

NERC's infrastructure defended

SIR—I wish to respond to the letter from J.S. McPherson (*Nature* 13 June, p.536) commenting inaccurately on the role of Natural Environment Research Council (NERC) HQ and NERC Scientific Services (NSS). The staff numbers he quotes are correct, but to say that "... NSS is largely administrative in composition" is wrong and grossly unfair to the 90 per cent of NSS staff who are scientists and technologists providing support for the research carried out by both institute and NERC-supported university scientists. Most of NERC's administrative staff are in the institutes.

A more than superficial perusal of NERC's annual reports for the four years 1980/81–1983/84 would reveal that in that period the "quality" of computing provided to institutes has increased by a factor of four, new and sophisticated marine

equipment has been brought into service, an image analysis facility has been brought into use (and incidentally attained a reputation sufficient to attract a Principal Investigator award from the National Aeronautics and Space Administration) and an instrumented aircraft made available for NERC-supported science. And all this has been achieved with staffing that is sensibly constant over the period.

Turning to the question of commissioned research, NSS has not, as a matter of policy, sought to sell its services in the market place. What is clear from the annual reports is that many of the contracts obtained by the institutes would not have been possible without the computing, the ships, the cartography and other support services provided by NSS and administrative services of HQ. It is regrettable that Mr McPherson does not

seem to have the text of NERC's annual report which describes the vital support role in which NSS staff are engaged.

Mr McPherson's letter contains other errors. He says that it is sad that 1,000 scientific jobs are to disappear. The NERC corporate plan published last February indicates that 900 (not 1,000) posts may be lost over the next five years. Staff reductions will be in all categories—scientific, technical and administrative—with the aim of maximizing scientific output in relation to available income. NERC would prefer not to have to reduce staff numbers but it has to be realistic, live within its means and provide its scientists with the equipment and support services which they need to be effective.

J. C. BOWMAN
Secretary

Natural Environment Research Council,
Polaris House, North Star Avenue,
Swindon,
Wiltshire SN2 1EU, UK

The science of sea-dumping

SIR—We wish to comment on the independent review of the practice of dumping radionuclides in the oceans, commissioned by the UK Department of the Environment, carried out by a group under F.G.T. Holliday and published last year¹. The terms of reference were to "review the scientific evidence, including the environmental implications, relevant to the safety of dumping radioactive waste at the designated North Atlantic site". The report gives a detailed description of the history of dumping and of the structure and operation of the model developed by the National Radiological Protection Board (NRPB) and the Ministry of Agriculture, Fisheries and Food (MAFF)^{2,3} which is used to assess the environmental effects of disposal.

Scientific modelling should clearly specify the model in terms of the underlying theoretical assumptions, and should indicate specific tests by which the model can be validated.

In the Holliday review, we find little discussion of the theory and none of experimental validation. The review notes that "the modelling exercise is complex and involves hundreds of man-hours of work which it has been impossible to check", but concludes that "the science being undertaken in the United Kingdom is of the highest quality. The results are published in the open literature and are openly discussed at international meetings, and this provides some safeguards on the reliability of the work."

Thus it is proposed that the ultimate guarantor of the quality of science being undertaken lies in some form of international peer review. We do not wish to comment on this process as it affects the MAFF/NRPB model as a whole but the part which concerns biological pathways.

The biological pathways sub-model is a crucial component of the whole because it concerns the potential concentration of hazardous materials which are otherwise dispersed in the ocean. In the MAFF/NRPB model the trophic level concept⁴ is used as the basis for calculating the concentration of radioactivity in marine life. Yet after the work of the International Biological Programme (1964–74) it became clear that although trophic level one (green plants) could be identified and trophic level two (herbivores) could be found in terrestrial systems, the remaining "trophic levels" could not be adequately identified⁵. This made the concept untestable and therefore suspect. Current concern about the inapplicability of the trophic level concept to aquatic ecosystems is shown by Ulanowitz and Platt⁶.

In the MAFF/NRPB model, it is assumed that the main food chain can be modelled by six trophic levels plus humans. Misleading conclusions can arise from this view that the food chain is limited in length. Materials cycle through the food web by organisms investing faeces and carcasses, creating food chains which are in trophic level terms indefinitely long^{7,8}.

Furthermore, science is surely about testing models, not simply asserting them, however authoritatively. The Holliday review illustrates several *predictions* about the effects of sea-dumping, but does not contain a single experimental result or reference. It is claimed that the model has been "adjusted" or "forced" to reproduce certain physical features of ocean dispersal, though this in itself does not imply predictive value. The final result of extremely long-range forecasting, involving release from dumped containers, oceanic dispersal and passage through food

chains, is a predicted radiation dose to humans over the next 100,000 years (peaking at 100 years). A minimum requirement for the credibility of such predictions is experimental validation in some simpler case. For example, earlier sea-dumping (1950–63) was carried out, without containment, in the English Channel; there has been the possibility of 30 years' monitoring of this more accessible release for comparison with predictions. Furthermore, much data have been collected on contamination of the Irish Sea, which could also be compared with model predictions. Are there no results of validation studies? What would the Committee on Safety in Medicines think of predictions not backed up by clinical trials?

The Holliday report does prudently recommend that sea-dumping not be resumed "until the current international reviews and the comparison of sea-dumping with land-based alternatives have been completed". It is essential that such reviews should address the two issues—the theoretical basis of the model and its experimental validation—that are absent in the current report.

ALAN REDDISH
STEVE COUSINS

Energy Research Group,
The Open University,
Milton Keynes,
MK7 6AA, UK

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