



CNS BULLETIN SNC

Vol. 3, No. 6

November-December / novembre-décembre 1982

Editorial

Dirty Pool

Around the beginning of November we received a letter from Energy Probe, a Toronto-based organization. The letter started as follows: "What I'm about to tell you may not be pleasant, but it is an indisputable *medical* fact. The very young and the unborn will be the first to suffer in the event of a nuclear accident."

The letter noted that radiation "preys on the most helpless members of society first" and concluded with the statement that "Traditional charities work at curing cancer; Energy Probe works at the equally important task of *preventing* cancer." An initial reaction was that Energy Probe certainly had a catholic approach to the purchase of mailing lists. Mature reflection allowed a sense of outrage to develop.

It is probably true to say that most fair minded people would agree with the proposition that an organization with the limited resources of Energy Probe cannot always afford the luxury of observing the intellectual disciplines, formalities, ethics and courtesies that characterize traditional scientific and technical discourse. Probe's self-imposed role is that of an activist, opposition group. Attention must be grabbed, even if the act of grabbing violates the conventions. All's fair in love and war. Almost all.

It appears to us that this latest pronouncement of Energy Probe, over the signature of Marilyn Aarons, goes too far. It seems a calculated attempt to arouse fear at the most visceral level, with complete disregard for the facts. In our opinion it is as cynical a manipulation of human emotion as we have ever seen.

Undoubtedly, organizations such as Ontario Hydro and the Canadian Nuclear Association will have responded (one hopes forcefully) to this outrageous letter. It is to be hoped that any CNS members who have received the letter will respond direct to Energy Probe. All too often organizational responses become delayed and diluted through the inevitable process of internal review. CNS members have a chance to speak for themselves. Let's hope they do it.



CNS Officers Seminar Well Attended

CNS officers with responsibilities on council, technical divisions and local branches, left to right: Jim Weller, Ex-Officio, CNS Council; Dave Paterson, Mining, Manufacturing and Operations Division; Hugues Bonin, Associate Editor, CNS Bulletin, CNS Communications Committee; Ron Lewis, Mining, Manufacturing and Operations Division; Joe Howieson, Technical Divisions Chairman, Chairman of Mining, Manufacturing and Operations Division, CNS Council; George Howey (front) Past CNS President, CNS Council; George Bereznoi (back) CNS Council Member-At-Large; John Martin, Design and Materials Division; Phil Ross-Ross, CNS President, CNS Council; David Barber, CNS Toronto Branch; Peter Stevens-Guille, Secretary Treasurer, CNS Council; Tjalle (Chuck) Vandergraaf, CNS Manitoba Branch; Tom Drolet, Program Chairman, CNS Council; David Jefford, CNS Toronto Branch; Riccardo Bonalumi, Chairman, Nuclear Science and Engineering Division; Tony Colenbrander, Membership Chairman, CNS Council; and Arthur Guthrie, Chairman, CNS Toronto Branch. Seminar was held September 23, 1982 in Toronto and included several officers not present for picture-taking.

This Issue

Our first typeset issue is out. This marks an important step forward for the *Bulletin*. That this step has been accomplished is due in large part to the untiring efforts of David McArthur, our Production Editor. David has worked long and hard on this issue and deserves the thanks of all CNS members — and especially the thanks of a congenitally

disorganized editor. In this issue our highlights are selections from Tom Drolet's November 30 lecture on fusion, presented to the Toronto Branch, and a personal account of the trials and tribulations of arranging a conference. And, of course, it's Christmas, so, to all CNS members, from all of us at the *Bulletin*, have a good Christmas and a happy New Year.

Contents

	Page
Editorial	1
Perspective	2
FYI	3
CNS News	5
CNS Branch Programs	6
Conferences & Meetings	7
The Unfashionable Side	8

Perspective

Space limitations precluded publication of the full text of Tom Drolet's November 30 lecture to the CNS Toronto Branch. Following are selected highlights from the portion of his talk dealing with the Canadian program and the Canadian Fusion Fuels Technology Project, which followed an excellent review of the international fusion effort.

The Canadian Fusion Fuels Technology Project — A Status Report

To make fusion energy a reality, what is needed now is an integrated fusion device that will not only bring together all the technology developed to date and scale it up toward a commercial size, but it will include fueling, maintenance, and other practical engineering aspects. Most important, it will feature the direct involvement of industry, the utilities, manufacturers, and engineering companies that will actually build and use future commercial fusion-power stations.

Among the engineering questions to be faced in the construction of this device are the materials for the first wall (the inside wall of the vessel); materials for the blanket; design of blankets for heat transfer and tritium breeding; technology for superconducting coils, refueling and ash-removal systems, and auxiliary heating systems; tritium processing and handling techniques; remote-maintenance methods, and the reactor-control system.

The Canadian Fusion Scene

Canada's overall program strategy is intended to develop scientific and technological expertise in Canada, permitting access to international work and allowing Canadian industrial participation in the development of commercial fusion power systems.

The prime focus has been at the National Research Council of Canada in Ottawa; in Quebec at Hydro Quebec's Research Division (IREQ) and at the University of Quebec's Institute Nationale Research Scientific. Post graduate studies at various universities has been of high quality but not high in volume. Industry has been involved — some examples include DSMA and UHV Instruments in Ontario and, Canatom and MPB — Technologies in Quebec.

Research has primarily been in the area of the "physics" of the two confinement processes — "magnetic" and "inertial". These efforts have been in aid of establishing the scientific feasibility of fusion. Engineering feasibility should now get more attention.

The above means that we have a natural

division of the overall Canadian program into three areas:

- **Magnetic Confinement Investigations**

The federal government and Hydro Quebec have entered into an agreement to jointly fund (total 37.5 M) the building of a tokamak at Varennes near Montreal — Hydro Quebec's Research Division. This facility would be the focus of this sub-program. It would concentrate on establishing the feasibility of continuously operating a tokamak, rather than the present pulsing concept. Also, they would specialize in finding out what is happening to the plasma under this continuous operating mode, i.e., diagnostics.

- **Inertial Confinement — Lasers**

Canada enjoys international recognition for its basic and applied laser research work; this is relevant to laser fusion systems.

There have been some attempts to focus this work into a national sub-program. This program has not yet been established.

- **A Program on Fusion Fuels Technology**

This is the new area we have just established in Canada. (Canadian Fusion Fuels Technology Project — CFFTP). We are concentrating on a few areas which we have some background in and on which we can develop. But what are these areas? In the remaining time, I will develop the rationale for the CFFTP.

Canadian Fusion Fuels Technology Project

Ontario Hydro produces heavy water (deuterium oxide) and uses it in its nuclear reactors. Radioactive tritium is a bothersome but controllable byproduct. The international consensus is that a combination of heavier hydrogen isotopes, deuterium and tritium is the fastest route to fusion because the confinement and temperature conditions are less stringent than for hydrogen itself.

Canada has (Ontario in particular) a special knowledge of the two fusion fuels — as a result of its present fission program. Also, we have some special knowledge in the field of remote operations — a discipline which will be in large demand for any fusion power system; examples are — Spar Aerospace arm — fuelling machine technology.

We also have some special knowledge on the methods of containing tritium and its effects on materials.

The CFFTP will fulfill two objectives:

It will act as a technology development agency by managing the funds provided by the partners in the project:

- National Research Council of Canada
- Provincial government of Ontario
- Ontario Hydro

The major part of the funds will be distributed to R&D institutions including those of:

- AECL
- Ontario Hydro
- Industries
- Utilities

Some example areas of technology to be developed are:

- fusion fuel systems and tritium cleanup, i.e.,
 - wet proof catalysts
 - electrolysis
 - lasers
 - cryogenic distillation
 - storage beds for tritium
 - tritium pumping
 - valves and other components for tritium gas and tritium liquid systems
 - inventory measurement
- uptake, retention and permeation of hydrogen isotopes in the first wall
- adsorption and desorption of tritium on surfaces
- remote handling needs of Princeton's TFTR
- development of tritium instrumentation for fusion
 - personal monitors
 - process monitors
 - area monitors
 - contamination monitors

Anticipated Industrial Spinoffs from the CFFTP Project

A broad spectrum of spinoff opportunities are possible as a result of the activities outlined. A sample of these are provided below for illustration.

- The sale, by Canadian industry, of specialized components developed with the assistance of FFTP funds to the international fusion community.
- The use of Canadian engineering talent in the design of components and systems for use in experiments by the international fusion community.
- Catalysts developed for isotope separation or re-combination of hydrogen isotopes with oxygen should have application in conventional chemical industries.
- Electrolysis cells developed for the recovery of tritium gas from tritiated water should have application in electrolysis for hydrogen production and for tritium cleanup in fission applications.
- Development of coatings to prevent tritium permeation will have applications in all processes or industries which encounter hydrogen damage to alloys. These include chemical, petrochemical, power generation and other industries.
- Coatings developed to prevent surface contamination by tritium, and the oxidation of HT to HTO, may have applications where chemical exchange reactions should be inhibited. This could include medical implants and corrosion inhibition in conventional and fission industries.
- The development of valves with metal sealing gaskets capable of preventing tritium leakage will have direct application to the vacuum industry.
- The development of remote handling equipment for fusion should have spinoff in a number of areas such as underwater exploration and salvage, industrial assembly operations, repair and decommissioning of nuclear reactors and manage-

ment of spent fuel. Miniaturized equipment may allow internal surgery to be performed without major incisions.

- The development of laser techniques for monitoring or separating hydrogen isotopes may have spinoff in monitoring conventional industrial pollutants and in isotope separation in general.

Conclusion

In my travels, I have reviewed our CFFTP capabilities with people in the US, European and Japanese programs. They are anxious to have us enter the fusion club, they like and want what they see.

One message came through loud and clear in these visits. Research and development and industrial capability in the high technology areas I mentioned, **MUST BE ESTABLISHED SOON**. It is vital to involve industry as soon as possible and in a meaningful way. We have only to look at the Japanese successes in electronics and semi-conductor technology to underscore this point. Experience has shown that Canada can only penetrate a high technology hardware market or engineering market if a capability for excellence has been clearly demonstrated at home.

To give you some idea of the market, the US alone will need tritium handling systems and remote operations equipment worth as much as \$50 M a year over the next 15 years.

It is clear that a substantial world market exists for this type of technology and equipment and that the market will be satisfied during the current decade by someone. If we have the capabilities to satisfy that market, surely now is the time to establish our credentials and be that "someone".

We should not stand by and watch an important new power source being totally developed elsewhere. The country must make a credible contribution toward fusion research or, sooner or later, it will have to buy its way into the field — likely at high cost.

To make a credible contribution, we must focus on the things that we as Canadians do well to gain entry to the "club". By so doing, we could well be taking important steps towards energy independence for Canada in the 21st century.

FYI

CANDU Startup Milestones

(AECL)

The Canadian CANDU nuclear reactor in the Republic of Korea was started up November 21 at its site in Wolsung. It was the fourth CANDU to reach a milestone that month.

Atomic Energy of Canada Limited announced that the South Korean reactor had shown it can sustain continuous fission, the first step in a commissioning process

leading to commercial production of electricity.

The CANDU at Wolsung, a 600MW model, is similar to those in Argentina, New Brunswick and Quebec. The first concrete was poured at Wolsung in November, 1977, and construction of the station there was completed in the shortest time of all AECL projects.

Also on November 21 the CANDU 600 at Point Lepreau, NB, reached 50 per cent of capacity and is now feeding 285,000 kilowatts into the New Brunswick power grid. The Point Lepreau reactor went into operation in July.

At Gentilly, PQ, the CANDU 600 reached 5 per cent of capacity November 22. The reactor there went into first operation in September.

The reactor in South Korea is the fourth CANDU to start up in less than four months. Along with the three 600s to reach that stage in Korea, Quebec and New Brunswick, the fifth 500 megawatt model at Pickering, Ontario, passed that step in October. The Pickering reactor is one of eight units in Ontario Hydro's nuclear program at that site. It reached 5 per cent of capacity on November 20.

The Argentine CANDU reactor is nearing completion and is scheduled for service next year.

Ontario Reactor News (Staff)

The first unit at Ontario Hydro's Pickering "B" station, Unit 5, went critical October 23. The commissioning program for the unit is progressing steadily, Commissioning Manager Ken Talbot told the *Bulletin*, and the unit is expected to be declared in-service April 1, 1983. Ken noted that his "countdown" for Unit 5 started 24 months before first criticality, and everything's been on schedule, and going to stay that way. A unique feature of this commissioning program, Ken notes, is its relationship with the operation of Pickering "A". "We're right alongside an operation where continued production is a priority," he says. "Now with the "A" station we have a large reservoir of talent and facilities to draw upon, but bearing in mind the "A" station's priority — continued operation — we've had to develop a team dedicated to the commissioning program". Another challenge is posed by the differences between the "A" and the "B" units. While the "B" units were designed to be as similar as possible to the "A" units, in detail the units are "very different animals indeed" Ken notes, and this has meant, for example, that training "A" unit experienced staff for "B" units has required fairly extensive "debriefing" before training for the new "B" unit examinations can proceed. When all four "B" units are complete, operating the eight-reactor Pickering plant will be rather "like flying an aircraft with four piston engines on the starboard wing and four gas turbines on the port" Ken says.

Unit 2 at Ontario Hydro's Bruce Nuclear Generating Station has been shut down since October 29 after traces of heavy-water were detected in the unit's annulus gas system, indicating a leak from the primary heat transport. After exhaustive testing two tube leaks have been located, in channels A-14 and J-11, and tentatively diagnosed as delayed hydride cracks, resulting from "over-rolling" during pressure tube installation. A similar problem in unit 2 earlier this year required the replacement of channel X-14. At the time of writing, preparations are in train for tube replacement. The failed tubes will be sent to AECL's Chalk River Nuclear Laboratories for detailed examination. Leak location was hampered by the very low leak rate, compared with that of X-14. The unit is expected to return to service in the new year.

Outlook Gloomy for Maritime Heavy Water Plants (Staff)

The Glace Bay and Port Hawkesbury heavy water plants in Nova Scotia will close soon if no market is found for heavy water, Energy Minister Jean Chretien told a House of Commons energy committee. Their fate is now in the hands of cabinet. The government apparently hasn't decided on suggestions by the heavy water workers that Canada lift its ban and sell heavy water to India or that several domestic CANDU 600MW reactors be built to utilize the surplus heavy water. The excess heavy water is reported worth \$330 million and storage is near capacity. Closure of the plants is thought to be slated for March 1983, the end of Atomic Energy of Canada Ltd.'s fiscal year. Besides the 760 workers likely to be affected, workers with Nova Scotia Power which supplies energy, as well as Devco miners, may feel the cutbacks. The towns are developing contingency plans, however for some specialized heavy water workers, future employment in the field could be a problem. Nova Scotia Premier John Buchanan, in condemning the federal layoff plans said, "It's rather ridiculous and contradictory to say in one breath you're going to spend \$1 billion to create jobs throughout the country and then have 500 or 1000 jobs lost when an industry could be kept going."

Layoffs and a Stretchout (Staff)

Atomic Energy of Canada Ltd. in November announced an employment reduction of 600 workers, phased over the next ten months, at its locations in Mississauga, Ontario and Montreal, Quebec. The new staffing levels were described as necessary to allow AECL to stay viable until improved prospects for the nuclear sector exist.

In another development, Ontario Hydro in November decided to add two years to the construction schedule of units 3 and 4 at the Darlington nuclear project, under construction. The move, to limit borrowing require-

ments during the economic downturn, coincided with the announcement of a new electrical load growth forecast of 2.1% per year to the year 2000 for Ontario.

Remote Handling Develops at Ontario Hydro (Staff)

As part of Ontario Hydro's remote handling program for its nuclear division, several devices are built or planned, a few of which are described here. All would significantly reduce radiation exposures to personnel, reduce maintenance time and costs, and would also improve the reactor capacity factor.

Spar Aerospace has completed preliminary design work on a Remote Manipulator Control System for the utility. The system includes a manipulator arm an order of magnitude larger than the US space shuttle's Canadarm, which Spar also developed, but designed for use in gravity and "hardened" for use in a high radiation environment. It would be used to replace fuel channels in the Pickering A NGS. Control would be via computer or manual direction and a pair of the arms could operated on both reactor faces simultaneously.

Another device designed for the retubing program is a fuel-channel shifter built by Atcon Services, used in the realignment of 390 fuel channels of the Pickering-1 reactor last May. Atcon Services, a companion company of DSMA Atcon Ltd. also designed and built the special test rigs for Spar Aerospace for the Canadarm testing.

In addition, a 6-wheeled robot vehicle developed by Pedesco Canada and originally built for bomb disposal work was recently used by Ontario Hydro to recover a damaged radioactive fuel rod jammed in a fuelling machine at Bruce A NGS. Small robots have also been used to navigate piping to perform various duties.

Several years ago, Ontario Hydro, with AECL gained much experience in remotely controlled repair while fixing leaks in auxiliary heavy water lines at the Douglas Point NGS. For use in radiation fields up to 5000 roentgens, a wide range of welding tools, manipulators, viewers, etc., were designed and developed for this specific repair job.

Canada has the advantage of a well-established automatic fuelling machine and reactor control technology. Other areas in which remote technology could be applied is in automatic flaw detection and inspection vehicles, automatic washing or welding machines, etc.

Real CANDU Construction Cost Increase Only 1% per Annum (Staff)

Researchers with Atomic Energy of Canada Ltd. and Ontario Hydro conclude that the trend in real construction cost increases for multi-unit CANDU stations is only about 1% per year. The "real cost" was defined as the capital cost less interest during

construction and escalation and less the effects of schedule changes, factors affecting many megaprojects. The 1% increase was attributed to increased regulatory requirements and cost-effective design improvements, the latter expected to improve CANDU reactor performance. This real cost is expected to stay fairly level for future stations, however the study makes clear that tight construction schedules are needed to minimize cost overruns. The paper *Trends in the Capital Costs of CANDU Generating Stations*, by A.M. Yu and D.L.S. Bate, was presented at the IAEA International Conference on Nuclear Power Experience, held in Vienna in September.

Waste Sites to be Decommissioned (Eldorado)

Eldorado Nuclear Ltd. has indicated it intends to decommission its two waste management sites, starting in 1986. The sites are located at Port Granby, mid-way between Port Hope and Bowmanville on the shore of Lake Ontario, and at Welcome, adjacent to Port Hope.

In order to meet this schedule, Eldorado is beginning to develop an acceptable decommissioning plan.

The only way in which the AECB's directive to decommission can be implemented by the 1986 target date is to develop a permanent disposal system, which meets modern regulatory criteria, at a site in the immediate area.

Although the actual design of the system is still open for consideration, Eldorado's will employ internationally accepted engineering methods now in use to dispose of the wastes.

Low-level Radwaste Office in the Works (EMR)

The federal government has approved the establishment of a low-level radioactive waste management office to carry out federal responsibilities in this area.

The new office will be a separately-funded

program under the Atomic Energy of Canada Research Company, and will be located in Ottawa. AECL has expertise, developed over the years, in handling radioactive wastes, both low and high-level. It has provided a waste management service to users of its medical and industrial isotope products, and has managed storage facilities at both of its research establishments.

A program on uranium mill tailings research was announced earlier and is to be managed by the Canada Centre for Mineral and Energy Technology Laboratories of the Department of Energy, Mines and Resources.

Majority of US Scientists Endorse Nuclear (INFO)

Nuclear energy development enjoys overwhelming support among US scientists according to a random sampling of the 130,000 scientists listed in *American Men and Women of Science*. The survey was undertaken by two researchers, Stanley Rothman and S. Robert Lichter, as part of a study of American social and political trends they are conducting under the auspices of Smith College, Columbia University and George Washington University. The results are reported in the August/September issue of *Public Opinion*, a magazine published by the American Enterprise Institute.

More than half (53%) of the scientists polled endorsed rapid development of nuclear energy, and 36% supported slow and cautious development. Only 7% would halt nuclear energy, and only 3% wished to dismantle existing facilities.

Among scientists in energy-related disciplines, moreover, the overwhelming majority (70%) endorsed rapid development. And 92% of scientists in fields related to nuclear energy (including nuclear medicine, radiation genetics, etc.) backed rapid development.

One reason that scientists support nuclear energy is that three-fourths of them regard the energy crisis as "very" or "extremely" serious, the authors say.

Scientists in energy-related disciplines, more-

Decided Cost Advantage for Nuclear

(Nucleonics Week)

Ontario Hydro has forecast a decided advantage in nuclear electricity costs over coal electricity costs in the time period from 1995 for Ontario.

Nuclear plants are expected to achieve 80% capacity, versus 40% capacity for fossil-fuelled plants, which have a high

anticipated fuel cost. The "nuclear edge" over coal is moderately reduced in the short term due to inflated debt charges, inflation and steam generator rebuilding. The coal versus nuclear comparison appears below.

Station:	Lakeview	Lambton	Nanticoke	Pickering A	Pickering B	Bruce A	Bruce B	Darlington
Fuel	coal	coal	coal	nuclear	nuclear	nuclear	nuclear	nuclear
Capacity	2,300MW	2,100MW	3,900MW	2,100MW	2,100MW	3,000MW	3,000MW	3,500MW
for costing								
In service	'62-69	'69-70	'73-78	'71-73	'83-85	'76-78	'84-87	'88-92
1990	5.3	5.6	6.2	3.5	4.8	3.1	4.9	6.6*
1995	8.1	8.2	9.3	5.2	5.4	4.3	5.5	7.1
2000	11.9	11.9	13.3	7.6	7.0	6.1	7.0	7.8

*based on two of four Darlington units

over, "are far less sanguine than the general public about the short-term contribution from solar energy." Only 2% of them believe any form of solar energy will provide a large amount of energy in the next 20 years. By contrast, they rated nuclear fission's potential behind only coal and oil, from among a list of 16 energy options.

Three Mile Island Trial Proceeds

(Staff)

General Public Utilities, in their effort to recover \$4 billion in damages from Babcock & Wilcox, manufacturers of the crippled TMI Unit 2 reactor, are contending that B & W withheld vital information on how to operate the reactor under crisis conditions. According to reports in the *New York Times*, a shift supervisor and a control room operator have both given evidence to the effect that their training by B & W had not equipped them to deal with the March 1979 emergency.

Shift supervisor William Zewe said that the B & W instructors had taught the crew that a loss of cooling water was caused by a crack or break in the reactor coolant system. Such a quick loss of water would be expected to show up on control room instruments. At the Three Mile Island plant the loss of water from the PORV didn't register directly on these instruments. Under questioning from the GPU lawyer, Mr. Zewe said that none of the B & W instructors, simulations or drills had dealt with such a problem.

The operator on duty at the time of the accident, Edward Frederick, testified that the mishap could have been averted if he had had access to a memorandum that B & W had not distributed, concerning a similar event at another B & W plant.

Babcock & Wilcox maintains that the accident was caused by faulty operation and maintenance of the plant by the utility. Under questioning by Robert Fiske, B & W's lawyer, Mr. Zewe acknowledged that he could have taken a number of other possible steps to minimize the damage from the accident. And subsequent questions to Mr. Frederick brought out the fact that the sump below the reactor had filled and was not emptying, even with both sump pumps working. Asked why he had not checked the PORV at that point, Mr. Frederick said "I had no reason to suspect the sump pump was open," adding that he thought the water was from the normal drainage system.

Maine Yankee Stays in Business

(Staff)

Maine voters once again rejected a referendum proposal in November to shut the Maine Yankee nuclear plant, by a 55-45% margin. The station had been operating for about 10 years and produces nearly 30% of the state's electricity. The winning argument was that higher electricity costs and

reduced capacity would hamper economic growth. Ironically, this may mean a loss to Canada since expansion at Point Lepreau to serve the export market would be more likely if Maine had dropped Maine Yankee.

CNS News

CNS President to Chair Meeting of World Nuclear Society Heads

Phil Ross-Ross, President of the Canadian Nuclear Society, is due to chair a meeting of the interim working group of the International Nuclear Societies organization during the 4th Pacific Basin Nuclear Conference in Vancouver, September 1983. The twelve-member group comprising three representatives from each of Europe, the far East, Latin America and North America is charged with the responsibility for putting together an on-going international nuclear societies group with the objective of stimulating inter-society cooperation world-wide.

Decontamination Conference Highlights

The International Conference on Decontamination of Nuclear Facilities was held September 19 to 22 in Niagara Falls, Ontario, co-sponsored by the Canadian Nuclear Association and the American Nuclear Society. Here follows a few highlights of the conference:

Total number of delegates (paid): 284
Representation: USA 136
Canada 42
Other 106

Number of countries represented: 17

Proceedings were printed ahead of time and available at registration.

Additional proceedings are being sold by ANS and CNA at \$100 per set of three volumes. Several sets have been sold already.

Highlights of the conference were lectures by:

- Conrad McCracken..... US NRC
Stressed positive attitude of NRC towards decontamination.
- John Marcum..... White House
Positive support by administration for all aspects of nuclear power — reprocessing, non-proliferation, more power stations, waste disposal, etc.
- Herman Dieckamp..... President, GPU
Lessons learned from TMI-2 accident included considerations of costs, public involvement, insurance requirements, regulatory sensitivity, political hostility, public mistrust.
- Glen Thompson..... Deputy Energy Minister
Province of Ontario
Provincial Government support for nuclear power, illustrated by large existing and planned nuclear program in Ontario.

J.E. LeSurf

Conference Report — Materials in Nuclear Energy Conference

This conference was co-sponsored by the Canadian Council of The American Society for Metals and The Canadian Nuclear Society, and was held September 29 to October 2, in Huntsville, Ontario. It attracted approximately 70 attendees and the papers presented in all five sessions generated lively interest and discussion. The full conference proceedings are to be published in hard-back form by The American Society for Metals, Metals Park, Ohio, 44073, USA, sometime in the fall of 1983. Following are some of the highlights of the conference.

Session 1 — Fabrication

Of the eight papers in this session, 2 were related to PWR reactors and six were concerned with CANDU components. The first paper looked at the potential of replacing tubular forgings in the primary circuit of PWR's with centrifugally cast austenitic stainless steel tubes. It was demonstrated that these centrifugally cast tubes produced in metallic moulds are a high quality product eminently suitable for the primary circuits of PWR's and, moreover, these tubes offer significant financial savings when used to replace forgings. Another paper looked at the variations in mechanical and metallurgical properties through the thickness of a large integral nozzle belt and closure flange forging in ASTM A508 Class 3 material used in a PWR pressure vessel. The forging was found to be remarkably homogeneous. The 6 papers on CANDU were concerned with steel end-fittings for pressure tubes, feeder piping, heat exchanger tubing, valves and heat exchangers, end-fitting-pressure tube joints, and the UO₂ fuel. The papers on end-fittings and joints between end-fittings and pressure tubes generated much interest particularly with respect to the possibility of using a diffusion bonded joint in place of the standard rolled joint design.

Session 2 — Performance: Behaviour of Zirconium Alloys

Dimensional changes of pressure tubes due to irradiation creep received considerable attention and discussion in this session. A very practical paper on Ontario Hydro's program to evaluate and minimize the amount and effects of these dimensional changes was presented. This was followed by a paper which concentrated on irradiation growth and examined the effects of various material parameters (micro-structure, processing schedule, alloy content) on the magnitude and direction of growth. Recommendations were made with respect to the optimum metallurgical form of commercial reactor pressure tubing for reduction of irradiation growth.

Two papers were concerned with the effects of a hypothetical loss-of-coolant accident in a CANDU reactor. There was a paper on the effect of oxide films on the thermal resistance between contacting Zircaloy sur-

faces which was an attempt to improve prediction of the rate of heat flow from an over-head pressure tube which comes into contact with its calandria tube. The second paper was concerned with predicting the fuel behaviour under LOCA conditions. Under such conditions the fuel sheaths may become oxidized in steam, and a knowledge of the steady-state creep properties of oxidized Zircaloy-4 fuel sheathing is required in order to model the fuel behaviour. Fuel sheathing was tested with a wide range of oxygen contents (0.1 to 1.2wt%) over a temperature range of 600-1200°C.

The final paper in this session presented the basis for a number of computer codes for predicting the elasto-plastic deformation behaviour of thin shell nuclear components in the CANDU reactor.

Session 3 — Poster

The poster session was a mixed bag of papers ranging from having equipment running to measure the surface corrosion of alloy 600 (used to sheath mineral-insulated cable) to detailed poster display illustrating the materials selection procedures at Ontario Hydro nuclear generating stations.

Session 4 — Performance: Corrosion and Corrosion Related Effects

The session opened with an excellent review paper on the BWR pipe cracking problem. The problem is one of intergranular stress corrosion cracking in the weld heat-affected-zones of Type 304 stainless steel pipes. EPRI, jointly with the Boiling Water Reactor Owners Group, had sponsored a major four year research and development program to provide an engineering solution to this serious problem. The second paper in the session was concerned with a similar problem in that certain heats of welded 304 stainless steel can undergo low temperature sensitization during 10 years of service at 300°C.

There were 2 papers on steam turbine materials. The first reviewed 10 years of operational turbine experience, principally from Muehleberg NGS, and the second reviewed disk cracking in low pressure steam turbines. The final 3 papers examined pressure tube crevice corrosion in CANDU reactors, fatigue failure of reactor pressure vessel steels and carburization of nickel-base superalloys in graphite moderated reactors.

The overriding impression coming from this session was that there are a multitude of corrosion related problems in nuclear reactors and that we are only just now beginning to understand them. Much work seems to be needed to find engineering solutions to these problems.

Session 5 — Futures

The session began with a keynote address on "Fusion Research in Canada." It gave an interesting historical account of the development of fusion research in Canada which included a financial analysis of

dollars spent and research areas supported. One of the centres doing fusion research in Canada is INRS — Energie in Varennes, Quebec and a representative of that establishment presented some preliminary results on laser-fusion reactor wall interactions. Of course one of the major centres for fusion research is Princeton University with their Tokamak Test Reactor. One is often overwhelmed by the materials problems in fission reactors but from the review by a Princeton researcher there is an even wider range of materials and materials problems to be considered in the fusion reactor.

The final two papers in this session were concerned with packaging high specific activity tritium for transport and storage and a review of material problems in the isolation and disposal of irradiated fuel. Delegates were left with a positive impression with respect to the amount and depth of work being undertaken in the Canadian waste disposal program.

The other highlights of the conference were the Keynote Address by Dr. Adrian Roberts (EPRI) on "Improvement of Nuclear Power System Reliability: The Search for 'More Forgiving' Materials" and the banquet address by Dr. John Runnalls (University of Toronto) on "Living Better in a Radioactive World." Dr. Roberts' address contained a wealth of information on many of the materials problems in nuclear reactors. Beginning with a brief review of current materials problems in nuclear systems, largely drawn from light water reactor experience, Dr. Roberts went to specific examples of progress to develop radiation damage resistant alloys and corrosion resistant alloys for current and future reactor concepts. John Runnalls gave an interesting 'layman-type' view of the need for nuclear energy and cost comparisons with oil, gas, etc. The arguments were very convincing and could be appreciated by those in the audience not versed in the pros and cons of nuclear power.

Derek O. Northwood
Treasurer, Materials In
Nuclear Energy Conference

Note: Anyone wishing to obtain a copy of the Programme of Abstracts should write to Dr. Northwood at:

Department of Engineering Materials
University of Windsor
Windsor, Ontario
N9B 3P4

The Launching of a Symposium — A Personal Account

The visitor dropped by my peaceful and orderly office back in May to inform me that the Canadian Nuclear Society was considering the sponsorship of a symposium on the subject of commissioning.

"Do you think this would be an appropriate subject that would generate sufficient interest?", the visitor inquired. I replied enthusiastically, suggesting that if a wide diversity of interest and viewpoint was pre-

sented it would be a very beneficial and interesting undertaking.

Before I'd finished suggesting how I thought things should be handled, I had the job, and immediately appreciated the old adage "talk is cheap." How easy it is to offer advice freely and with genuine enthusiasm — to then find the tables turned and asked to execute all that "good advice."

The decision was made by the CNS District Council shortly thereafter to proceed, and I was asked to chair an organizing committee.

The task ahead was how to structure a one-day symposium that focused on the specific subject of commissioning that would be of interest to a wider audience than Utility Commissioning engineers.

The first bit of sound advice I received was to ensure that the organizing committee reflected the target audience. The second was to solicit through a "Call for Papers" a range of commissioning-related subjects.

Following discussions with experienced commissioning people as well as people with conference organizational skills in the CNA and CNS, a basic theme for the symposium emerged. The purpose of the event would be to provide a forum for the exchange of ideas and knowledge associated with the transition from construction to an operational nuclear power plant.

At the moment it seems this objective will be met. A number of papers have been proposed reflecting the desired range of commissioning-related subjects. Utilities, consultants, manufacturers and others have all indicated a desire to participate and many have submitted papers.

The next hurdle is to firm up the agenda and line up speakers. However, now that the level of interest is demonstrated to be high, this becomes the fun part of the organizing. The Commissioning Symposium has been successfully launched, and it should be an exciting and highly informative day on May 3 at the Constellation Hotel in Toronto.

B.E. Harling

CNS Branch Programs

Chalk River Branch

On November 30, the Chalk River Branch held a successful inaugural meeting with over 60 attending, the guest speaker was Dr. Ara Mooredian, Corporate Vice-President R&D, Atomic Energy of Canada Limited. The meeting approved a set of by-laws and also elected a slate of officers to take office January 1, 1983:

Chairman: Dr. A.J. Stirling
AECL-RC

Chalk River Nuclear Laboratories
Chalk River, Ontario K0J 1J0

Phone (613) 584-3311 - Extension 2414, 2533

Vice-Chairman: A.D. Lane
AECL-RC

Chalk River Nuclear Laboratories
Chalk River, Ontario K0J 1J0
Phone (613) 584-3311 - Extension 2651
Past-Chairman: Dr. I.J. Hastings
AECL-RC
Chalk River Nuclear Laboratories
Chalk River, Ontario K0J 1J0
Phone (613) 584-3311 - Extension 2277, 2651
Secretary-Treasurer: Dr. P.J. Fehrenbach
AECL-RC
Chalk River Nuclear Laboratories
Chalk River, Ontario K0J 1J0
Phone (613) 584-3311 - Extension 2869, 2776
 Some external areas where the branch is getting involved are:

- sponsorship of mathematics prizes at Mackenzie High School, and
- co-sponsorship of a science show (open to the public and schools) to be held in conjunction with the Science Teachers Seminar in 1983 Spring.

Ian J. Hastings

Ottawa Branch

The branch has had good turn-outs for the last two meetings held on October 20 and November 24.

At the October meeting, Dr. Jack Richman of Ontario Hydro outlined Ontario Hydro's involvement in the fusion program and its possible future, noting that Ontario's CANDU reactors are a substantial source of tritium, a basic fuel for fusion.

Dr. L. Amyot, Vice-President of AECL's Quebec Operations, was the guest speaker at the November meeting. He described the programs AECL is supporting in Quebec, including research, education and liaison with Hydro Quebec and the Quebec government.

The branch executive has drawn up a set of by-laws which, it is hoped, will be endorsed at the January meeting.

Planning for the winter/spring season is underway, and the program will be announced shortly.

F.C. Boyd

Conferences & Meetings

International Symposium on Geochemical Behaviour of Disposed Radioactive Waste

Sponsored by American Chemical Society, to be held **March 20 to 25, 1983** in Seattle, Washington. Further information available from **Dr. James D. Navratil, Rockwell International, Rocky Flats Plant, P.O. Box 464, Golden, CO 80401.**

International Symposium on Reliability of Reactor Pressure Components

Sponsored by International Atomic Energy Agency, to be held **March 21 to 25, 1983** in Stuttgart, West Germany. Further information available from **Robert Najjar, Conference Service Section, IAEA, P.O.**

Box 100, A-1400 Vienna, Austria.

International Symposium on Biological Effects of Low-Level Radiation with Special Regard to Stochastic and Non-Stochastic Effects

Sponsored by International Atomic Energy Agency, to be held **April 11 to 15, 1983** in Venice, Italy. Further information available from **Robert Najjar, Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.**

4th International Ocean Disposal Symposium

To be held **April 11 to 15, 1983** in Plymouth, UK. Further information available from **Iver W. Duedall, Executive Chairman, 4th Int. Ocean Disposal Symposium, Marine Sciences Research Center, SUNY, Stony Brook, Long Island, NY 11794.**

International Symposium on Operational Safety of Nuclear Power Plants

Sponsored by International Atomic Energy Agency, to be held **May 2 to 6, 1983** in Marseilles, France. Further information available from **Robert Najjar, Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.**

Commissioning Symposium

Co-sponsored by Canadian Nuclear Society and Canadian Nuclear Association, to be held **May 3, 1983** at the Constellation Hotel, Toronto. Further information available from **B. Harling, Ontario Hydro, 595 Bay Street, Toronto, Ontario, K5G 2C2.**

International Conference on Advances in Scintillation Counting

Sponsored by University of Alberta and Alberta Environmental Centre, to be held **May 15-18, 1983** in Banff, Alberta. Further information available from **C. Ediss, Faculty of Pharmacy and Pharmaceutical Sciences, University of Alberta, Edmonton, Alberta, T6G 2N8.**

23rd Annual International Conference Of The CNA And 4th Annual Conference Of The CNS

Co-sponsored by CNS and CNA, to be held **June 12 to 15, 1983** in Montreal. For information contact CNS.

Canadian Nuclear Society International Conference on Numerical Methods in Nuclear Engineering — Call for Papers

To be held **September 6 to 9, 1983** in Montreal, Quebec. Co-sponsored by ANS. **Summary Deadline: Postmarked by Friday, March 25, 1983.**

General Information: Summaries of all contributed and invited papers will be reviewed by the Conference Paper Review

Committee. Summaries may be accepted with or without amendments, but will not normally be published. The Conference Proceedings will contain the full papers (absolute deadline: July 15, 1983) of the accepted summaries. If the full paper corresponding to an accepted summary is not received within the deadline, the summary will be published in the Proceedings but the paper presentation will **not** be included in the final program of the conference. All accepted summaries and full papers become the property of the Canadian Nuclear Society.

Subject Categories for Papers: Subjects are grouped in areas as indicated below: It is expected that each area may allocate 5 to 8 papers. All summaries complying with the instructions will be reviewed, but excess papers in any one area may have to be rejected. Invited papers are not classified under any of the areas below. Normally, the papers should be methodological in character, but papers describing relevant applications will be considered.

Area A: Thermal-Hydraulics and Fluid Dynamics (Reactor System, Channel and components, Containment, Fundamental algorithms).

Area B: Reactor fuel modelling methodology (Subchannel analysis, Modelling of rewetting, etc.).

Area C: Modern system-assessment methodology (PRA, operational analysis of multi-mode and multi-link systems and their reliability).

Area D: Multidimensional Reactor Theory, Transport theory applications (including Fusion and Shielding).

Area E: Correlation of In-core Data and Application to Power Control and Optimization, Software Engineering.

Area F: Advanced Fuel Cycle Methodology, Resource of Energy Management Methods.

Authors will be notified of the status of their summaries and presentation instructions will be sent to authors of accepted summaries on or before **April 22, 1983**. Amended summaries deadline: **May 27, 1983**. Absolute deadline for presentation of full papers is **July 15, 1983**.

Summary Deadline: March 25, 1983 is the deadline for all invited and contributed summaries. Four sets (original plus three copies of each summary, including cover sheets) must be submitted to the Technical Program Chairman at the address listed below:

R.A. Bonalumi, Conference Chairman, Nuclear Studies and Safety Dept., H16-H17, Ontario Hydro, 700 University Ave., Toronto, Ontario, M5G 1X6.

Note: This conference will absorb the 1983 Simulation Symposium.

4th Pacific Basin Conference

Co-sponsored by CNS, CNA et al., to be held **September 11 to 15, 1983** in Vancouver. For information contact CNS.

The CNS Bulletin is the membership newsletter of the Canadian Nuclear Society.

Le Bulletin SNC est l'organe d'information de la Société Nucléaire Canadienne.

CNS provides Canadians interested in nuclear energy with a forum for technical discussion. For membership information, contact the CNS office, a member of the Council, or local branch executive. Membership fee is \$30.00 annually.

La SNC procure aux Canadiens intéressés à l'énergie nucléaire un forum où ils peuvent participer à des discussions de nature technique. Pour tous renseignements concernant les inscriptions, contacter le bureau de la SNC, les membres du Conseil ou les responsables locaux. La cotisation annuelle ext de \$30.00.

Editor / Rédacteur

David Mosey
(416) 592-3328

Associate Editor / Éditeur associé

Hugues Bonin
(613) 545-7613

Production Editor / Rédacteur, production

David McArthur
(416) 977-6152

Canadian Nuclear Society Council 1982-83 /
Conseil de la Société Nucléaire Canadienne 1982-83

President / Président

Phil Ross-Ross
(613) 584-3311

Vice-President / Vice-président

(Communications Chairman /
Président du Comité des communications)

John Hewitt
(416) 978-2976

Past President / Ancien Président

George Howey
(613) 584-2023

Secretary-Treasurer / Secrétaire-trésorier

(Administration Chairman /
Président du Comité administratif)
Peter Stevens-Guille
(416) 592-5211

Membership Chairman /

Président du Comité du recrutement des membres
Tony Colenbrander
(416) 823-9040

Technical Divisions Chairman /

Président du Comité des divisions techniques
Joe Howieson
(613) 995-9351

Program Chairman / Président du Comité organisateur

Tom Drolet
(416) 592-7796

Members-at-Large / Membres en général

George Bereznaï	Jan G. Charuk
(416) 592-2254	(514) 934-4811
Ernie Card	Irwin Itzkovitch
(204) 956-0980	(613) 238-5222

Ex-Officio / Ex-Officio

(CNA Representative / Représentant de l'ANC)
Jim Weller
(416) 977-6152

CNS 1983 Annual Conference Chairman /
Président de la conférence annuelle de la SNC

Jan G. Charuk
(514) 934-4811

Workshop on Analytical Chemistry Related to Canada's Nuclear Industry — Call for Participants

Sponsored by CNS et al., to be held **October 24 to 26, 1983** on Hecla Island, Manitoba.

The workshop is open to any person interested in either the routine or innovative analytical aspects of the uranium industry. It emphasizes small, informal discussion groups organized around a central theme. The subject matter should fit into one of the following categories:

- present problems
- present work
- future plans and projects

There will be no workshop proceedings. Each participant will be requested to forward their affiliation, areas of interest, and a brief abstract of the subject they wish to discuss by **June 1, 1983**.

For further details, contact **P. Campbell, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba, R0E 1L0**.

The Unfashionable Side

It's a pleasure, this edition, to be able to introduce a new contributor to the column, Chuck Wood. A former unemployed itinerant archivist and part-time newt-skinner, Wood currently works as a dirty-postcard salesman and communications consultant. In his spare time (of which he has plenty) Wood collects federal government energy policies and stands in for one of the sluice gates on the Rideau Canal.

Nuclear Robots on the Move

Sources at a large Canadian utility have indicated that as part of a drive for fiscal austerity, the utility will help produce the movie "E.T. II" along with the creator of the highly successful movie "E.T.", Steven Spielberg.

"This ties in nicely with the increasing use of robotics in our nuclear reactors," a spokesman at the utility said. The movie, about the continuing adventures on earth of an engaging extraterrestrial known as "E.T." features a robot in the form of an alien.

The plot concerns his visit to Canada, in which he directs retubing operations at a CANDU station while becoming emotionally involved with a resident of Oshawa. Future movies in the series will deal with his son who eventually becomes appointed chairman of the utility.

Technicians at the utility are currently redesigning robot bodies to resemble the alien. The movie is expected to be released in the late 1980s.

"With the draw these movies have, expected revenue from the project will keep rate increases down for decades," the spokesman added.

Solar Breakthrough Group Formed

An international group of scientists who've all had research breakthroughs in solar energy research have formed a body known as the "Association of Solar Laboratories for Ephemeral Energy Production" (ASLEEP).

To qualify as an ASLEEP member, new applicants are required to have had a solar breakthrough widely reported in the media within the last two years. Included in the current membership are solar-powered water splitting researchers, amorphous photovoltaic (breeder) researchers and others involved with solar crystals and other wonder substances.

The first endeavour of the association is to create a kit for high school students instructing them as to how they too can achieve a solar breakthrough using common household materials and a press release. A report on the success of this and a profile of the ASLEEP head, Dr. Solomon Breder of Gecko Solar Laboratories Inc. to follow.
Chuck Wood

CANDU Pressure Tube Growth — A New Look

Aphasia University's Visiting Distinguished Reader in Energy Studies, Dr. Dennis Molestrangler has been studying the problems posed by pressure tube growth and sag at Ontario Hydro's CANDU nuclear stations. Under neutron bombardment the pressure tubes are gradually increasing in length and sagging in the middle. Methods suggested for dealing with this problem have ranged from palliatives such as re-fabrication of end-fitting bearings (to accommodate more longitudinal growth) to complete retubing. However, Dr. Molestrangler has come up with an approach which promises to completely accommodate both tube growth and tube sag. Briefly, tube growth would be accommodated by constructing the reactor vessel and its calandria tubes in two halves, the two halves being joined by bellows or being constructed with slightly different diameters and allowed to slide with respect to one another, in the manner of a telescope. This would accommodate pressure tube growth. Accommodation of sag is an even simpler matter. The calandria would be fitted with a large ring gear at each end and supported on roller bearings. At regular intervals, selected to coincide with planned maintenance outages, hydraulic motors, fitted with Bendix gears, would rotate the calandria 180 degrees (or 200 Grad). This plan would necessitate some modification to end-fittings (probably two graylock connections per end-fitting would be required). But Dr. Molestrangler is working on that. The proposal has been submitted to Ontario Hydro's Design and Development Division but as yet they have made no response.

Ernest Worthing