rejected as too costly. But the Northumberland Committee's estimates of the likely cost of prophylactic vaccination—£13 million in the first year and £5 million annually thereafter—should put an end to the ridiculously high estimates that have been bandied about by antivaccination lobbies. And the Government's acceptance of the recommendation that contingency plans for ring vaccination in the event of an outbreak should be prepared, even though they will cost about £1 million a year, is the most encouraging outcome of the inquiry. This means that vaccination is no longer automatically equated with accepting the disease as endemic.

Unfortunately, however, the committee did not recommend that ring vaccination should be used immediately an outbreak occurs but was content to say that "ring vaccination would not limit the number of primary outbreaks but it could limit spread. Although it has considerable disadvantages, we think that in certain conditions ring vaccination could be a useful adjunct to slaughter". Who will decide when an outbreak has reached a great enough size to warrant vaccination? And how great must the outbreak be before vaccination is started? Only one member—Mr A. Cripps, QC—of the committee of eight, in a dissenting note, said that "the immediate application of ring vaccination to any outbreak which occurs seems to me essential". The obvious advantage of this policy, apart from reducing immediately the risks of the disease spreading, is that it leaves no room for interminable argument and lobbying about when an outbreak has reached a size which warrants vaccination.

NUCLEAR POWER

The Tobacco Reactor

THE United Kingdom Atomic Energy Authority is all set to sell its first nuclear power station abroad for ten years. As part of an intricate trading agreement, the AEA hopes to supply the Public Power Corporation of Greece with a steam generating heavy water plant, and in return the Greek Government is hoping to sell quantities of Greek tobacco in Britain. The irony of replacing Rhodesian tobacco with imports from Greece cannot have escaped even the most unpolitical of the salesmen at the AEA, but this does not mean that the authority has not done well in getting as far as it has done.

The negotiations involve the AEA and the Greek Public Power Corporation on the reactor side and United City Merchants and the Greek Tobacco Board on the tobacco deal. If things go well, the AEA will build a 450 megawatt SGHW reactor at a site about thirty miles from Athens. This would be the first SGHW to be exported from the United Kingdom, the earlier attempt to sell one to Finland having collapsed when the Finnish authorities decided to steer clear of nuclear generation for the time being. The only SGHW operating in Britain at present is the one at Winfrith in Dorset, which is supplying the national grid with about 100 MW of power.

It is the flexibility of the SGHW system that seems to have caught the eye of the Greek power authority. For one thing, the reactor can use a variety of possible fuels, of which the cheapest and most probable is the enriched uranium used at Winfrith. The SGHW is

also considered to have high intrinsic safety, and the flexibility of its operating conditions makes it a very attractive proposition for the medium sized power demand envisaged by the Greek Power Corporation.

A further advantage of an SGHW station is that much of the constructional work can take place in the factory rather than on the building site. It is expected that about 70 per cent of the cost of the Greek power station will go towards paying for prefabricated parts manufactured in Britain. With the total cost of the power station expected to exceed £30 million, this represents a sizable export figure. The plant should be completed and up to full power by 1974.

British companies have not exported a nuclear power station since the first success a decade ago, when they sold two of the first generation of gas cooled graphite moderated power plants, one to Italy and one to Japan. Since then Japan has bought information on the SGHW from the AEA and a new attempt to sell the latest model of advanced gas cooled reactor is now under way, to South Korea (see page 515).

Political factors necessarily play a part in both the Greek and Korean reactor deals. In the first, the Board of Trade describes the present state of trade between Britain and Greece as "normal", subject only to Britain not furnishing goods that could be used for internal suppression. But much may depend on the relationship between Greece and other members of the Council for Europe in the days ahead.

TECHNICAL RESEARCH

Making it Work

from a Correspondent

ON May 5 the Institute of Physics and the Physical Society held a conference in London on the organization and management of research and development. Mr P. Trier, director of the Mullard Research Laboratory, set out to distinguish between research and development and their proper modes of organization. He decried the conventional basic/applied dichotomy: all industrial research and development is applied, but a distinction is to be made between radical innovation, which is the practice of research, and the later stages of design and production engineering—development—which is intimately tied to economic considerations. Mr Trier favoured separate development laboratories attached to individual project decisions: this aids the symbiosis between design and manufacture, needed to ensure commercial success. This opinion, however, was contested later; views on this aspect of organization seem to vary widely.

Economic features of development were analysed further by an accountant, Mr J. Bullock (Robson, Morrow and Co.), who emphasized the vital importance of maintaining month by month estimates of costs (including forward commitments) attributable to the development project, so that an up to date comparison with forecast expenditure could frequently be made, preferably with the use of discounted cash flow calculations. This harmonized with Mr Trier's insistence that the viability of development projects needed to be reassessed at regular intervals. Mr Bullock's presentation made elegant use of visual aids, and he delighted the audience with his faintly cynical quotations concerning the justification of research and develop-

ment facilities, as for example: "Visitors and shareholders alike are impressed by the sight of so much science and the smell of H_2S ".

The economic bent of the meeting was maintained by a lecture on the operations of the Programmes Analysis Unit, jointly administered by the Ministry of Technology and the Atomic Energy Authority, which exists to assess proposed civil research and development projects in the Government sector. Its director, Mr P. C. R. Nicholson, explained some of the problems of evaluating the cost effectiveness of a project in the event of its successful completion. Benefits may be hard to assess because they depend on how a technical advance is to be utilized (for example, a saving of weight in an aircraft might be used to improve range, payload or comfort). The last alternative is related to the difficult problem of quantifying the benefit of developments which improve public amenities. Less noise, more prestige, even effective entertainment as provided by Moon-shots, are apt to defy the earnest analyst. The problems of classifying and evaluating benefits was elegantly illustrated by reference to possible methods of diminishing losses by fire. Mr Nicholson concluded by urging the importance of trusting responsibility for programmes analysis in industry to very senior specialists.

Mr S. H. Clarke, a former officer of the now defunct Department of Scientific and Industrial Research, spoke compellingly about the social management of research and development staff. His wise comments were evidently based on varied experience, conscientious analysis and long reflexion. He was particularly concerned with problems of appraisal and promotion, and described an experiment with a series of old annual confidential reports, anonymously submitted to a number of panels for assessment, which convinced him of the solid virtues of such reports as a basis for judgment. He also discussed the advantages of self-appraisal. He echoed Mr Nicholson by urging that personnel management, including the responsibility for evaluating reports, should be the charge of someone at directorial level.

GERMAN SCIENCE

Up with the Mark

GERMAN science is as buoyant as the mark itself, according to a Unesco survey of science policy and the organization of research in the Federal Republic (*Science Policy Studies and Documents*, No. 12, Unesco, 11s, \$1.75). Federal support for science, the report says, is intended to increase by an average of 16 per cent each year. This is the highest growth rate shown by any part of the budget. Nuclear and space research, data processing and possibly oceanography are most likely to benefit. Germany's nuclear scientists are giving priority to projects which include the development of advanced converter and breeder reactors, and the space scientists are shifting their horizons outward from the basic aspects of space research to an increasing concentration on satellite and space-probe projects. For the time being, Federal Germany sees large-scale space projects as beyond reach for a purely national effort and is concentrating on participation in European cooperative projects and in joint projects with the United States and France.

Unfortunately, however, the Unesco survey, carried out by the German Research Association under the guidance of Dr Claus Müller-Dachn, throws no light on the reason for the post-war boom in German science. It gives no hint, for example, of why federal spending on space has gone up from £1.2 million in 1962 to between £45.3 and £56.9 million in 1971, or why the Federal Ministry for Scientific Research should think it worthwhile to go in for oceanography. Nor does the survey investigate the part scientific research has played in placing Germany on its present economic pedestal.

It does, however, stress the number of organizations which have a finger in the scientific pie. As well as involvement by the federal government and by the individual states themselves, West Germany has its science foundations, chiefly the Donors' Association, the Volkswagen Foundations and the Thyssen Foundation, and a big commitment from private industry. The Donors' Association, made up of 4,800 associations, firms and individuals who want to support science, is a particularly commendable idea. Its members give money either without strings attached or earmarked for a particular scientist, institute or piece of research. There are criteria as to what the contribution from each member should be, and most of the money goes in the form of a lump sum to the science organizations.

MEDICAL RESEARCH COUNCIL

Quietly Growing

Now that the dust of the budget has settled, the university teachers have learned to live with the idea that the Prices and Incomes Board does not equate professors with captains of industry, and the universities have digested the latest financial cuts, the Medical Research Council's budget for 1969-70 deserves a second reading. The MRC has come through it all remarkably well. Its funds, far from being cut or held constant have risen by about 12 per cent. This year, excluding the £63,000 subscription to the International Agency for Research on Cancer, the MRC has £17,078,000 to spend compared with £15,248,000 in 1968-69. Of this, £2,819,000 is earmarked for capital expenditure on sixty schemes, fifty-eight costing less than £50,000 each and twelve much larger long-term projects (see Table 1). The remaining £14,259,000

Table 1. MRC SCHEMES INVOLVING CAPITAL EXPENDITURES OF MORE THAN £50,000 AND IN PROGRESS APRIL 1, 1969

Scheme	Current total estimate	Required for 1969-70
National Institute	£1,439,000	£359,000
Clinical Research Centre	£7,320,000	£950,000
Molecular Biology, Cambridge	£478,000	£118,000
Cellular Immunology, Oxford	£101,000	£6,000
Carshalton Laboratories	£170,000	£30,000
Demyelinating Diseases, Newcastle on Tyne	£116,000	£32,000
Clinical and population cytogenetics, Edinburgh	£1,080,000	£42,000
Computer Unit	£330,000	£15,000
Child Nutrition, Uganda	£93,000	£7,000
Pneumoconiosis, Cardiff	£100,000	£27,000
Hammersmith Laboratories	£260,000	£10,000