over a seven-year period the whole programme has cost under \$40 million.

Already other countries, particularly those with favourably geological conditions, have shown close interest in the programme. Once a year the programme managers hold a formal seminar in Sante Fe to discuss the progress of the project, attended by scientists from many parts of the world.

Both the Japanese and West German governments have offered to provide funding for the programme.

The federal programme is now focused on 1986, when a decision will be taken on whether to move the whole programme up to a near commercial scale.

At Los Alamos, they are confident that these investigations will be successful. "I don't think that the world has discovered hot dry rocks yet. But we see it as the only major alternate energy source that can be developed in this century, and do not understand why the powers that be are not more excited about it," says Mr Nunz. □

Harrisburg shakes up Sweden's nuclear war of words

THE Harrisburg reactor accident hit the Swedish nuclear energy debate like a karate chop. The Social Democrats, long supporters of Sweden's nuclear development and opposed to a referendum on it, announced that the accident was serious enough to make them change their basic judgements: there should be a Swedish committee of enquiry into Harrisburg and a referendum should be held. The Liberal party government changed with them and declared that no more reactors should be loaded until after the referendum. And an opinion poll taken after the accident shows a dramatic anti-nuclear swing: 53% of people asked said that they would vote against nuclear power in a referendum and only 26% said they would vote for. In January, the same question produced 43% against and 41% for. On the face of it, then, Sweden's nuclear future is wide open again. Or is it?

The seven years of Sweden's public nuclear debate has shown that facts enter politics only to the degree convenient for either side. More facts are being gathered now: a party of Swedes and Danes left this week for Harrisburg, and, on the domestic front, a working group is about to investigate Good Friday's accident at the Barsebäck 1 plant, within sight of Copenhagen. In this accident—"the worst in Sweden so far", according to a spokesman at the Nuclear Power Inspectorate—the generator exploded, throwing out metal projectiles (including a two-ton steel capsule) which did not, however, penetrate into the reactor itself. But it is hardly likely that any of the facts uncovered by these groups will be treated any differently from those already paraded. The referendum, to be held next spring, will be advisory—but its 'advice' will no doubt be used only so far as the politicians find convenient.

The last act of last year's three-party coalition government was to refuse the nuclear industry's application for the loading of the Ringhals 3 and Forsmark 1 reactors, on the grounds that the industry had not shown the existence of a sufficiently large rock formation with appropriate characteristics for final disposal of waste. The government said that, if the industry found rock they

considered more suitable, and if it is approved by the Nuclear Power Inspectorate, the government would give permission to load the reactors. After the coalition fell, and the pro-nuclear Liberal party government took over, the industry duly made more inspections on Sternö, near Karlshamn in southern Sweden, and made a new application.

The Inspectorate decided to appoint a group of eight independent geologists (six from Sweden, the others from Norway and Finland) to assess the industry's report, giving the Inspectorate's Board a factual base for its recommendation to the government. The new government announced that it would be bound by the Inspectorate's recommendation—and that it was confident that the Inspectorate would be able to recommend that the loading should go ahead.

Rock unsuitable

Seven of the eight geologists found that the geological properties of the Sternö rock were such that it "cannot be used for the storage proposed by the nuclear industry". They reported: "The holes drilled (by the industry) are too few and drilled in such directions that, even if they had all shown fracture-free, homogenous rock, they would not have sufficed to show unambiguously that the rock fulfils the set conditions." The group found fractures not discovered by the industry, and these could reduce the area usable for storage from the desired 1 km² to 0.3 km². Although storage requires homogenous rock, the investigated area contained three different types of rock, and the consequences of this had not been sufficiently investigated. The group maintained that it is impossible, at present, to determine the permeability of the rock—yet the nuclear industry's safety analysis depends on this parameter.

But the Inspectorate's Board did not recommend that the loading be stopped. In a masterly formulation, it told the government that the geological qualities of the rock must be seen in the context of *all* the barriers designed to prevent leakage of waste including vitrification and encapsulation. "The

Inspectorate does not maintain that each one of these barriers must give that degree of protection assumed by the nuclear industry in order for the final result to be regarded as wholly secure. . . . The importance of the demands made on the geological barrier should not be exaggerated . . . if the other barriers work satisfactorily." The question of whether the industry had shown that the rock met geological standards for deposition of nuclear waste was neatly sidestepped. The Board said that it was not unanimous on the meaning of the word "show", and therefore could not say whether the standards had been met or not.

"This has been such a political affair that science has been totally overridden", says Dr Arne Wesslén, one of the eight geologists. "It is regrettable that a regulatory authority can appoint a group of experts who give such a consistent opinion, and then ignore it for political reasons." Dr Bengt Åberg, another of the geologists, agrees. "We did the work scientifically. The Inspectorate tried to find ways around certain parts of our report", he says. And a spokesman at the Inspectorate admits, "We found ourselves under intense political pressure".

Ironically, all the geologists think that it should be possible to find rock in Sweden with the desired characteristics. "Sternö was not chosen for geological reasons", says Dr Åberg. "The industry has had to rely on areas it owned or where it was given permission to drill. On Sternö, no holes could be drilled outside the power station fence! We should have a law allowing drilling to be done in geologically-likely areas."

The day after the Inspectorate's Board met, the accident happened at Harrisburg. In the aftermath of that, with the ban on loading more reactors until after the referendum, the Board's verbal acrobatics proved to have been unnecessary—for the time being. Politicians' energies are now concentrated on the fight over the wording of the referendum question, and bitter fights lie ahead. In the meantime, as September's general election looms, nuclear power is not likely to be forgotten.

Wendy Barnaby