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BACKGROUNDER:

FIRST NUCLEAR-GENERATED ELECTRICITY IN CANADA (JUNE 4, 1962)

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The story of this historic achievement of 1962 begins shortly before the outbreak of World War II, with the German discovery of nuclear fission. Scientists everywhere immediately realized the potential of this new energy source, and in Canada Dr. George Laurence conducted some of the world's first "critical pile" fission experiments at the National Research Council (NRC) laboratories in Ottawa.

Meanwhile, a handful of French scientists escaped to Britain from Paris with almost all the world's supply of heavy water (about 200 kg), just ahead of the German invasion. They and the heavy water eventually ended up in Montreal. While the remainder of Canada's wartime nuclear effort was devoted to helping the American bomb program, the end of hostilities in 1945 found this country with the second largest nuclear research infrastructure in the world (after the U.S.).

Part of this legacy was the ZEEP nuclear research reactor at the Chalk River Laboratories (about 200 km north-west of Ottawa), the only non-U.S. reactor at the time, commemorated in 1966 by a plaque from the Archaeological and Historic Sites Board of Ontario.

With the wartime diversion out of the way, scientists again turned to the alluring peaceful potential of nuclear energy. In 1950 George Laurence, now at Chalk River Laboratories, began advocating a Canadian power reactor based upon natural uranium fuel and heavy water – both areas of domestic expertise. As the only member of the wartime British-Canadian-American nuclear alliance not to pursue atomic weaponry after the war, Canada found itself cut off from technological cooperation with the other two, and forced to go it alone.

August of 1951 saw the formal publication of "An Atomic Power Proposal", by Dr. W. Lewis of Chalk River Laboratories. The following January a series of meetings between Ontario Premier Leslie Frost, Ontario Hydro (then the Hydro-Electric Commission) Chief Engineer Richard Hearn, National Research Council (NRC) President C.J. Mackenzie, and federal minister C.D. Howe, lead to preliminary joint feasibility studies between Ontario Hydro and the newly-created crown corporation Atomic Energy of Canada Ltd. (AECL had taken over the reins of Canada's nuclear research program from the NRC in April 1952).

In 1954 the "Nuclear Power Group" was established at Chalk River Laboratories (now part of AECL), under the leadership of Ontario Hydro's Harold Smith. This handful of representatives from electric utilities, engineering companies, and manufacturers, joined with AECL's scientists to forge the fundamental design of a prototype heavy-water, natural-uranium-fuelled power reactor that could compete with coal-fired plants.

Although "made-in-Canada" was the overlying goal of this enterprise, "made-in-Ontario" largely resulted by default. Ontario not only provided the industrial base for much of the manufacturing, but was also the seat of Canada's nuclear engineering and scientific expertise, as well as uranium production (mined at Elliot Lake, north of the Lake Superior).

In March of 1955, Canada General Electric (CGE, now GE Canada) in Peterborough, Ont. was selected from seven bids as the Prime Contractor for the Nuclear Power Demonstration (NPD) project. The implementation team was now in place: CGE would provide the design work at its Peterborough engineering offices (forming the Civilian Atomic Power Division, CAPD), as well as $2 million in funding. Ontario Hydro would provide the plant site and all conventional equipment, plus operate the plant and purchase the nuclear-generated steam. AECL would provide the balance of funding (the projected cost at that time was $20 million) and own the nuclear side of the plant.

The site itself was a spot on the Ottawa River, just downstream from Ontario Hydro's massive Des Joachims hydro-electric power station at Rolphton, Ont. (about 230 km north-west of Ottawa).

The CAPD in Peterborough included roughly a dozen engineers each from CGE and AECL, under the guidance of General Manager Ian McRae (CGE), Engineering Manager Ian Mackay (AECL), and Design Manager John Foster (AECL). These were heady days, where design and development proceeded in parallel, and key late-breaking design decisions became the blueprint for future CANDU designs.

The most significant of these decisions was made in 1957, when the team resolved to redesign the core of the reactor to better reflect the thinking on future CANDU designs. Instead of having one large pressure vessel, as in American designs then being developed, NPD would assume the horizontal, pressure-tube arrangement characteristic of all CANDU cores to this day. This would make NPD the first commercial power reactor to have a completely replaceable core, and able to refuel while operating at full power – both signature CANDU traits.

This decision also ensured that the manufacturing phase would approach 100% Canadian content, since the specifications now more closely matched our industrial capabilities at the time. More importantly, it meant that international experience would be largely irrelevant to the Canadian nuclear program: our bold decision to be unique also meant self-reliance.

As the hurdles and delays were gradually overcome, an Operations group, assembled under Lorne McConnell of Ontario Hydro, prepared to take over and bring Canada into the Nuclear Power Age.

NPD began supplying its first electricity to the Ontario grid on June 4, 1962, and reached full power (about 20 MWe – enough for 10,000 homes) on June 28. Ontario Hydro would continue to operate the plant for the next 25 years, even as much larger CANDU versions came on-stream in Southern Ontario, dwarfing NPD's meagre contribution. Today Ontario is one of the largest nuclear-powered jurisdictions in the world.

The more important role of NPD was always as a prototype for CANDU engineering. Over the years it was an invaluable test bed for new fuels, materials, components, and instruments – most never envisaged at the time of NPD's conception.

Equally important, NPD was the training centre for generations of Canadian and off-shore operations staff. This role began shortly after the start of operation, when a training program was set up by George Howey of Ontario Hydro. Howey was to oversee the evolution of the training and simulation centre over the next two decades.

In 1987 a decision was made to shut down NPD permanently, based upon unsupportable maintenance costs. In its 25-year career it had met and surpassed every goal set for it, and was a strong symbol of Canadian innovation, boldness, tenacity, and self-reliance.

NPD also epitomized the symbiotic good that can come of federal/provincial/private cooperation in research and development. The partnership forged in the early 1950s between AECL and Ontario Hydro (now Ontario Power Generation) continued and prospered – and served as a model for other utilities in Quebec and New Brunswick that later installed CANDU reactors. The participation of private manufacturing and engineering firms (headed by CGE) has evolved into a well-established nuclear industry to which most CANDU construction and design contracts are now channelled.

References:

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