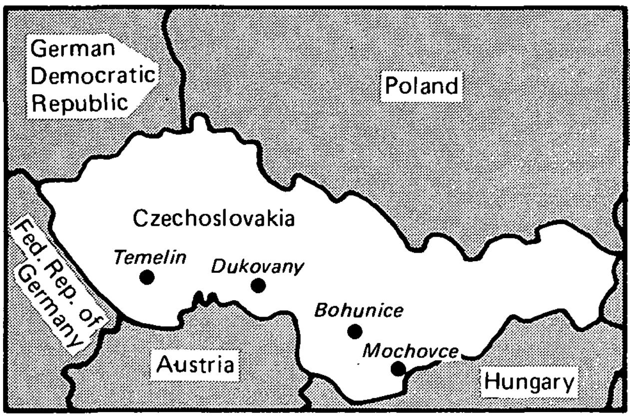

Report from

CZECHOSLOVAKIA

Nuclear power today and tomorrow

An update of operations and plans

by Stanislav Havel

The Czechoslovak Socialist Republic belongs to countries that have relatively high energy consumption. On average, the annual consumption of primary sources of energy amounts to seven specific fuel tons (about 205 gigajoules) per inhabitant. In the past, the majority of the power demand has been covered by domestic coal; hydropower has also contributed a few per cent to power supply. Yet this structure of energy sources can no longer meet the growing power demands of the Czechoslovak economy. Steadily growing costs of coal mining have become an economic burden and the present rate of exploitation would deplete resources in the not-too-distant future. The decreasing quality of steam coal used for power generation adversely affects the human environment, so its burning has to be curtailed for these reasons as well. High-quality coking coal is only allocated to ferrous and non-ferrous metallurgy. Regarding oil and gas, Czechoslovakia is fully dependent on imports, which cannot expand without due regard to the economy's purchasing power. They are, therefore, channelled only to those areas of use where they are irreplaceable.

Under these circumstances — and taking into consideration expected structural changes in the economy — the future energy supply and demand balance would depend on:

- Implementation of a broadly-conceived energy-saving programme
- Intensified development of nuclear power as the only form of energy that can meet the growing demand for power and increase the share of electrical energy in the structure of energy sources.

Nuclear power operations and plans

In the middle of 1986, Czechoslovakia was operating six nuclear power reactors totalling 2640 megawatts-electric (MWe). All are pressurized-water reactors (PWRs) of the type known as WWER-440. Six units of the same type and output are under construction. Recently, construction work has started at a new site (Mochovce) where four 1000-MWe WWER units are planned for a total output after completion of 4000 MWe. Three additional new sites for nuclear power plants, with two WWER-1000 units at each one, are under evaluation and preparation.

Within the period to 2000, the new plants will not only cover increased demand for power, but they will also substitute for supplies from some coal-fired steam plants that are supposed to be closed down for economic reasons and heavy emissions of sulphur dioxide and other pollutants. The share of electrical energy produced in nuclear power plants will thus exceed 50% of total output of electrical energy in the country, representing about 18% of all primary energy sources. The use of nuclear energy for heating purposes (in the form of combined electricity/heating plants) will contribute to achieving the above 18% share. The potential of a region to absorb the heat supply from a nuclear power plant has, therefore, become one siting criterion. Using such plants to supply heat to large industrial and residential complexes would curtail the burning of coal in heating systems even more. If accompanied by reconstruction of obsolete heating systems and introduction of central heating systems in urban areas with predominantly individual heating, the project may bring about considerable environmental improvements as well. It is expected that smaller nuclear reactors to be used purely for heating purposes will be ready for construction before the year 2000; they will also substitute for the use of fossil fuels.

WWER-440 reactors representing the basic generation of Czechoslovak nuclear power plants are to be gradually put into operation until 1989. The first reactor of the new generation of WWER-1000 should be put into operation in 1991 and the programme should go on with these reactors; by the year 2000, five of them should be in operation and one nearing completion. Speeding up this programme is under consideration.

Experience acquired in operating WWER-440 reactors particularly proves their high reliability. Due to this feature, they contributed considerably to the stability of the electricity supply system, particularly in periods of extraordinary climatic conditions. The reliability of the WWER-440 reactor rests primarily on a good design concept elaborated in design institutes of the USSR and verified and further improved at the Voronezh nuclear power plant and other sites in the USSR. There are, of

Mr Havel, Chairman of Czechoslovakia's Atomic Energy Commission, currently is a Vice-Chairman of the IAEA Board of Governors.

Map above: Czechoslovakia's nuclear power programme is centered around these sites.

course, other reliability factors: The fuel, supplied by the USSR, has from the beginning of the WWER-440 reactor era always been marked by high tightness and fail-safe operations. Additionally, qualified operating personnel periodically attend training courses and pass exams. In spite of satisfactory results, the issues of nuclear safety are under permanent review; research results in this field both at home and abroad are studied and measures are taken to improve nuclear safety. Compliance with safety regulations, which have been issued in accordance with the IAEA *Safety Series*, is controlled and supervised by the State regulatory body and by other supervisory bodies at all stages of preparation, construction, and operation, as well as during manufacturing and assembling of all nuclear power plant components and installations that may influence nuclear safety. This task of the regulatory body is facilitated by the fact that most parts of the primary and secondary circuits are manufactured in Czechoslovak metallurgical and heavy engineering factories.

Emergency planning

Great attention is also being paid to measures in case of accidents and emergencies. Emergency plans are being formulated and prepared at each site at the stage when the first reactor is to be commissioned. Plans cover measures both at the nuclear plant site and in the adjacent region. A countrywide stand-by monitoring system is in operation, capable of monitoring the discharge of radioactivity and the contamination of the human environment, thus enabling calculation of doses. The monitoring system can be activated at any time and, if needed, it can be extended or amended. Therefore, the events related to the accident at the Chernobyl nuclear plant on 26 April 1986 have not caught Czechoslovakia's competent authorities unprepared, although the emergency and monitoring plans have been designed to handle accidents on its own territory. This situation called for a certain modification of the system: After it had been activated, it was necessary to modify it to collect and record much more data because the cloud containing radioactive pollutants moved over the whole State territory within a short time and left behind specific radioactivities and dose rates that deviated from natural levels.

Post-Chernobyl monitoring

Having evaluated extensive, detailed, and frequent monitoring results both in the field and in laboratories, Czechoslovak authorities did not find it necessary to introduce extraordinary restrictive measures after Chernobyl, with the exception of direct consumption of fresh sheep milk and the cheese of short-term cultivation made from it. The iodine-131 specific activity reference level for consumption of milk was set at 1000 becquerel per litre (Bq/l). If exceeded, the milk would have been excluded from distribution. Distribution of powder milk produced in one factory and consumed by children at the age of 1 year was held up for a short time. Specific radioactivity values measured over the territory, and dose rates, varied considerably. Maximum levels were well below (at least by two orders of magnitude) values indicating the possibility of acute health damage.

The short-term, one-day maximum dose rate from external exposure achieved at one site in northern Moravia was 3.5 gray per hour (Gy/h); on average, it amounted to 0.25 Gy/h until 15 May 1986. Contamination of iodine-131 milk in Bohemia and Moravia reached almost the reference level (1000 Bq/l) in the course of two days in May only. At the same time in Slovakia, the reference level was almost reached at several collection points, while milk from some farms scored 1570 Bq/l. On average, this value amounted to 150 Bq/l until 15 May. The caesium-137 contamination of beef meat culminated around 25 May, when it reached at some places 240 Bq/kg; on average, until July it descended to 20 Bq/kg. Caesium-137 contamination of milk culminated in June, when it amounted to 110 Bq/l; the average until July was 20 Bq/l.

Reporting on the radiation situation in Czechoslovakia and on the mitigation of the accident at Chernobyl was accepted by the public with understanding and sympathy. No doubt, the accident should not have such an impact on the Czechoslovak nuclear programme to restrict its scale or time schedule. We shall fully support the IAEA's efforts to improve nuclear safety of operating nuclear power plants and to upgrade the level of nuclear safety of the forthcoming generation of reactors.

As it did after the Three Mile Island accident in 1979, Czechoslovakia will concentrate on improving the safety systems of nuclear plants. As is evident, the human factor is the decisive element in nuclear safety. Therefore, it seems desirable to further upgrade the automatic control of reactors, including linkage to the secondary circuit. It perhaps should not be understood as the application of the "30 minutes criterion" formulated after the TMI accident, which required the secure automatic control of the reactor without operator interference for 30 minutes. What should be aimed at is the application of the principle that an operator should not be exposed to a time stress when solving failure or accident situations. The stress may result in misjudgements and errors with far-reaching consequences, even in case of highly qualified and well-trained personnel. We also share the view that technical measures should be improved to such a level that they would prevent any initial failure from unfolding into an accident. Consequently, criteria defining anew the maximum design-basis accident should be based on the assumption that the accident must be mastered by inherent means, even if one or two elements of the event tree do not occur.

The accident at Chernobyl is understood by personnel associated with our nuclear power programme as a warning that upgrading nuclear safety cannot be a matter of a campaign, but that it must be a permanent task.