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Editorial

Interesting Times

The oriental malediction "may you live in interesting times" is, to a pretty fair extent, becoming fulfilled for a large number of CNS members. Those involved in Ontario's nuclear power program have seen any possible *hubris* engendered by the very promising early progress in retubing at Pickering inevitably overtaken by *Nemesis* in the form of delays imposed by carbon-14. And problems with pressure tube fretting at Pickering 8 during hot conditioning promise to delay the in-service date of that unit, while unit 3 developed a pressure tube leak.

But these are engineering problems and, though not insignificant, are being solved. Less predictable are the political problems. The publicly owned research and development arm of Canada's nuclear energy enterprise is faced with major financial amputation ("by the end of the decade they may well have cut off both arms and a leg" was the way one AECL scientist put it). A federal government receiving an overwhelming mandate for, among other things, closer control of the exchequer, cannot be faulted for cutting spending, and indeed, there may be economies to be made in federal research and development spending. But financial cutbacks which might eliminate a principal national scientific resource cannot be realistically described as "economies." The CNS has a potential role to play in seeing that the politicians and their science policy advisers are aware of the importance of maintaining a viable national research capability in the nuclear science field.

In Ontario, the new Liberal governing party has not in the past been distinguished by its enthusiastic support of nuclear energy. Nor has its supporting party, the NDP. It is a fairly safe bet that Ontario Hydro's nuclear power program will yet again come under scrutiny by the legislature, via the new Select Committee on Energy. The CNS should be prepared to offer input, speaking on behalf of the community of individuals professionally involved in nuclear energy development. It's worth noting, however, that the new governing party may well find that issues such as nuclear power assume somewhat different perspectives, depending upon which side of the dispatch box you rest

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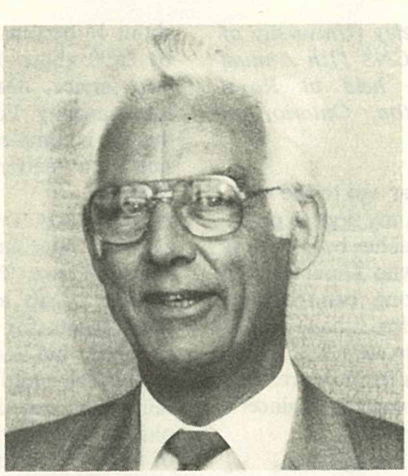

Joe Howieson Elected CNS President

Joe Howieson was elected President of the Canadian Nuclear Society at the annual meeting in Ottawa in June. He is the fifth CNS President and is a former Vice-President and Technical Division Chairman. Howieson is Advisor, Nuclear Waste Management in the Department of Energy, Mines and Resources in Ottawa. In this position he has interests and responsibilities in all types of radioactive waste management from radioactive fuel to uranium tailings and low level radioactive waste.

After receiving his BSc. in Mechanical Engineering from Edinburgh University and his MSc. in Aeronautical Engineering from Cranfield University, Joe came to Canada and started his nuclear education at Chalk River in 1953. He was involved in fuel development and conceptual reactor design; during this period he continued this dual role for the first five years of Power Projects. Subsequently he moved to Westinghouse Canada Ltd. where he was responsible for the engineering and manufacturing development of CANDU fuel. He joined the Federal Government in 1975 and has occupied his current position for the last five years.

Joe has written many technical papers during this career and was active in the CNA Technology and Awards Committees. Since the formation of CNS he has been particularly associated with the development of the Technical Divisions and the Ottawa chapter.

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your feet.
Although relatively young, the Canadian Nuclear Society has some solid experience in articulating the concerns of its members in the public forum, the most significiant being its submission to the Interfaith Hearings. This experience should come in useful in the interesting times ahead.

Perspective

A View from the Rocking Chair

Presented by D.A. Meneley (University of New Brunswick) at the CNS 11th Annual Simulation Symposium, held at Royal Military College, Kingston, Ontario, on April 22-23, 1985.

Since I retired nearly a year ago to the rocking chair of academic life, my urge to pontificate on matters in general has become very strong — in fact, those who know me well claim it was plenty strong enough even before I left Ontario Hydro. I have picked three rhetorical questions to serve as a framework for a few comments from the rocking chair on what I see the nuclear engineer's job to be over the next 30 years.

The first question is "What have we wrought?"

The immediate answer is obvious in the plants that are running and producing cheap electricity, although there is more than that. But first, who is included in "we?" Speaking for myself, I came in near the start of the second nuclear generation. The first generation included the pioneers and the inventors; the second consists mostly of the implementers. This second generation is nearly finished its work. The third generation doesn't yet have a name — such a name can be applied only after the fact (or, one might say, posthumously). All three generations are part of the group which is often called the nuclear community. It is a worldwide community of professionals — quite small, about 20-30 thousand members on any given day. This is what I mean by the term "we."

What then, have we wrought? From 1925 to 1955, the first nuclear generation conceived the idea of nuclear energy conversion and produced the most devastating explosive devices ever known. At the same time they invented the cancer therapy machine (which, to date, has saved far more lives than the bombs have taken away). They also laid firm groundwork for the peaceful application of fission energy. The second nuclear generation has been occupied with bringing these peaceful applications into large scale use, refining the technology, and building many uranium fuelled power plants. We have made our full quota of mistakes but in the end have brought a totally new energy system into being for our societies. This concept didn't exist only 60 years ago. There now are about 370 nuclear-electric power plants operating in the world, generating about 15 percent of the world's electricity. By 1990 about 150 more units will come into service, nearly doubling the present total capacity. For all intents and purposes this job is complete. Further capacity expansion is a matter for the energy marketplace.

A few minor caveats and one fundamental question must be placed against this optimistic picture. There may or may not be enough cheap and available fuel to run these plants for 50 years. Canada is well supplied, but some other countries don't have much uranium. Perhaps more important is the question of whether or not the plants can be run efficiently for this length of time. What to do with them when they wear out is really a matter of economics, and looks like a manageable job. Stripped of its rhetoric, waste management also is quite a simple task. The strongest reservation must be placed on public attitudes to the whole nuclear energy system. Many see power plants, environmental pollution, big business and bombs all wrapped together in a package called "nuclear." We are identified by the adjective rather than the noun which it modifies. As engineers we can see how the energy system can be completed, and can see that cost, safety, and environmental protection issues are manageable. We try to distinguish our peaceful enterprise from the weapons issue. We see nuclear energy in terms of a series of jobs to be done. But how are we to convince the society that these jobs should be done? And that the whole development is valuable to them? This brings me to the second rhetorical question, which is:

"Are we good guys or bad guys?"

White hats or black hats? What do you think Energy Probe's answer would be? If a public referendum were held on the issue, who would win? How could anyone refuse to accept the vision of nuclear energy as we see it? Isn't it obvious that this is a "good" energy system? A working definition, it seems, is that good is whatever the society decides it to be. Good is a transient, evolving phenomenon rather than a fixed point. If you insist on being a good guy you have to convince the people that you are one, by some means or other.

As a background for discussion, the recent book by Mary Douglas and Aaron Wildavsky, titled "Risk and Culture" gives a reasonable interpretation of the process going on now in our societies. In simplifying this complex subject they identify the "Centre" and the "Border" of society with the headings "The Centre is Complacent" and "The Border is Alarmed." The typical position of border groups is that people are poisoning the earth irreversibly and must change their ways to avoid Armageddon. Nature is put up as the benevolent but potentially vengeful agent watching over our actions (100 years ago the reference would have been to one God or the other, but the message is the same). Chemicals, acid rain, and nuclear power are all placed on the "bad" side of the ledger. In fact most of the activities of the centre are defined to be bad by one or the other of these groups. The border people are never very clear on the specifics of the "good" way, but clearly it is their way. (It is an interesting fact that many of their arguments contain a grain of truth. One could postulate that the border groups are the initiators of change in the society. While their whole agenda is never adopted, without them the complacent centre might simply stagnate.)

Sitting as we are at the centre of society, what are we to make of all of this? How should it influence our actions? If the centre is indeed complacent, one option is to simply ignore all the fuss. Alternatively, some individuals recommend that objective risk-benefit balances should be struck by informed specialists on behalf of the whole society (this could be called the paternalistic school). In the present state of uncertain public attitudes to nuclear energy these do not seem

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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, ($5.00 to students).

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, veuillez bien entrer en contact avec le bureau de la SNC, les membres du Conseil ou les responsables locaux. La cotisation annuelle est de $30.00 ($5.00 pour les étudiants).

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to be viable options — only about 50 percent of the Canadian public seem to be in favor of what we are doing — when most Canadians are philosophically at the centre of society. We are in real danger of being pushed out of the centre and being labelled as bad guys.

What is going on is a public trial of sorts. The case at issue is often called life style; in fact it is about whether Canadian society should proceed more or less along the present path or should be radically changed. The litigants are nukes and greens; the jury is the public. The common media are the advocates, with some clearly favoring each side but most positioned in the middle. Government is sometimes a participant but most often a cautious observer — political parties like to win, and to do this they must back the majority of the people. The more uncertain is the outcome of an issue the less likely they are to take a firm stand.

Government is an example of what Douglas and Wildavsky call a hierarchical structure within the centre group. Other examples of hierarchies are utilities and reactor vendor companies. Some of these support while others oppose the nuclear enterprise as a matter of self-interest (one would hardly expect a gas company to be strongly supportive of the nuclear industry). Each hierarchy attempts to make its case before the jury through public relations campaigns and other activities under the heading of "public information." Most of us (being also part of the public) are quite skeptical of such pronouncements. Compare your own reaction on watching an oil company commercial and a nuclear industry commercial. In the former case I react negatively and in the latter, positively. It would be nice to think that the distinction is between true and false but realistically it is more likely between knowledge and ignorance or some other fundamental reaction, perhaps even narrow self-interest. Some of the extravagant claims made by "nukes" may well produce similar reactions in large numbers of people outside our industry, even if the claims happen to be true. Perhaps a touch of humility would be more effective.

It is unlikely that the nuclear industry will be able to shake its bad guy image in the short term. It takes times to establish a positive image and perhaps to reverse an established negative image. For instance, over 80 percent of people interviewed recently in the US and Western Europe believe that a power reactor can blow up like a Hiroshima bomb, and nearly half think such an event is somewhat or very likely. No wonder they are scared. If they also link nuclear energy with real nuclear weapons, either consciously or unconsciously, the whole package creates a powerful negative image. No wonder they listen to the border groups with their predictions of doom. Our "communicators" seem to have missed at least one important point in their flood of words.

Fortunately, the nuclear power industry is well established in Canada. By 1992 there will be about 16,000 megawatts of capacity operating. The first key to convincing the people that we are good guys is to produce this power cheaply, economically, and steadily for about a generation. The second key is to do it without incident or accident, especially any involving radioactive contamination. The third key is to be completely open and honest about both positive and negative events — the corporate tendency to tell only the good news must be resisted, because someone will eventually spill the beans and then the news will have a much greater negative impact. The fourth key is to avoid pitched battles with the regulatory process unless we are both (a) right, and (b) a large majority of the public will decide in our favor. A better strategy is to overwhelm the regulators with knowledge and logic — that is, to be always a step ahead of them in examination of safety issues. Finally we must continue to talk on the facts of our business in any and every forum so as to reduce the considerable ignorance which exists even among otherwise well-educated people. It is up to us to do the job — it can't be left to the PR machinery. Public relations people can provide an attractive package for information, but the substance must come from the professionals.

Meanwhile, a number of us will be trying to make a living and a contribution to society during the same generation in which the public is making up its mind about nuclear power. Even if more plants are built in this period I expect the emphasis to be on building the same thing faster and cheaper — not very much scope there for scientists or innovative engineers. The huge investment needed for these plants leads to well justified conservatism in design decisions; if the current plants are running well there will be strong pressure to simply repeat the design. Some engineering will be needed to keep plants running, but this will be on a small scale compared to the huge efforts of the recent past. The regulatory upheavals of the past ten years seem to be about over — very little more can be done to extend accident analysis except toward reduced consequence estimates, and there is unlikely to be much regulatory pressure in this direction. Waste management is a rather small-scale task. This brings me to a third question:

"What should we do next?"

A reminder of what is meant by "we" — I mean the professional community. The prime source of innovation must be individuals — corporate entities don't innovate, people do. Innovation is our job.

The question of what to do next is related to the more dangerous question of whether or not our services are needed at all. (I'll ignore that question). With some fairly minor exceptions, the first stage of the CANDU development task is finished from the engineering point of view. New generating stations committed within the next few years are likely to be very similar to the present ones, therefore needing a minimum of engineering effort except to speed up construction and to make sure all the parts are available and fit their role. Even considering simulation, the topic which brought this group together, it is my opinion that we already know enough, to a good approximation, to design, license and operate any current-generation CANDU plant. Finding out where every drop of water goes in every circumstance may be a great scientific challenge but it has little to do with engineering. What, exactly, does the society need nuclear engineers for? How are we to justify our pay? I'd like to present my opinion of some work which should be done in two or three areas, so as to try to convey my own optimistic feeling about the future of nuclear engineering.

As I've mentioned, there is a great deal of inertia against introduction of new concepts, caused mainly by the high investment cost of a commercial plant. This inertia is greatly increased by the fact that the present plants are running well — a new concept would have to be exceedingly good to beat CANDU. A more realistic approach is to aim for CANDU-Better. This could be started by taking a new look at a few limiting components of present designs such as fuel channels and safety systems. Reduction of heavy water cost would have a marked effect on reactor design, particularly in reducing the optimum channel power. The optimum reactor would be larger for a given capital cost, with resulting freedom of margins on channel and bundle power as well as improved fuel burnup. Trip systems, emergency cooling, and containment all deserve a new creative look to see if we can design them cheaper and better. A new pressure tube material would be extremely valuable.

Another area in which work should be done is the fuel cycle of existing CANDU plants. Used fuel bays contain an enormous inventory of usable fissile material, just waiting on the development of economic reprocessing techniques. There are several unique features of CANDU fuel which promise to make this possible. A difficult but sensible target is to produce recycle bundles at an overall cost per megawatt hour which is the same as that for natural uranium at current prices. This capability would freeze natural uranium prices for at least another generation. A combined cycle using five CANDU's and one metal fuelled fast breeder reactor with the same output could freeze uranium prices forever. Such a system is much more logical than is the present proposal, to put perfectly good used fuel deep underground just because it contains a trace of fission products.

Another area of development which could be very useful during the design phase of CANDU-Better is a comprehensive design simulator. At present, a great deal of effort is required just to match the plant's component parts together and to understand systems performance during operational transients and accidents. The basic idea is to build an electronic plant in the office, using dedicated mini- or micro-computers to simulate major components. These systems would then be coupled together to simulate the whole plant. Designers of each system would be responsible for simulation of their section. Proposed design changes would be tested on this unit before acceptance into the reference design. It should be possible to do almost all of the accident analysis on this simulator. It may also be a useful machine for operator training.

There are many other development tasks which could be identified for CANDU-B. We cannot wait until project commitment time to start on these, because by such a time it is too late to do serious development work. A small separate unit should be established to do the basic thinking, at least two years before the expected next project start. In the present climate it is, however, very difficult to initiate this type of work. The main reason is that most of us are employed by large organizations which have become quite bureaucratic and unreceptive to new ideas. Budget controls are pervasive, and employees have to show "useful" work product for each unit of time spent on the job. The term useful is defined by senior management, who have neither the time for innovative thinking nor, perhaps, the up-to-date knowledge needed to address the problems. Meanwhile, some laboratory staff have become isolated from the end uses of their work. The net effect is very likely to be stagnation of further CANDU development.

One possible way to alleviate this problem is to initiate a routine exchange system, through which individuals would be "farmed out" from applications groups to laboratories and universities, while other individuals would be "farmed in" from labs to applications groups. Another way to do the same thing is to move the job rather than the people. A research group could, for example, be assigned a design job (deadlines and all). In the same way, an operations support group might be assigned a specific research task, and so on. Preferably, the net cash flow between institutions involved in this type of exchange would be kept to about zero.

The traditional method of maintaining technical communication and exchanging ideas is through professional meetings such as this one. This is a very pleasant way to do business but has a number of limitations in information transfer of which I'm sure you are aware. I don't suggest stopping this fine tradition, but only adding to it.

Some of you may be pondering the question of how I propose to get funding for all these grand schemes. The very best method, of course, is through an enlightened management. The only requirement should be that we be able to show a payoff in the medium to long term. Proposals must be well conceived, packaged, and sold — you have to be a salesman as well as an engineer. If the management isn't enlightened, the next best way is to change management. The ways to do this are obviously to convert them to your way, to engineer a palace coup, or to vote with your feet. The situation dictates the method of choice. In the end, though, the issue of funding is closely tied to the issue of public acceptance. If people understand and agree with what we're doing, funding shouldn't be a problem. So the most important future skill might not be engineering at all, but communication.

The big jobs ahead are many — small reactor development, space power systems, fusion energy, and so on. A particularly interesting area is the many uses for radiation outside reactors — such as food sterilization, medical treatment and diagnosis, measurement of industrial process parameters, etc. There are many small-scale development jobs to do in these fields which could be of considerable benefit to society. We could discuss the possibilities for many days — but this is not the time. I only want to encourage you all to think about items which you consider to be worth pursuing. Develop your thoughts, make proposals, and fight for their acceptance. In no other way can we succeed.

Nuclear engineers have many jobs to do during the next generation. Most of them are, however, very different than those which have occupied the second nuclear generation. There may well be fewer nuclear engineering jobs over the next few years, but there will be plenty of scope for all those with drive and imagination. We cannot expect to continue in the comfortable niches into which we have fitted during the past few years. If we want to stay in the nuclear business we'll have to get up on our hind legs and create our own future.

D.A. Meneley

Three Mile Island Revisited

Contributed by Neil Craik of Maritime Nuclear, Fredericton, New Brunswick.

In April of this year I was called to attend a business meeting with state officials in Harrisburg, the capital of the State of Pennsylvania.

I immediately recalled hearing Harrisburg frequently mentioned during the on going news media reports which followed the incident at the TMI-2 reactor in March 1979. A look at a map showed that Three Mile Island was only 12 miles from Harrisburg, so I enquired about the possibility of a tour of the station.

A telephone call to (717) 948-8829, the General Public Utilities Corporation visitors centre at TMI, got my name added to a tour on a suitable day (April 17, 1985), but I was advised that I was fairly lucky because the tours get fully booked up with both business and casual visitors.

The flight path into Harrisburg Airport was quite close to Three Mile Island and I had an excellent view of the station and could see a fair quantity of water vapour coming from two of the four cooling towers. Knowing that both the TMI-1 and 2 reactors had been shut down since the 1979 incident, made me wonder whether I had ever really understood the exponential mathematics of residual decay heat.

The power station is on a three mile long island in the middle of the Susquehanna river downstream from Harrisburg. The visitors centre is an excellent facility on the mainland and has a high-level viewing platform with binoculars which give an excellent view of some external details of the station.

The first thing I noticed was that the top of the two reactor buildings were different. TMI 2 had numerous tall vertical tubes or rods on top of the reactor building roof, whereas TMI 1 did not. Also the whole station did not seem symmetrical, in that the turbine buildings were oriented differently with respect to the reactor buildings.

On enquiring, I discovered that TMI 1 and 2 units were really two different designs even though the units went into commercial operation only four years apart — 1974 and 1978. The turbine generators were of different manufacture and capacity (800MW vs. 900MW), the architect engineers were different, the control room design and layout were different, and the reactor and other buildings were different. The only similarity seemed to be the use of Combustion Engineering Co.'s design of PWR. Hence the tall rods on top of the unit 2 reactor building were lightning conductors in accordance with one of the AE's specifications.

The reason for all this variety, which had a major bearing on the TMI-2 incident, was that the TMI-2 plant was originally designed and purchased for a sea water site in New Jersey, but because of labour difficulties at that site, the whole project was switched to the Three Mile Island site. This seemed a good idea at the time because $20M worth of design and manufacturing was done, and the station output would be higher at 900MW.

Unfortunately the control room design of TMI-2 was inferior to TMI-1 in that some critical instrumentation was mounted at the back of the main control panels, specifically the temperature and pressure indicator of the reactor coolant drain tank into which hot water from the stuck-open pressure relief valve (PORV) had been pouring for 2 hours. Eventually the rupture disc on this drain tank blew and the temperature came down, but there was no temperature chart recorder, only an indicator. Whereas on TMI Unit 1 there is a temperature chart recorder and the drain tank instrumentation, while mounted on a panel at the back of an operator at the control desk, is still within his view when he turns around.

The guided tour took us into the TMI-2

control room and although we were not allowed much into the control area, we were right next to the reactor coolant drain tank instrumentation at the rear of the main control panel. Apparently if this panel had been better located and instrumented, an operator could have deduced from the alarm lamps and from a temperature spike on a recorder that the PORV valve had been discharging coolant.

Great emphasis was laid by the tour guide on the separation of personnel between the two units and the fact that operating staff are not allowed to have licenses to operate both units, because of the dissimilarities between the units.

Continuing the tour of Unit 2, we saw the facilities which control the access and work in the reactor building. There is a TV monitoring area with 2 large TV monitors and more than a dozen smaller monitors showing what is going on inside the reactor building. Staff in plastic suits could be seen cleaning up and decontaminating various areas inside the reactor building. A chart showed that over 580 entries had been made to the reactor building since the 1979 incident. Entries can include more than one person and are of varied time duration. Some 14,000 hours of labour had been spent by that date, cleaning up inside the reactor building.

The decontamination crews included women and I was told there were 28 women on the TMI site staff, including one professional in the technical group, a control room operator, an auxiliary operator and some radiation control supervisors.

A female auxiliary operator trainee played a minor heroic part during the early hours of the TMI-2 incident when she was assigned to manually rotate a main boiler feed pump turbine one half turn every 2 minutes to prevent the shaft from warping when shutdown. The motorized turning gear was under repair. She remained at this lonely task for 4 hours, until relieved, despite hearing general evacuation orders over the loudspeaker.

The cost estimate for this clean up operation is $1 billion, about half of which has already been spent, and the operation is due to be completed in 1988. The cleanup funds have been provided from various sources, including $18M from Japan. In addition Japan is going to provide the service of 20 professionals for 2 years in order to learn as much as possible about the cleanup task.

The cleanup requires the use of a fair quantity of water which, after the nuclear contaminants have been removed by chemical processes, is said to be as good as the water in the Susquehanna river. However, discharge back into the river is not allowed, so the cleaned water is recycled to the reactor clean up process. Solid radioactive wastes are extracted from the water and transported to a nuclear waste disposal site elsewhere. The only obvious major additional clean up facility on site consists of two large stainless steel tanks (about the same size as the diesel fuel oil tanks at Lepreau) in which this decontaminated cleaning water is stored.

As regards overall progress at TMI 2, this will no doubt continue to be well-reported in the technical press. The reactor head and service structure was removed in July 1984 and the plenum was inspected in October. During my visit, preparations for removing the plenum were under way. Defuelling should start this summer.

The tour also included a walk around Unit 1 turbine building, where hot functional testing was in progress. The heat was being generated by Unit 1's four 9000 HP reactor coolant pumps, and this was sufficient to cause the plumes of water vapour I had seen on my flight in. TMI-1 was shutdown for maintenance in March 1979 when the incident occurred at Unit 2, and was ordered by the NRC to remain shutdown. The legal justification for this was "extraordinary circumstances."

$95M dollars worth of modifications have been made to Unit 1 arising from the TMI-2 incident, mainly in instrumentation and communications. Unfortunately, the tour did not take us into the Unit 1 control room, because they wished to minimize distractions during the re-commissioning work.

Also during this 5-1/2 year shutdown, 1,541 of the 31,000 tubes in the steam generators became defective, and these have been plugged. It was recently reported that the NRC staff had concluded that the plant could be safely started up again, but an intervenor group is arguing that all the steam generator tubes should be completely replaced — a massive and very costly undertaking.

The tour group I had joined consisted of local librarians and so we made a visit to the station library. This had really been built up following the TMI-2 incident to become a comprehensive technical reference centre comprising 1,652 books, 213 periodicals, 5,419 reports, 1,078 standards and 2,964 manufacturer's manuals.

The final stop on the 3-1/2 hour tour was a look inside one of the Unit 2 cooling towers. There are 4 cooling towers — 2 cooling towers per unit. A single large cooling tower per unit would have been more economical, but there was a restriction on the cooling tower height because of the proximity of the Harrisburg International Airport and the Olmstead Airforce Base.

As we drove off the site in the tour minibus, the guide pointed out various precautions which had been taken against possible flooding of the Susquehanna river.

I thought how fortunate we were in Canada to have such excellent sites for nuclar power stations such as Point Lepreau which avoided all the siting disadvantages of Three Mile Island.

N.G. Craik

FYI

Tenure Stream Position in Nuclear Engineering (University of Toronto)

Applications are invited for a tenure stream position in the Department of Chemical Engineering and Applied Chemistry, University of Toronto. The appointment will be made at either the Assistant or Associate Professor rank. Candidates should have a doctoral degree, preferably in nuclear engineering, and have experience in research or engineering development related to one or more of the following areas: nuclear reactor analysis and control; advanced nuclear systems; nuclear shielding, safety and containment; nuclear calculational methods and nuclear chemical engineering.

The successful candidate will be expected to give leadership in the definition and prosecution of a creative research program, to teach in the established Bachelor's, Master's and Doctoral degree programs in nuclear engineering, to supervise graduate students, and to give active support to the activities of the Centre for Nuclear Engineering. The teaching and research facilities at Toronto include the SLOWPOKE nuclear reactor, a heavy water-uranium subcritical reactor, a fast neutron generator, a radiochemical laboratory, a broad range of modern nuclear instrumentation, facilities for heat transfer and fluid flow investigations, and extensive computational resources. Candidates should provide a curriculum vitae, the names of at least three referees, and a summary of teaching and research interests. Applications should be addressed to Professor J.W. Smith, Chairman, Depart-

Morison Receives ANS Zinn Award

(P. Stevens-Guille)

W.G. Morison, Ontario Hydro's Vice President of Design and Construction (left) receives the Walter H. Zinn award from American Nuclear Society President Joe Hendrie at the ANS Annual Conference in Boston in early June. The award was established in 1976 to honor the first President of the ANS and is awarded for outstanding contributions to the advancement of nuclear power. Morison's citation reads "for specific contributions to the development of the Canadian CANDU heavy water reactor."

ment of Chemical Engineering and Applied Chemistry, University of Toronto, Toronto, Ontario, M5S 1A4, and arrive by mid August, 1985.

In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian citizens and permanent residents of Canada. The position is subject to Provostial approval.

AECL Cuts Budget and Protests Heard (Staff)

In the budget speech of May 23, the federal government announced that the budget of Atomic Energy of Canada Ltd. will be cut by 50%, from $200 million per year to $100 million per year over a five year period, "in light of the fact that the CANDU technology is now recognized as being well established." In addition, $70 million is cash reserves will be removed, and the Glace Bay and Port Hawkesbury Heavy Water Plants in the Maritimes will be closed, since "there are ample supplies of heavy water already on hand."

Protests at the cuts have been mounted by many individuals and organizations. Included is the Society of AECL Professional Employees at Chalk River Nuclear Laboratories who in a release, warn: "Atomic Energy of Canada's federal funds for research and development will be cut in half by Finance Minister Michael Wilson's recent federal budget. This cut could cripple Canada's nuclear industry and cause significant damage to many sectors of our economy. Prospects for foreign sales of the CANDU Power Reactor in an already tough market will suffer if Canada's commitment to the system now falters.

The statement by the Minister of Finance that federal support for nuclear R and D would be halved over the next five years is causing grave concern among members of the Society of AECL Professional Employees (SAPE) at the Atomic Energy of Canada Limited's Chalk River Nuclear Laboratories.

The AECL laboratories were established 40 years ago to exploit peaceful uses of atomic energy. Their most visible product, CANDU, is acknowledged by Prime Minister Mulroney as "the most successful nuclear power system in the world". It is a leader in reliability of operation and low electricity cost. But any high-tech activity must have continuing development to stay competitive. Tomorrow's buyers of power reactors will be interested in only technologically advanced models — not those of yesteryear.

R&D associated with the upkeep and maintenance of current CANDUs can be the responsibility of existing users, but user's interests do not guarantee adequate funding for future development. If the ongoing development of CANDU and other nuclear technology is curtailed, the future energy needs of Canadians and the commerical prospects of a key Canadian industry will be jeopardised. These cuts come at a time when foreign competitors are increasing their commitment to, and investment in, nuclear technology.

Reactors are not AECL's only activity. Of equal concern is the effect that such a steady reduction of funds will have on other research and development at the Chalk River Laboratories. These laboratories now employ multidisciplinary teams of world class scientists and engineers. It has taken decades to build up groups of people with such diverse expertise. Similar capabilities exist in only a few laboratories around the world.

In addition to the power reactor technology and associated health and safety aspects, these researchers develop for all Canadians a great range of products and applications for medical and industrial uses, and carry on the basic science upon which spin-offs depend. The proposed fifty percent cut in federal funds threatens to destroy this multidisciplinary approach, curtailing research activities and impeding innovation.

Industrial R and D work at Chalk River now generates about thirty-five million dollars each year. This revenue is growing steadily but federal support should not be withdrawn before alternative funding has been secured.

Canada has built up a nuclear industry over the past forty years with funds that are a fraction of those spent in other countries with nuclear power systems. Today, over 30,000 Canadians are employed directly in this high-tech industry as well as an estimated 50,000 indirectly. Reliable funding is essential to maintain the research on which these jobs depend and to protect the value of the Canadian investment. Canada cannot afford, and its citizens should not tolerate, another Avro Arrow."

Pickering — One Unit Down, One Unit Delayed (Staff)

The start-up date of Pickering Unit 8 has been delayed following the discovery of some pressure tube fretting. Pressure tube inspection following hot conditioning revealed that in some tubes vibration of the dummy fuel bundles had caused fretting damage in a number of tubes. All tubes have been inspected and Ontario now has to decide on the most appropriate ameliorative measures. These could include pressure tube replacement in a few cases and honing where fretting marks are comparatively minor. As Commissioning Manager Ken Talbot noted, "the objective is to be extra picky now, while we don't have radioactive components to deal with, rather than wait and face the possibility of having to do the work later in the life of the machine." Despite the delay imposed, Talbot said that he still had confidence that Unit 8 would be in-service by the end of the year.

Unit 3 at Pickering was shut down July 2, following detection of moisture in the annulus gas system. Subsequent investigation traced the leak to channel F-13. While the cause of the leak was not positively identified at the time of writing, informed opinion

TECHNICAL SUPPLEMENT

CNS Bulletin May/June 1985 Canadian Nuclear Society

ENGINEERING APPLICATIONS OF CURRENT MICROCOMPUTER SOFTWARE PACKAGES

Paper Presented at the CNS 11th Simulation Symposium on Reactor Dynamics and Plant Control, Kingston, Ontario, April 22-23, 1985

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Abstract — *Recent advances in microcomputer hardware and associated software have received considerable attention in the business world through such developments as increased memory capability and spreadsheet type software. Attempts to date at bringing these developments to the engineer's desk are limited to simplistic uses of spreadsheets as design table generators.*

This paper explores the use of spreadsheets for the heat and mass balance analysis of a process system in the nuclear industry. Visicalc is used to model the mass and energy balances of the CANDU 600 Primary Heat Transport System. The software tool's capability of recalculating values rapidly when new values are entered is used to show how changes in process variables such as feedwater flowrate, reactor inlet header or outlet header temperatures affect other system parameters such as steam flowrate, reactor core flowrate and thermal power generated.

Further, the use of a computer algebra package is explored for fault tree analysis and simple electrical network evaluations. These examples serve to indicate the diverse engineering uses of recent advances in the microcomputer world.

USING VISICALC TO MODEL THE CANDU 600 PRIMARY HEAT TRANSPORT SYSTEM

Visicalc is a software tool which is user friendly and has the capability to recalculate values rapidly when new values are entered. The program basically consists of an electronic spreadsheet which is represented as an array of 254 rows (ie. 1 through 254) and 63 columns (ie. A through Z, AA through AZ and BA through BK). Labels, numbers or formulas can be written into the array elements. Once relationships are established between the elements, any one value or formula can be changed and the impact on the other elements can immediately be seen. Visicalc has many screen formatting facilities (ie., capability to change column width, splitting of a screen horizontally or vertically). (Ref. 1)

Visicalc's capabilities to solve linear equations and to perform statistical analyses and "what if" analyses have led to its wide use in the business world. However, recently Frost and Pomernacki (Ref. 2) have used Visicalc to generate engineering design tables for engineering applications. The general format of these design tables had (1) the input parameters and the incremental values by which they were to be varied, specified at the top of the tables and (2) the output parameters generated beneath the information in (1).

Going one step further beyond engineering design tables, the rest of this section discusses how Visicalc was used to model the steady state behavior of a process system in the nuclear industry. The mass and energy balances of the CANDU 600 Primary Heat Transport System were modelled. This spreadsheet program serves as a useful tool for analyzing commissioning data of the heat transport system. The software shows schematically how changes in process variables such as feedwater flowrate, reactor inlet header or outlet header temperatures affect other system parameters such as steam flowrate, reactor core flowrate and thermal power generated.

(Figure 1) gives a flowsheet diagram of the CANDU 600 Primary Heat Transport System. The input conditions (ie. feedwater flowrate, feedwater enthalpy, reheater drains flowrate, reheater drains enthalpy and steam enthalpy, etc.) are given and the required output parameters (ie. steam flowrate, fission heat generated, header to header power, core flowrate, thermal power generated, etc.) are to be calculated. (Table 1) gives the mass and energy equations of the system under steady state conditions. An error analysis was also done on the heat transport system. Errors in measured inputs affect the errors in calculated results.

Table 1

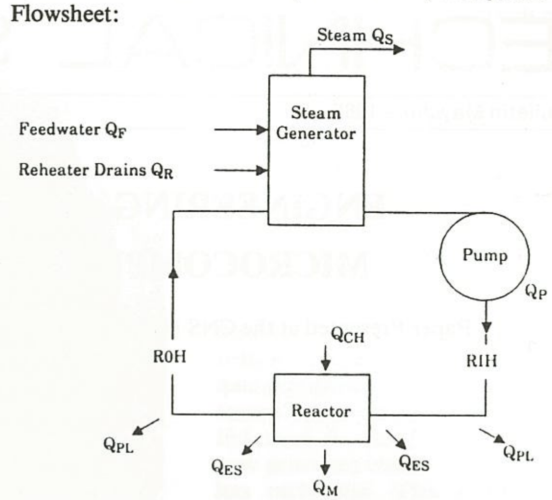
Setup of Equations

1. $QF = M_f h_f$
2. $QR = M_R h_R$
3. $M_S = M_F + M_R$
4. $QS = M_S h_S$
5. $QBS = QS-QF-QR$
6. $QCH = QBS+QM+QES+QPL-QP+QA$
7. $QHH = QCH-QM-QES-QPL$
8. $M = QHH/(HROH-HR1H) * 1000$
9. $\% = (QBS/2064) * 100.$

The Primary Heat Transport System (ie. process components and piping) was depicted pictorially by placing labels into the elements of the array. To avoid entering asterisks repeatedly which represented the outline of the process components, the Visicalc command R which is used to replicate one part of the spreadsheet to another location on the spreadsheet was used. The flowsheet was essentially set up on the electronic spreadsheet as shown in Figure 1. Known inputs and equations were inserted into the appropriate boxes. Using the Visicalc command G, which takes an action that affects the entire spreadsheet, all the variable values were converted to two decimal places after the decimal point. See (Figure 2) for the completed electronic sheet.

Visicalc does have shortcomings in the modelling of a process system. Its main drawback is that it does not have an effective method of performing iterative calculations. When performing such calculations, changes resulting from each iteration are printed out. Another drawback of Visicalc is that there are no conditional or "branching to another element" statements available. The program has to be run sequentially.

System: Candu 600 - Primary Heat Transport System
Flowsheet:



Given Information:

M_F = feedwater flow
h_f = feedwater enthalpy
m_R = reheater drains flow
h_R = reheater drains enthalpy
h_s = steam enthalpy
Q_p = pump heat
Q_{ES} = endshield heat loss
Q_M = moderator heat loss
Q_{PL} = feeder piping heat loss
H_{R1H} = R1H enthalpy
H_{R0H} = R0H enthalpy
Q_A = auxiliaries heat loss

Required Information:

QF = feedwater heat transfer
QR = reheater drains heat transfer
M_S = steam flow
Q_S = steam heat transfer
QCH = fission heat generated
QHH = header to header power
M = core flow
QBS = thermal power generated
% = % reactor full power

Figure 1

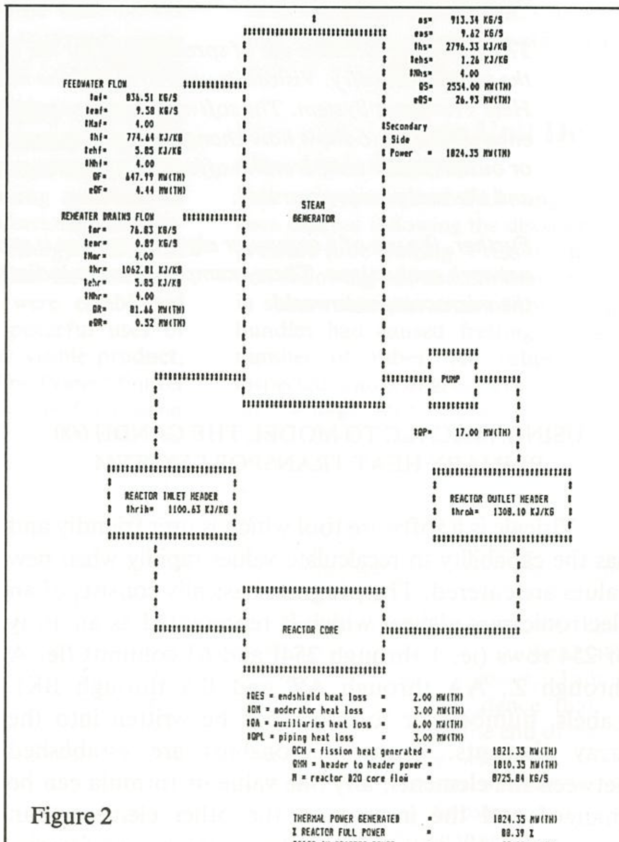


Figure 2

A third disadvantage is known as a forward referencing problem. If a user wishes to embed the numeric values within a schematic diagram, it is not always possible to have the equations executing in the right order. This is due to the fact that equations are executed either across one row at a time or one column at a time. Finally, due to the size of a process, the user can only view a portion of the spreadsheet at any one time.

Besides its major feature of rapid responses to changes in inputs, Visicalc has the following useful capabilities. Since overlaying of files is allowed in Visicalc, different data files can be created (ie. data at different reactor power levels) and overlayed on a master program file which contains the relationships between the elements. Visicalc's global recalculation command allows the user to make as many changes to the spreadsheet before recalculation of the equations begin.

APPLYING COMPUTER ALGEBRA TO FAULT TREE ANALYSIS AND SIMPLE ELECTRICAL NETWORK EVALUATION

Recently, advances have been made in software based on symbolic processing requirements as opposed to numeric processing needs. Attention is being focused on symbolic processing because it enables computers to manipulate data types and symbols made up of lists of associated properties. Symbols and their properties are stored in a relational database in which the interrelationships amongst them are determined by the application of general rules rather than limited by predetermined data structures. This is in contrast to numeric processing, where data are stored in fixed formats and properties cannot be added to the definition of a data element without restructuring the information in memory.

Computer algebra was one of the earliest and still one of the most successful applications of symbolic processing. Computer algebra systems use symbolic processing to manipulate mathematical equations which contain abstract symbols that represent numerical quantities. MUMATH is an interactive symbolic math system implemented in the programming language, MUSIMP, for the microcomputer. It is used to transform and simplify formulas into equivalent formulas, either automatically or at the explicit request of the user. Some of the capabilities of the MUMATH system include indefinite precision rational arithmetic, matrix algebra, trigonometric and logarithmic manipulation, symbolic integration, symbolic summation and the solution of nonlinear differential equations. MUSIMP is a variant of LISP (List Processing Programming Language) which is currently the most widely used symbol manipulation language. MUSIMP, however, has been optimized for the manipulation of symbolic mathematical expressions. Its main data structures are lists.

The rest of this section discusses how the programming language, MUSIMP and the microcomputer program MUMATH were used to develop a fault tree analysis program and an electrical circuit network evaluation program.

Fault Tree Analysis

The MUSIMP program, FAULT.SYS performs fault tree evaluations of repairable components. More specifically, it calculates the top or intermediate event unavailabilities of a fault tree. The assumptions made in the program include (1) component failures are statistically independent, (2) component failure and repair rates are constant and (3) there are no basic repeated events. The third assumption is also known as the rare events approximation. This means that minimal cut sets are not known but basic event probabilities are less than 0.1. The error is negligible then, if repeated events are not eliminated.

The time dependent failure probability for a terminating event is the unavailability, $\overline{A}(t)$. Unavailability is stated mathematically as $\overline{A} = \lambda \tau$ where λ = component failure rate and τ = mean down time. The unavailability of an output from an OR gate in a fault tree is equal to the sum of the individual unavailabilities entering the gate. Stated mathematically,

$$\overline{A}_T = \sum_{n=1}^{N} \overline{A}_n$$

The unavailability of an output from an AND gate is equal to the product of all the individual unavailabilities entering the gate. Stated mathematically,

$$\overline{A}_T = \sum_{n=1}^{N} \overline{A}_n$$

FAULT.SYS calculates the unavailability of a system and returns a numerical symbolic result and an associated symbolic name. If a component failure rate or mean down time is unknown in a calculation, an error will not result but instead the symbol representing the variable is carried through the calculation. The symbolic output gives a simplified symbolic representation of the unavailability of a system. For example, the symbolic unavailability of a system which has the inputs A, B and B entering an OR gate, would be A + B. The program, FAULT.SYS implements the following two identity rules: (1) A + A = A, and (2) A.A = A.

The first step in using FAULT.SYS is to generate the fault tree database for the system to be analyzed. For each basic or primary event, the following inputs are required: (1) the name of the event, (2) the component failure rate and (3) the component mean down time. The function DB was written to handle the creation of a system data base. It has the following input format:

DB (event 1 name, failure rate 1, repair time 1),
(event 2 name, failure rate 2, repair time 2) ...)

The MUSIMP concept of "property lists" was used in developing the function DB. In MUSIMP, every name has an associated PROPERTY LIST which is a list of data pairs. The first element of each pair is an expression called the key or indicator and the second element is an expression called the associated information. A MUSIMP command of the form PUT (name, key, information) causes the value of "key" linked with the value of "information", to be placed on the property list of the value of "name". Therefore, DB creates a database by storing a component's failure rate and mean down time on the component's property list under the keys 'FAILURE RATE' and 'REPAIR TIME' respectively. The unavailability of the event is then calculated and stored on the event's property list under the key 'UNAVAIL'. To later retrieve information stored on a name's property list, a MUSIMP command of the form GET (name, key) is used.

The function ANDD was written to calculate the unavailability at the output of an AND gate. Given an input list of event names entering an AND gate, the function ANDD first multiplies all the individual unavailabilities together and then generates the output event name by using the MUSIMP string manipulation function, COMPRESS. COMPRESS returns the name whose printname is a packed version of the printnames of the atoms in its argument list. For example, if the three inputs into an AND gate were named A, B and C then the output event name would be "ABC". The calculated unavailability is stored on the property list of the compressed event name under the key 'UNAVAIL'. Only the output event name is returned to the user.

The function ORR calculates the unavailability at the output of an OR gate. Similar to the function ANDD, ORR accepts an input list of event names. It sums the unavailabilities of the individual inputs and stores this value on the property list of the compressed output event name, under the key 'UNAVAIL'. For an OR gate, if the inputs were A, B and C, then the compressed output event name would be "A+B+C". ORR only returns the output compressed event name to the user.

The function NAVAIL is used to extract the unavailability of an event. It simply uses the MUSIMP GET command to look on the property list of the event, under the key, UNAVAIL, for the unavailability.

As an example of how this works, (Figure 3) gives a fault tree for a simple electrical circuit. To create the database for the electrical circuit, the user would enter:

DB (LIST(A1, A2, ...A10));

where A1 represents (X1, λ1, τ 1), etc. To input the fault tree configuration and to find the unavailability of the top event, the user would enter:

NAVAIL (ANDD (ORR (X2, X1), X4, ORR (X3, ANDD (ORR (X7, X8), ORR (X9, X10))))); FAULT. SYS responses with an algebraic expression for the unavailability. If numerical values are supplied for any or all of the parameters, these numerical values are inserted in the expression and evaluated.

Sample Problem for FAULT.SYS.

Fault Tree Analysis

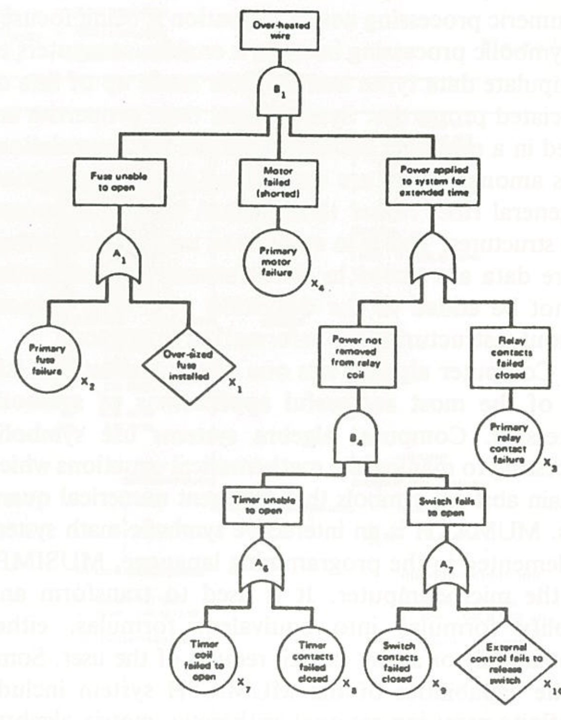


Figure 3:
Reduced fault tree for an electrical circuit (From W. Hammer, "Handbook of System and Product Safety", Prentice-Hall, Englewood Cliffs, New Jersey, 1972).

Simple Electrical Network Evaluation

EL is a LISP program which performs electrical circuit analysis during symbolic processing and heuristics on the mainframe computer. Using MUSIMP, a simple linear circuit analysis program CIRCUIT.SYS was developed to be run on a microcomputer. Given an electrical network of linear components (ie. resistors, inductors and conductors) connected in series and/or parallel (Ref. 3). CIRCUIT.SYS calculates the circuit's impedance and voltage.

Initial conditions of CIRCUIT.SYS include: (1) all component values must be known or assigned a symbolic value, (2) resistances are in units of ohms, inductances in units of henries and capacitances in units of farads and (3) current through a component may or may not be known initially.

Two terminal networks of resistors, inductors and capacitors are represented as list structures. Initially, to assign names and values to the components in a circuit, the MUSIMP functions RESIST, INDUCT and CONDUCT are used. For each component, its name and value are inputted to the appropriate function. For example, if a capacitor, C1 has a value of 1 μ F, then the user enters a command of the form, CONDUCT (C1, .000001). Each of the three functions also calculates and stores a component's impedance. For the above example, impedance is calculated to be -1/(OMEGA*CAPACITANCE). OMEGA, a global variable is the angular frequency in radians per second. It is initialized outside any function definition. Since impedance is, in general, a complex quantity, a component's impedance is represented as a list consisting of a real part and an imaginary part. For the capacitor, the real part is equal to zero and the imaginary part equal to -1(OMEGA*CAPACITANCE). A component's impedance is stored on the component's property list under the key, 'Z.

To connect components in series, the user uses the function SERIES. Component names are the inputs to SERIES and the new name of the equivalent circuit is the output. For example, to tell the program that three resistors R1, R2 and R3 are connected in series, the user enters SERIES (R1, R2, R3). The name of the equivalent circuit is formed by linking the names of all components connected in series. An S is placed in front of the name to indicate a series connection. For the above example, the output name is SR1R2R3. SERIES also forms a list of the components' impedances and adds the individual impedances together via the CPLUS function. The total impedance is then stored on the property list of the output circuit name under the key, 'Z. In CPLUS, the real parts of a complex variable are added together and the imaginary parts likewise.

To connect components in parallel, the MUSIMP function PARALLEL is used. Like SERIES, component names are the inputs, and the name of the equivalent circuit is the output. A "P" is placed in front of the name to indicate a parallel connection. PARALLEL also forms a list of the inverses of the components' impedances and adds the inverses together via the CPLUS function. The result is inverted again to give the final answer for the impedance.

Given a component or circuit name, the function IMPEDANCE extract the name's impedance value from the name's property list under the key 'Z.

To calculate the voltage drop across a circuit consisting of components in series, the MUSIMP function VOLTS is used. Like SERIES, the name of the equivalent circuit is formed by linking the names of all the components connected in series and then placing an "S" in front of the name. To calculate the voltage drop, VOLTS first checks if the component/circuit name already has a voltage value under the key, "VOLTAGE" in its property list. If a value exists, the voltage is returned. If none exists, VOLTS checks the key, "CUR" to see if the current through the component/circuit is known. If the current is not known, the current is given a symbol formed by linking the letter, "I" with the name of the component/circuit (ie. R12R3→IR12R3). The current is then multiplied with the component's impedance. A list is formed of all the voltages calculated and the individual voltages are summed to give the total voltage drop.

VOLTP calculates the voltage drop across a circuit consisting of components in parallel. First, IT, the total current through the circuit is found by adding the individual currents through the components. The inverses of the individual components' impedances are calculated by CINVERSE and then summed. The voltage drop is calculated as the total current, IT, divided by the sum of the inverses of the impedances, and stored on the name's property list under the key, "VOLTAGE".

Finally, given a component/circuit name, the MUSIMP function V extracts its voltage drop value from the name's property list.

As an example of how the program CIRCUIT.SYS works, below are commands the user would enter to perform an analysis on the circuit shown in (Figure 4). To declare the values of the linear components, the following commands are entered:

```
OMEGA: 2179.44;
RESIST (R1, 1000000);
RESIST (R2, 100.);
RESIST (R3, 1.0);
INDUCT (L6, 0.2);
CONDUCT (C4, 0.000001);
```

The circuit setup for calculating impedance is:

IMPEDANCE (SERIES (R3, PARALLEL (C4, R1, SERIES (R2, L6))));

The circuit setup for calculating voltage drop is:

V (VOLTS (R3, VOLTP (C4, R1, VOLTS (R2, L6))));.

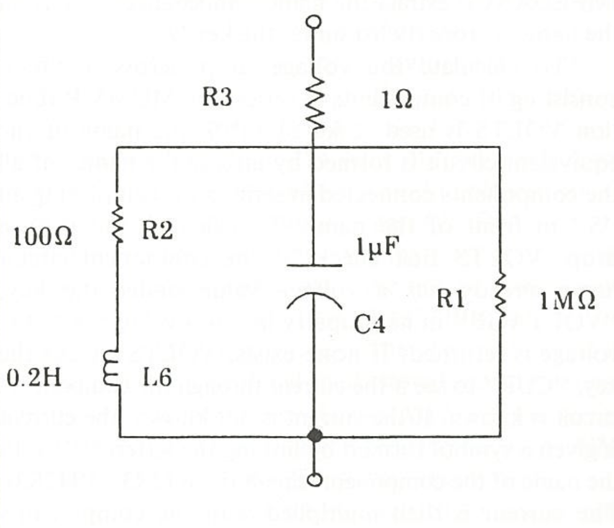


Figure 4

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2. Trost, S. and Pomernacki, C., "Visicalc for Science and Engineering", SYBEX, Berekley, 1983.
3. Winston, P.H. and Horn, B.P., "LISP", Addison-Wesley Publishing Company, Reading, Massachusetts, 1981.
4. The Mumath-83 Symbolic Mathematic System Reference Manual, The Softwarehouse Co., Hawaii, 1983.

inclined the view that the leak was most probably due to delayed hydride cracking in the rolled joint area. Units 3 and 4 at Pickering had a total of about 70 tubes replaced in the mid-seventies, after such leaks developed as a result of residual stresses caused by "over rolling" the zirconium-niobium pressure tubes. While stress relieving the over-rolled joints essentially eliminates the problem the occasional small leak can be expected from time to time. As one Ontario Hydro representative pointed out, similar leaks have appeared in a couple of pressure tubes at Bruce Unit 2. In the case of Pickering 3, one tube leak out of 390 in a ten year period is not a bad record.

Canada and Turkey Sign Nuclear Cooperation Agreement (Staff)

Canada and Turkey have signed a 15-year nuclear cooperation agreement, expected to increase the likelihood of a sale of a CANDU reactor to Turkey. The agreement was signed in Ankara and lays the groundwork for future deals in such areas as reactor construction, uranium supply, nuclear technology, exchange of experts and technical training. The foundation of the agreement is that Turkey will abide by the Non-Proliferation Treaty.

WR-1 Shut Down (AECL)

The WR-1 reactor at AECL's Whiteshell Nuclear Research Establishment was shut down in May. Designed to test the idea of using organic fluid as a reactor coolant, construction of WR-1 began in 1963 and the reactor went critical on November 1, 1965. WR-1 demonstrated that not only could the system work, where other attempts with organic moderators/coolants had failed, but it could work efficiently and reliably. For seven years one section of the 60MW (thermal) reactor operated with an outlet temperature of 400° Celsius, about 100° higher than current water-cooled power reactors.

During its 19-1/2 year operation, WR-1 proved to be a valuable test bed for different types of fuel, fuel channels and equipment, and enabled materials and chemistry testing in its loop facilities. For the past six and a half years the reactor has supplied plant heating and has saved a total of about $5.5 million in heating oil.

Today, the high cost of operating the reactor is not compensated by the revenue and advantages to be gained from continued operation. Content in the knowledge that the organic-cooled reactor technology is well-proven, WR-1 will be "mothballed" to finance new types of reactors, such as the SLOWPOKE demonstration reactor now under construction.

Ontario Hydro Strike Cost $30 million (Staff)

The 12-day long system-wide strike by the Ontario Hydro Employees Union, which ended May 17 with outstanding issues sent to arbitration, cost the utility about $30 million. The cost was due to extra coal purchased for thermal generating stations while nuclear stations were shut, as well as electricity purchases from nearby utilities and lost electricity export sales. Management operated hydroelectric and thermal stations and towards the end of the strike, was given permission to operate a nuclear reactor at the Bruce NGS by the Atomic Energy Control Board. The strike was over issues arising during the bargaining of a new contract and was preceded by a short, illegal wildcat strike in April.

Douglas Point Rejected by Ontario Hydro (Staff)

Ontario Hydro has determined that it would not be economic to acquire the prototype 220MW Douglas Point nuclear power plant from Atomic Energy of Canada Ltd., even for a nominal $1 fee. The station was closed down in May 1984 after 17 years of operation, and originally cost $82 million. With the need for pressure tube replacement and other costs, the plant would only be economic if there was a period of unexpectedly high electricity demand growth, assuming the plant was back in operation before the mid-1990s. Ontario Hydro also rejected the idea of producing power at Douglas Point with surplus steam from the Bruce NGS.

Nova Scotia Committee Appointed As Recommended by McCleave (Staff)

A six-man interdepartmental committee has been set up by the Nova Scotia Government to work on uranium matters, as recommended by Robert McCleave, who led the Uranium Inquiry which finished earlier this year. Other of his recommendations which were adopted include: the five year moratorium on uranium exploration (and mining) will continue, and land held under uranium licenses will be opened for exploration of other minerals. The committee will establish standards, monitor research into uranium mining technology, etc.

COG Evolves (AECL)

The CANDU Owners Group (COG), created in January 1, 1984, is taking on a large role in the Canadian nuclear scene. Current members of COG are Atomic Energy of Canada Ltd., Ontario Hydro (the COG administrator), Hydro-Quebec and New Brunswick Electric Power Commission. Its mandate is to promote closer cooperation among utilities owning and operating CANDU power reactors in areas relating to operation and maintenance, and to foster cooperative development programs (and share costs) leading to better performance. The largest of the COG programs is the garter spring repositioning operation (SLAR) and one involving single fuel channel replacement tooling. As on April 1, the CANDEV (CANDU Development) program, which began in 1980, administered by AECL and which deals mostly with safety R&D, is a COG program. Information is exchanged through CANNET (CANDU Network), an electronic messaging system. A future goal is to become COG — International, as KEPCO (South Korea) and CNEA (Argentina), both CANDU owners, become involved.

New Agreement Between Canada, Euratom Signed (Staff)

In June, Canada and the European Economic Community extended their nuclear cooperation agreement, first signed in 1959, for at least 20 years and eased the conditions under which Euratom states can re-export uranium and heavy water of Canadian origin. In the new agreement, Canada gives automatic prior consent (rather than formal authorization on a case by case basis as in the past) to all future re-transfers, provided that the countries to whom it is exported have signed a nuclear cooperation agreement with Canada. Canada must be notified of the details of the transfers, which may merely be 'book transfers' of consumer stockpiles of uranium, or fuel with Canadian origin uranium.

CNS Proceedings Available (Staff)

Proceedings of the CNS 11th Annual Symposium on Simulation of Reactor Dynamics, which was held April 22-23, 1985 in Kingston, Ontario, are available for $35.00 per volume from the CNS office. Availability is limited. Enclosed are 28 papers on simulation aspects of: Reactor physics, Commissioning, Numerical methods, Fuel management, and Microcomputer applications. Remittances should be payable to the CNS Nuclear Science and Engineering Division.

Also available are the Conference Summaries of the CNS 6th Annual Conference, held in Ottawa, June 3-4, 1985. This volume, c 300 pages, has summaries of over 100 technical papers, and is available for $20.00 to CNS members, $30.00 to non-members, from the CNS office.

Recommendations on Lepreau II Released (Environment Canada)

Construction of a second 630 megawatt nuclear power generating unit at Point Lepreau N.B. can proceed without significant adverse effects, provided certain recommendations are followed, according to the Lepreau II Environmental Assessment Panel.

The panel considered the actual impacts of the first unit in the process of assessing the incremental impacts of Lepreau II. It recommends that steps should be taken now to ensure that potential impacts are reduced to a minimum, and that existing concerns about Lepreau I are corrected.

The panel report says emergency plans should be improved, by discontinuing the siren warning system, modifying the telephone system, and giving better information to the volunteer wardens. It recommends existing monitoring programs should be maintained and additional data collected. A committee of all agencies monitoring the effects of Lepreau I should be formed to co-ordinate and report on monitoring programs. The panel also recommends a community advisory committee be created as soon as possible to provide a forum for exchange of information and problem-solving in communities adjacent to the plant site.

The proposal calls for a second 630 megawatt nuclear generating unit beside the existing Point Lepreau station. The proponent is Maritime Nuclear, a consortium of Atomic Energy of Canada Limited and the New Brunswick Electric Power Commission. The company intends to export power from Lepreau II to New England during the first years of operation.

The panel was appointed in November, 1983 by the federal and New Brunswick Environment Ministers to make recommendations to the two governments about the environmental acceptability of the proposal.

AECL and Hydro-Québec Sign Cobalt-60 Contract (AECL)

Hydro-Québec and the Radiochemical Co. of Atomic Energy of Canada have signed a contract for the production of cobalt at Hydro-Québec's Gentilly-2 nuclear generating plant. This contract is subsequent to an agreement reached in 1984.

During the next five years, Hydro-Québec will sell its entire cobalt production to AECL, earning revenues estimated at about $12 million.

Hydro-Québec is currently setting up the necessary equipment for handling cobalt-60. The production of cobalt will not affect the efficiency nor the safety of the plant. Moreover, at the time of the plant's annual shutdown in the fall of 1985, the metallic bars containing the cobalt will have reached a sufficient level of irradiation to be sold.

AECL uses cobalt in various industrial and medical uses, among which is the sterilization of disposable medical products.

OECD Nuclear Generation Grew at 18.7% in 1984 (OECD NEA)

Nuclear electricity production in the OECD countries grew at a rate of 18.7 per cent in 1984, the largest rate of increase since 1977, according to an annual survey just completed by the Nuclear Energy Agency.

All 13 OECD countries with nuclear programs, with the exception of the Netherlands, increased their nuclear electricity generation in 1984. Four countries reported a more than 30 per cent increase, including France, the Federal Republic of Germany, Spain and Sweden.

Electricity generation during the twelve month period rose by 4.7 per cent, from 5100 terawatt hours to 5340 TWh. The share of total OECD electricity generation met by nuclear power increased from 16 per cent to 18 per cent and now exceeds the share met by oil.

Total installed nuclear capacity in the OECD area reached 182 gigawatts at the end of 1984, an increase of 15 per cent. The number of operable nuclear power plants rose to 264, with 21 new reactors becoming operable in 1984. An additional 112 new reactors with a capacity of 116 GWe were under construction during this period and 27 reactors with 28 GWe were in the planning stage.

The survey shows that projections for installed nuclear capacity in the OECD area by 2000 are five per cent lower than last year, primarily because there are now fewer reactors in the planning stage.

Nuclear installed capacity, however, is expected to double by the year 2000 to 368 GWe.

$40 Million Lab Contract in Indonesia (AECL)

Atomic Energy of Canada Ltd. has signed a contract for the supply of a nuclear research laboratory to the National Atomic Energy Agency of Indonesia (BATAN).

The nuclear mechano-electronic laboratory, to be constructed at the Puspiptek research centre near Jakarta, will consist of five buildings, including a computer centre. The project, valued at approximately $40 million, will involve substantial participation by Canadian private sector equipment manufacturers and will extend over three and a half years.

AECL won out over large international competitors, including nuclear technology suppliers from France, Germany, Italy and the United States. The laboratory will be part of Indonesia's expanding research complex, active in such areas as nuclear medicine, health and safety, reactor technology and instrumentation.

Indonesia is strengthening its technological capabilities in nuclear energy in preparation for the eventual implementation of a power reactor program. AECL President James Donnelly said: "The opportunity for AECL to share in this important aspect of the program is strategically significant as it will ensure a role for Canadian nuclear technology as Indonesia moves toward long term energy decisions."

Three AECL operating divisions — CANDU Operations, the Research Co. and the Radiochemical Co. — will participate in the project.

CNS News

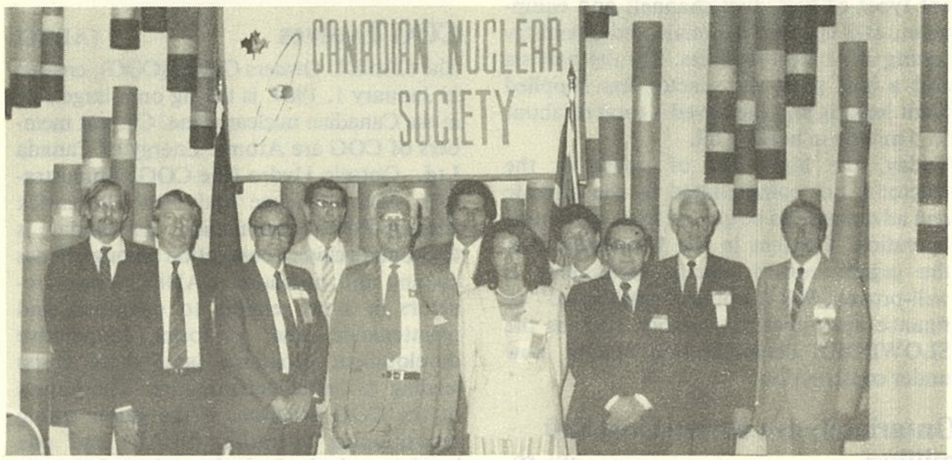
CNS President's Message

Your 1985/86 council took office on June 3 at the CNS annual meeting and the gavel of office was formally handed over from Peter Stevens-Guille at the CNS/CNA luncheon on June 4. Additionally the new council held its first meeting at the conference and made some significant decisions.

As your new President I want to summarize the remarks I made at the two formal occasions.

The membership of the CNS have been drawn together by a common dedication to the goals of the Canadian uranium and nuclear industries. Basically this means that we see that the provision of nuclear power,

CNS Council 1985-86



Left to right: Daniel Rozon, Gil Phillips (Secretary), Peter Stevens-Guille (Immediate Past President), Fred Boyd, Joe Howieson (President), Irwin Itzkovitch, Nabila Yousef (Vice President), Eva Rosinger, Rudi Abel (Treasurer), Richard Bolton, Jim Weller. Not present: Hugues Bonin, Phil Ross-Ross (Past President and International Delegate), Ernie Card, Ken Talbot, Al Lane, Dave Primeau, John Boulton (1986 Conference Chairman), Ed Price.

radioisotopes, uranium and waste disposal is necessary for the future of the world and that the CANDU reactor system is the best of the world's nuclear power systems.

For the last five years, we have seen a progressive belt tightening exercise in the industry culminating in the announcement of budget cuts to AECL. The industry's concerns have affected the CNS, but I believe that the right attitude now is to take a longer term view. Let us see the next few years to make sure that we as individuals and our organisations are ready to tackle the resurgence in orders and in public esteem which I believe will come before 1990.

The many excellent technical papers presented at the annual conference has shown that Canadian nuclear technology is thriving despite the industries' belt tightening. The CNS will do everything it can to maintain and improve that technical excellence because this technology is the foundation of our industry.

The CNS organisation like other technical societies is a peer group organisation whose members are also the major customers for its services. The members of CNS will always find an open door and a welcome for their suggestions from all members of council.

In addition to the high ideals and lofty aims of the society, we are also a social organisation and fully intend to have some fun in the course of our work.

I expressed the thanks of the whole membership to Peter Stevens-Guille and the outgoing council members for a job well done. The thanks of all participants and attendees to the best ever technical sessions of the CNS were extended to Peter French and this organising committee.

It was recognised that the 1984/85 council is a hard act to follow but your new council does intend to serve the membership to the best of our ability.

The major decisions taken by council at their meeting were to:

- Continue working to the goals outlined in Phil Ross-Ross' 1982 paper on the 'CNS of Tomorrow.' However, this will continue to be done with the present organisational structure rather than going to the revised structure proposed by Phil.
- Continue with the Joint CNA/CNS annual meetings format for at least the next two years. At the same time the CNS will try to support the EIC's 100th Anniversary Celebration of Engineering in Canada. This implies organising technical meetings for May 1987 in Montreal.
- Confirm that the major objective for the year will be to start the publication of a high class peer reviewed technical journal.

I look foward to meeting with many of our members over the coming year. I am sure it will be an interesting time for me and hope that it can be a productive and successful one for the society.

J. Howieson

Interested in Contributing to the CNS Bulletin?

To submit original articles, letters, FYI items, reviews, calls for papers, etc. contact one of the following:

- D. Mosey, Editor, *CNS Bulletin*, c/o Ontario Hydro, 700 University Ave., Toronto, Ontario, M5G 1X6.
- H. Bonin, Associate Editor, *CNS Bulletin*, c/o R.M.C., Dept. of Chem. & Chem. Eng., Kingston, Ontario, K7L 2W3.
- The *CNS Bulletin*, c/o the CNS office.
- Your local branch representative.

CNS Bulletin Issue:	Editorial Deadline:
January/February	January 1
March/April	March 1
May/June	May 1
July/August	July 1
September/October	September 1
November/December	November 1

Intéressés à contribuer au Bulletin SNC?

Pour soumettre des articles originaux, de lettres, des nouvelles, des revues, des appels aux communications, etc., veuillez bien entrer en contact avec l'une des personnes suivantes:

- D. Mosey, Rédacteur, *Bulletin SNC*, a/s Ontario Hydro, 700 University Ave., Toronto, Ontario, M5G 1X6.
- H.W. Bonin, Rédacteur Associé, *Bulletin SNC*, a/s Royal Military College, Départment de Chimie et de Génie Chimique, Kingston, Ontario, K7L 2W3.
- Le *Bulletin SNC*, a/s Bureau de la SNC.
- Le représentant de votre section locale.

Numéro du *Bulletin SNC*	Date limite pour l'éditorial
janvier/février	le 1 janvier
mars/avril	le 1 mars
mai/juin	le 1 mai
juillet/août	le 1 juillet
septembre/octobre	le 1 septembre
novembre/décembre	le 1 novembre

CNS/CNA Conference Report

The Canadian Nuclear Society had a strong 6th Annual Conference, the first annual CNS conference fully in parallel with the CNA conference, in which over 100 scientific and technical papers were presented. Over 500 delegates from 15 countries attended, at Ottawa's Westin Hotel, from June 2-4. The CNA/CNS conference theme was "Strategic Opportunities for Growth." Peter French was CNS Conference Committee Chairman. Special CNS sessions dealt with Ontario Hydro's Large Scale Fuel Channel Replacement Program, Fusion Energy, New Reactor Concepts and Public and Regulatory Issues. Joe Howieson of Energy Mines and Resources Canada became the new CNS President, replacing Peter Stevens-Guille of Ontario Hydro. Replacing Hal Dickout of CGE as CNA Chairman was Gavin Warnock of Acres International. CNA award winners were former AECL President W.J. Bennett (Ian McRae award) and radiation therapy pioneer Harold Johns (W.B. Lewis medal).

During the evening of June 2nd, an anniversary dinner in honour of the Canadian Nuclear Association's 25th anniversary was followed by an address on the first 25 years of the Canadian nuclear industry by Dr. John S. Foster, a past President of Atomic Energy of Canada Ltd., who was introduced by an earlier AECL President, J.L. Gray. W.B. Lewis was prevented from attending due to health reasons. Numerous other pioneers of Canada's nuclear industry attended the dinner.

The CNA sessions were highlightened by a panel on the future of CANDU in the final session "The Next 25 Years." Pat Campbell, Senior Executive Vice-President, Ontario Hydro, indicated that nuclear power as a source of electricity continues to be a strong contender as one of the main supply side options, certainly for Ontario and likely for other provinces. Ontario Hydro's reactors supply electricity much more cheaply than coal generation and projections indicate, more economically than PWRs. But, he indicated the need to restructure the components of Canadian nuclear capability to meet the low immediate workload and allow expansion when needed in the future.

James Donnelly, AECL President, indicated that despite 15,000MWe of CANDU generating capacity in operation or under construction and a committed investment of almost $30 billion, CANDU as a nuclear system might not survive if it doesn't increase its worldwide market share of only 6%. He saw the need to rationalize duplication in the industry, with AECL providing the leadership, and the need for the beneficiaries of nuclear R&D to contribute to the costs incurred. He saw an improved "perpetual CANDU" existing up to 100 years, using long-life components and advanced fuel cycles and called for a collective target of at least 12% world market share for CANDU.

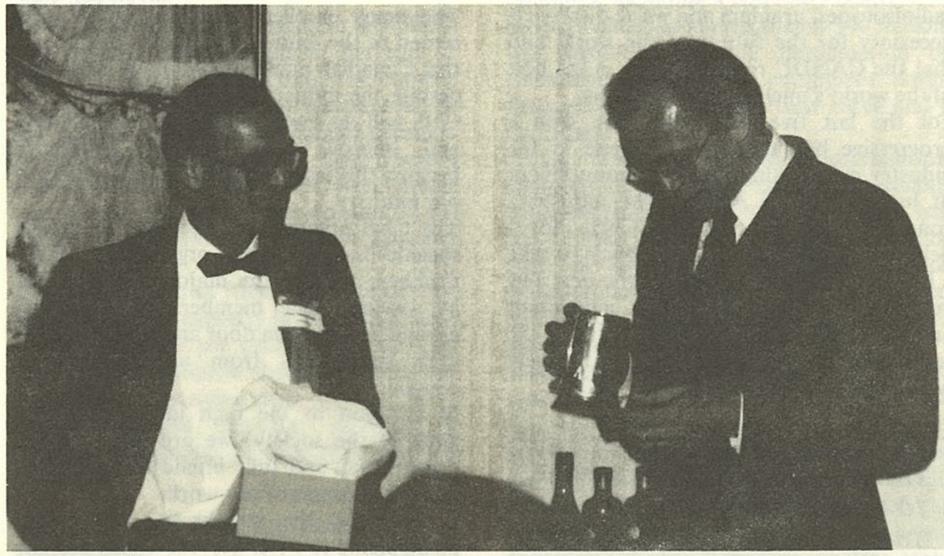
A "Team Canada" approach, along the lines of Britain's National Nuclear Corp., is needed to preserve a rationalized CANDU supply capability into the next century and make it a force to be reckoned with, according to Hal Dickout. He saw sales of 12 units to the year 2000: five 600MW units built in Canada to export electricity to the US, with the remainder being overseas sales, where the only competitor in the 600MW niche is West Germany's Kraftwerk Union. He saw the need for a cost reduction in CANDU of 20%, standardization and adequate government financing.

But he cautioned, without a "Team Canada" approach, after the year 2000, there may be an end to CANDU.

Banquet and luncheon speakers were Arnold M. Allen, Chairman of the UK Atomic Energy Authority (at the CNS luncheon) and James B. Edwards, President of the Medical University of South Carolina and former US Secretary of Energy, who discussed recent developments in the nuclear programs of their countries. The Tuesday banquet speaker was Robert E.J. Layton, the Minister of State (Mines), who summarized the achievements of Canada's nuclear program, and despite a recognition of the need for rationalization, indicated that "the federal government is deeply committed to the continued development of safe nuclear power as an important energy source."

Proceedings of the CNA conference and Conference Summaries of the Canadian Nuclear Society are available from the CNS/CNA office. Full CNS Proceedings will be published this Fall.

Staff



David Mosey, Bulletin Editor (right) receiving award from Peter Stevens-Guille, outgoing President of the CNS (left). David is applying QA to verify beermug has base integral with body.

Bulletin Editor Receives CNS Award

David Mosey, Editor of the *CNS Bulletin* for the last four years, was presented with an engraved beermug by Peter Stevens-Guille on behalf of the CNS Council. The award, presented at a CNS dinner during the Annual Conference in Ottawa, was presented to David, "For the insight, enthusiasm and professionalism" he has brought to the *Bulletin*, said Stevens-Guille.

Mosey replied to the presentation speech with one of his own which skillfully handled the accolades bestowed upon him. He entertained his audience with reminiscences and stories of his years in the nuclear industry.

The dinner, hosted by the council of the CNS, was held to honour David Mosey and to thank Peter French, Conference Chairman and his committee.

P. Stevens-Guille

Canada in INCONTT III Conference

CNS has arranged for strong Canadian representation at the important international nuclear conference: 3rd International Conference on Nuclear Technology Transfer, to be held in Madrid, Spain in October 1985. Canadians will present eight of the more than 150 papers in the conference program (see below). The papers by Arvo Niitenberg (Ontario Hydro) and James Donnelly (AECL) were invited by the ICONTT III organizers. Canadian manufacturers, research establishments, nuclear consultants and utilities are attending the conference as exhibitors. Three Canadians have been chosen to co-chair conference sessions: Prof. J. Hewitt (University of Toronto), N. Yousef (Ontario Hydro), and H. Dickout (Canadian General Electric).

As CNS Program Chairman (1984-85), Mrs. Yousef has been a member of the ICONTT III Program Committee since mid-1984, and was elected to the Paper Review Committee.

Participation in this conference will give wide international exposure to Canadian nuclear technology, to the Canadian Nuclear Society, and to leaders in the Canadian nuclear community. The CNS Council adopted, some time ago, a deliberate policy of increasing the international recognition of Canadian technology and of the CNS. This policy acquired fresh vigour with the 1984/85 CNS Council, led by President Peter Stevens-Guille. That Council chose a strategy of increasing our international recognition by organizing conferences with international appeal, and by helping to organize the conferences of other countries. The 1985/86 Council, under Joe Howieson, is committed to continuing the policy. The policy, and this strategy, are designed to promote Canadian nuclear technology, encourage visitors to Canada and to contribute to international nuclear power development.

CNS work on ICONTT III began in 1984, when CNS was approached by the sponsors of the conference. Following the initial groundwork, papers were solicited in Canada, speakers were approached, and a group of Canadian exhibitors was assembled. The result was the strong Canadian representation described above. Mrs. Yousef continues to coordinate Canadian activities for ICONTT III, in her present position as CNS Vice-President.

Spain was chosen as the venue for ICONTT III because the country is in a transition phase in its nuclear power development activities. Historically, Spain simply operated foreign-built reactors. Now the country is developing its own full-scale nuclear power industry. Spain therefore has, in the 1980's, a unique and important perspective on nuclear technology transfer.

ICONTT III is organized by the Spanish Nuclear Society, in co-sponsorship with the European Nuclear Society and the American Nuclear Society.

Canadian Papers in ICONTT III

Eight papers are to be presented:

- *"A Historical Perspective on Nuclear Technology Transfer." J. Donnelly (Atomic Energy of Canada Limited).*
- *"Simulators: A Tool for Nuclear Planning." A. Niitenberg (Ontario Hydro).*
- *"Ontario Hydro's Systems Approach to Radioactive Waste Management," T.J. Carter, P.K.M. Rao (Ontario Hydro).*
- *"Nuclear Fuel Waste Management in Canada." R.E. Green (Atomic Energy of Canada Limited).*
- *"Technology Transfer from Canadian Nuclear Laboratories." R.D. McDonald et al (Atomic Energy of Canada Limited).*
- *"Organizing for Transfer of Technology". J.D. Harvie (Atomic Energy Control Board).*
- *"Canada's Natural Ceramic UO_2 Production, Fuel Fabriation and Heavy Water Production." M.R. Galley (AECL), P.D. Schofield (Canadian General Electric), I.J. Itzkovitch (Eldorado Resources).*
- *"CANDU Self-Sufficiency Through Technology Transfer." R. Hill (Atomic Energy of Canada Limited).*

More Canadian exhibitors are welcome to come to ICONTT III. Organizations whose products and services pertain to the nuclear industry, in any way, are invited to request display space at ICONTT III. Manufacturers, laboratories, consultants and utilities are invited to consider and exhibit. The exhibits will enhance Canada's reputation as an important centre of nuclear industry and expertise, as well as providing excellent advertising for individual organizations.

The conference will provide exhibitors with an extensive international forum for displaying their products and services. Conference visitors will represent all aspects of nuclear industry including operations, development, research, and manufacturing. For information on arranging a display, contact N. Yousef (416) 592-5983, or write to her at the CNS office.

John McFee

CNS Branch Programs

CNS Toronto Branch

The Toronto Branch finished its 1984-85 season on 14 May with a presentation by Dr. J.M. Cuttler, AECL — CANDU Operations, entitled "Public Acceptance of Nuclear Power". The meeting was sponsored jointly with the Centre for Nuclear Engineering at the University of Toronto.

Dr. Cuttler began his talk by laying blame for public misgivings about nuclear power with three groups: political activist opposition groups who seek publicity, the media who thrive on controversy and calamity, and nuclear scientists and engineers who fail to communicate properly with the public and the media. The focus of the talk was on the third group — us.

Evidently, depending on the background of the people with whom we are communicating, our choice of words may distort the message we are trying to convey. For instance, when we state that an event "could" happen, we may mean either that the event is eventually expected (such as a jet crash killing 300 people) or possible (such as a mid-air collision of two jets killing 600) or imaginable (such as a jet crashing into a crowded stadium killing thousands). The word "could" includes all these situations and does not indicate how probable it is that an event will occur. But, said Dr. Cuttler, the public does not respond well to mathematical descriptions of probabilities. Thus, we must choose less ambiguous wordings.

Dr. Cuttler outlined in detail a comparison between cigarette smoking and exposure to given amounts of radiation. Although some members of the audience were concerned that smoking is a voluntary risk whereas receiving radiation as a result of nuclear plant accidents is not, Dr. Cuttler reminded us that a certain amount of second-hand smoke is unavoidable in our society and that the smoke intakes in his equivalency comparisons with nuclear accidents, were far less than one cigarette per week.

The questions which followed the talk often sparked discussions involving Dr. Cuttler and many members of the audience. The familiar feeling of frustration over how to responsibly present information to the public and the media without creating a distorted perception of reality, was in the air. No consensus was reached although many interesting viewpoints were expressed.

With this meeting, the Toronto Branch closed its 1984-85 season and will resume meetings in the fall.

Eva Hampton
John Marczak
Toronto Branch

Conferences & Meetings

International Topical Meeting on Computer Applications for Nuclear Power Plant Operation and Control

Sponsored by the ANS, co-sponsored by CNS et al., to be held **September 8-12, 1985** in Pasco, Washington. For information contact: **Lino Magagna, Ontario Hydro, 700 University Ave., Toronto, ON M5G 1X6.**

International Topical Meeting on High Level Nuclear Waste Disposal

Sponsored by the ANS, co-sponsored by CNS, to be held **September 24-26, 1985** in Pasco, Washington. For information contact: **Dr. H.C. Burkholder, Battelle Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352.**

Annual Information Meeting of the Canadian Nuclear Fuel Waste Management Research Program

To be held **September 26-27, 1985** in Winnipeg, Manitoba. For information contact: **Dr. Eva Rosinger, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba, R0E 1L0.**

Executive Conference on TMI-2: A Learning Experience

Sponsored by the American Nuclear Society, to be held **October 13-16, 1985** in Hershey, Pennsylvania. For information contact: **F. Coffman, Federal State Remedial, IT Corp., 600 Maryland Ave. S.W., Suite 302, Washington, DC 20024.**

3rd International Conference on Nuclear Technology Transfer (INCONTT-III)

Sponsored by the Spanish Nuclear Society, ENS and ANS, to be held **October 14-19, 1985** in Madrid, Spain. For information contact: **Spanish Nuclear Society, Estebanez Calderon 5, 3 E, 28020 Madrid, Spain.**

3rd Workshop on Analytical Chemistry Related to Canada's Nuclear Industry

Sponsored by the CNA, Chemical Institute of Canada, AECL, et al., to be held **October 20-23, 1985** in Kimberley, Ontario. For information contact: **Dr. A. Guest, Ontario Hydro, A2 C7, 700 University Ave., Toronto, Ontario, M5G 1X6.**

International ANS/ENS Topical Meeting on Thermal Reactor Safety

Sponsored by the American Nuclear Society, co-sponsored by the Canadian Nuclear Society, ENS et al., to be held **February 2-6, 1986** in San Diego, California. For information contact: **David Okrent, University of California, 5532 Boelter Hall, Los Angeles, CA 90024.**

Topical Meeting on Advances in Fuel Management

Sponsored by the Canadian Nuclear Society, American Nuclear Society and Electric Power Research Institute, to be held **March 2-5, 1986** in Pinehurst, North Carolina. For information contact: **Dr. G.M. Frescura, Ontario Hydro Nuclear Studies and Safety Dept., 700 University Ave., Toronto, Ontario M5G 1X6.**

Topical Meeting on Nuclear Power Plant Maintenance

Sponsored by the American Nuclear Society, co-sponsored by the Canadian Nuclear Society, ENS et al., to be held **March 23-27, 1986** in Salt Lake City, Utah. For information contact: **Ken Talbot, Ontario Hydro - Pickering NGS, P.O. Box 160; Pickering, Ontario L1V 2R5.**

Second International Conference on Radioactive Waste Management

Sponsored by the Canadian Nuclear Society, co-sponsored by the American Nuclear Society, to be held **September 7-12, 1986** in Winnipeg, Manitoba. For information contact: **Dr. T.S. Drolet, Program Manager, CFFTP, 2700 Lakeshore Rd. W., Mississauga, Ontario, L5J 1K3.**

International Conference on Water Chemistry and Materials Performance in Nuclear Reactors — Call For Papers

Sponsored by Canadian Nuclear Society, to be held at the King Edward Hotel, Toronto, Ontario, **October 20-21, 1986**. This water chemistry and materials technology based conference is intended for plant operators, equipment designers and researchers and will focus on plant life and plant life extension and uprating measures and their effects. Plant life extension, as it is affected by materials performance, water chemistry, the desire for plant uprating and the impact of plant modifications and improvements, is of importance to operators of all nuclear power plants. The life spans of PWR, PHWR, BWR and GCR reactor types are all dependent on the chemistry of the primary heat transport system, the secondary steam side and the auxiliary systems. We invite papers concerning the impact of water chemistry on materials performance in primary, secondary and auxiliary systems in nuclear power reactors. It is intended that 20-25 papers will be presented and they will include the following topics:

- Changes in operating and plant lay-up water chemistry specifications and control for improved plant performance.
- Preventative maintenance — cleaning and decontamination of heat exchangers and equipment.
- Equipment fixes (eg. sleeves), improvement, replacement.
- Plant uprating — effects of higher operating temperatures, stresses and flows.

Those wishing to present a paper are requested to submit a summary of approximately 500 words containing concise statements on the contents of the proposed paper. This will be used for paper selection. Titles of accepted papers will be published in the Conference program brochure. Summaries must be submitted by **January 31, 1986.** Authors will be notified of acceptance or rejections of the submitted summary by **April 1, 1986.** The Conference Proceedings will be issued at the conference and will contain the full papers. Authors will be required to provide a camera-ready copy of accepted papers (in prescribed format on mats to be provided) by **August 15, 1986,** for inclusion in the Conference Proceedings. All summaries and full papers should be sent to "Water Chemistry and Materials Performance," c/o **Canadian Nuclear Society, 111 Elizabeth Street, 11th Floor, Toronto, Ontario, Canada M5G 1P7.**

All accepted summaries and full papers become the property of the Canadian Nuclear Society.

The Unfashionable Side

Conference Season

In keeping with its long tradition of interdisciplinary and multi-disciplinary scholarship and research, Aphasia University is hosting a three week conference of the Society of Joint Societies. This umbrella group includes such learned societies as The Back to Babbage Society, The Canadian Society for the Numerical Analysis of Shakespearean Sonnets, The Canadian Association of Feline De-elevationists[1] and the Canadian Neutron Registration Society. Conference organisation is the responsibility of the Department of Underwater Ornithology (Chairman Prof. Armitage Loathing) and the Department of Plausible Energy Studies (Chairman Dr. Dennis Molestrangler RMS, EMF, Btu/min).

As might be expected with such a large number of such diverse groups, there have been some organisational and other problems. And discussions have been of a level of intensity for which "lively" and "animated" are totally inadequate terms. In order to cope with crowd control problems, campus police have called upon the local detachment of the RCMP who in turn are rumoured to be considering requesting assistance from the British Special Air Service.

Off-campus too, things have not run altogether smoothly. A confrontation between Canadians Concerned About Seals and the Canadian Salt-Water Fish Preservation Society at The Stuffed Parrot (a popular downtown drinking establishment) erupted into a particularly ugly fracas when a tired and emotional member of the latter society attempted to balance a ball on his nose in a taunting fashion.

But the most serious contretemps so far occurred at the prestigious Hydride Regency Hotel where members of the Canadian Society of Biodegradable Materials in Reactor Design, returning from a demonstration of a new plywood pressure tube for CANDU-PHW reactors, invaded a reception held by the Back to Babbage Society, under the impression that they were visiting the Hospitality Suite run by Acme, Armitage and Hardcastle Forest Products (Nuclear) Inc. The situation was further complicated (and the tension heightened) by the inexplicable presence a number of tired and emotional members of the Canadian Association of Euclidian Geometricians who were chanting "QED" for no discernable reason. Following the unscheduled explosion of the boiler on the steam engine driving the display model of the Back to Babbage Society's Difference Engine the crowd reportedly panicked and rushed the Star and Garter Spring Bar where Dr. Dennis Molestrangler was hosting an informal seminar on fluid flow. Luckily, Dr. Molestrangler and the other participants in the seminar were quick-thinking enough to bar the door and hold off the ravening crowds until the arrival of the city police.

The conference program has been adjusted to accommodate schedule changes dictated by medical and/or legal considerations.

Ernest Worthing

1. This comprises those members of fire brigades who specialise in getting pussy cats down from trees and telephone poles.