) the disappearance, from a girls' school in Coventry, of 'Plutonium, Radium 88 and Strontium 90, ... in a lead-lined case', (ii) the contamination of 35 men (7 of them internally) with radioactivity at the Windscale Atomic Energy Establishment, Cumberland, who 'ignored alarm signals and went on working', and (iii) the ineffectiveness of world-wide protests at further atmospheric testing of nuclear weapons by certain countries. Meanwhile there are plans in various parts of the world to multiply out of all bounds the number of nuclear fission plants, without due consideration of their impact on the environment of Man and Nature.

The above four items, and many others of various sorts and sizes, have one thing in common: they not only introduce man-made local hazards but also increase the threat of build-up to dangerous proportions of radiation in the biosphere at large. And when we say 'dangerous', we mean not only to Man and his genetic heritage but also, and perhaps even more so, to other living organisms which may prove far more sensitive. This could lead to population changes among plants, animals, and microbiota, and hence to insidious alteration of ecosystems—and nobody knows or can confidently say what else besides. The mind boggles at the possibility of emergence of lethal or other devastating genes in Man or the main crops on which he is dependent for the wherewithal of life, or of particularly virulent strains among their pathogens or other parasites. Indeed the entire development of nuclear fission energy on a wide scale seems to represent a 'Faustian bargain' of selling ourselves to the Devil, or at least of mortgaging our future for some respite in the ever-increasing problems of energy supply as human populations grow and expand their demands. Still more inexorably is the future of our descendants being mortgaged; for the fossil fuels are finite, irreplaceable, and all too limited.

This theme of the dangers of even the most peaceful of nuclear fission development was excellently elucidated by Professor John T. Edsall, in his paper 'Hazards of Nuclear Fission Power and the Choice of Alternatives', published in our first issue (pp. 21–30), wherein he concludes that the risks involved are 'unacceptably high'. For it is clear that sabotage and enemy action should be added to the risks posed by technical and human failure which could lead to major accidents. These points are further emphasized in a paper which we unfortunately have not the space to publish, but which pungently concludes that 'nuclear fission power [should] be rejected as an energy source and a global effort be made to explore technologically feasible options that do not jeopardize mankind as does nuclear fission power'.

Accepting, as we must, the limitations of fossil fuels and the hazards of nuclear fission, what are the alter-

natives that can keep this man-dominated world going in the matter of energy indefinitely into the future? There is nuclear *fusion*, which is supposed to be far 'cleaner'; concerning it we have in press a paper 'Nuclear Fusion Power and the Environment', by the Director of the Division of Controlled Thermonuclear Research, United States Atomic Energy Commission (AEC), and his Special Assistant. Then there is solar energy, the most universally abundant source of all, which, with storage and transportation in the form of hydrogen, looks most promising: it will be dealt with in a later issue by Professor John O'M. Bockris, now of Australia, in a paper entitled 'The Coming Energy Crisis and Solar Resources'. Other sources apart from fossil fuels are geothermal, marithermal, wind, and tidal—not to mention the use of horses, bicycles, and other devices of ancient or recent times. All these, and yet some others, should be considered and developed so far as proves practicable in the ultimate interests of our threatened environment. For currently most of the used or widely foreseen sources of energy are badly polluting at best and, at worst, quite suicidally dangerous. Through their continued employment Man would seem bent on destroying himself and even life itself.

This brings us back to the subject of nuclear fission energy, which is what these comments are primarily about. The risks inherent in its widespread development seem far too great for mankind to take. Thus right from the mining of the uranium ore to the storage of the radioactive wastes there are risks often of the gravest nature. The medical and biological hazards include increased incidence of cancer from increased exposure, while genetic and developmental damage is also likely to be extreme, the human foetus being several hundred times more susceptible to injury by atomic radiation than is the human body. Accidents killing hoards of people and devastating vast areas could be caused by a whole gamut of possibilities, ranging from faulty or malfunctioning plants to human fallibility or worse—including sabotage, theft, and purposeful enemy action. And then we must allow for earthquakes and other 'acts of God', and for all manner of man-made ecodisasters. Nor are emergency measures, such as special core-cooling systems, by any means always effective. Moreover there is a tendency for forms of technology to decline as their operations become more routine and their operators become careless or complacent—doubtless starting from a lower level of efficiency as their numbers expand.

It is authoritatively stated that the hazards of the present nuclear fission reactors would be multiplied many-fold by the use of fast-breeder reactors, containing great quantities of Plutonium-239—the most toxic material known to Man. A major incident involving such a reactor could endanger the health and very lives of millions of people, and render vast areas

uninhabitable for many years; yet the AEC proposes to have as many as 2,000 of them in operation by the year 2020 in the United States alone. This would require daily 100 railway cars loaded with casks of spent fuel to be taken to *no known place of safety* for storage for something like half-a-million years; yet containers so far tried for such radioactive wastes have

leaked in less than 40 years! From a sober biological viewpoint the entire prospect looks too appallingly dangerous even to contemplate. Clearly the world has got to develop saner means of getting energy and also to use its remaining stores of fossil fuels far less profligately.

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Whither Ecologists?

As they seem disinclined to control themselves in most countries, the real ecologists of the world may need to be united into an organization that would insist on, and maintain, adequately high standards of training, practice, and integrity, for its elected members. The supervising body might well be the International Association for Ecology (INTECOL), which is holding the First International Congress of Ecology at The Hague during 8–14 September 1974, when it is much to be hoped that something will be done towards remedying the present unsatisfactory situation. Indeed if nobody else raises the issue on that occasion we propose to do so ourselves.

The present situation is one of near-anarchy, in which anybody, anywhere, can call himself or herself an ecologist and even set up as an expert or consultant dealing with environmental matters often of the gravest nature. The outcome of such irresponsibility can be extremely dangerous, as for example when concerned with such hair-raising possibilities as those resulting from nuclear fission power development in the manner outlined in the preceding note. Think of the possible outcome of action based on the wrong advice given to a political leader in a situation of extreme stress: the result could be the ecodisaster of all time—for which we are waiting, but not knowing what form it will take or when or where it will strike! Whether or not an action is based on ecological principles, these should certainly be considered in any decision involving the environment—as an ever-increasing proportion of outcomes nowadays seem to be. Indeed with human population pressures on space and resources building up ever more drastically, the remaining environmental options must come under increasingly severe scrutiny.

For such purposes and many others there is a vital need of really qualified ecologists of suitable training, experience, and integrity—professionals in the best sense of that most meaningful word. Thus the time seems overdue for the real ecologists of the world to get together and insist on proper standards, both among themselves and for others aspiring to join their ranks. At present the situation is wide open to all manner of charlatanism, with so many unqualified people calling themselves ecologists nowadays that the genuine ones often hesitate to do so. As we commented already in our old journal in 1972 (*Biological Conservation*, Vol. 4, No. 5, p. 321), '... how would we all react if physicians

and surgeons were allowed to emerge in such a haphazard manner, and to practise upon us without proper training and experience!'

Yet the biosphere is infinitely more complex than the human body, and its ills are pathetically manifold in the contexts of fragility and increasing attack. Its guardians, the ecologists, to be effective as they have to be in future, need a training which should be at least as arduous as, and should be even more widely based than, that required for medical practice. They must have adequate practical experience before pronouncing, and must do so only with absolute integrity both professionally and ethically. Moreover they should command at least comparable recognition and remuneration to that enjoyed by exponents of the most revered of other professions.

To be fully qualified an ecologist should have at least some background knowledge of a very wide range of sciences—including Botany and Zoology, Geology and Pedology, Physics and Chemistry, Oceanography and Limnology, Meteorology, Statistics, and yet some others. Thus our genuine ecologist must be highly interdisciplinary in training and outlook, while leading universities might with wide advantage provide encouragement by offering suitable degrees etc. in the field. With or without specialist emphasis to stress particular lines of interest or future specialization, this gamut of knowledge should be acquired over at least several years of intensive *ad hoc* study and be supplemented by practical experience. Could not INTECOL, either itself or through the pertinent national or other organizations, insist on adequate standards of qualifications based on both controlled training and tested experience? Then only individuals accepted at least by their national or major regional chapter or affiliated organization should be allowed to seek employment and make pronouncements as real ecologists.

For the health and future of Man's and Nature's entire environment it would seem vitally important that suitably qualified and experienced ecologists should have due influence in the higher echelons of government and industry from now on. And, ecology being the study of living organisms in relation to their environment (including one another), it is essential that these ecologists be biologically versed.

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