

Dissent hits climate accord

Geneva

THE 137 countries represented at last week's World Climate Conference left Geneva having agreed to begin negotiating towards an international convention on climate change problems, with the aim of signing an agreement at the United Nations Conference on Environment and Development to be held in Rio de Janeiro in 1992. But even at this preliminary stage there is disharmony: a newly formed coalition of the small island states, perceiving an imminent threat from any rise in sea level, made known its disappointment with the ministers' final conference declaration.

Hours before the ministerial declaration was adopted the Alliance of Small Island States (AOSIS) came into being. Delegates from the AOSIS nations agreed to adopt the final declaration in Geneva, but only after expressing support for an alternative version that contained stronger wording on the threat to low-lying islands and the need for precautionary measures to combat global warming. Lincoln Myers, environment minister of Trinidad and Tobago, said he was angry at being treated as "a codicil" to the meeting, and said AOSIS would "be extremely firm in the negotiations to come", pushing for limits on carbon dioxide emissions from the industrialized countries.

Although the co-ordinated effort will strengthen the hand of the island states, it is still expected that the greatest role in the negotiations (which will begin in Washington next February) will be played by the three nations most strongly opposed to carbon dioxide emission controls (the United States, the Soviet Union and Saudi Arabia) and those industrialized countries which have already adopted targets to stabilize or reduce their emissions. A binding protocol to limit carbon dioxide emissions still seems unlikely before 1992. John Knauss, under secretary in charge of the National Oceanic and Atmospheric Administration, and head of the US delegation in Geneva, said "we ought to reach an agreement on a framework convention first and then discuss protocols".

Another difficult issue is the transfer of technology and funds to poorer countries to allow them to develop industrially while limiting greenhouse gas emissions.

As expected, the conference declaration falls short of urging industrialized countries to set targets that would stabilize carbon dioxide emissions by the turn of the century. But the declaration mentions by name those countries which have set such targets, and the US delegation failed to gain recognition for US efforts to limit total greenhouse gas emissions. In diplomatic language, this indicates growing

"irritation" with the US position, according to a member of the British delegation.

Brice Lalonde, the French environment minister, explained that the European Communities countries had wanted to

avoid isolating the United States before the start of convention negotiations, and so had not fought hard for stronger statements on carbon dioxide. But the United States must soon begin to alter a way of life "founded on the low cost of energy", he said, and increase energy prices to reduce carbon dioxide emissions.

Peter Aldhous

Iron solution no solution

Washington

AN ambitious proposal to remove excess carbon dioxide from the atmosphere by using iron fertilizer to stimulate the growth of gigantic algal blooms was dealt a blow earlier this month when a group of experts determined that the technique would be hugely expensive, potentially dangerous, and would only reduce total carbon levels by a small amount.

The proposal surfaced earlier this year as a possible last-ditch response to a runaway increase in carbon dioxide levels and the accompanying rise in global temperatures caused by the greenhouse effect. In a widely reported article, John Martin, of the Moss Landing Marine Laboratory (see *Nature* 345, 374; 1990), hypothesized that the growth of algae in the ocean around Antarctica is limited by a shortage of iron. Simply adding iron to the water could prompt massive algal growth, Martin wrote. He calculated that addition of 300,000 tonnes of iron would be sufficient to remove 2,000 million tonnes of atmospheric carbon, which is equivalent to about a third of the yearly output of the world.

But at a recent conference in Irvine, California, with sponsorship from the US National Research Council (NRC), scientists presented new data that suggest more iron will be needed and less carbon can be extracted. The best guess is now that between one and five million tonnes of pure iron would be required to stimulate the growth of algae capable of soaking up 1,000 million tonnes of carbon. That figure assumes that iron — rather than some other nutrient — is indeed the limiting factor in antarctic algae growth, something that has not so far been conclusively established. Those calculations represent an increase of some three to fifteen times the amount of iron level specified that Martin specified in his original calculations, with only half as much carbon likely to be extracted.

Compared with the current world output of some five to six million tonnes of carbon, savings of 20 per cent may not be worth the trouble, says Karl Banse, a biologist at the University of Washington who served on one of the panels of the conference. "Maybe we would be better off investing our money somewhere else",

Banse suggests.

Neglecting even the environmental and practical uncertainties of such a project, economics remain a major question mark, says Thomas O'Brien, a technology assessment expert for US chemical company. DuPont Crude calculations, he suggests, show that the iron itself — in the form of a 30 per cent solution of liquid ferrous chloride — would cost between \$150 and \$200 a tonne; the equivalent of five million tonnes of pure iron could cost as much as \$3,000 million.

Although ferrous chloride happens to be a natural waste product of other DuPont production processes, such a massive demand would quickly outstrip the levels that result from routine production, forcing the company to make it for its own sake — at even higher prices. But even those costs, he says, would be "insignificant" compared with the expense of transporting the caustic chemical to the Antarctic ocean in hundreds of rubber-lined barges.

Troublesome, too, are the questions of the environmental impact of sudden algae blooms. Biologist Gustav Paffebhofer, of the Skidaway Institute of Oceanography, says that for krill, a small crustacean that plays a vital part in the antarctic food chain, huge algae fields "could be the best thing that ever happened — or the worst". Krill feed on algae, but they also lay their eggs in the water below the surface. Both algae and eggs slowly sink, the eggs eventually hatching while the algae deteriorate. If algal decay creates oxygen-depleted strata at the same depth as that at which the eggs hatch, entire generations of young krill could be killed. Likewise, tunicata, jellyfish-like organisms that eat both small krill and algae, could "take over", unbalancing the food chain, he says.

Nevertheless, the conference participants agreed that the 'iron solution' — even if it is never the answer to the threat of global warming — is worth further study. They suggest two years of preliminary laboratory and field studies, followed by a trial iron-fertilization experiment covering some 400 square kilometres of ocean. NRC is considering a formal study and report, which could be completed late next year.

Christopher Anderson