

committee stage ends, probably before the Easter recess.

Under the new arrangements, British Telecom will be able to manufacture and sell attachments only through independent subsidiary companies. Financing such ventures, however, will be difficult within the government's constraints on public borrowing. This is one reason why the government has amended the bill to allow British Telecom access to private finance. It may allow the corporation to work outside the public sector borrowing requirement, an issue not finally settled by the Treasury. One difficulty is that, whatever the source of capital, the government is still ultimately the guarantor.

In the next few months, equipment manufacturers will be keenly waiting to see how the removal of the monopoly is to be staged. The plan is to have a transitional period of three years during which the Department of Industry would control the market, giving British manufacturers time to plan for free competition. Much will depend on the Secretary of State for Industry, who is given wide enabling powers by the bill. Another open question is the arrangements for value added services. The bill gives the Secretary of State power to instruct British Telecom to allow private companies to lease part of the public network for the provision of services to third parties. What Sir Keith finally decides may depend on the outcome of a study by Professor Michael Beesley of the London Business School. **Judy Redfearn**

## Carcinogen criteria

### US retracts

Washington

Pressed by a recent Supreme Court ruling, US occupational safety officials have agreed to relax their previous opposition to including risk assessment calculations in decisions about reducing exposure to potential carcinogens. Hitherto, officials of the Department of Labor's Occupational Safety and Health Administration (OSHA) have argued that the scientific uncertainty of risk calculations — and the lack of an explicit requirement in the agency's authorizing legislation — meant that they should not be used as the basis of policy decisions. Instead, they have maintained that that once a substance has been demonstrated as a potential hazard, exposure should be lowered to the "lowest feasible level".

OSHA is being required to shift its position as a consequence of a decision by the Supreme Court last summer to strike down regulations which the agency had proposed for limiting industrial exposure to benzene (*Nature* 286, 97; 1980). The court ruled that OSHA had failed to demonstrate that reducing benzene exposure limits from ten to one parts per million would reduce the level of "significant risk". Following this ruling, OSHA

has now announced that it is revising its generic carcinogen policy, introduced last year as a mechanism for regulating any chemical suspected of causing cancer.

Under the terms of this policy, any chemical which meets one of a number of criteria — for example, which is shown to cause cancer in one experiment with laboratory animals, and also produces a positive result in a short-term test — is automatically labelled a carcinogen.

Originally, this would have been sufficient to invoke automatically the requirement that exposure be reduced to the lowest feasible level. Now OSHA officials have agreed to include consideration of whether the chemical poses a significant risk — using a variety of data to make this judgement, including court interpretations of previous rulings, OSHA's previous experience in regulating toxic substances and "prudent occupational health policy".

According to an announcement made in the *Federal Register*, three aspects of the benzene decision will be incorporated in the cancer policy. First, the significance of existing risk must be estimated before issuing a carcinogen standard; second, the exposure level must be set at the lowest feasible level which is "reasonably necessary or appropriate to eliminate significant risk"; and third, that OSHA must consider "all relevant evidence" in making such determinations.

This change in policy represents a significant shift from OSHA's previous position. The agency's former head, Professor Eula Bingham, has described risk assessment calculations as "abhorrent" to public health administrators; and the agency has strongly resisted pressure from government economists to push occupational regulations into a neatly quantifiable mould.

At the same time, the shift does not go as far as many in industry would like. Their demand is for full-scale cost-benefit analysis of all occupational health and safety regulations, based on the argument that federal controls have become a major economic burden. Although the Supreme Court, in striking down the benzene regulation, did not make the widely expected pronouncement on whether cost-benefit was required to demonstrate that a new regulation was "reasonably necessary", it is expected to do so in ruling on another case which has been brought against OSHA on cotton dust standards.

In any case, agency officials expect that a demand for full-scale cost-benefit analyses of future regulations — with the requirement that the least expensive option be adopted — will be one of the first ways in which the new Administration will try to meet its election promise of reducing the force of government regulations.

The labour movement, which has consistently argued that cost-benefit analysis is little more than a smokescreen designed to cover the relaxation of safety and health

controls, is preparing for a fierce and lengthy battle. It has already complained about one of Mr Reagan's first anti-regulation acts, withdrawing new regulations published by OSHA in the last days of the Carter presidency which would have required the labelling of all hazardous chemicals used in the workplace.

**David Dickson**

## Greenhouse effect

### Act now, not later

Stockholm

The theme that the time has come for policy-makers to take account of carbon dioxide when drawing up energy policies ran through an Earthscan meeting on carbon dioxide, climate and energy last week. But speakers' conviction that action should be taken now was matched by their caution in predicting exactly what would happen if carbon dioxide emissions continue to increase.

The fundamentals are broadly agreed. The pre-Industrial Revolution atmospheric concentration of carbon dioxide was about 290 parts per million, and the burning of fossil fuel has been the largest single factor contributing to concentrations which are expected to double by the middle of the next century, assuming a 2 per cent annual growth rate in the use of fossil fuels.

The reality of the greenhouse effect was also common ground between the speakers. Predictions about specific climatic changes in specific parts of the globe were, however, more equivocal.

Current models, according to Professor Bert Bolin of the University of Stockholm, are inadequate but "they are all we have". The models are especially inadequate in dealing with the role of clouds and the interaction of the atmosphere and the oceans. Dr Tom Wigley of the University of East Anglia pointed out the difficulties of distinguishing the signal from the noise: knowing when variations in regional climates stem from a particular factor such as carbon dioxide and when they are simply part of the continual natural variation.

Professor S.K. Sinha from the Indian Agricultural Research Institute in New Delhi was the only speaker daring to be at all optimistic, and even his belief that agriculture could adapt to climate changes was conditional on fruitful research being done on water management, the identification of new genotypes more tolerant of temperatures 3–4°C greater than at present and on higher crop yields with a smaller input of fossil fuels.

The most eloquent plea for energy policies to take account of carbon dioxide came from Gus Speth, chairman of President Carter's Council on Environmental Quality. In the last days of the Carter presidency, the council urged that "full consideration" should be given to carbon dioxide in the development of

United States and global energy policy.

One of the first priorities in a preventive strategy would be to decide "what level of atmospheric carbon dioxide should be considered a prudent upper bound". Should we allow an atmospheric build-up of, say, 50 or 100 per cent over pre-industrial levels? The upper bound would carry with it implications for both developed and developing countries and would raise questions about the sharing of the fossil fuels whose use would be allowed.

Speth was not particularly optimistic about the chances of getting these things done. It is very hard to provoke an international response to an intangible problem whose consequences are not yet even predictable. Dr Thomas B. Johansson of the University of Lund could offer a little encouragement in that the sorts of energy policies desirable from a carbon dioxide point of view were also becoming increasingly necessary, in Sweden at least, for economic reasons. **Wendy Barnaby**

## Plasma research

### German setback

The Max-Planck-Institute for Plasma Physics at Garching has been forced to make a major reappraisal of its future. Because of government financial restraints (*Nature* 5 February), the institute's next

major project, the "Zephyr" tokamak, has been cancelled. The institute, one of the three leading fusion laboratories in Europe, is now planning that its next project should be financed by a redistribution of resources within its total budget of about DM100 million a year.

Zephyr had been planned to leapfrog the joint European tokamak machine called JET, now being built at Culham in the United Kingdom, and would have experimented with ignited plasma. The hope now is that a redistribution of the budget will yield between DM20 million and DM100 million over the next seven years to build a less ambitious machine.

The reassessment at the institute will be carried out under new management. Last week, Professor Klaus Pinkau was appointed director of the laboratory. Although not a plasma physicist but a cosmic ray physicist, he has considerable experience of international collaboration, the politics of big science and the management of scientific institutions. He has been the director of the Max-Planck-Institute for Extraterrestrial Physics, next door at Garching, and is chairman of a committee reporting to the federal government on the merits of ten big science projects which, curiously, did not include Zephyr.

Pinkau said last week that it was dangerous to make scientific institutions too dependent on "annual changes" in the financial position of governments but, also, that budgets should not grow too fast. Certainly this year's changes at the Institute for Plasma Physics will give him pause: not only has Zephyr been deleted but the proposed budget for 1981 has been cut by 15 per cent. This trimming of sails may give the laboratory a sense of realism, persuading it that it cannot alone compete with JET, but a tough internal struggle seems inevitable between the advocates of an upgraded stellarator and a mirror machine. The edge might be taken off this battle if the new project were adopted by Euratom as a "preferred project", in which case between 10 and 20 per cent of the cost could come from Brussels. The advocates of an improved stellarator point to their success last year when the existing machine at Garching, Wendelstein VIIA, was used to show that a stellarator plasma could be held stable in conditions only previously obtained in tokamak machines. The same series of experiments created conditions of plasma density and confinement time more stringent than those reached by tokamaks of similar size, apparently putting stellarators back in business.

Tokamaks are in fact beginning to lose favour because of the various difficulties (fatigue and maintenance, for example) expected to arise in power reactors. Diversification is therefore considered prudent, whence current interest in stellarators and mirror machines. The Lawrence Livermore Laboratory in

California is in fact building a mirror machine (the Mirror Fusion Test Facility) in which a large long solenoid is plugged at the ends with magnetic quadrupole mirrors. Garching cannot hope to compete with Livermore in money terms but, some argue, could attack the principles of such a device. This, broadly, is the second proposal being considered at Garching. A decision is expected in the middle of the year. **Robert Walgate**

### Princeton perplexities

There are slippery hands and red faces at the Princeton Plasma Physics Laboratory, where a gaggle of lawyers is trying to decide who was responsible for dropping a 350-ton generator component during the construction of the Tokamak Fusion Test Reactor (TFTR).

The accident happened in December, when the outside stator of the vertical axis generator was being lowered into position. A crane bearing broke and the stator fell 15 feet, damaging both itself and the central rotor.

The incident is not expected to have a significant impact on the construction schedule for the TFTR, which will be used to achieve energy breakeven for the first time and to investigate the engineering features of large fusion systems. A second generator, already in place, will be able to supply sufficient energy for the test reactor, at least in the early phases of operation. However, a detailed study will now be necessary to determine whether the generator can be repaired — or whether a replacement is needed, which could cost up to \$2 million, and take some time to deliver.

Present construction schedules anticipate that the TFTR will come into full operation in July or August 1982. This is about seven months later than the original completion date of December 1981, due largely to delivery delays on some of the major components — in particular the toroidal and ohmic field coils used to contain the plasma — which have presented more technical difficulties than expected.

Officials at Princeton say that they do not foresee any insuperable problems, as most of the technology is "state of the art". However, the delays will inevitably add to the construction costs, which are expected to exceed the predicted \$284 million by about 10 per cent.

More than five subcontractors may be involved in the heated debate over the responsibility for December's accident. A report is expected shortly from the Department of Energy, which is expected to identify errors of judgement responsible for the crane overload. However, with large insurance sums at stake, any such conclusion is likely to be contested — and will almost inevitably end up in the courts.

### Tokamaks and stellarators

In both tokamak and stellarator, plasma is confined to a torus by two superposed magnetic fields. One field runs around the torus, along its long circumference; the other winds round and round the small circumference of the plasma ring.

The first field is created in both tokamak and stellarator by a coil wrapped round the small circumference of the torus. The second is created differently in tokamak and stellarator.

In the tokamak, it is the result of a current carried in the plasma itself; in the stellarator it is the result of a component of current in the outer coils along the major circumference of the torus. As the plasma ring is electrically isolated, the tokamak must create the longitudinal current in the plasma by a transformer effect, and so must be pulsed.

The stellarator, on the other hand, can in principle be run statically. Early tokamaks — which were invented in the Soviet Union — were successful principally because of their large "aspect ratio" (major torus radius over minor), it is now believed, rather than because of any intrinsic merit of the tokamak design; and the need for pulsed operation is seen as a disadvantage in the construction of a true reactor, where the variation of thermal, neutron, and magnetic stresses could increase material fatigue.