

US nuclear power

Diablo Canyon at full power*Washington*

A *cause célèbre* of the US nuclear power industry appears finally to have been laid to rest—or almost. On the last day of 1984, a US Court of Appeals panel gave its opinion that the Nuclear Regulatory Commission (NRC) acted within its legal discretion in granting a full power operating licence to the Pacific Gas and Electric Company for its Diablo Canyon 1 plant, ordered in 1966. With two minor exceptions, which did not merit judicial relief, the panel dismissed a petition by Mothers for Peace in San Luis Obispo alleging that the commission had committed legal errors, and proclaimed that "Diablo Canyon is ready to begin generating electric power for the citizens of California". The decision is being hailed as a significant victory by the industry.

In fact, the plant has been producing electric power for the citizens of California since November, though at only 50 per cent of capacity; Pacific Gas hopes to move to full power operation by the end of March. But San Luis Obispo Mothers for Peace have not yet given up: they plan to use their legal right to take the petition to a full hearing before all 12 justices of the court. And there is always the Supreme Court.

The issue of an operating licence for Diablo Canyon became controversial in the 1970s, with the discovery of an offshore geological fault within 3 miles of the site. An element of farce was added in 1981 when it was discovered that blueprints used in construction of the reactor had mistakenly been reversed; an investigation then revealed numerous other design faults. A full power licence was eventually issued by NRC last August, only to be suspended immediately by the Appeals Court after the petition from Mothers for Peace.

The Court of Appeals panel now finds that NRC has been guilty of only two minor misdemeanours, relating to operator training on simulators and the right of petitioners to a hearing on construction quality assurance. Both issues were later overtaken by events and have no present bearing on safe operation of the reactor, according to the panel. On the question whether earthquakes near the plant pose a safety threat, which has been central to the Diablo Canyon saga, the panel states that the seismic design of the plant is such that "the likelihood that an earthquake will trigger a nuclear accident at the facility is so small as to be rated zero". The chance of a core meltdown occurring coincidentally with an earthquake—relevant to emergency evacuation plans—is "extremely small", and NRC acted within its discretion in deciding that this eventuality need not be considered in evacuation planning.

Evacuation plans were, however, the subject of a dissenting opinion by Judge Patricia Wald, who held that ignoring the

effects of earthquakes for emergency planning was "a substantial lapse of rational decision making". Judge Wald confessed to being "baffled" by NRC's "paradoxical stance" on the importance of earthquakes, considered in plant design though not in evacuation planning.

Nuclear industry spokesmen are, not unnaturally, hoping that the Diablo Canyon ruling will signal a turn-around in the industry's fortunes. A recent comparison study by the Atomic Industrial Forum (AIF) indicates that new nuclear power plants ordered in the late 1980s will typically have a 10 per cent price advantage per kilowatt hour over coal-fired plants. The study, which used assumptions conservative for the nuclear case, highlights the long construction times for nuclear plants in the United States—up to 16 years for more recent plants. In France, by comparison, the range is 5 to 8 years. The study group concludes, however, that standardization of licensing procedures, improved

economic conditions and the recent rapid growth in electricity demand—up 6 per cent in 1984 over the previous year—will all reduce US construction times to the best European levels. Demand is now more than 2 per cent above the 1984 level, and surplus capacity is down to 30–32 per cent. Demand for new plants will rise sharply when surplus capacity falls to 20–25 per cent, according to AIF; some surplus is needed to cope with periods of peak demand.

The AIF conclusions depend on nuclear fuel maintaining its current cost advantage against coal. But the indications are that the fuel price advantage will tend even more strongly towards nuclear electricity.

Apart from the Diablo Canyon ruling, 1984 as a whole was a mixed year for the industry. NRC imposed 27 fines on electricity utilities for safety violations. And the total of eight low-power operating licences issued during the year exactly offset the number of cancellations. But that is fewer cancellations than in some recent years, and the industry—now providing 13 per cent of US electricity—expects to bring 30 more plants into operation before the end of 1986.

Tim Beardsley**Bhopal disaster****Technical inquiry under way***Bhopal*

THE 16.2 tonnes of methyl isocyanate (MIC) left over at the Union Carbide India Limited (UCIL) plant after last month's tragedy, when more than 2,500 people died, has been converted into the pesticide Carbaryl and the plant has been declared safe. UCIL staff, released temporarily from police custody, disposed of the remaining MIC after a specially assembled team had been satisfied that the operation would pose no risk. A third of the people living in Bhopal nevertheless moved out of the city during the five-day operation (codenamed "Faith"), which went off uneventfully. Meanwhile, the state government of Madhya Pradesh made it clear that the plant would not be allowed to reopen either in Bhopal or elsewhere in the state.

The cause of the accident on 2 December is the subject of a judicial inquiry and another by the Central Bureau of Investigations (CBI). Dr S. Varadarajan, director of the Council of Scientific and Industrial Research and former head of Indian Petrochemicals Limited in Baroda, is helping with the CBI investigation. He says that, at the time of the accident, the temperature of the MIC storage tank had exceeded 80 degrees centigrade and that the pressure rose above the 2.5 kg per square centimetre that the relief valve could deal with.

The cause is thought to have been either the entry of water into the tank or the spontaneous polymerization (in the absence of inhibitors) of the liquid MIC, which had been in storage for a month, a longer period than normal. The heat released during the process of polymerization might

be sufficient to vapourize the remainder of the MIC. A maintenance team had been cleaning the vent lines with water shortly before the accident, but it is not known how two tonnes of water (the minimum that would have been needed to trigger such a reaction in the 45 tonnes of MIC in the tank) could have entered through the apparently airtight seals of the tank.

A third theory is that nitrogen used to pressurize the tank might have been contaminated; MIC is known to react with virtually all chemicals. The only evidence collected so far consists of samples of polymerized MIC recovered from the tank by forcing through high-pressure nitrogen.

Between 80,000 and 90,000 people are undergoing treatment for MIC exposure. About a third of the victims have returned to hospitals with secondary complaints of liver and kidney disorders. The problems appear to be similar to those caused by chlorine poisoning, in which case, according to Dr Hans Weill, professor of pulmonary medicine at Tulane Medical School, New Orleans, "a large number will recover". But an Indian expert on chest diseases, Dr A.S. Paintal, says that the victims would be prone in future to all kinds of allergic disorders.

Although some people have been blinded, most of the eye injuries are thought to be self-healing because only the outer layer of the cornea (the epithelium) would be involved. But Indian eye surgeons nevertheless estimate that 1,000 donor eyes will be needed for corneal grafts in those whose cornea has become opaque.

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