

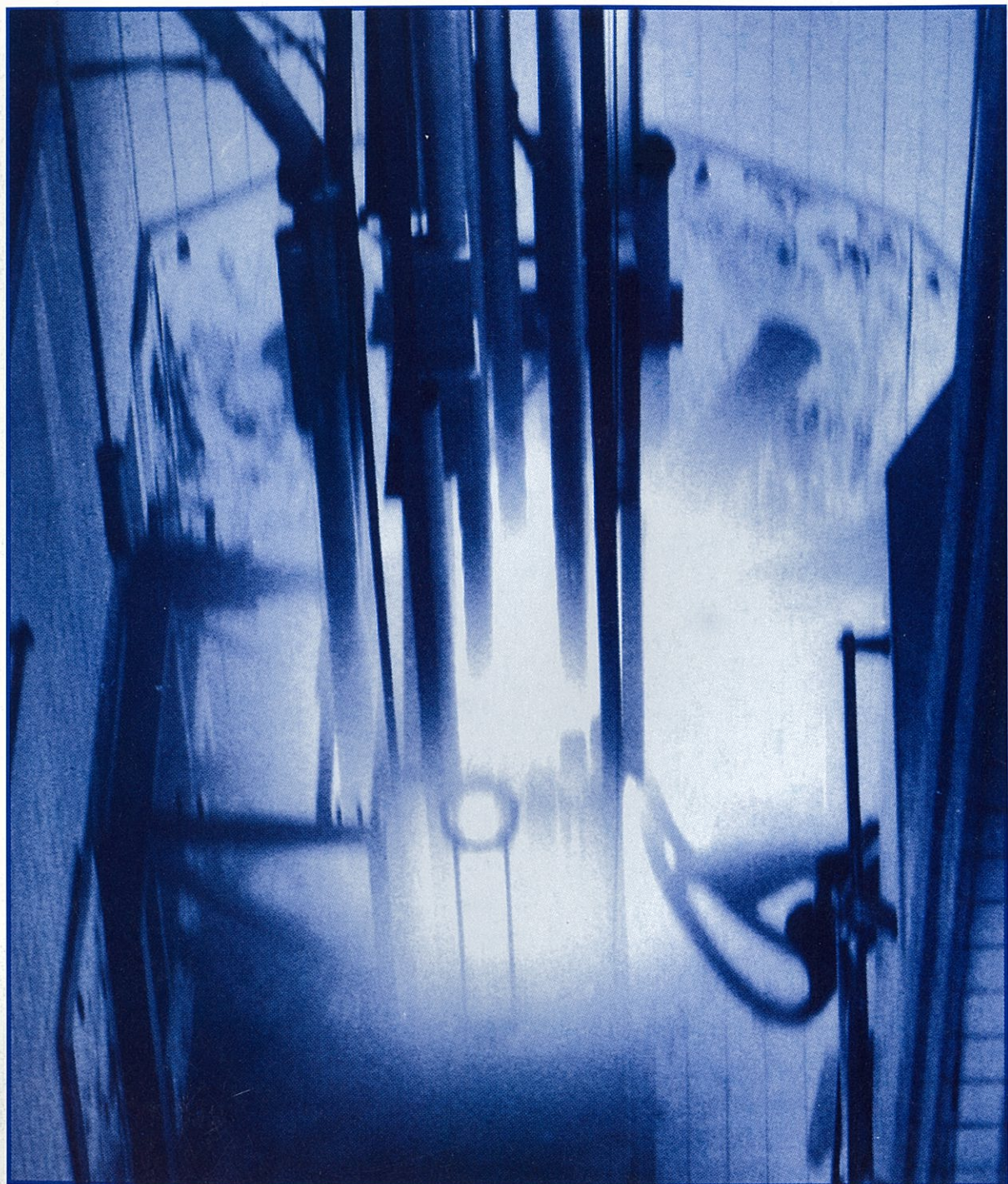


CANADIAN NUCLEAR SOCIETY **bulletin**

DE LA SOCIÉTÉ NUCLÉAIRE CANADIENNE

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IMPRIME SUR PAPIER RECYCLE

Cover photo

The photograph on the cover is of the core of the McMaster Nuclear Reactor under seven metres of water taken while the reactor was operating. This photograph and those accompanying the article, "McMaster Nuclear Reactor Turns 35," are all courtesy of the MNR staff.

(Photo courtesy of Jeremy Whitlock)

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CANADIAN NUCLEAR SOCIETY

Bulletin

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Forward or Back?

There have been a number of developments in the Canadian nuclear scene over the past few months, some of them encouraging, some disturbing, and some just puzzling.

On the good news side it appears that Ontario Hydro, in particular Ontario Hydro Nuclear, is settling down and getting on with the job of running their nuclear plants safely and efficiently. The turmoil of the corporate re-structuring – which even OHN general manager Don Anderson described as an “upheaval” – is reportedly largely over and those still in the organization are gradually finding their new places.

There is also the good news that Ontario Hydro Nuclear will join the Canadian Nuclear Association. The withdrawal of Ontario Hydro from the CNA hurt the organization and resulted in the staff reductions reported in the last issue (which also hurt the CNS). The effect of OHN joining (or re-joining) has not been fully studied but it is undoubtedly positive.

On the negative side, the Atomic Energy Control Board appears insistent on issuing their revision of consultative document C-6 on safety analysis requirements for CANDU

plants. Those who have seen the penultimate draft are appalled with its lack of overall philosophy, excessive amount of arbitrary analyses required, and, most worrisome to some operators, the proposal to apply it to existing plants. Some reviewers have been so dismayed that they predict the shut-down of plants if the document is issued as a “regulatory” document, as is the AECB staff intention.

Then there is the “we wonder what that means” developments at the upper levels of Atomic Energy of Canada Limited. With the leaving of Bruce Howe, AECL has gone through three presidents in the past four years. In these times of government fiscal restraints, lack of electrical demand, and general uncertainty about the economy, our national nuclear company needs strong leadership. Let us hope that the federal government, and, in particular, Minister of Natural Resources Anne McLellan and her special review team, can come up with a solution soon.

Otherwise, spring is coming and so is the annual conference in Montreal. See you there.

In This Issue

Hopefully you will have noticed the changes in the cover and internal format, to mark our 15th year and to make the *Bulletin* more inviting.

Now to the contents of this issue.

Our lead article **McMaster Nuclear Reactor Turns 35** is an excellent review of this facility to mark its 35th anniversary this month. With all the attention on our large nuclear power stations it is easy to overlook the pioneering role of the McMaster reactor and its major contributions to teaching, research and irradiation analyses over the years.

The fact that this article was initiated and prepared by someone too young to have experienced the beginnings of this unique (to Canada) project is a stinging reminder to those of us who were involved that our history is slipping away, largely unrecorded. We thank Jeremy Whitlock for his work.

To mark the CNS' formation of a Nuclear Operations Division we had hoped to have several “operations-related” articles only to find that there are very few such papers of general interest. (Presumably operations personnel are too busy to write papers.) Given that situation we accepted an invitation to visit Darlington NGS and attempt to record some impressions of the operation of a large nuclear power plant. Whether or not we have succeeded in **Day at Darlington** we leave to you.

An important aspect of operation of a nuclear generating station is the training and examination of key operating personnel. The paper **Developments in AECB Operator**

Examination presents the new and evolving approach of the Atomic Energy Control Board to make more use of simulators for training and examination of operators.

There is a report, thanks to organizer Paul Berkeris, on the very successful **CNA/CNS Student Conference** along with abstracts of some of the winning papers. Space limitations prevented printing of the full papers but the proceedings are available from the CNS office.

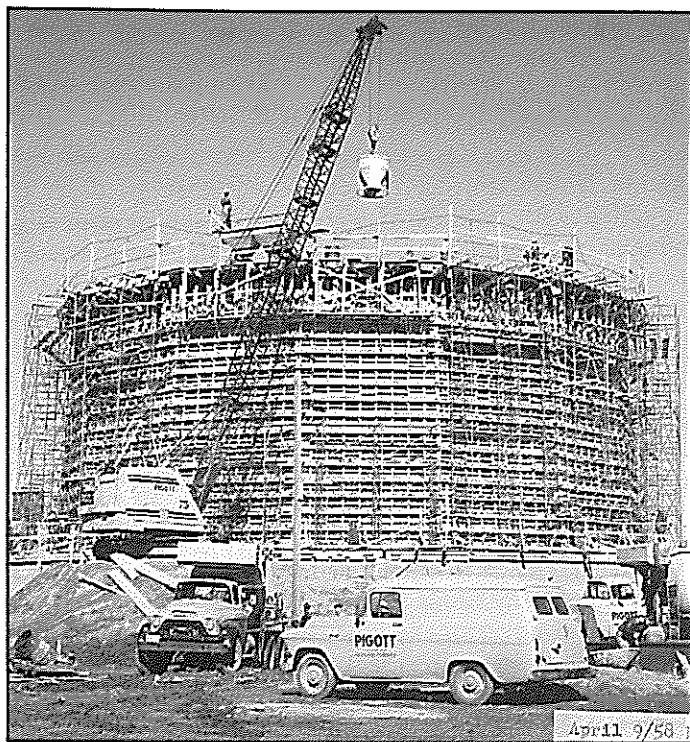
With the trial about the Nuclear Liability Act finally over we present some excerpts from the judge's reason for ruling against Energy Probe and the other plaintiffs who had challenged the constitutionality of the Act in **Energy Probe Loses Nuclear Liability Act Challenge**.

The views expressed by Arthur Dickenson of the Association of Major Power Consumers in Ontario, to a meeting of the CNS Toronto Branch, on the “new” Ontario Hydro, sufficiently intrigued associate editor Ric Fluke that he prepared the extensive account **Reorganization at Ontario Hydro – the AMPCO Perspective**. Perhaps you will agree (or disagree) with Dickenson's controversial comments.

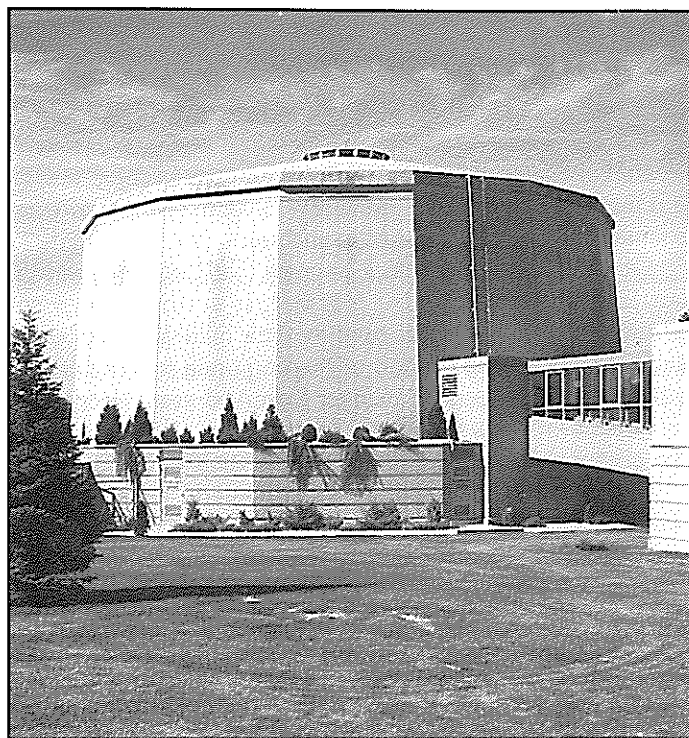
There are a number of “miscellaneous” items on developments in our industry, including the great news that Pickering unit 7 has achieved a new world record for continuous operation.

Finally there is a considerable amount of information about developments in the Society.

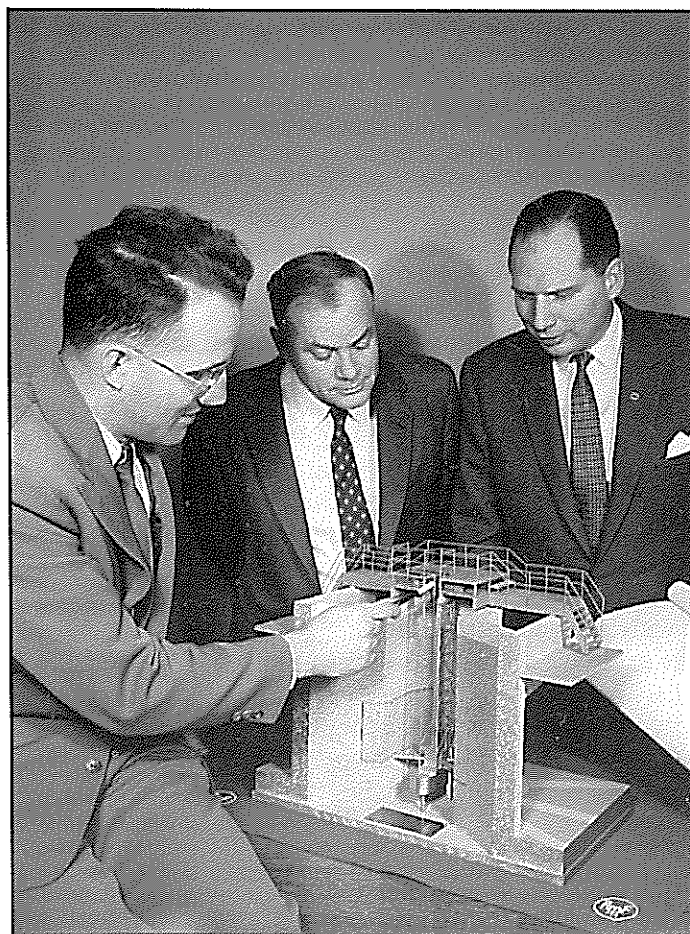
As always, we thank our contributors and invite your input.



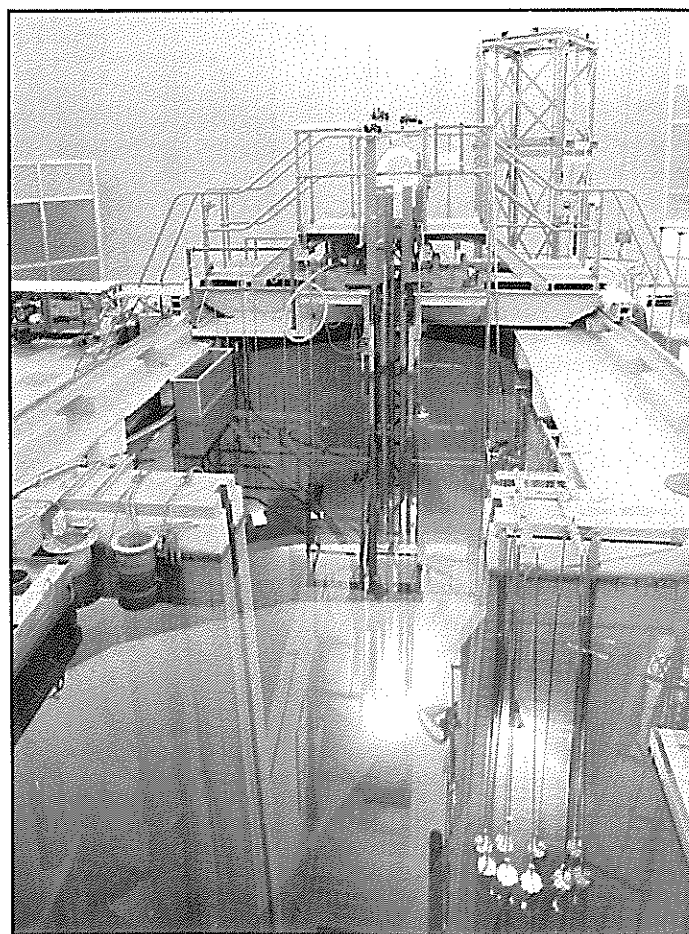
Spring 1958: A local company erects the concrete containment building.



An early exterior view of MNR: The cooling towers are to the left, and on the right a personnel access ramp connects the containment building to the Nuclear Research Building.



Dr. W.H. Fleming (left), Dr. H.G. Thode (centre), and Mr. D.M. Hedden (right) examine a model of MNR during the planning stages.



View from the Instrument Bridge: The section of the pool in the foreground is for storage.

McMaster nuclear reactor turns 35

by JEREMY WHITLOCK

***Ed. Note:** We wish, very much, to thank Jeremy Whitlock for preparing this excellent review of the McMaster Nuclear Reactor as it celebrates its 35th anniversary. The MNR has been a major part of our nuclear history in Canada. Jeremy is a PhD candidate in nuclear engineering at McMaster and is also co-chair of the CNS Golden Horseshoe Branch. On a personal note, having been associated with the commissioning and start-up, it is shocking to realize that MNR is now 35 years "young" (one more sign of the maturing of our nuclear programme).*

The oldest and largest university reactor in the British Commonwealth turns thirty-five this spring and many people might be surprised to learn that it is found at McMaster University in Hamilton, Ontario. Since its official opening on April 10, 1959, presided over by then Prime Minister John Diefenbaker, the McMaster Nuclear Reactor (MNR) has provided facilities for neutron beam experiments, isotope production, neutron activation research, neutron radiography research, and education in a variety of fields including Materials Science, Nuclear Science and Engineering, and Health and Radiation Physics. Additionally, MNR hosts thousands of visitors each year from schools, industry, and the public at large.

Reactor Design

MNR is a 5 MW (thermal) pool-type reactor of the Materials Testing Reactor (MTR) design. This design is common in the United States but MNR is the only one of its kind in Canada (the other six university reactors in Canada are SLOWPOKE-2 technology, with two orders of magnitude less thermal power). The fuel is plate-type U-Al_x enriched to 93% in U-235 and clad in Aluminum. These plates are grouped 10 or 18 to a fuel element, and about 35 fuel elements make up the core. The heat of fission, transferred by ordinary (light) water from the 10 meter deep pool to a secondary coolant loop, is dissipated to the atmosphere.

A unique feature of MNR in Canada is its many auxiliary systems that mirror, on a much smaller scale, the familiar systems associated with full-scale power reactors. These systems include fail-safe control rods

(five shut-down/trim rods and one regulating rod), separate primary and secondary cooling systems, cooling towers, on-site spent fuel storage, and full negative-pressure concrete containment with personnel and equipment airlocks. While things like the containment and cooling towers raise the profile of the reactor on campus, these and the other systems that mirror power reactors help visitors understand the nuclear power industry.

Until a few years ago MNR operated around the clock, seven days a week, 50 weeks a year; however, budget constraints (no stranger to the nuclear industry) have forced a cut-back in recent years to two shifts a day, five days a week, at the 2 MW level. Staff currently numbers ten, of which four are operators, and the annual operating budget is around \$1 million.

The Beginning

The man largely responsible for the building of MNR at McMaster is Harry Thode, Professor Emeritus of Chemistry, former President of McMaster University, and still an active member of the McMaster community. Dr. Thode is one of Canada's most distinguished scientists who, among other accomplishments, contributed much to our knowledge of fission products through his mass spectrometry work at McMaster (including an accurate measurement of the fission yield of Xenon-135, one of the most important isotopes associated with reactor operation). During the Second World War Dr. Thode carried out fission product analysis for the National Research Council's (NRC) Montreal Laboratory – a keystone of the Anglo-Canadian wartime nuclear programme and a precursor to Chalk River Laboratories. Since mass spectrometers were not commercially available anywhere, security arrangements were made for Dr. Thode and his team to perform their work in their own lab in Hamilton Hall at McMaster; the McMaster group thus became an exception to the popular wartime practice of cloistering scientists in tightly guarded government labs.

In the early fifties McMaster was the site of the first Canadian university radioisotope laboratory, and Dr. Thode, Director of Research for McMaster at the time, spearheaded an effort to build a reactor that would act, in part, as a source of the new medical and

industrial radioisotopes. He and his colleagues envisioned a high quality, multipurpose facility that would not only support the emerging radioisotope technology, but also world-class physics and engineering research, and the McMaster team fought hard to make MNR the realization of this dream.

At the time six other "piles" (a common word for reactors in the earlier years) similar to MNR were being built in the United States (the closest at the State University of New York in Buffalo). In Canada McGill and McMaster Universities were both vying for the same government funds to build one.

"We were in competition with McGill," Dr. Thode remembers, "and the NRC gave us the nod."

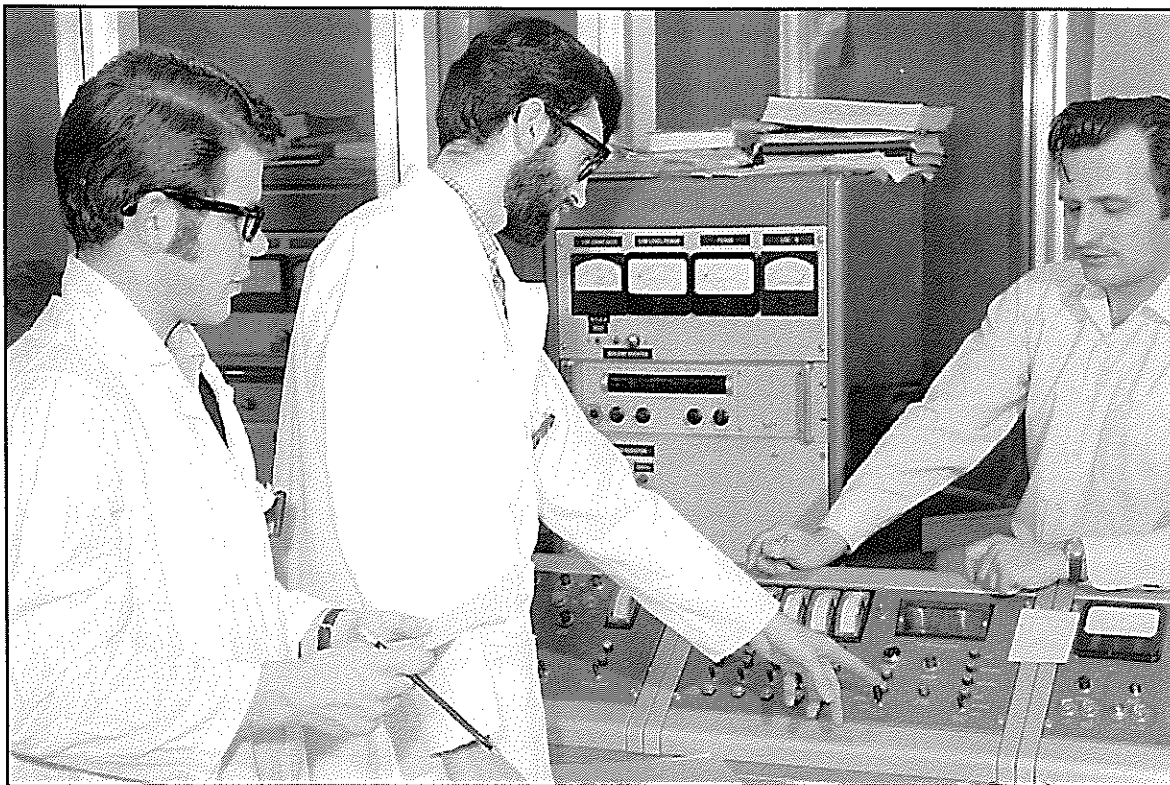
Planning for MNR began in 1955. The \$2 million capital cost had been raised, with much heroic effort and last minute negotiations, through a 50/50 sharing by government (including the RC, the Defence Research Board, the Ontario Government, and Ontario Hydro) and industry (including local companies such as Stelco, Dofasco, and Westinghouse). The American Machine and Foundry Co. (AMF) was the designer and builder of the reactor, while local companies engineered the containment and associated structures.

In late 1957 construction began with the creation of a 140-foot wide, 5-foot thick reinforced concrete base, followed by the continuous pouring (still a novel technique at the time) of the two-foot thick concrete containment walls. Construction continued for well over

a year, into 1959.

At 12:36 in the morning of April 4, 1959 the pile went critical for the first time, and, as mentioned, the official opening took place with much hoopla the following week, on April 10. AMF Chairman M. Patterson noted during the ceremony that he hadn't ever seen life-preservers hanging around a reactor pool before – still a source of amused interest for MNR visitors today. (Ironically, MNR got the idea from another AMF reactor at Battelle Memorial Institute in Columbus, Ohio.) Besides Prime Minister Diefenbaker, others attending on opening day included Dr. C.J. Mackenzie (Chairman of the AECB), Dr. G.P. Gilmour (McMaster University President), J.S. Duncan (Chairman of Ontario Hydro), Dr. R.L. Hearn (former chairman of Ontario Hydro), Dr. A.H. Zimmerman (President of the Defence Research Board), and Dr. D.A. Keys (AECL – Chalk River Laboratories).

Among the names of people who worked with Dr. Thode in the planning and operation of MNR in those early days are: D.M. Hedden (assistant to the Director of Research, later a Vice President of McMaster), Dr. M.W. Johns (Physics), Dr. W.H. Fleming (Reactor Superintendent), J.B. McDougall (Chief Reactor Supervisor), Dr. C.C. McMullen (Physics), Dr. R.H. Tomlinson (Health Physics and Chemistry), Dr. C.H. Jaimet (Nuclear Medicine), Dr. H.E. Petch (Director of Research), Dr. G.L. Keech (nuclear engineering) and Dr. T.J. Kennett (Physics).



From 1970: Undergraduate students Al Lowe (left) and Bill Garland (centre) study the MNR control panel during an experiment while operator George Hannas (right) looks on. Bill Garland later worked at Ontario Hydro and AECL-CANDU before coming back to McMaster, where he is now Chair of the Department of Engineering Physics. George Hannas is still an operator at MNR.

Research at MNR

Thirty-five years later MNR still provides excellent research facilities for several hundred scientists and graduate students from 20 universities across Canada and the United States, as well as half a dozen government labs. The diverse disciplines served include: Materials Science, Earth Sciences, Nuclear Physics and Engineering, Chemistry, Environmental Studies, Biology, and Medicine.

Research at MNR can be divided into four main activities: isotope production, neutron activation analysis, neutron beam experiments, and radiography. In-core irradiations use a neutron flux of up to 4×10^{13} neutrons $\text{cm}^{-2}\text{s}^{-1}$, while activation and beam port fluxes reach 5×10^{12} neutrons $\text{cm}^{-2}\text{s}^{-1}$. Among the many isotopes produced at MNR, which provide commercial revenue towards the facility's operation, is Gold-198 (Au-198). MNR is currently the largest Canadian supplier of this isotope, used to fight certain types of cancer (lip, tongue, retinal, skin, and prostate). Neutron activation analysis is carried out in an automated, commercial mode to identify and quantify trace elements in materials, where other forms of analysis are inadequate. As an example, mining companies can search for minute amounts of the mineral they seek in vegetation taken from a prospecting region.

Neutron beam experiments form an important part of MNR's research reactor capabilities. Six beam tubes extending radially from the core through the pool wall bring streams of neutrons into experiments in the lab on the other side. These experiments are carried out in a variety of fields, including material science where the neutrons become part of a powerful "microscope" for probing the arrangement and behaviour of atoms. Not too long ago Chemistry Professor John Greedan was the first to determine the complete atomic structure of the -180°C superconductor using MNR neutron beams. Another major use of neutron beams is neutron radiography – a similar concept to x-radiography but with specialized applications because of the different material sensitivities of neutrons and photons. Besides the ability to take high quality static radiographic images of objects, a state-of-the-art "real-time" radiography camera at MNR can visualize dynamic phenomena like two-phase flow in channels, which is of importance to the nuclear power industry.

Education at MNR

MNR is located on a university campus and therefore education plays a significant part in the facility's activities. Besides the graduate student work that falls into the many categories of science and engineering supported by MNR, the very existence of the reactor has led to the development of graduate programmes in Nuclear Engineering and Health & Radiation Physics at McMaster. Undergraduate students benefit as well, particularly those in the Department of Engineering Physics who have opportunities to perform engineering experiments on the reactor, such as

flux mapping and reactivity worth measurement, under the supervision of MNR staff.

Another important component of education is interaction with the public. MNR provides an opportunity each year for hundreds of high-school and university students to go inside a reactor containment building and see an operating nuclear core first-hand. Many are surprised by the apparent simplicity of the whole apparatus, and delighted by the pleasant blue glow of Cerenkov radiation emanating from the core deep in the pool. Guided tours also take visitors past the neutron beam experiments, where most non-scientific visitors learn for the first time how many different things can be done with a nuclear reactor besides making electricity. Being a prominent fixture on the McMaster campus, MNR is a highly visible part of the Hamilton and area community and this accessibility has tended to encourage communication with the public on all nuclear issues. During tours of MNR questions about nuclear electricity generation usually abound, and can be handled quite effectively using MNR as a model.

The Future of MNR

For 35 years MNR has operated in support of basic and applied science research, education, and service to the community, and McMaster University has every intention of continuing this support. With the loss of government funding in recent years MNR has had to seek out ways of becoming more self-supportive, and complete success is hoped for with future expansion of its commercial isotope production.

MNR Director Malcolm Collins sees two potential approaches to improving facility operation in the future: a "low-capital" upgrade to around-the-clock operation at 5 MW (thermal), for which it is already licensed, with corresponding increases in irradiation and beam ability, and a "high-capital" upgrade to a 12 MW (thermal) modified design which would make MNR one of the best research reactors in the world. Both approaches promise to keep alive and honour the efforts of Harry Thode and his colleagues in the late 1950's. For the scientists and students who currently use MNR, and for the thousands of scientists, former students, and other members of the public whose lives have been touched at some time by MNR over the last 35 years, this optimism is welcome news indeed.

Anyone wishing to obtain more technical information regarding MNR should call the MNR Director's Office, (905) 525-9140 extension 24065. For non-technical information and/or to arrange a group tour, call McMaster Public Relations, Director of External Communications, (905) 525-9140 extension 24354.

Acknowledgement

Thanks are expressed to Malcolm Collins, Peter Ernst, and Glenn Harvel for their assistance in preparing this article, and to Harry Thode for sharing his reminiscences of the early days. All historical photographs are courtesy of MNR.

A Day at Darlington

Fred Boyd

As announced in the last issue of the CNS Bulletin the CNS Council has endorsed the creation of a new division – Nuclear Operations – which will focus on the interests of members (and potential members) involved in the operation of nuclear facilities, especially nuclear power plants.

Wishing to herald that move with articles in this issue on "operations" we were dismayed to find that there are not many papers available with a "generalist" view of operations (in fact we could not find any). This we concluded was due to the fact that those involved in operation are too pre-occupied with their tasks to spend much time writing about it for us uninitiated.

Therefore when CNS Council member Eric Jelinski suggested a "day at Darlington" we jumped at it. The following article is an attempt to provide some insight into the operation of a large facility such as the Darlington NGS. Our apologies for oversights and for the inevitable superficiality.

Darlington NGS is Canada's newest nuclear power station. Just an hour's drive east of Toronto the plant is hidden from passers-by on highway 401 by an immense berm. Once on the plant road, however, the massive size of the plant soon becomes apparent.

Like most of those who work there, visitors enter through the administration building, a typically modern, three-storey, office building. Located on the north side of the moat-like water intake channel and connected to the plant by a covered bridge spanning the moat (channel) the administration building is suggestive of a gate house for a castle. And, one of its functions is the same – to control access to the plant.

The upper two floors of the administration building are crammed with people – engineers, analysts, administrative personnel, etc. – by far the greatest concentration of "bodies" in the entire plant.

That fact is the first vivid indication that "operation" of a modern nuclear power plant involves very few people at the "controls" but requires large numbers of skilled, knowledgeable men and women to review the operation, to prepare for outages, to analyze problems and plan for changes, and to carry out the myriad of other tasks necessary to ensure that the highly automated plant keeps running smoothly.

And smooth it is. On the day of our visit units 2, 3, and 4, were continuing to run at 100% while unit 1 was on a planned outage. (The performance for the first three months of this year is shown in Fig. 1.)

Outages focus the work of the staff. To keep the downtime to a minimum any activities must be conducted in parallel- requiring careful planning and great team effort. (An insight into a typical outage problem is given below.)

There are over 1500 staff at Darlington of which about 600 are on the five shifts. Each shift has a Shift Superintendent (with overall responsibility for the plant as well as units

1 and 2) and a Shift Supervisor (responsible for units 3 and 4 and fuel handling). Each unit has a senior Control Room Operator, with the remaining shift personnel distributed between the control room, fuelling operations, field work, laboratory support, radiation protection, maintenance, security, and other functions. (Shift Supervisors and Control Room Operators must be examined and authorized by the Atomic Energy Control Board – see an article in this issue on new directions in AECB examinations.)

Darlington has a computer generated "Surrogate Tour" by which you can simulate wandering through the plant with only a computer and a "joy" stick. We chose to use our own legs and see the plant for ourselves.

Before entering the bridge to the plant it is necessary to go through the security access control where, even if you are with a qualified person, your I.D. is scrutinized before you are issued with safety shoes and goggles and a hard hat, which is a conspicuously different colour so that everyone can identify you as a "visitor".

The bridge leads to the central service area with a number of important activities – chemistry laboratories (radioactive and non-active) shops, radiation protection facilities, etc.

At Darlington, as at all Canadian nuclear power plants, each worker is trained in radiation protection and responsible for themselves. Radiation protection professionals and technicians provide support, do analyses and conduct audits.

The chemistry laboratories at Darlington have qualified for and registered with the ISO 9000 international quality standards. It is the first such laboratory to do so. Supervisor Terry Doran feels that the initiative has been very positive, leading to better results and higher morale.

As is typical in Canadian nuclear power plants areas at Darlington are "zoned" according to their potential for radioactive contamination. When crossing from a higher

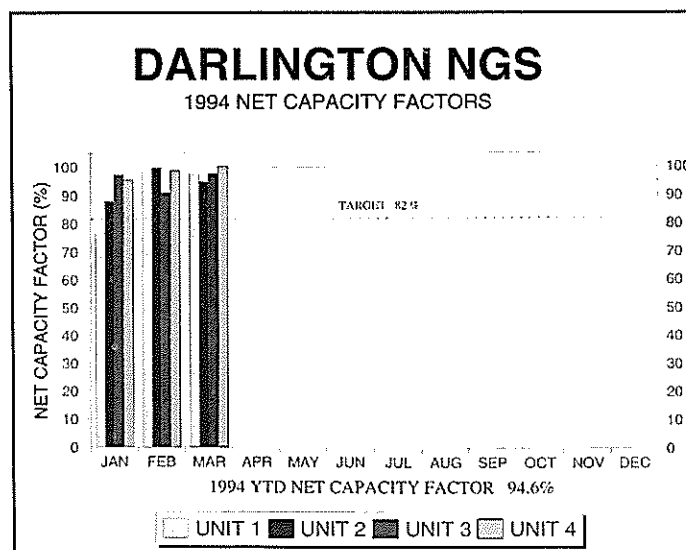


Figure 1

zone to a lower one it is necessary to monitor – so personnel monitors are widely distributed. On leaving the main plant everyone is subjected to a full body “talking” monitor at the exit gate. Being told to “turn around” or “move your arm” by a disembodied voice is disconcerting but accepted by the hundreds who pass through these monitors daily.

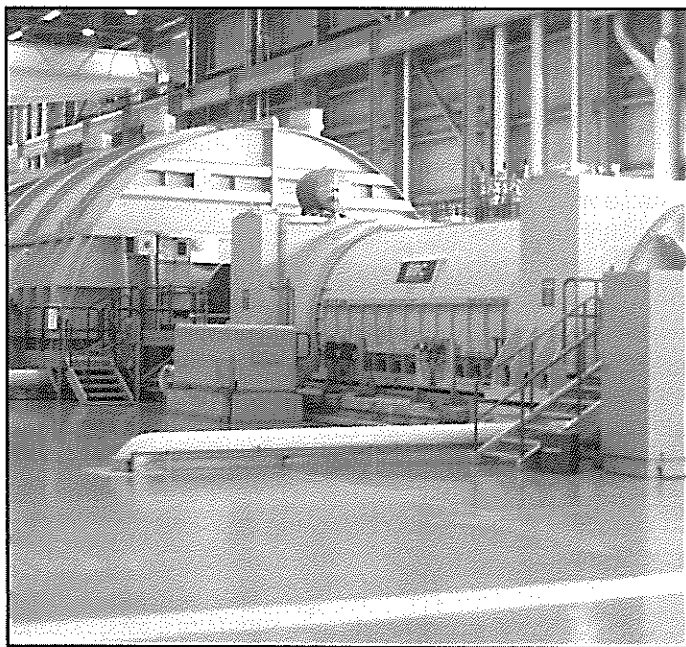
The huge turbine hall (as long a football field) houses the four large turbines driven by the steam generated by the four reactors. Each turbine directly drives a relatively small generator – representing the end-product of the entire plant. When operating smoothly (most of the time) there are very few persons visible (or needed) in the turbine hall. When a unit is down there may be maintenance work, such as on unit 1 that day when technicians were carefully regrounding the slip-rings of the generator exciter – a maintenance task requiring skill and care, typical of the many such activities necessary to keep a large complex plant operating well.

Darlington has an Equipment Status Monitoring System which makes use of electronic taggers that can be fed into computers to provide greater assurance that valves, switches and other equipment are in the proper state.

The Control Room is the heart of the station. Unlike those in other Ontario Hydro multi-unit stations the Darlington control room is laid out linearly, with the control panels of each unit side by side along the long wall of the Control Room. On the opposite side of the room are the controls for common services and the fuel handling systems.

When all is running smoothly (as for units 2, 3, and 4 that day) the alarm panels are reassuredly dark and the few operators on duty concentrate on over-seeing the operation and the general condition of the many systems. For a shutdown unit the situation is quite different, with a brightly lit alarm or status board and a number of operators coordinating the shutdown activities.

A major task during the April outage of unit 1 was an examination of several fuel channels. That required isolating the channel, removing the water and defuelling.



The generator is dwarfed by the low-pressure cylinders of the turbine.

The following excerpt from the Darlington newsletter for April 8 by Guy Hornett gives some insight into the work involved.

The first challenge of the outage was to flow defuel 10 channels ready for CIGAR inspection. The first six were defuelled without a hitch but channel M18 was a problem. Bundle #4 (a long bundle) and bundle #5 only came out part way. In accordance with the plan only two heat transport pumps were operating.

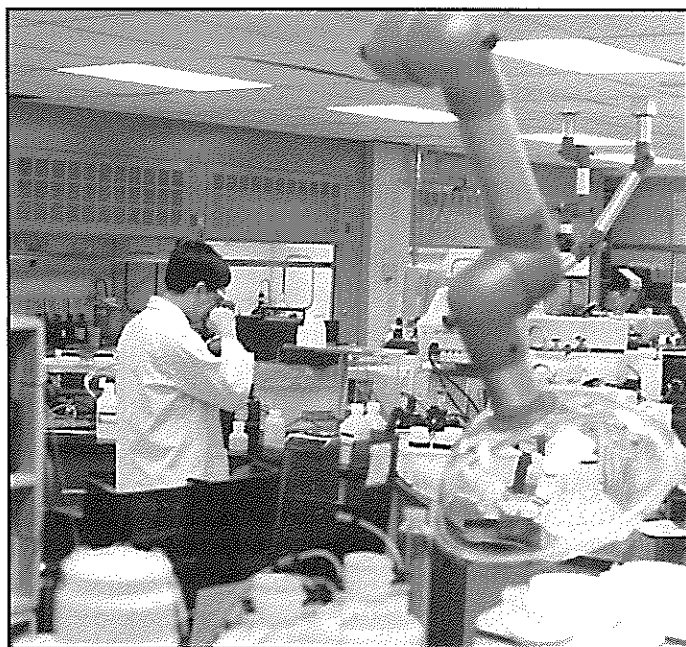
Recovery started early Sunday morning. The defuel carrier, with both bundle, was dropped off in the endfitting liner; however, bundle #5 was protruding from the carrier. The channel closure plug was then reinstalled. Overnight the irradiated fuel was discharged from the fuel handling trolley and a component swap completed to allow the errant fuel bundles to be “scooped” and the rest of the fuel string to be defuelled.

Bundle #5 could then be pushed carefully out of the defuel carrier into the channel endfitting liner, ensuring the carrier was not detached not the bundles damaged. Next the endfitting liner was successfully “scooped” to remove bundle #5. Bundle 6 to 13 were then successfully push defuelled to empty the channel ready for inspection.

One more tricky step remained. The scoop carrying bundle #5 had to be discharged through the irradiated fuel port and placed on the irradiated fuel discharge mechanism ladle and then onto the defective fuel conveyor. This had to be accomplished quickly since the maximum “bundle in air” time was 15 minutes.

What could have been a very time-consuming problem became a success story.

The operation of a large complex plant such as Darlington is a challenging, and non-ending, task. In a short visit it is impossible to see more than part of the surface of the work of the large team that keeps this plant (and other Canadian nuclear power plants) operating at a standard equal to any in the world.



A corner of the chemistry laboratory.

Developments in AECB Operator Examination

Norman Sawyer, Andre Vachon
Atomic Energy Control Board

Ed. Note: The following is a very recent paper describing the on-going evolution of the system used by the Atomic Energy Control Board to assess the qualifications of shift supervisors and control room operators of CANDU nuclear power plants. Further information can be obtained from the authors.

1. Introduction

Until a few years ago, the approach used by the Atomic Energy Control Board (AECB) to obtain assurance that CANDU station staff were competent was basically the same as it was defined about thirty years ago (see reference 1 for more details). It consisted in acquiring evidence that some members of the operating staff (i.e. Shift Supervisors and Control Room Operators) were initially qualified to perform their job by means of a number of written examinations and that other candidates for key station management positions possessed the required attributes and experience.

This paper addresses the approach followed for the examination of Shift Supervisor (SS) and Control Room Operator (CRO) candidates only. Since its inception, the approach was modified somewhat over the years in an attempt to eliminate some of the difficulties encountered in its application. For example, about ten years ago, the separate general and specific written examinations in Radiation Protection were combined into one. Another important change was the introduction, also about ten years ago, of "marking guide" meetings between the AECB staff and utility representatives in the case of the specific written examinations. Despite these changes, by 1990, it was obvious that some of the difficulties presented by the approach were still significant and could not be eliminated without some important adjustments.

One recurring comment from the utilities over the years was that the AECB knowledge expectations for SS and CRO candidates, when translated into the scope and depth of the regulatory questions and answers, went beyond what was actually required to do the job. This had the unintended effect of having the regulatory examinations driving, at least to some extent, the training program content.

The "marking guide" meetings also presented some difficulties. Although they served to make the examination process more objective and the AECB expectations better known and understood, they were never successful in resolving the differences between the expectations of the AECB and those of the utilities. In fact, the introduction of these marking guide meetings created some problems of their own. They increased significantly the number of persons needed to implement the process, both for the AECB and the utilities, and also the time required before the results of an examination could be finalized. This translated into delays of up to five months before candidates could be notified of their standings.

Another difficulty arose from the numerous types of written examination in use resulting from the artificial separation of topics between the nuclear, conventional and radiation protection subject areas and between the general and specific domains. Not only did this create difficulties to the AECB examiners when preparing the examinations but it forced a certain sequence of training by the utilities which was not always conducive to effective training.

Since the Three Mile Island accident, major efforts have been made to improve the training of nuclear power plant personnel everywhere. For example, in Canada, plant-specific full-scope simulators were acquired for all stations and the principles of a Systematic Approach to Training were adopted to varying degrees by all utilities. Further, the importance of continuing training, requalification testing, team training and the competence of workers other than SSs and CROs to the safe operation of the stations gained greater recognition. Some of these developments increased the need for changes in the regulatory approach while some others offered the opportunity for change. Table 1 (next page) summarizes the changes to the AECB regulatory examinations that have been made so far as well as those planned for the near future.

2. Changes Made

Taking into account the developments mentioned above and the recommendations of various nuclear industry reviews such as the one conducted by the Hare commission, the AECB, in 1990, as part of an overall increase in regulatory staff, almost doubled the personnel resources of the Operator Certification Division. The reorganization that accompanied this increase in staff allowed OCD to start an initiatives program which included important adjustments in the approach used for the direct assessment of the competence of SS and CRO candidates. The first initiative in the direct regulatory examinations took advantage among other things, of the opportunity afforded by the availability of full-scope simulators at all stations through the introduction of routine simulator-based testing. Subsequent changes made since or planned are intended to address the difficulties of the original AECB approach to authorization of SSs and CROs and the developments that occurred in the last decade.

All the initiatives of the AECB in this field are taken in close consultation with the utilities. The Standing Inter-Utility/Regulatory Working Group (SIU/R WG), which was formed in 1990, is the main vehicle for these consultations. Working subgroups of the SIU/R WG have also been formed to address specific issues. These are:

- Simulator based examination methodology. So far, this group has made possible the development by the AECB of a detailed procedure for the simulator-based examination of CRO candidates. Additional work is being done to define a similar methodology for the SS candidates.

- Stations Systems Knowledge objectives. This group has the mandate to define the knowledge requirements for CRO and SS candidates which, once endorsed by the AECB, will be used to define the content of the regulatory examinations.
- General Training requirements. This group is reviewing the science fundamentals, equipment and system principles knowledge requirements for CRO and SS candidates. This work will be directed at improving the effectiveness of the training programs in this field and should lead to future changes to the corresponding regulatory examinations.

The changes made so far to the regulatory examinations touch both the general and the specific examinations. The last separate conventional general and nuclear general examinations were held in 1993. The combined general examination introduced this year will focus on topics that are more closely related to operational safety. The list of these topics was defined in consultation with the utilities. The topics that are no longer covered by the direct regulatory examinations will still be part of the regular training program however, and the candidates' knowledge of these topics will be assessed formally by the utilities themselves. The AECB will audit the activities of the utilities in this area.

The last separate conventional specific and nuclear specific written examinations held as part of the regular schedule were in 1992. They have been replaced by a new combined conventional and nuclear station-specific written examination and by a simulator-based examination. The content of the new station-specific examination has been revised to eliminate all questions dealing with the operators actions and checks required in response to major upsets since these are now covered by the simulator-based examinations. In addition, the marking guide meetings for specific written examinations have been discontinued. However, a technical review of all written examinations have been discontinued. However, a technical review of all written examinations by

utility representatives was introduced in 1992. The reviews take place approximately one week before the date of the examinations. Their purpose is to ensure that the questions are clear and do not contain technical or other ambiguities. During these reviews, the utility representative is given full access to the AECB marking guide and has the opportunity to comment on its content. It is considered that these reviews, less resource demanding, replace adequately the more formal marking guide meetings that were held previously.

The routine simulator-based examinations introduced formally in 1993 address the performance of a candidate when responding to plant upsets. The candidate's performance is assessed against the station specific expectations. The test is conducted in a way to reflect the control room environment as much as possible but some deviations are necessary to ensure that the process is objective and to make sure that the candidate is the one who responds to the upset rather than somebody else in the support team. Further details about the method used may be found in reference 2. An outline of the experience gained so far is presented in the last part of this paper.

Finally, the AECB has indicated that it does not intend to introduce direct regulatory requalification testing but that the utilities must put in place an objective process to verify continuing competence of authorized persons. The AECB will evaluate the implementation of the continuing training and requalification testing. Thus far, the AECB has observed requalification testing at two stations.

3. Changes Planned

The next planned change in the AECB regulatory practices will be the elimination of the separate written examination in radiation protection. The utilities training programs are being reviewed to confirm that they prepare adequately the staff to fulfil their role in this field. When such assurance is obtained, the present separate examination will be discontinued. However, some topics covered in the radiation

Table 1: Overview – Changes to the Regulatory Examinations

Type of examination (duration in hours)

1992	Now	Future
Radiation Protection (3)	Radiation Protection (3)	Written comprehensive (5)*
Conventional General (3)	General (3)	Simulator (2)*
Nuclear General (3)	Station Specific (4)	Written Shift Supervisor (2)*
Conventional Specific (4)	Simulator (2)	Nuclear Specific (4)
Total: 17 hours	12 hours	7 hours* for the CRO 9 hours* for the SS

** Precise duration to be determined*

protection examinations will continue to be examined directly as part of a comprehensive station specific written examination. These topics are:

- Radiation Emergency procedures,
- Control of emissions during normal operations and in cases of incidents,
- Station systems classified as radiation protection systems,
- In-station response to incidents which could lead to radiological emissions.

The AECB will continue to evaluate the conduct of radiation protection training once direct regulatory examination is discontinued.

Subsequent changes to the regulatory examination process will include the elimination of the separate general examinations, and modification of the content of the written specific examination to capture some of the topics from the past general examinations that are considered particularly relevant to the safe operation of a station and to accord with the agreed upon station systems knowledge objectives referred to earlier. The single remaining comprehensive written examination for SS and CRO will comprise mainly topics which used to be part of the separate nuclear specific and conventional specific examinations but will also include topics previously covered in the radiation protection and the general examinations. It is expected that these changes will be in place during 1996. The exact date will depend on the progress that is made by the various working subgroups and the success that the utilities will have in implementing the necessary changes to their training programs.

Another planned change to the regulatory practices is the introduction of an additional written examination for SS candidates. In past written examinations, the particularities of the SS training requirements were covered by a limited number of questions addressing issues falling within the responsibilities of the SS only. The comprehensive written examination referred to in the previous paragraph will be a requirement for all CRO and SS candidates. The SS candidates will write an additional examination focussing exclusively on SS job requirements such as:

- Greater in-depth knowledge of science fundamentals particularly reactor physics with emphasis on the phenomena that may affect core reactivity;
- Greater in-depth knowledge of equipment, techniques and procedures for reactor fuelling, fuel handling and storage, fuelling limitations;
- Detailed knowledge of the station's Operating Licence, together with other documents referred to therein such as Operating Policies and Principles including the potential consequences of operation outside their stated limitations.

A more comprehensive list of the topics that could be covered in a future specific written examination especially designed for SSs can be found in reference 3. After this examination is introduced, to obtain authorization as an SS, well-experienced CROs meeting certain criteria, possessing the required personal attributes and being recommended as exceptional by their employer will need only to complete

successfully the additional SS training and pass this complementary examination.

An important administrative change planned to the regulatory process deals with the possibility for the candidates to appeal the AECB examination results. For many years, an informal process has been in place whereby a copy of each candidate's paper is retained by the utilities for the purpose of parallel marking. Before the results of the regulatory examinations are formalized, under confidential arrangements, utility representatives are given the opportunity to present the results of their marking. Information is obtained by the representatives regarding the preliminary results of the AECB and representations are made on behalf of the candidates who are marginal according to AECB marking. Even though it is clear that an appeal must be possible and that the approach just described has the potential for preventing errors in assessment on the part of the AECB examiners, its disadvantage is that it attempts to prevent a failing grade for those candidates who are considered marginal by the AECB on the regulatory examinations. Put in another way, the approach has a detrimental effect on the independence that the AECB examiners should possess when assessing candidates. To deal with this, a documented, more objective process to appeal AECB staff decisions resulting from regulatory examinations is being prepared. It is intended that when this appeal process is in place, the approach described above of making copies of the candidates' papers, parallel marking, and so on will be discontinued.

4. Simulator-Based Examinations Experience

OCD's experience with simulator-based examinations is still relatively new but enough tests have been conducted to observe advantages of this type of examination and at the same time to identify some areas of concern. In 1993, the first year when the simulator-based examinations became part of the formal regulatory process, twenty-five candidates were tested at five stations. It must be noted that the AECB had already gained some experience with the basic approach through the conduct of fourteen special simulator-based examinations between 1990 and 1992, most of them at the Gentilly-2 station. As reported in Reference 4, these early experiences with simulator-based examinations brought about important operational safety benefits such as clarification of the minimum shift team complement requirements and of the response strategy to follow in case of upsets which, in turn, led to numerous revisions of the operating documentation (mainly the operating manuals) resulting in their improved quality and effectiveness.

Even though it is recognized by all concerned that the first routine simulator-based regulatory examinations were clearly an overall success and beneficial to the general goal of ensuring competence of the candidates, it has, as expected, presented some difficulties. It must be pointed out that special measures are being taken during the first two years of this new type of testing to ensure that the process itself is not in some way detrimental to the candidates. For example, in all cases of apparent fail-ure, the utility is given an opportunity to review the evidence and, if considered justified, to appeal the preliminary AECB assessment.

One particular difficulty encountered, which was anticipated, was the testing of multi-unit station SS candidates. This difficulty is due in part to the large number of authorized staff normally present in the control room of a multi-unit station. In order to challenge the SS candidates abilities, this requires scripting special conditions to prevent other team members from dealing with the upset as it would be expected in reality. Another factor, which is no less important, is the lack of clear and comprehensive station performance expectations for multi-unit station SSs. The test procedure used for these candidates in the fall of 1993 was an interim one based in large part on the method for the CROs. As already mentioned, work is being done in consultation with the utilities to define a comprehensive method for the assessment of the performance of multi-unit SS candidates using the full-scope simulators. This work also addresses the need for better definition of performance expectations of these supervisors on the part of the utilities.

The human resources required for simulator-based examinations is also of concern. The resources are mainly needed for the development of the test scenarios and of the Examiner's guides. As an example, in the case of one station with only CRO candidates, twenty person-weeks, shared equally between the AECB and the utility, are needed during the development phase. For a multi-unit station, presenting CRO and SS candidates, this number increases to twenty eight person-weeks. Furthermore, the human resource requirement during the conduct phase of the examination is particularly demanding on the utilities since they have to

provide the staff for the role players. In consultation with the utilities, measures have already been identified that would allow to reduce these resource requirements. For example, in the case of test scenarios development, personnel resource requirements could be reduced to below half the current requirements.

Ensuring the consistency of the simulator-based examinations between stations and over time presents more of a challenge than for written examinations. The OCD-ST6 procedure provides enough guidance to ensure adequate consistency but nevertheless, some difficulties were encountered in its initial implementation. All inconsistencies were addressed to ensure that they did not have a detrimental impact on the candidates and measures are being taken to minimize if not eliminate them in the future. For example, a user guide is being prepared for OCD-ST6 and additional training for AECB examiners will be conducted.

Maintaining as much as possible the objectivity of the simulator-based examination process also offers an interesting challenge. The front part of the process has already been made adequately objective. For example, the collection of data such as audio and video recordings and the Trainee Action Monitor printouts renders very objective the observations of the candidates' performance. The challenge lies with the need for translating a set of objective observations into an objective result. The method used so far permits the derivation of a score in an objective way but these scores have not been sufficiently validated to allow an automatic conclusion on the result. Errors classified as "critical" or "significant"



Point Lepreau Generating Station Simulator

have also been defined to assist in making the assessment as objective as possible. As things stand now, the subjective judgment of the Examiners is very important in the determination of the final results. While it is generally recognized that when undertaking human performance evaluations it is not possible to devise a completely objective assessment method, it is believed that after the two year introductory period, enough data will have been collected to rely rather more on the assessment scores. An independent validation study of this aspect and of the entire test procedure for the CRO is presently being coordinated by the AECB Human Factors specialists.

Even though difficulties have been encountered, simulator-based examinations have advantages that make them clearly an improvement. First, it must be remembered that their introduction has permitted the AECB to eliminate from the written specific examinations the questions that asked candidates for the actions and checks they should perform in response to various plant upsets. These questions made up a significant part of the examinations and, even though it was not intended, led to considerable effort and time being spent during training memorizing procedures. The simulator-based examinations offer the possibility of assessing directly the candidates' abilities to translate knowledge and skills into realistic performance and, more importantly, they allow the time previously spent in training memorizing procedures to be channelled into improving performance.

As already mentioned, based on the early experience, the simulator-based examinations were found to generate important positive side effects. While it would be unfair to claim that these positive effects are due exclusively to the introduction of simulator-based examinations it is clear that they contributed significantly. Clarifications of various issues such as shift complement and improvements to the operating documentation have resulted at all stations just as the early experience had shown at the first. Such clarifications have been obtained on numerous other aspects related to station operation but the very important advantage that all these improvements manifest is the increased involvement of station line management. It is clear that staff training can only benefit from the more active participation of management which *inter alia* leads to better guidance and clearer expectations for the training activities. The regulatory simulator-based examinations foster and facilitate this participation because the regulators insist that the candidates be tested against station expectations.

The simulator-based examination process requires and has resulted in more frequent communications between utility staff and AECB examiners. These communications have been beneficial to both the utilities and the AECB through the introduction of improvements in training, and in making adjustments to the regulatory examinations that enhanced their effectiveness and fairness. For example, additional simulator malfunctions have been suggested by AECB Examiners which, after having been verified for examination purposes, can now be used for training purposes. On the other hand, utility staff have provided information which facilitated test scenario design and development and which contributed to the fairness of the examination by ensuring

that station expectations were well-reflected in the examiner's guides.

5. Summary

The difficulties that have been associated with regulatory examinations, for both the utilities and the regulators, are being resolved by changes on several fronts. These changes take into account developments in the training field over the last decade, particularly the availability of full-scope simulators at all stations, the possibility of complementing direct regulatory with training program evaluation and the importance of continuing training and requalification testing. All the changes are being introduced after close consultation with the utilities mainly through discussion in the SIU/R WG and its working subgroups.

When the changes are complete, the direct regulatory examinations which, in 1992, comprised five written tests lasting a total of seventeen hours, will be reduced in a few years to two tests for CRO candidates lasting about half the time. SS candidates will have to pass one additional written examination addressing their specific knowledge requirements and duties. The utilities will be expected to hold formal written examinations of their own as well as make changes to their training programs which will be evaluated by the AECB.

The main change to regulatory examinations is the introduction of routine simulator-based testing which occurred in 1993. These examinations have enhanced regulatory assurance of SS and CRO competence by checking the performance capabilities of the candidates; the test procedure is tuned to the utilities' training programs; they have resulted in spin-off operational safety benefits; and, not the least, were conducted in a fair and even-handed manner. An introductory period of two years which is in place calls for additional checks to be made on the process to ensure its effectiveness and fairness. The main difficulty has been with the testing of multi-unit SSS and efforts are under way to resolve this issue.

The introduction of this regulatory simulator-based testing of SS and CRO candidates has been a considerable success. This has been due quite simply, to the high degree of consultation and cooperation that has taken place between the AECB and the utilities. As it pursues its initiatives towards a progressive, new regulatory regime for operational personnel training and qualification, the AECB will continue the practice of close consultation with the utilities and will count heavily on their co-operation.

6. References

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2. AECB, Operator Certification Division Procedure, OCD-ST6, Simulator-based examinations, 1993.
3. Letter from R. Thomas dated 9 June 1992, The new station-specific written examinations for 1993.
4. Competency Assessment of Reactor Operator Candidates Using Full-Scope Simulators: The Emerging Canadian Regulatory Approach; Turcotte, G. and Vachon, A.; CNS Annual Conference, 1992; St. John, N.B.

Energy Probe Loses Nuclear Liability Act Challenge

In a judgement released March 23 Justice Blenus Wright dismissed the action taken by Energy Probe, City of Toronto, and Rosalie Bertell against the Government of Canada back in 1987 concerning the Nuclear Liability Act. The plaintiffs charged that the NL Act was unconstitutional, infringed on the Charter of Rights and Freedoms and on the Canadian Bill of Rights.

Ontario Hydro and New Brunswick Power were intervenors in the case.

Not only did Judge Wright dismiss all actions brought by the plaintiffs he also awarded legal costs of the defendant and the intervenors. It has been estimated that these might amount to \$1 million or more.

Following are some excerpts from Judge Wright's "reasons for judgement".

The Nuclear Liability Act (N.L.A.) passed by Parliament limits the liability of an operator of a nuclear plant to \$75 million for all claims arising from a nuclear incident.

The parties agree that the possibility of a nuclear incident in Canada exists, and in the event of an incident the damages could exceed the \$75 million limit.

The plaintiffs request declarations declaring certain sections of the N.L.A. unconstitutional.

The plaintiffs claim that the N.L.A. is legislation in relation to property and civil rights in a province; therefore, the enactment of the N.L.A. is beyond the legislative powers of Parliament.

The plaintiffs claim that limiting the liability of operators of nuclear plants results in an increased risk of nuclear incidents and less safety in the operation of nuclear plants which infringes "the right to life, liberty and security of the person" set out in Charter section 7.

The plaintiffs further claim that the limitation of liability for a nuclear incident infringes Charter section 15 equality rights. They allege that in the event of a nuclear incident victims would be treated differently than victims of other incidents who have full resort to the court system for all claims for damages.

In addition, the plaintiffs claim that the N.L.A. infringes sections 1(a) and 2 (e) of the *Canadian Bill of Rights*.

The pertinent provisions of the N.L.A. for the purpose of this case are:

- The operator of a nuclear plant is absolutely liable for damages caused by a nuclear incident.
- No other person is liable for damages caused by a nuclear incident (i.e. contractors, suppliers, consultants).
- Claims for damages under Part I must be brought within three years of the knowledge of the damages and in no case shall any action be brought after ten years from the date the cause of action arose.

- The operator is required to maintain insurance in the amount of seventy-five million dollars.
- Where the Governor-in-Council is of the opinion that an operator's liability could exceed seventy-five million dollars, or it is in the public interest to provide special measures for compensation, a proclamation would issue, the effect of which would be to stay court proceedings and place the determination of compensation in the hands of a Nuclear Damage Claims Commission.
- Except as otherwise authorized by Parliament the total compensation shall not, in respect of any one nuclear incident, exceed seventy-five million dollars.

Division of Powers

Subject Matter of Legislation

The plaintiffs contend that the N.L.A. is legislation in relation to "Property and Civil Rights in the Province", under section 92.13 of *The Constitution Act, 1867* and, therefore, *ultra vires* the Parliament of Canada.

Briefly stated, the plaintiffs' position is: the main purpose of the N.L.A. is to shield nuclear operators and suppliers from civil liability with a secondary purpose of providing compensation for victims of any nuclear incident. Those purposes, the plaintiffs maintain, do not come within any valid federal objective. The N.L.A. makes incursions into provincial jurisdiction, for example, the displacement of civil claims for compensation and the limitation of access to adequate funds for victims are incursions which are not essential to any federal objective.

I disagree with the plaintiffs' characterization of the purpose of the N.L.A. The plaintiffs have over-emphasized the effect of the N.L.A., which is to shield nuclear suppliers from civil liability and to limit the absolute liability of the nuclear operators.

"Without [the N.L.A.] the industry would not exist today."

The chief purpose of the N.L.A. is to facilitate the development of nuclear energy for peaceful purposes. Without such legislation, and the indemnities which preceded it, the industry would not exist today. The thrust of the evidence on this issue amply supports this interpretation. Due to inherent risk associated with nuclear power the federal government faced certain problems in developing nuclear energy for peaceful purposes. Nuclear suppliers and operators expressed concern as to their potential liability, the fact that insurance coverage was not available in the amounts necessary for the possible consequences of a nuclear incident, and its own concerns for providing compensation to potential victims of

a nuclear incident. The N.L.A. was enacted to meet those concerns.

Without the provisions of the N.L.A. the development of atomic energy for production of electricity would not have proceeded and the continued operation and maintenance of nuclear reactors would be in jeopardy.

From the inception of the atomic energy industry suppliers and operators have demanded indemnification from liability. Initially, contractual indemnification sufficed until legislative protection was demanded.

From the commencement of the trial I have had reservations about the justiciability of the issues in this case. Having completed thirty days of trial with 1092 exhibits filed, I am still haunted by thoughts that this case as presented is not a proper case for adjudication. The plaintiffs' claim is premature, speculative and hypothetical at this point in time.

The plaintiffs' case was unfocused. Much of the cross-examination of the defendants' and intervenors' witnesses was irrelevant. The plaintiffs' three-volume written argument was disorganized and not in the format of a proper written argument. The lack of cohesiveness in the plaintiffs' case I believe is not due so much to the inexperience of counsel as to the formidable task of proving their claims.

"The plaintiffs' case was unfocused – the argument disorganized."

As I understand the plaintiffs' case, the main contention is that in the event of a nuclear incident with catastrophic consequences, victims would be denied access to the court system to prove their damages and, because of the limit on liability, victims would not be adequately compensated for the damages suffered.

But, unless a nuclear incident causes damages beyond \$75 million, victims do have access to the court system. Even with damages beyond \$75 million there can be no determination as to the adequacy of compensation. The N.L.A. leaves the government with a discretion to compensate victims beyond the \$75 million limit. The end result may afford victims more compensation through the N.L.A. than they would receive through the court system.

Charter Section 7

Section 7 reads:

Everyone has the right to life, liberty and security of the person and the right not to be deprived thereof except in accordance with the principles of fundamental justice.

The plaintiffs maintain that members of the public are deprived of security of the person on two levels: the activity level and the care level.

Activity Level

Activity level is terminology used by the plaintiffs to describe the existence of nuclear reactors which because of their inherent danger pose a risk to the public. Since the N.L.A. fosters development of nuclear reactors, the N.L.A. is the cause of increased risk to the public.

I have great difficulty with a proposition that would bring

a government policy decision concerning use of nuclear power within the scope of section 7. The government decided to develop atomic energy for peaceful purposes, one being to generate electricity by the use of nuclear power. The government was well aware of the inherent risks but, in its wisdom, proceeded with fostering the development of nuclear reactors by enacting the N.L.A. to deal with the economic consequences of the known risks to the public. Those policy decisions cannot invoke section 7.

Furthermore, the plaintiffs have failed to prove that increased use of nuclear power increases the risk to security of the person. Electricity is produced by various uses of natural resources to produce power: for example, coal and gas, which also have their impact on the environment. The plaintiffs have not provided evidence to show that there is a greater risk to the public of producing electricity by nuclear power than by alternate methods.

Care Level

Care level is the terminology used by the plaintiffs to allege that the limit of liability under the N.L.A. diminishes incentives for safety on the part of the operator of nuclear reactors, which means that nuclear reactors are operated less safely, increasing the risk to the public of a nuclear incident.

As a general proposition it may be that less liability results in less incentives for safety. But, that proposition depends on the activity involved and the surrounding circumstances. For example, it could be said that the mandatory insurance coverage required for owners of automobiles tends to allow drivers to drive less safely; if owners and drivers were personally liable for all damages caused their negligence they would tend to drive more safely.

In the case of nuclear plants, consideration must be given to the incentives of operators and the role of the regulator in the safe operation of nuclear reactors.

The plaintiffs' "less liability, less incentives for safety" argument does not prove the plaintiffs' case. There are a number of explicit incentives for safety for nuclear plant operators which more than offset any implicit incentives for less safety. Explicit incentives for safety include the concerns: for the health and safety of employees who work at the plants, loss of the operating license, loss of public confidence, and possible financial loss. Ontario Hydro is self-insured for property damage with an estimated current book value of its nuclear plants ranging from \$1 to \$14 billion. These are significant incentives for operators to operate reactors safely. Of prime importance is the role of the AECB in regulating safe operation.

"I have struggled to find the facts."

Herein lies the crux of the case, where the plaintiffs have difficulty providing the evidence upon which to make the finding the fact, and where I have struggled to find the facts to make the declarations sought. Throughout this case I have been looking for something concrete, some hard facts which support the plaintiffs' position.

The problem stems from trying to apply, to the operation

of nuclear reactors, the legal term "standard of care" which is taken from other contexts of tort liability such as driving a car or maintaining a highway. The standard of care required of the reasonable person in those contexts is familiar. But what is the standard of care in operating a nuclear reactor? As counsel for the plaintiffs admitted in oral argument, "We don't know the level of safety that is appropriate."

What is clear from the evidence is that: the operator of a nuclear reactor is under a duty to operate the reactor safely, the AECB as regulator issues licences to operators, and oversees the operation of nuclear reactors and has authority to shut down reactors if, in its opinion, there are safety concerns.

Nuclear reactors have operated safely in Canada since 1962 generally, and since 1976 under the N.L.A. I heard no evidence describing the standard of care for the operation of a nuclear reactor, nor was any evidence presented to show that nuclear reactors in Canada are not operating safely.

No direct evidence was presented that the N.L.A. has had any effect on the safe operation of nuclear reactors. Of the 1,092 exhibits filed there is no hint that the N.L.A. was ever considered in any safety decisions made by either the operator or the regulator. When officials of the operator and regulator were questioned as to any role played by the N.L.A. in their decision making process, the answers were all negative.

Assessment of the Alleged N.L.A. Link to Safety

The plaintiffs list a myriad of other issues which they claim involve less safety because of the N.L.A.: backfitting; containment; fuel shift problem; maintenance backlogs; pressure tube problems; seismic hazards; etc.

"I find that the plaintiffs have failed to prove that the N.L.A. has caused less safety."

This judgment would become voluminous if I addressed the arguments on both sides of all the safety concern issues raised by the plaintiffs. I see no point in so doing because I find that the plaintiffs have failed, on a balance of probabilities, to prove that the existence of the N.L.A. has caused less safety in the operation of nuclear reactors which has resulted in increased risk to the public.

Principles of Fundamental Justice

No one is to be deprived of a Charter s. 7 right, "except in accordance with the principles of fundamental justice." In the event of a nuclear incident causing injury and damage, injured persons, if the N.L.A. was not enacted, would have the right to commence an action against anyone who caused or contributed to the injuries and damages. Because of the N.L.A. members of the public are denied access to the courts to seek compensation if the damages from the incident could exceed \$75 million or the Governor-in-Council decided it was in the public interest to provide special measures for compensation.

I believe it to be fundamentally just for a government that

decides to use atomic energy for peaceful purposes knowing the inherent risks, to enact legislation which gives the Governor in Council authority in the event of a nuclear incident to act in the public interest by providing for special measures for compensation. Such a decision exchanges the court system of compensation for a better compensation scheme.

I suggest that these special measures for compensation fit in with "our societal notion of justice"... "in a manner which yields an understandable result", and which "would have general acceptance among reasonable people", and, therefore, any deprivation of section 7 rights would be in accordance with the principles of fundamental justice.

The N.L.A. could be characterized as a policy decision of government which does not attract the principles of fundamental justice.

The plaintiffs argue that there is no guarantee that the federal government would pay any compensation beyond \$75 million. I find it inconceivable, and believe it would be political suicide, for the federal government not to pay reasonable amounts of compensation beyond \$75 million in the event of a nuclear incident causing damages above that amount.

A federal government which in its wisdom decided to harness nuclear energy for the purpose of generating electricity, and which in its wisdom enacted the N.L.A. placing limits on liability, and in its wisdom left the door open so it could decide to pay amounts over \$75 million, would in its wisdom pay out reasonable amounts beyond the \$75 million limit. As plaintiffs' counsel remarked, it would be "outrageous" if the government did not compensate beyond the \$75 million.

For the above reasons the N.L.A. does not in-fringe Charter section 7.

Charter Section 15

15.(1) Every individual is equal before and under the law and has the right to equal protection and equal benefit of the law without discrimination and, in particular, without discrimination based on race, national or ethnic origin, colour, religion, sex, age or mental or physical disability.

The plaintiffs claim that persons living close to a nuclear reactor are more susceptible to sustaining injuries because of the risk of a nuclear incident. They therefore suffer discrimination by bearing the burden of the production of electricity by nuclear power while others living farther away enjoy only the benefits.

They also claim that in the event of a nuclear incident, persons injured suffer discrimination due to the time and monetary limitations of the N.L.A. in comparison to persons who are injured by other causes and who have access to the full remedies under the court system.

The plaintiffs have failed to substantiate their allegation of discrimination under section 15(1). Section 15(1) cannot be invoked to protect a hypothetical class of persons, i.e., "potential victims of a nuclear accident." Such a hypothetical group is clearly not a "discrete and insular minority" that can point to a historical experience of discrimination such as

to warrant protection under section 15(1).

"The N.L.A. does not discriminate."

The N.L.A. does not discriminate on the basis of an enumerated or analogous ground protected by section 15(1). Any distinctions created by the Act relate to the type of accident suffered, not to anything personal to the victims or related to the immutable traits of individuals.

The plaintiffs contend that a nuclear accident will deprive Canadians of the right to enjoyment of property without due process of law. Paragraph 1(a) of the *Canadian Bill of Rights* does not guarantee an absolute right to the enjoyment of property. Rather, it protects an individual from being deprived of that right, except by due process of law. "Due process" constitutes procedural fairness; it does not grant a substantive right. In the event of a nuclear accident, Part II of the N.L.A. establishes a qualified panel for the express purpose of hearing claims for compensation against losses, including property. The exact rules of proceeding will not be known until Part II of the Act is brought into force, and, to this extent, the plaintiffs' challenge is premature.

The plaintiffs maintain that the N.L.A. violates paragraph

2(e) of the *Canadian Bill of Rights* because it fails to provide a "right to a fair hearing" and an appropriate compensation scheme. Paragraph 2(e) guarantees the determination of an individual's rights and obligations in the context of a fair hearing: it does not guarantee a right of access to a court of law, nor does it provide an absolute right to compensation. Since the rules of proceeding and the amount of compensation will not be known until Part II of the N.L.A. is brought into force, the plaintiffs' argument is, once again, premature.

Result

The plaintiffs' action is dismissed. I express my appreciation to counsel for the defendant and the intervenors for their well-prepared written arguments which facilitated the writing of this judgment.

Costs

There are no special circumstances which warrant a departure from the general principle that costs should follow the event. The defendant and intervenors have their party and party costs after assessment.

19th Annual CNA/CNS Student Conference

Ed. Note: *The following account is based on a report by Paul Bekeris, chairman of the student organizing committee for the 19th CNS/CNS Student Conference.*

Paul Bekeris

About 80 delegates from Manitoba to New Brunswick (with an "international" contingent from MIT) gathered at the University of Toronto, March 18 and 19, 1994, for the 19th annual CNS/CNS Student Conference. All involved agreed that it was a great success.

Hosted by the Department of Chemical Engineering at U of T the conference was organized by a 14 member undergraduate and graduate student committee from both the Departments of Chemical Engineering and Engineering Science (Nuclear and Thermal Power Option).

Over the two days the delegates heard 38 high quality papers at the Bachelor's, Master's, and Doctorate levels. The majority of the participants were from Ontario universities, however the conference was enhanced by delegates coming from as far as Manitoba and New Brunswick. The conference was also fortunate to have an international flavour with delegates from MIT participating. The sessions focused on a wide range of topics including iodine chemistry, nuclear equipment and modelling simulations, environment and waste management, radiation health and safety, nuclear physics, nuclear analytical methods, thermohydraulics, and nuclear materials.

Prize categories for best papers were divided into Bachelor's, Master's, and Doctorate categories with first and second place prizes in each. With the universally high quality of the papers the judges had a difficult time deciding the winners.

The Master's category had a tie for first place so three prizes were awarded there.

The winners were:

Bachelor's category: 1st place, Peter Middleton (U.of T.),
2nd place, Winston Pun (U.of T.);

Master's category: 1st place tie, Brita Schulze (McMaster),
Toni Korzan (MIT),
2nd place, Guy De Carufel
(Ecole Polytechnique de Montreal);

Doctorate category: 1st place, G. Naterer (Waterloo),
2nd place, Jeremy Whitlock (McMaster).

Judging was conducted by a four person panel: Ed Price (AECL CANDU, CNS Vice-Pres.); Dr. Jerry Cuttler (AECL CANDU, CNS Vice-Pres.); Dr. John Hewitt (MNR) and Dr. John Luxat (Ontario Hydro). These gentlemen did a highly professional job and took the task at hand very seriously which showed when they were in final deliberations. They were integral to the success of the conference.

The Banquet Dinner had a number of industry guests in attendance, including Dr. Bryan Murdoch (Ontario Hydro Nuclear) who delivered a captivating after-dinner speech. His address was geared towards the nuclear student audience and touched upon the employment prospects of Ontario Hydro, encouraging students not to give up hope for finding employment in this industry. In addition to making some light hearted comments, he painted a picture of what real professionals do at Ontario Hydro on a daily basis by presenting "a few days in the lives of" some real people and situations. He delightfully surprised many by announcing

that Ontario Hydro Nuclear is rejoining the CNA.

Following Dr. Murdoch, Professor Arche Harms (McMaster University) presented a few mementoes from the student conference held 25 years ago at McMaster University. After dinner, students and industry guests alike were invited to go pub hopping, which extended into the wee hours of the morning. The affair was quite enjoyable and relaxing and presented a wonderful opportunity for the delegates to meet and join in some interesting conversation.

The members of the organizing committee were (in alphabetical order): Paul Bekeris, Ana Brito, Christopher Deir, Rajesh Dhoun, Nick Dinadis, Luigi Dipede, Ka Hing Lin, Peter Middleton, Edward Panyan, Raymond Quan, Ross Rock, James Rodgers, Fariborz Taghipour, and Sophia Wang.



Participants of the CNA/CNS Student Conference in March relax at the banquet.

The student committee was responsible for all aspects of organization including fund raising. In addition to the regular financial support provided by the CNA and CNS, the committee was able to raise funds from Canadian organizations and companies with nuclear interests. Additional sponsors included Ontario Hydro Nuclear, AECL CANDU, Natural Resources Canada, GE Canada Nuclear, Department of Chemical Engineering (U. of T.), Centre for Nuclear Engineering (U. of T.), Canadian Standards Association, and The Chemical Institute of Canada. The committee gratefully acknowledges the financial support and leadership of all these organizations. It is encouraging to see that these organizations have taken an interest in the affairs and professional development of today's nuclear students.

The organizing committee would like to thank all individuals, named and unnamed, who contributed to the outstanding success of the conference. In particular acknowledgements are extended to Ed Price, Dr. Bryan Murdoch and Dr. Greg Evans (U. of T.), our mentor and supervisor.

Abstracts of the winning papers, where available, are given below:

A. Undergraduate

1st

Two-Phase Fluid Flow Parameters Contributing to Flow-Induced Vibration in Horizontal Flow Through Tube Bundles

Peter B. Middleton, Division of Engineering Science, University of Toronto.

Abstract

Flow-induced vibration problems have afflicted in-service heat exchangers, steam generators and nuclear reactor fuel channels. Such vibrations can potentially lead to fretting wear or fatigue damage of the affected components, leading to reduced service life or failure. In order to assist in preventing damage to operational equipment due to the development of these phenomena, it is necessary to gain further information on the contributing physical factors. Previous experimental and analytical work in the area has concentrated on the mechanical aspects of the vibrational system, treating the fluid media in a spatially averaged, homogeneous manner. This treatment of the fluid problem is inadequate, particularly in horizontal two-phase flow situations where significant spatial variations in the flow parameters are experienced.

An experimental study has been undertaken to investigate vibrational behaviour in horizontal tube bundles. Selected tubes are fitted with piezo-electric accelerometers to record vibration response. Two-phase flow is simulated through the use of an air/water mixture. The fluid mass flow rate, and volumetric ratio of injected air flow rate to total fluid flow rate can be varied. The study will attempt to correlate the tube vibrational response, characterized by the RMS acceleration amplitude and damping ratio, with various flow parameters, measured in the vicinity of the instrumented tubes. The measured flow parameters include the local dynamic pressure fluctuations, and local void fraction. The vertical level of the measurements within the bundle can be varied by rotating the test section.

The local void fraction measurement is obtained through the use of a point probe, which relies on the difference in electrical conductivity between the gas and the liquid components of the flow. A computer data acquisition system is used to continuously sample the signal from the probe for a number of seconds. The signal is then processed using an averaging technique to obtain the local void fraction at the point where the probe tip has been placed in the test section. Further processing of the void probe signal yields Probability Density Functions of the void fraction which can be used to characterize the flow regime as being bubbly flow, slug/churn-turbulent flow, or annular-dispersed droplet flow.

It is hoped that by establishing these void fraction measurements at varying horizontal levels in the test section over a variety of mass fluxes and homogeneous void fractions, an overall pattern of flow regimes can be constructed. Such a mapping, in conjunction with the measured vibrational response of the instrumented tubes, can be used

to identify potentially severe vibration situations. The paper presents preliminary results of this study.

2nd

Liquid Film Behaviour in Countercurrent Annular Flow

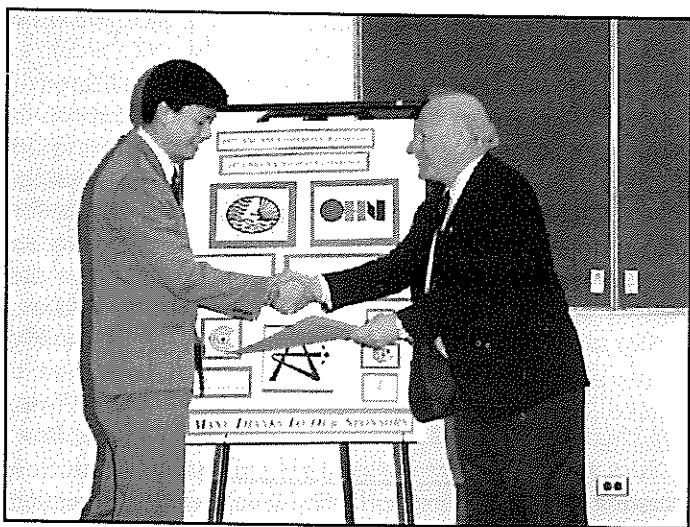
Winston Pun, Division of Engineering Science, University of Toronto.

Abstract

A potential Loss-of-Coolant Accident (LOCA) in a nuclear reactor requires rapid replenishment of the coolant. Emergency coolant may be prevented from reaching the core by a phenomenon known as flooding. This is caused by the boiling of coolant in the core, which produces a strong countercurrent gas flow, limiting the downwards penetration of liquid. The mechanism that causes flooding has never been fully understood, despite over thirty years of research (Hewitt, 1963). Previous studies (Tien and Liu, 1979) which are based on average fluid velocities, have not provided accurate and reliable estimations of the interfacial and wall shear stresses. The objective of this experimental work is to provide new data on this subject. A flow loop was designed and constructed to obtain this information.

A photochromic dye activation (PDA) technique is used to obtain velocity profile data for a thin falling liquid film with a countercurrent gas flow. An ultra-violet (UV) laser produces traces in the test fluid. A high speed video camera obtains images of the liquid film containing the traces, which are subsequently digitized and processed to yield instantaneous velocity profiles. With reliable velocity profile data, an accurate estimation of the wall and interfacial shear stresses can thus be made.

Preliminary results show that a relation proposed by Bharathan and Wallis (1983) significantly underpredicts the wall shear stress. Further analysis must still be undertaken to estimate the interfacial shear stress, however it is clear that current two-fluid prediction models must be revised.



CNS Vice-president Ed Price (R) presents the Bachelor-level second prize to Winston Pun at the CNA/CNS Student Conference March 19th in Toronto.

B. Masters

1st (tie)

Synthesis of PET tracers by C-11 Acylation reactions

Brita G. Schulze, Brian E. McCarty, Günter Firnau, Department of Radiology and Nuclear Medicine and Dept. of Chemistry, McMaster University.

(abstract not available)

Application of a Passive Electrochemical Noise Technique to Localized Corrosion of Candidate Container Materials

M.A. Korzan, S.A. Simonson, Department of Nuclear Engineering, Massachusetts Institute of Technology.

(abstract not available)

2nd

Simulation of Two-Phase Flow up to Critical Heat Flux in Tubes

Guy de Carufel, Ecole Polytechnique.

(abstract not available)

C. Doctorate

1st

Anisotropic Permeability Model of Casting Processes for Nuclear Waste Management

G.F. Naterer, University of Waterloo, Canada

Abstract

A mathematical and numerical procedure for binary metal alloy casting simulation is presented. An anisotropic permeability model for multiphase mass-momentum transport processes is developed and applied to Pb-Sb solidification processes. The Isotherm Gradient (IG) model incorporates pressure loss effects due to interdendritic crossflow processes. The effects of the flow and isotherm directions on the phase front propagation and distortion as well as the species segregation are discussed.

2nd

Estimates of Relative Change in Axial Leakage due to Voiding in a CANDU Reactor

Jeremy J. Whitlock, Dept. of Engineering Physics, McMaster University.

Abstract

The Monte-Carlo method and a deterministic method are used to estimate the relative perturbation in axial leakage from a lattice cell upon instantaneous coolant voiding. Results are grouped into four energy bins.

Reorganization at Ontario Hydro

The AMPCO Perspective

Ric Fluke

Arthur Dickenson, president of the Association of Major Power Consumers in Ontario (AMPCO), gave a mixed message in his address, January 25, 1994, to the CNS Public Seminar Series held at the University of Toronto.

He blasted Ontario Hydro's past performance as a utility "out of control", and outlined the reasons why AMPCO had pressured Hydro to change. He then criticised the change that had taken place, noting that the resulting reorganisation deviated from that recommended by Hydro's own Task Force on Change. But at the end of his talk, he praised Hydro for its efforts to reestablish a stable rate structure and for its willingness to listen to the customer. It was not clear just what is AMPCO's position on Hydro's reorganisation, perhaps because it is taking a wait-and-see approach while monitoring the effects of the change.

Blasting the Past

Mr. Dickenson, who holds a M.Sc. in Mathematics and Statistics, began by presenting the statistics on Hydro's performance between 1987 and 1992. Quoting from Annual Reports, primary energy grew by six percent, from 126 TWH to 134 TWH. During the same period, regular staff grew by 19%, OM&A (Operations, Maintenance and Administration) costs soared by 96% and government levies skyrocketed by 200% (including \$109 million for "annual water rental"). Revenues increased by 47% during this period, far short of the swelling costs, while user rates increased annually at more than double the rate of inflation. For industrial users rates since 1990 have soared by 33%. Clearly, a degree in maths and statistics is unnecessary to conclude Ontario Hydro had some explaining to do! (To be fair, Mr. Dickenson should have noted the rate increase includes 7% for GST imposed since 1992, although it only makes a small dent in his argument.)

"Darlington is being used as a scapegoat for Hydro's overspending in other programmes"

According to Hydro, the reason for the "rate shock" was Darlington coming on line. (Capital costs can not be applied to user rates until the project is in service, and interest charges spiralled because construction was prolonged during a period of record high interest rates.) But using data supplied by Hydro during the OEB rate hearings, Mr. Dickenson showed that Darlington's costs should have been recovered, by 106%, by 1992, and by 156% by 1993. He speculated that Darlington was being used as a scapegoat for Hydro's overspending in other programmes.

Despite rate increases well in excess of inflation, Hydro contends its rates are competitive with the U.S. Not so, according to Mr. Dickenson. He noted that rate comparisons

are made with New York rather than average American states. He used Hydro's own comparison of 1992 electricity bills to show Ontario ranked near the middle, meaning half of the states had lower rates than Ontario.

He then produced the Motor Vehicle Manufacturers Association rates comparison, which also shows Hydro's deteriorating position. Ten years ago, Hydro's rates were 48% of the average of US rates; in 1993 it was 98%. He claims that high electricity rates are a major factor in automobile manufacturers recent decisions to move from Ontario to the U.S. (Ontario Hydro did not increase rates in 1994, so this comparison may improve if American utilities raise their rates.)

Criticising the Change

Mr. Dickenson gave a brief recap of the changes at Ontario Hydro since Maurice Strong took over and "did the right thing". A "Task Force on Change" was immediately established and given 60 days to recommend how the utility should be restructured. AMPCO was invited to make suggestions to the Task Force.

The Task Force recommended a completely new organisation. It proposed that the New Ontario Hydro should have three groups: the Electricity Company; Ontario Hydro Enterprises; and, the Energy Services Company. The rationale was to separate major business activities to make them more independent and accountable, based on business principles with accountable managers, and to facilitate more appropriate decentralisation of support services.

"Hydro may become a vehicle for ...environmental missionaries..."

But, what was implemented was not the Task Force recommendations. Using the new Organisation Chart, he showed that the Energy Services Company came out as Energy Services and Environment Group, and he emphasized the word "Environment". In the Task Force's recommendation, each group in the organisation was to be accountable for environmental issues; but the change puts environment as a high corporate priority, in line with an agenda for a "Sustainable Energy Development Plan". Mr. Dickenson's concern is that the shift in priority may "drive the utility in the wrong direction".

Backing his concern, he quoted Hydro's new mission statement:

"To help Ontario become a world leader in developing an energy efficient and competitive economy and a leading example of sustainable development,"

compared to the original Hydro mission:

"To meet the requirements of the Ontario community for electric service, including the manner of its provision, so as to result in the greatest overall benefit to that community and in the greatest value to the customer for that service over the long term."

He reflected AMPCO's serious reservations about a mission statement that does not include the company's primary product – electricity. Does this mission apply to oil companies as well? Hydro may become, explained Mr. Dickenson, "a vehicle for the government and environmental missionaries to exert inappropriate pressure on electricity users through rates to meet its sustainable development goals." Backing his concerns, he cited some past examples of Hydro being used, "as a means of achieving social engineering objectives". Subsidies paid to Elliot Lake were a recent example cited. Although AMPCO supports sustainable development, it opposes programmes that add to the cost of electricity.

Mr. Dickenson claimed Hydro only partially followed the Task Force's recommendation that the Electricity Group be decentralised, accountable and functionally independent, and that the Energy Services Company be a distinct and separate business. This is because the Energy Services and Environment Group now controls customer relations and rate structures, policies on NUGs (Non-Utility Generation) and environmental policies. Hence, the Electricity Group can not operate as envisaged by the Task Force. Mr. Dickenson also questioned whether the increased emphasis on environmental activities is warranted, noting the more practical approach proposed by the Task Force. Such a comment is significant coming from someone who was the former Director of Consumer Affairs for the Ontario Ministry of the Environment.

"It is bizarre to make [Demand Management] a high priority"

He then lashed out at the Energy Services policy of criticising the customers' use of electricity, rather than looking more critically at its own operation. He quoted the Chairman's introduction to the report on Sustainable Energy Development:

"Ontario is one of the least energy efficient economies in the world, forcing our exporters to compete with one hand tied behind their backs."

This is simply wrong, according to Mr. Dickenson, and AMPCO resents such statements. He said, in reality, it is the utility that has been inefficient due to lack of competition. He explained there is no evidence to support Mr. Strong's assertion; on the contrary, Ontario is a leader in energy efficiency. He said the report is a "classic example of confusing energy intensity with energy inefficiency."

Mr. Dickenson turned his attention to Demand Management. It is bizarre, he said, for Hydro to make it a high priority to pay its customers to use less of its product. To make matters worse, Mr. Dickenson explained that the

Electricity Group pays the Energy Services and Environment Group **twice**; the cost of the programme **plus** the lost revenue. AMPCO members need assurances that funding demand management will not lead to higher rates. Based on Hydro's new Mission Statement, Mr. Dickenson said, there is a risk that environmental considerations will outweigh sensible business practice.

Mr. Dickenson finished his attack on Hydro by noting it has removed yet another important responsibility from the Electricity Group: the central business planning function, now taken over by Corporate Finance and Public Affairs. He reminded the audience of the intent of the Task Force recommendations, to make separate lines of business more independent and accountable. Hydro has broken away from this model, he claims, "weakening its commitment to creating truly independent business units".

Hope for the Future?

According to Mr. Dickenson, the positive effect of the Task Force on Change was to break up the status quo and its corporate inertia by creating an entirely new company. As a result, OM&A costs are expected to be much lower. He noted the large reduction in staff by 6500 persons. Although Mr. Dickenson feels the cuts were necessary, he expressed concern. Some essential skills were lost, creating shortages in some areas while at the same time staff levels have been frozen. He also criticised the inconsistency in filling internal vacancies, where new blood has been brought in at management levels (citing John Fox, for example) whereas at the professional and union levels, selection is by seniority. He questions whether those selected by seniority have the right skills.

Mr. Dickenson supports further efforts to reduce costs, but he noted disturbing signs within Hydro that mistakes made in the 1980s (cutting back on nuclear plant maintenance to cut costs) might be repeated. According to Mr. Dickenson, "it would be tragic if [Bruce 'A'] were sacrificed to meet cost reduction targets". He noted that the current surplus of 2000 – 4000 MW assumes Bruce 'A' is operating, and warned that load growth may rise suddenly.

"It would be tragic if Bruce 'A' were sacrificed"

In closing, Mr. Dickenson expressed optimism for the future. Although Hydro must continue to reduce its costs while providing a reliable supply of electricity, he notes the utility has become more customer oriented and responsive to customer needs. He acknowledges that John Fox is listening to AMPCO's cry not to have to pay for demand management in other sectors, indicating a long needed culture change has begun. He added his personal advice: Hydro must recognise that in a Sustainable Development world, nuclear's role becomes more important.

A flood of questioners ensued. Asked about TVA's zero rate increase over the last five years, Mr. Dickenson explained that TVA was able to write off its capital debt. He noted, however, that electricity supply is much more reliable in Ontario. Again, he stated his personal opinion that Hydro

should not abandon nuclear reliability by cutting back on maintenance.

Asked if AMPCO had any preference for nuclear generation, he conceded his personal opinion that CANDU technology is the best in the world, but AMPCO does not have a preference for how electricity is generated.

He was asked if he was aware of any anti-nuclear sentiments within Hydro, given Maurice Strong's voiced

concerns about nuclear. Mr. Dickenson replied there was none he was aware of.

When asked if he felt there was a competent pool of business talent at the senior levels of Hydro he replied "probably not", but conceded they had good concepts. He also noted the senior levels are subjected to government interference.

A. G. M.

**The Annual General Meeting
of the
Canadian Nuclear Society**
will be held

Tuesday, 7 June 1994, at 1700 hrs
in the

**St. Laurent Room
Queen Elizabeth Hotel,
Montreal, Quebec**

All members are invited to attend

2nd International Steam Generator and

Heat Exchanger Conference

Toronto, Ontario

13 – 15 June 1994

For information or registration contact
the CNS office.

ANNUAL CONFERENCE

**The 15th annual conference of
the Canadian Nuclear Society**

and the

**34th annual conference of the
Canadian Nuclear Association**

will be held jointly in the

**Queen Elizabeth Hotel
Montreal, Quebec**

5 to 8 June 1994

For information or registration
contact the CNA/CNS office.

WORKSHOP*

**Management and Operation of
Nuclear Power Stations Using
Digital Computers**

A workshop on the use of digital
computers in the management and
operation of nuclear power stations
will be held

19, 20 September 1994

at the

**Wu Centre, University of New Brunswick
Fredericton, New Brunswick**

The format will consist of invited papers followed
by "breakout sessions" where attendees and
lecturers can discuss the topics presented.

For information contact: Roger McKenzie
Maritime Nuclear Ltd.
Fredericton, NB
Tel.: 506-453-3186
Fax: 506-453-1356

*Sponsored by: University of New Brunswick
Co-sponsored by: N.B. Power, Canadian Nuclear Society

OH Board Focuses on Nuclear Safety

The Board of Directors of Ontario Hydro has created a committee of the board specifically concerned with nuclear safety.

The new "Nuclear Safety Review Committee" will be chaired by long-time board member, Dr. O.J.C. (John) Runnalls) formerly Chairman of the Centre for Nuclear Engineering at the University of Toronto.

Runnalls informed the April 7 meeting of the Atomic Energy Control Board about the new committee and other steps taken by the OH Board to ensure the safety of Hydro' nuclear plants, in response to the peer review undertaken last fall. That review, which used the evaluation methods developed by the Institute for Nuclear Power Operation, was conducted by an international team of experts.

As well as the new Board committee Runnalls referred to the adoption of a Nuclear Safety Policy, which reads:

Ontario Hydro's nuclear facilities will be operated and maintained in a rigorous and vigilant manner to ensure that the radiological risk to workers, the public and the environment is acceptably low and in keeping with the best practices in the international nuclear community.

Runnalls was joined in the presentation to the AECB Board by Don Anderson, general manager of Ontario Hydro Nuclear and Ken Talbot, Director of Bruce 'A' NGS.

Anderson acknowledged that the re-structuring of Ontario Hydro had led to some problems but assured the AECB Board that there were many signs of improvements.

He pointed out that the staff directly involved in operations and maintenance was "NOT at a historic low" and that under the re-organization resources would be placed where they are needed.

Anderson noted a new corporate Nuclear Safety Directorate, the appointment of Nuclear Safety Managers at each station and the re-vitalization of the internal corporate Nuclear Integrity Review Committee with local NIRCs at each station.

Ken Talbot spoke primarily about the status and future of Bruce 'A' (which is up for AECB re-licensing in June), commenting that the OH corporate decision to "lay-up" Bruce 'A' unit 2 in September 1995 allows greater attention to the other three units. He assured the AECB that unit 2 would be maintained in a safe condition until the lay-up, noting, in an area of particular concern, that there had been no steam generator leaks this year.

He showed data on several areas such as: non-compliances with Operating Policies and Principles; special safety system unavailability; and forced outages; to show the continuing improvement at Bruce 'A'.

As support for his contention that there was a good team spirit at Bruce 'A', despite the major corporate re-structuring over the past year, Talbot was joined by Darcy Wilson from the Society of Ontario Hydro Professional and Administrative Employees and John Haight from the Power Workers Union.

The AECB Board will consider the renewal of the Bruce 'A' operating licence at its May and June meetings.

AECB President Named



In mid-February the Prime Minister announced the appointment of Dr. Agnes J. Bishop as President of the Atomic Energy Control Board.

Dr. Bishop is professor and head of the Department of Paediatrics at the University of Manitoba; head of the Department of Paediatrics and Child Care at the Children's Hospital of Winnipeg, and head of Paediatrics at the St.

Boniface Hospital. She has been a member of the five-member AECB Board since 1989.

Dr. Bishop received a B.Sc. degree from Acadia University in Nova Scotia in 1959 and an M.D. from Dalhousie University in 1964. She was named a Fellow of the Royal College of Physicians and Surgeons in Canada in 1969 and has served on both the Council and the Executive of the College, being named president-elect in 1993.

As well as these appointments Dr. Bishop has sat on

more than 12 boards of directors of different organizations. She has written numerous papers and articles.

The AECB president serves as both the chairman of the Board and as the chief executive officer. At the present time the president is the only full-time member of the AECB Board.

The other members of the Atomic Energy Control Board are:

Dr. Robert N. Farvolden, professor of geology at the University of Waterloo;

Dr. Pierre O. Perron, president of the National Research Council; and

Mr. William M. Walker, former vice-president, engineering, of B. C. Hydro.

The president of NRC is ex-officio member of the AECB under the Atomic Energy Control Act.

There is still a vacancy on the Board since the retirement of Rene J. A. Levesque as president in January 1993.

Sheep vs. BHWP

The sheep on Eugene Bougeois' farm are dying and he blames emissions from the near-by Bruce Heavy Water Plant.

Bougeois appeared at the April 7 meeting of the AECB Board to further his claims that H₂S and SO₂ releases from BHWP had harmed both his sheep and his health.

Bougeois stated that his lamb mortality had reached 50% compared to a provincial average of 8% despite confirmation by Agriculture Canada officials that his farming practices were very good. He also said he had symptoms of central nervous system problems which had been confirmed by doctors at McMaster University.

In both cases the specialists suspected that the cause could be H₂O and SO₂ emissions from the heavy water plant.

Rob Maloney reported on AECB staff studies and commissioned research. AECB staff acknowledged that the health of Mr. Bourgeois and his sheep had been affected "by something" but concluded that there was no correlation with emissions from BHWP which, averaged over hours or days, have been within provincial guidelines. At the level of the releases neither staff nor their consultants would expect any health effects.

AECB research director-general Jim Harvie summed up the AECB staff position by saying that they had spent over \$300,000 on contracted studies plus a large amount of staff time on this issue and felt they had met any responsibility of the AECB. He acknowledged that Mr. Bourgeois and his sheep were experiencing problems but there was no evidence that the BHWP or the AECB licensing standards were at fault.

Changes at AECL

The Minister of Natural Resources announced, March 17, 1994, the appointment of Robert F. Nixon as Chairman of Atomic Energy of Canada Limited.

Nixon was Treasurer of Ontario from 1985 to 1990 and earlier leader of the Ontario Liberal Party from 1967 to 1976. He has a B.Sc. degree from McMaster University and prior to entering politics was a high school science teacher.

On April 10, it was announced that Bruce Howe was stepping down a President of AECL. Dr. Terry Rummery, president of AECL Research, has been named as acting corporate president of AECL.

The Minister has also appointed a two-member team to review the proposal for re-structuring AECL developed by a senior staff task team appointed by Bruce Howe last fall. Members of the review team are: Gordon McNabb, one time Deputy Minister of Energy, Mines and Resources (and a former member of AECL's Board of Directors) and Dr. O.J. C. (John) Runnalls, one time Senior Adviser for Uranium and Nuclear Energy in EMR, formerly Chairman of the Centre of Nuclear Energy at the U. of T. and a member of the Board of Directors of Ontario Hydro since 1981.

Pickering Unit 7 sets world record

On Sunday, April 10, 1994, Unit 7 of the Pickering NGS surpassed the world record for continuous on-line operation of a nuclear power plant. The previous record had been 713 days, 21 hours, which was achieved by the Oldbury 1 unit in the U.K.

Accolades flowed in to the Pickering crew from Don Anderson, general manager of Ontario Hydro Nuclear, from Maurice Strong, Ontario Hydro chairman, and others.

We at the *CNS Bulletin* join with other members of the Association in extending our congratulations to the Pickering 7 crew and all others who helped in this achievement.

Bruce 'A' Unit 2 Lay-Up

Ric Fluke

Ontario Hydro announced, 14 February, 1994, that Unit 2 reactor at the Bruce 'A' NGS would be taken out of service for lay-up in September, 1995, two years earlier than planned.

This is in addition to the moth-balling of two thermal units at Lennox and two at Lambton. (A moth-balled thermal unit can be returned to service within a few months, if needed.) Some capital programme cuts at Bruce 'A' were also announced. The Heavy Water Plant will continue to operate as long as there are external orders for heavy water.

The Bruce 'A' announcement is not as bad as was rumoured or as some employees feared might happen on the anniversary of the St. Valentine's "massacre". In fact, "lay-up" is a technical procedure which prepares a reactor for retubing, and has already been performed at Pickering 'A'. According to Station Director Ken Talbot, lay-up means, "...shutting the reactor down but maintaining it in a preserved state to ensure future flexibility". Mr. Talbot expects the lay-up operation will take an additional year, so that the estimated staff reduction of 220 will not take place before mid-1996.

Although the decision to lay-up Unit 2 is driven by the need to reduce costs by reducing surplus generating capacity, Bruce 'A' unit 2 is most vulnerable because of its deteriorating boiler tubes. The tubes are corroding at a faster rate than normal due to chemical attack caused by a lead shield which was mistakenly left inside one of the boilers during a maintenance procedure.

The rest of the station is unaffected by the decisions. Units 1, 3 and 4 are still planned to operate until 2000, 2008 and 2006, respectively. To minimise the financial impact of the Unit 2 decision, post-1995 depreciation will be written down against 1993 revenue, which will put Unit 2 in a good position to compete with other generating options. The cost of retubing, rehabilitation and boiler replacement is a minimal price for 740 MWe compared to building a new unit, either coal, hydro or nuclear.

President Reports on Year

Ed. Note: At the CNA / CNS Nuclear Energy Winter Seminar, held in Ottawa in February, CNS President Paul Fehrenbach reviewed the activities of the Society during 1993. Following is most of his address.

The Canadian Nuclear Society is the technical society the CNA; and we are in our 14th year of operation. As a technical society, we are a society of individuals, currently about 800 in number and growing, engaged in a variety of occupations throughout the Canadian nuclear industry. We are a national organization, reflecting the national scope of the Canadian nuclear industry, with members from across Canada and with 10 local Branches from Saskatchewan to New Brunswick. We also have a growing number of members offshore, reflecting the increasingly global nature of our industry.

Our primary objective is to provide a forum for exchange and debate of technical information, for both our members and for the nuclear industry at large, and increasingly, for the public. The main vehicles for this information exchange are the many Conferences, Topical Meetings, Seminars, and Workshops which the CNS either organizes on its own, or co-sponsors with other sister societies or groups such as the CANDU Owners Group (COG). These technical activities are conceived and organized by CNS members through our five Technical Divisions of Mining and Manufacturing, Nuclear Science and Engineering, Design and Materials, Waste Management and Environmental Affairs, and Nuclear Operations.

To date, our primary interaction with the public has been through events organized by our local Branches, where high profile speakers are invited to make presentations on issues or topics of current interest, to which the public is also invited. However, our members also participate, on behalf of the the Canadian Nuclear Society, in the preparation of briefs and presentations to various public hearings and panels.

Another extremely important vehicle with respect to information exchange and communications is the quarterly *CNS Bulletin*, which serves as the primary communication channel to our members and to the industry, and which contains not only reports on the many conferences and meetings noted above, but also news reports, articles, and papers of topical interest. The latest issue has just been published, and I commend it to your attention.

In discussing highlights from our recent activities, let me begin with Conferences and Meetings. In May, we held a 2½-day **CANDU Safety Course** attended by about 45 participants from across the industry. The topics discussed included The Origin and Evolution of CANDU Safety Philosophy, Canadian Regulatory Practice, and the transfer of Canadian safety philosophy to operator action. This is an area where the CNS is providing very important training and

development opportunities for the industry, particularly in light of the many changes in personnel occurring within the industry and the need to train a new generation of safety analysts.

The **4th International Conference on Simulation Methods in Nuclear Engineering**, held in Montreal last June, was a three-day conference attended by about 150 specialists and focused on thermal-hydraulics, fuel behaviour, safety analysis, reactor physics and reactor control.

The **International Conference on Rolled and Expanded Joint Technology** held in Toronto last September was organized and sponsored by the CNS, with cosponsorship from ASME and COG. Seventy specialists from around the world attended this conference to share their experience and research results. This was the first full conference on this important joining technology, which is used in a variety of industries. It was an important forum in bringing together the R & D and application experience from a number of different applications, in addition to those in CANDU, and topics covered at this meeting included design, analysis & modelling, joint characterization, tool design, and joint deterioration. This also was a technical conference on a topic which met the particular needs of the Canadian nuclear industry.

And, of course, a final highlight was the very successful **International Nuclear Congress INC'93** last October, which we co-sponsored with the CNA.

This coming year we look forward to an equally exciting lineup of conferences and meetings. In March, we will have the **CNS Introduction to CANDU Chemistry** course, which is a repeat of a very successful course given a few years ago and on a topic which is still very current and important. The annual **Student Conference** will also be held in March, and is this year being organized and hosted by staff and students at the University of Toronto. In June we will have the **CNA/CNS Annual Conference** in Montreal with the theme "Power and the Future Generation," as well as the **CNS Steam Generator Conference** in Toronto, which is on a very timely topic for the nuclear industry. The **Third International Conference on Containment Design and Operation** will be held in Toronto in October, and is expected to be every bit as successful as the last conference in this series in 1991. We are also organizing the **19th Annual Simulation Symposium** to be held in Chalk River this fall, and are participating in the planning of a workshop on **Computers in Nuclear Plant Operations and Maintenance** at the University of New Brunswick being organized by the Centre for Nuclear Energy Research at UNB.

Incidentally, we welcome and encourage AECB staff participation at our meetings and seminars. We believe it is important that the technical issues within our industry are debated and discussed openly in a technical forum such as those we offer, to ensure that the recommendations we are

all helping to formulate are based on the most current and reliable technical understanding. I would hope that the current AECB policy preventing its staff from joining the CNS can be reviewed, so that they can play a greater role in the technical exchange activities of the CNS.

All ten of our local Branches are active, and have attracted some very high profile speakers to their public presentation programs over the past year, including Dr. Margaret Maxey, Dr. Roslyn Yalow, and Mr. Bruce Howe, to name a few. The Branches are also becoming more active in **community activities**, particularly associated with local and regional educational systems, e.g. in providing speakers for high schools, in assisting with development of science experiments for high school courses, and in sponsoring prizes at science fairs and graduation exercises. A number of our members are also active in the **outreach program** initiated by the CNA, and for which the CNS is pleased to have become a formal sponsor. This is all part of our objective to increase the public profile of the CNS, and to become a more effective public voice in support of the many benefits provided to society by nuclear technology.

We also look forward to continuing our activities on the International stage through organizations such as the **International Nuclear Societies Council** and the **Pacific Nuclear Council**. This past year we participated in the formulation and adoption of a Global Creed for members of the worldwide nuclear industry, and are currently working with international colleagues on a declaration on Nuclear Science and Technology in Support of Sustainable Development, and on a statement of our vision of the next fifty years of nuclear energy.

Another highlight I would like to mention concerns the honours and awards which have been established by the the Canadian Nuclear Society. This past year, the **CNS Innovative Achievement Award**, created to recognize a "significant innovative achievement in the implementation of new concepts in the nuclear field in Canada" was presented to **Dr. Dé Groeneveld** of AECL Research Chalk River Labora-

tories for establishing and implementing a method for unifying and utilizing Critical Heat Flux data in thermalhydraulic analysis codes such as those used for thermalhydraulic analyses of nuclear reactors. We also bestowed the honour of **Fellowship in the CNS** to four worthy recipients this past year in recognition of "their major sustained contributions to the advancement of nuclear technology in Canada." **The new CNS Fellows named in 1993 are Dr. John Foster, Dr. Terrence Rummery, Mr. Ken Talbot, and Mr. Alan Wyatt.** I should also point out that the CNS Honours and Awards Committee is currently inviting nominations for this year's awards, and I encourage you to put forth the names of those you feel worthy of recognition.

Another very important highlight that has just occurred is the formation of the new **Nuclear Operations Division**. This Technical Division has been formed in response to interest from a growing number of members and potential members involved in the operation of nuclear facilities, and in recognition of the importance of operations in our industry. Like other CNS Technical Divisions, the new Nuclear Operations Division will concentrate on organizing and presenting conferences, workshops, seminars, etc., of particular interest to those involved in the operation of nuclear facilities. An early task will be to plan for the next CANDU Maintenance Conference scheduled for 1995. We have obtained support from senior "sponsors" in a number of the key operating facilities, and are currently in the process of establishing the first executive committee for this Division.

Finally, let me close with an appeal. To maintain the level of valuable technical information exchange, peer review, training, and career development services we are providing to our industry, we need the help of employers in the industry to first encourage their employees to become members in the Canadian Nuclear Society, and second to provide support for them in planning and participating in CNS activities. It is a win/win/win situation for employers, employees and the industry.

Branch News

Chalk River

The Chalk River Branch has had an active season with monthly meetings as well as other activities.

On January 27, Len Hopkins, M.P. for Renfrew Nipissing gave a talk on, "Science: An International Language".

Just two weeks later, on February 9, Beth MacGillivray, of the Ottawa General Hospital, spoke to the CNS and CIC on "Radioisotopes in Nuclear Medicine".

Then on March 14, Dr. Gerry Lynch, AECL vice-president for marketing and sales, outlined the historical development of marketing programs in AECL Research.

Scheduled for April 20 is J. Kramer of the Whiteshell Laboratories, who will present a paper on "The Cigar Lake Analogue Study, and on May 19 R. Mitchell will speak on, "What Determines the Risk ?". The latter talk will be given

at Algonquin College in Pembroke.

The Branch is participating in the "Science for Educators" Seminar which will be held in Pembroke and CRL, April 14 to 16, and has contributed \$100 to the Renfrew County Regional Science Fair.

Ottawa

Even though members of the AECB are not allowed to join the CNS (because of its relationship with the CNA) the February 8 meeting of the Ottawa Branch was held in the AECB Board Room. Dr. David Rogers of the National Research Council gave an interesting talk on "Monte Carlo Simulation: From High-energy Physics to Clinical Physics". After explaining the use of Monte Carlo techniques for determining the penetration and scattering of photons, he



Jerry Cuttler (R), CNS vice-president, confers with Ottawa Branch chairman Jeff LaFortune, March 29, after giving his third talk in two days to CNS branches in Saint John, Montreal and Ottawa.

spoke primarily of the use of the method in radiotherapy. Despite the highly technical nature of his presentation it elicited many questions.

On March 29 Dr. Jerry Cuttler, of AECL CANDU (and CNS vice-president), spoke on the "RBMK Safety Review Project", with specific examples from his recent two week visit to the Simolensk atomic energy station in Russia. He reviewed the Chernobyl accident and outlined identified problems in the areas covered by his group on control and protective systems.

Dr. John Stewart has stepped down after serving as Treasurer of the Branch for many years.

A closing dinner meeting is planned for late May.

The Branch has contributed to the Ottawa Regional Science Fair and a member of the branch executive is assisting with the fair.

Saskatchewan

The Saskatchewan Branch of the CNS sponsored the visit of Dr. Karen Strauss, an environmental engineer, in January, which involved a whirlwind of activities in Regina and Saskatoon. The Regina agenda included a wine and cheese reception at the University of Regina, a lecture at U. of R., and an address to a Chamber of Commerce luncheon. In Saskatoon, Dr. Strauss addressed a breakfast meeting of "Synergy Today" and "Energize Saskatchewan" and a CNS luncheon. There was considerable media coverage of her visits.

Over May 19 to 21, CNS Saskatchewan is sponsoring Carol Gold, of the Ontario Science Centre, to promote science and technology in schools.

In late May the branch plans to hold a luncheon meeting to discuss the results of a recent Decima poll in Sask-

atchewan which showed that nuclear energy was favoured over coal or hydro.

Toronto

The CNS Toronto Branch continues its popular public lecture series held at the University of Toronto.

The talk by Arthur Dickenson, president of the Association of Major Power Consumers in Ontario, on January 25, on "AMPCO Perspective on Reorganizational Changes at Ontario Hydro" is reviewed by Ric Fluke elsewhere in this issue.

On February 15 Dr. Hilary McCormack, assistant crown attorney, spoke on "The Introduction of DNS Evidence in Criminal Cases in Canada".

The Branch hosted the successful 19th CNA/CNS Student Conference, March 18-19, which is also reported elsewhere.

Quebec

Members of the Quebec Branch met in Montreal, March 29, with CNS vice-president Jerry Cuttler as guest speaker.

Discussions were held on the future of the Branch with the suggestion that two sections be formed, one in Montreal and the other at the Gentilly 2 nuclear station. With that in mind a meeting has been scheduled at G-2 for Friday, May 13, with Pierre Charlebois, Director of Pickering NGS, as the special speaker.

Anyone interested in participating in this development for the Quebec Branch should contact Jerry Cuttler at (905) 839-1151 Ext. 6885; Hong Huynh (514) 392-5614; or Nor-mand Gilbert (514) 871-1116.

Central Lake Ontario

Jerry Cuttler, the CNS's peripatetic lecturer, gave an interesting talk on the **Safety of RBMK Reactors** to a large audience at a luncheon meeting of the Central Lake Ontario Branch held at the Darlington NGS in late March.

The C.L.O. Branch is considering creating two sections, one at Darlington and the other at Pickering NGS. More on this later.

New Brunswick

The New Brunswick Branch held its annual dinner meeting in Saint John, March 28, with TWO speakers, Dr. Jerry Cuttler, of AECL CANDU, who spoke on "Safety Aspects of RBMK Reactors" and Dr. Bob Keating, AECL Regional VicePresident, providing updates on CANDU sales initiatives and joint NB Power - AECL projects. A number of the national CNS Executive attended the meeting.



New Brunswick Branch chairman, Paul Thompson addresses the branch annual dinner meeting, March 28.

CNA/CNS Winter Seminar

What has become an annual event, the Nuclear Energy Winter Seminar, sponsored by the CNA and the CNS, was held in Ottawa, February 22, with a reception for members of Parliament on the evening of February 21. As has been the practice in recent years the seminar provided an overview of the nuclear industry by senior representatives.

The new Minister of Natural Resources, Anne McLellan, spoke to the delegates and about 25 MPs at the reception with some positive comments on the nuclear industry (based on the Ernst & Young study reported in the last issue of the Bulletin).

Lloyd Jones, chairman of the CNA and Paul Fehrenbach, CNS president, began the day with reviews of the activities of their respective organizations.

David Anderson, of CANATOM and John Beadle, of Industry Canada, reported on the "Going Global" program on marketing Canadian goods and services worldwide, including the publication of a Directory and a mission to Korea last fall. Allan Culham, of Foreign Affairs, provided an update on the many nuclear cooperation agreements Canada has with countries around the world. Further agreements are being pursued with the Czech Republic, Lithuania, Slovakia and Slovenia. To a question he reported that progress was slow on an agreement with China.

Don Lawson, president of AECL CANDU, provided progress reports on the Cernavoda project in Romania and the Wolsong 2, 3, & 4 units in Korea.

Ontario Hydro's new nuclear structure was the subject of an address by Ron Field, Director of financial and Business Services, Ontario Hydro Nuclear. He stated that he expected "customers and employees to be proud of Ontario Hydro Nuclear because of its competitive performance, superior

safety and contribution to a sustainable environment". Regarding staffing, Field stated that Ontario Hydro Nuclear now had 0.6 operations personnel per MW of installed capacity, compared to the U.S. average of 0.8. When asked if this was not potentially dangerous Field replied that it was "expedient".

Tim Meadley, president of Uranium Saskatchewan, presented a clear and comprehensive overview of the uranium mining situation. Canada remains the world leading producer of uranium.

Francoise Guennette, AECL corporate, and Roxanne Summers, CNA, reported on the Public Information Program and showed the new TV advertisements which began airing that day. In a trial program, inserts were placed in all newspapers in Saskatchewan. Follow-up surveys indicated that awareness and acceptance increased markedly.

A different perspective was provided by David Shier, president of the Canadian Nuclear Workers Council. He questioned the basis for Ontario Hydro's shutdown plans, noting that the Power Workers' Union, with which the CNWC is affiliated, had, a few days previously, called on the provincial government for a public review of the plans. Shier was particularly critical of the continuing purchase of non-utility generated power at a price several times that of Ontario Hydro's cost when there is already a surplus of generating capacity.

At the end of the day, CNA president John Reid summed up the presentations and discussions by noting our future is abroad. At home we have an on-going struggle to educate the public. He noted, however, that not only nuclear is suspect, but anyone who produces wealth, uses science or proposes large projects.



CNA/CNS staff members Sylvie Caron and Tatiana Wigley await registrants for the CNA/CNS Winter Seminar.

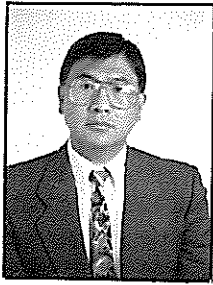


Dave Anderson, CNA chairman and Stefan Kupca, CNS secretary converse with M.P.s at the CNA/CNS Winter Seminar.



Minister of Natural Resources, Anne McLellan, addresses the opening reception at the CNA/CNS Nuclear Energy Winter Seminar held in Ottawa, February 21 and 22.

New Chairman for WMEA Division



The CNS Waste management and Environmental Affairs Division has a new chairman.

M. M. (Mitch) Ohta was confirmed as the chairman of the WMEA Division at the March 8, 1994 meeting of the CNS Council.

Mitch, who is currently the manager of the Underground Research Laboratory at AECL's Whiteshell laboratories, has been actively involved in the nuclear industry for 28 years as an operations engineer, designer, project manager, engineering manager and business developer.

In the early 1970s Mitch was responsible for the development of dry storage canisters for irradiated fuel. For much of the 1980s he was involved in business development for the nuclear battery and the SLOWPOKE Energy System.

He and his wife Leny, who also works at the Whiteshell Laboratories, and son Derek live in Pinawa. Two daughters, Tammy and Kathleen, are attending university.

Mitch says that his first activities as Chairman will be to re-establish a division executive and begin plans for activities such as the international waste management conference scheduled for the fall of 1995.

For anyone interested in the work of the WMEA Division, Mitch's telephone number is (204) 345-8625.

Montreal is Venue for Annual Conference

The 15th annual conference of the Canadian Nuclear Society will be held at the Queen Elizabeth Hotel in Montreal from June 5 to 8, in conjunction with the 34th annual conference of the Canadian Nuclear Association.

The theme of the joint conference is: **"Power and the Future Generation."**

The CNS technical program begins the afternoon of Monday, June 6, following a joint plenary session. Over the period from then to Wednesday afternoon, June 8, almost a hundred papers will be presented in 16 sessions with subject

titles of: Thermalhydraulics; Fuel Channel; Operations; Reactor Physics; Fuel; Technology; Waste Management; Safety; and Training.

Tours to Centre Canadienne Fusion Magnetique, Gentilly 2 and the Canadian Space Agency are offered for the Wednesday afternoon.

Members should have received a copy of the preliminary program and registration forms for the conference and the hotel.

For information contact the CNA/CNS office.

Tie Awards

A mis-understanding appears to have developed regarding the offer of a CNS tie (or scarf) for members signing up a new member.

There is a limit of one tie per recruiting member. Also, the offer applies only to regular membership. Nevertheless, members are encouraged to continue to sign-up new members, to increase the strength and effectiveness of the Society.

New Telephone System at CNA/CNS Office

The CNA/CNS office has installed an automated telephone answering system. Two important locals are: #16 Sylvie Caron, and #18 Tatiana Wigley, who share registrations and memberships.

Council Meeting

The next meeting of the CNS Council will be held Thursday, May 5, at the CNA/CNS offices in Toronto.

If you have any questions, suggestions or items to raise, contact any member of the Council (see inside back cover).

Agreement of Cooperation



The "Agreement of Cooperation" between CNS and the Korean Nuclear Society was renewed for another 5 years with the joint signing of the agreement at Taejon, Korea last fall by Dr. Yong-Kyn Lim, President of the Korean Nuclear Society and President of the Korean Institute for Nuclear Safety, and Mr. E.G. Price, Vice President, CNS. Helping with the ceremony is Dr. Young-Soo Eun, Director of the Safety Inspection Division, Korean Institute of Nuclear Safety.

Mort aux Bâtards!

Ed. Note: The following article by frequent contributor (and one-time co-editor) Keith Weaver was submitted as a book review. However, Keith has expanded his review into a broad, thought-provoking essay on reason, rationality and science. It is certainly not a typical book review or usual Bulletin material. Nevertheless, we urge you read it. You may then, as Keith exhorts, be sufficiently intrigued to pursue the topic through the book he reviews or other sources.

Voltaire's Bastards: The Dictatorship of Reason in the West, John Ralston Saul, The Free Press (A Division of Macmillan Inc.), New York, 1992.

by Keith Weaver

Francois Marie Arouet was born in 1694. He was brilliant and unconventional; he led a chequered life. He was a courtesan, a writer and shrewd in the ways of the world. He was, at various times, an exile, a prisoner in the Bastille and the originator of fierce social and political commentary. He changed, practically single-handedly, the political consciousness of France. He died wealthy, and a hero, in Paris. He is better known by the name of Voltaire.

It was Voltaire, and men like him in the eighteenth century, who first embraced the possibility that reason could displace the arbitrary tyrannies which European peoples suffered from many sources. The hope was that a society enlightened by reason would be able to cast off fickle persecutions and bring under control many or all of the other tribulations, natural and man-made, with which peoples of the time were beset.

Their plans succeeded beyond the wildest of nightmares.

Voltaire's bastards, in Saul's reckoning, are bastards in every sense of the term. The modern world is now trussed by all-encompassing methodologies and structures, built and operated in the name of Reason. They overwhelm everything. They distort personal lives, politics, business dealings. Whole countries and cultures have fallen under the sway of the rational strait-jacket. What this means

is that instead of tempering other excesses in the individual and social make-up, those for example that made life before the Enlightenment so onerous and unpredictable, rational structures have now crowded out all opposing or competing influences. Even those that could complement it have been pushed aside. The classic exemplars of pure rationality, e.g. Macchiavelli, Bacon and Loyola, have inspired the self-justifying structures that maintain the arms race, that drive nations to the very brink in areas such as energy production, environmental threats, political misadventure and commercial folly. Why has this happened? Largely, according to Saul, because the division of labour has resulted in the formation of elites, technocratic priesthoods that control every activity and discipline, and touch every facet of life. These priesthoods have their own rituals and languages which lock out the uninitiated and the unwelcome. They exist nominally as formal, professional groupings of experts and managers, ploughing their narrow furrows. But in fact they also exist because their existence and structure ensures that the elites they serve can continue in their positions of power.

In discussing these technocratic structures, established upon and built up from principles of reason, Saul stretches across astonishingly wide reaches. The text sweeps from the vast but tawdry business of arms and armaments, to the realities of cultural and political life, and culminates in fascinating lengthy studies of the role and importance of the hero figure, and of those individuals who are "stars", who occupy, to the exclusion of almost all else, the public stage. There is a stunning analysis of the development of the image in Western culture, and an en-thralling discussion of how literature, in particular how the novel, has been quietly and slowly removed from a place of public importance and general access, and been placed effectively out of public reach within the precincts of the technocrats, in this case, the literary critics and professional students of literature. If you just lean back and read, this book will take you on a wild, exciting, intoxicating journey through many aspects of the past four hundred years of Western culture,

with side trips much further back. The experience is stupefying.

There are glimpses of some classic individuals.

On the plus side, there are Cincinnatus, Solon, Socrates, Christ, and then crossing the divide of the Renaissance, Dante, Locke, Swift, Voltaire (of course), Paoli and Jefferson. Each of them has some specific place. Cincinnatus: the small farmer turned victorious commander and emperor, who relinquishes power when the job is done, re-instates the republic and returns to his farm. Solon: the supreme lawmaker and balanced ruler. Socrates: who used questions not (as rationality demands) to make obligatory the provision of answers, but instead to demonstrate the breadth of possibilities for understanding the thing questioned. Dante: humanist extraordinaire. Jefferson: a modern combination of many of these.

The minus side is heavily populated. The most interesting examples come from very recent history. They are most interesting because it is the present perceived predicament we are concerned about, and they illustrate the problem, a cumulative inheritance from the past but alive today in the flesh. Robert McNamara, Henry Kissinger, James Baker and Simon Reisman are the examples that jump out of Saul's discussion.

These embodiments of the rational imperative are described at some length. The discussion centred on Robert McNamara is particularly interesting. Here, according to Saul, is the ultimate modern man of reason. Most people would deem McNamara a success. A high-flying career at Ford was followed by distinguished service at the highest levels in the U.S. government, and this in turn was followed by appointment as Chairman of the World Bank.

But. It appears that he was not only unable to do anything right, but that everything he touched with plans of improvement did more than just go completely sour. Saul brings out evidence from which he concludes that McNamara bears a significant responsibility for the more virulent excesses of the international proliferation in arms, both nuclear and conventional, as a result of actions he took while in the Cabinet.

As chief of the world bank, his devotion to existing structures and methodologies (to the exclusion of balanced attempts first to see what really is wrong, what isn't working, and why) is blamed in large part for the development of ruinous Third World indebtedness. Similarly damning cases are made against Kissinger, Baker and Reisman. This discussion occurs early in the book. It's at about this point that questions might begin to arise in the reader's mind. Isn't there something wrong with the way all this is presented? Could anybody actually screw up this badly, even if they tried? Aren't these cases being very much over-stated? Why? It is easy enough to overlook or suppress these questions; the themes presented in the book are broad and alluring, the writing is riveting, and one reads on.

Eventually, I had to face my own daunting question. "How do I review something like this?" Very few people, I suspect, could step up and speak with interest and authority, and in detail, in so many diverse areas of human endeavour. Certainly I cannot. One way out is to pick an area one knows something about and concentrate on that. I did.

On page 310, one finds the following quote:

"Repeated leaks at the nuclear plant of Pickering – in the suburbs of Toronto, surrounded by five million people – are consistently described as technical problems. In the post-Chernobyl period, a documented public report in Canada threw doubt on local nuclear safety standards. The Canadian government reacted by instructing its Crown-owned nuclear reactor development corporation to reexamine those standards. Instead, the corporation explained at great length that reexamination was unnecessary because the public report was based upon unfounded fears. The refusal to entertain doubt seemed to be absolute."

And on page 311, as a convenient set-up, "the scientist's" view is stated to be that:

"...while nuclear weapons are a necessary evil dictated by the needs of uncivilized man, nuclear power is a good necessary to the well-being of man. And yet the risk of a catastrophic reactors than from bombs. The weapons, after all, are dormant. Someone must decide to use them. Common

sense and simple humanity protect us. The reactors, however, are constantly exploding. That is how they produce energy. All that stands between man and the unleashing of this force is the effectiveness of the machinery containing the explosions and the competence of those responsible for administering the plants. One thing we do know is that neither mechanical nor human fallibility has ever existed. Passenger jets crash. High-speed, high technology trains crash. Dams give way. Bridges fall down. And there were 2,940 nuclear accidents in the United States alone in 1987 in only 105 plants."

On page 475, Marshall McLuhan is quoted:

"The expert, as such, is full of insecurity. That is why he specializes in order to obtain some degree of confidence."

Is it superfluous to say that there are things wrong with these statements? I have reproduced them here as an illustration of the author's tone. He sees exclusive elites, technocratic manipulation and secrecy, bands of experts who serve as hoarders of specialised knowledge. He leaves the impression that there are many linked conspiracies in place; unconscious conspiracies perhaps, not the sort that have been purposely constructed aforethought, but conspiracies all the same. Conspiracies that function as mutually supporting, sanctioned, social structures firmly based on reason.

A response by members of the conspiracies is, naturally, predictable. What else would one expect? They are conspirators. They will defend the cabal. They can't be trusted. There is no way to verify their factual statements – which may in any case just be blizzards of disconnected scientific verbiage aimed at confusing – because the high priests not only have control of the knowledge, but they also have control of who has access to it. Any commentary on the author's overall thesis by those whose professions render them informed is immediately cast in doubt, their participation in debate on the topic discouraged or blocked. The opinions of such individuals can be discounted because by their membership in the coercive structure they have disqualified themselves. Such is the nature of conspiracy theories. Checkmate, wipe and flush.

Obviously, this state of affairs won't do. One can also question the validity of the author's generalisations, on which this whole sceptical superstructure is

founded.

Up to about the time of Erasmus, it was possible for a gifted individual to keep abreast of the latest developments of the age. To be a well-informed generalist was an entirely reasonable possibility. The requirements were brains, money (or connections) and a good memory. The memory bit was important. You couldn't just pop down to the World's Biggest Book-store and pick up the collected works of Marcus Aurelius in paperback for \$15.95. This was what made it possible. Journals and magazines didn't exist, and books were not produced in great quantity.

In contrast, today there are thousands of specialised journals covering subject areas that are often almost unbelievably narrow. There are about 60,000 books published per year in English alone. More than 1,000 a week. To be a generalist is very much more difficult these days. In order to make authoritative general statements in more than a few factual domains, enormous preparation is required. To be expert in even a few narrow fields is very taxing. To be a generalist, one simply has to be prepared to vault large tracts of detailed knowledge and hope for the best when one generalises even slightly. The possibility of error has increased sharply for the generalist.

What does all this mean for "Voltaire's Bastards"? Do these observations cast any doubt on Saul's arguments? Can the whole exercise just be written off as another castle built in the air? What about the judgments, apparently very firm and admitting little or no doubt, that Saul puts forward to summarise the nuclear scene? Are they suffused with the spurious confidence born of slight knowledge? Do they reflect a form of what the author decries in his final chapter as "world-weary cynicism"? If they are found wanting, or sloppy, or just somehow madly cavalier, are all his arguments thereby suspect? Should one, then, discount or reject the whole grand thesis of the book? Are Voltaire's bastards really just specious mirages, incomprehensible rubbish that should be chucked over the side?

I think not. And I suspect that Saul's basic thesis is correct.

There is a need to generalise in every context. Newton's law is a generalisation. Science is full of generalisations, of necessity. But there is a disciplined procedure by which these generalisations are arrived at and agreed upon. The

success of this whole endeavour, the "scientific method", has resulted in it being elevated to an exalted and privileged position, a weirdly deified mental stance, the ultimate essence of intellectual mechanism that can unfailingly grind ignorance and uncertainty out of existence if only it is applied with sufficient diligence. Such a view overshadows the intellectual reality of science, which is that the underlying mental processes are almost completely obscure. Philosophers of science are so far from agreeing on what science actually is that the utterance of any such conceit as "the scientific method" is a risky thing indeed. Nor is "science" alone in this. The terms "rational" and "logic" are in a similar situation; both of them are maddening beasts that escape satisfactory definition. In the case of "logic", for example, its nature and ultimate source are not immediately clear. Usually described as "constituting the laws of thought" or some such tidy circularity, "logic" also evades easy definition. Nobody is ever taught logic formally as a child, yet everyone knows what it is. Where does it come from? From the language (in which case, from all languages)? From some deeper source? Whatever its nature and origin, it enjoys high standing. The labels "illogical" and "irrational", as applied to individuals, are usually offered (and taken) as serious insults. Why? Is "logic" or "rationality" the only bulwark protecting us from Unspeakable Chaos?

Starting from rather simplistic definitions such as "the laws of thought", one could conclude that "logic" is really an instrumentality: what it provides is the means to arrive somewhere rather than the ability to specify the destination. Destinations are just "where one wants to go" and the word "want" gives the game away. "Wants" have little or nothing to do with logic but they obviously play a significant role in setting the agenda. The business of setting and dealing with this agenda, of thinking, in its broadest sense, of being a reasonable human being, are things seen through a glass darkly, not in detail. Clear thinkers and reasonable people are easily recognised when encountered. But there are no formulae to follow that will render one "a clear thinker" or a "reasonable person". The process may require many inputs. Intellectual tidiness may have to be ditched and multiple incompatibilities simply tolerated. In fact, it seems all a bit disorderly, a case of lifemanship, of groping in a state of constructive doubt, of catch

as catch can.

The point of the previous two paragraphs is to indicate that there exists a basis for believing that Saul has a point. The only rule is moderation and balance. Excessive reliance on one crutch, such as "reason", may result in anything from mild distortion to terminal stasis. But the sword may well have two (or more) edges, and one can't solve the problem by substituting one crutch for another.

At many points in the book, Saul comes back to "common sense" and everyday "morality". He seems to treat them as fixed givens. How much does he want us to rely on *them*? They may not be as fixed as one might like to believe. They may vary greatly, or be completely at loggerheads, depending on time, place and subject area. Common sense, for example, may derive from all kinds of inputs: experience, logic, judgment and, yes, information gained from higher level empirical or "scientific" understanding. How important are these inputs? Could there be divergent strains of common sense? If so, which sort of common sense is Saul referring to? Is it similar to the kind that scoffed at a spherical Earth? Is it related to the variety which brought forth statements early in the nineteenth century (when railways were just being introduced) that the human frame would not survive travelling at speeds in excess of 20 miles per hour? Is it the sort that feels specialist knowledge banishes insecurity and breeds confidence? Is it a type of common sense convinced that knowledge destroys imagination and the ability to wonder (viz. the wretched poet who blustered "I will not circumscribe the sky lest I should lose infinity")? I suspect that a somewhat similar argument might apply to "morality".

Moderation and balance have to be forged in the context of everyday life, perhaps the ultimate touchstone. There, everyone is, without exception, a generalist. Ordinary chap, rocket scientist, or eccentric prize-winning inventor of the high-tech self-cleaning bird cage, nobody escapes being a generalist. And one might expect that the better the generalist, the more fulfilled. As the complexity of the society and its toys increases, one might also expect to find a greater demand for the generalist to be more accomplished. But something not particularly compatible with this is observed. There is a shift of focus to the individual, toward extremes of self-gratification. The Great I, the Me generations

emerge. The effects of this are not insignificant. What is happening?

Charles Taylor, a distinguished academic at McGill University, and author of the 1991 Massey lectures (in book form, "The Malaise of Modernity"), has studied the whole phenomenon in great depth. He describes how individuals and whole societies are being derailed by the sort of thing that Saul talks about. Indeed, a strange double progression appears to be at work. Humankind has been forced increasingly by science to relinquish its arrogated central position in the scheme of things: the Ptolemaic system with its Aristotelian trappings gave way to the Copernican, and today we find ourselves circling an undistinguished star, part of an unimportant spur on one arm of an unremarkable galaxy, one of an unknown but huge number of similar galaxies, adrift somewhere in space. Concurrently, especially in recent times, the individual is seen to exercise a progressively weaker social role and become increasingly inward looking, more concerned with self-gratification. The importance of the individual eventually becomes primary, ending in an extreme form of narcissism. In the words of de Toqueville, who first suggested that this might occur, the individual "*menace de le renfermer enfin tout entier dans la solitude de son propre coeur*". The wider social function is effectively lost. The malaise of modernity is at work.

Saul describes a situation of rampant, destructive rationalism, but if he sees any way out he doesn't let us know. Taylor seems a bit more hopeful, and he concludes

"What our situation seems to call for is a complex, many-levelled struggle, intellectual, spiritual, and political, in which the debates in the public arena interlink with those in a host of institutional settings, like hospitals and schools, where the issues of enframing technology are being lived through in concrete form; and where these disputes in turn both feed and are fed by the various attempts to define in theoretical terms the place of technology and the demands of authenticity, and beyond that, the shape of human life and its place in the cosmos."

"But to engage effectively in this many-faceted debate, one has to see what is great in the culture of modernity, as well as what is shallow or dangerous. As Pascal said about

(concluded on page 36)

book reviews

Chernobyl Revisited and Cosmology Introduced

Ablaze: The Story of Chernobyl, Piers Paul Read, Secker & Warberg, London 1993

Reviewed by Fred Boyd

This month will mark the eighth anniversary of the disastrous accident on April 25, 1986, in the number 4 unit of the Chernobyl nuclear power station in the Ukraine (then part of the USSR) and a good time to review that tragic event which has had such a negative effect on nuclear power programmes everywhere.

Read's book is not a technical review, although it is factually detailed and, apparently, accurate. A British writer, Read was, as many, intrigued with the story and took advantage of the relative openness that developed after the political upheavals in the former USSR in 1991 to interview almost everyone (still alive) who had been involved, even distantly, with the Chernobyl disaster. From that research he has put together a detailed account of events leading up to the accident as well as the accident itself and its ramifications.

As a non-technical writer Read tends to concentrate on the individuals involved; the plant operators, the local politicians, the many "experts" in Moscow and others. The picture that emerges is a mixture of heroism and stupidity, of impressive marshalling of resources and hopelessly incompetent bureaucracy, of individually dedicated and capable people and an impossibly flawed system.

For those technically inclined he provides considerable detail about the accident itself and the actions taken, while for the general reader Read presents an intriguing human drama.

Read appears to be neither pro nor anti nuclear. Rather his book reflects thorough research presented in a very readable manner.

The book is highly recommended for anyone wishing a further perspective on nuclear power's worst accident.

Wrinkles in Time: The Imprint of Creation, George Smoot (and Keay Davidson), Little Brown & Co., London, 1993.

Reviewed by Keith Weaver

For anyone interested in cosmology but not keen to wade through heavy duty mathematics or great dense thickets of astronomical jargon, this book is just the mark. It is, at once, a discussion of the work leading up to, the design of, the tribulations associated with, the

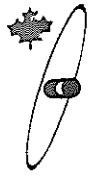
launch of, and the final success of COBE, the Cosmic Background Explorer satellite. But it is also a personal testimony by its author, expressed with a charming understatement, of his 20-year odyssey through all this work.

George Smoot is a member of the Centre for Particle Astrophysics and the Space Sciences Laboratory. Both are located at the University of California (Berkeley). He has worked on the instrumentation for the COBE satellite since 1974. The satellite's job was to try to detect a texture in the background microwave radiation emanating from all parts of the universe. Such a texture would be confirmation that a period of rapid inflation early in the universe's history produced irregularities that would later act as seeds for the galaxies. "Wrinkles in Time" is his account of those years.

In the preface, the author states: "This book is designed to be an easy read that still contains the full concepts and essential ideas of modern cosmology". In this the book succeeds particularly well. The writing style is very approachable; in fact, it seems at times to have the peculiar flatness and smoothness of an over-polished text. Rather than working against the book, this quality is a plus. If one is not prepared to face some very odd notions, then cosmology can be somewhat like sausage meat: you're better off not knowing too much about what's in it. Thus, embarking on a serious discussion of the state of the universe when it was about 10 metres in diameter, could easily make one sound like either a totally disconnected boffin or a complete raving lunatic.

"Wrinkles in Time" is more than just a recounting of technical exploits and mysteries unravelled. Smoot is obviously someone at ease with the history both of his subject and of science in general. Some fairly lengthy historical sketches are woven into the account, to great advantage. But the subject matter, cosmology, comes out as part of the author's discussion of 20 years of effort. The book is also a scientist's personal account, a technical history. The frustrations of building unique instruments and coaxing them to do the right thing at the right time, the climatic and cultural exasperations of launching, following and recovering high altitude balloons in the Brazilian interior, the madness of erecting a home-made dish antenna within sight of the geographic South Pole – these all come across as vividly remembered, felt experiences, and may well bring sweat to the palms of more than one experimentalist. Finally, there is an account of the sweetness of success.

This is a warm and friendly book: understated, crafted, civilised and humorous. Would that all sausages were this good.



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1994

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|-----------------|--|-----------------|---|
| April 24-27 | 8th International Conference on Radiation Shielding
Arlington, Texas
contact: Richard Rubin
Dallas, TX, USA
Tel.: 214-812-8247 | June 19-24 | ANS Annual Meeting
New Orleans, Louisiana
contact: Dennis Tolleison
Martin Marietta Energy Systems
P.O. Box 2009-8221
Oak Ridge, TN, USA 37831-8821
Tel.: 615-574-9877 |
| April 24-28 | 4th International Conference on Nuclear Fuel Reprocessing & Waste Management
London, England
contact: Richard Rubin
British Nuclear Forum
22 Buckingham Gate
London, SW1 E 6LB, UK
Tel.: 214-812-8247 | August 14-18 | SPECTRUM 94 International Nuclear and Hazardous Waste Management Conference
Atlanta, Georgia
contact: John Steele
Westinghouse Savannah River
Aiken, SC, USA 29802
Tel.: 803-725-1830 |
| April 24-27 | International Symposium on Decontamination and Decommissioning
Knoxville, Tennessee
contact: Analyses Corp. Conference Management
Oak Ridge, TN, USA
Fax: 615-576-0709 | September 12-16 | 3rd International Symposium on Contribution of Materials Investigations to the Problems Encountered in Pressurized Water Reactors
Fontevraud (Chinon), France
contact: Ms. Christiane Moura
Société Française d'Energie Nucléaire
48 rue de la Procession
F75724 Paris Cedex 15, France |
| April 27-29 | Chemistry in Water Reactors
Nice, France
contact: French Nuclear Society
Bureaux 48, rue de la Procession
F 75724 Paris Cedex 15, France | September 19-20 | Workshop on Management and Operation of Nuclear Power Stations Using Digital Computers
Fredericton, New Brunswick
contact: Roger McKenzie
Maritime Nuclear Ltd.
Fredericton, N.B.
FAX 506-453-1356 |
| May 1-6 | 9th Pacific Basin Nuclear Conference
Sydney, Australia
contact: 9PBNC Conference Secretariat
Fax: INT 61-6-273-2918 | October 2-6 | ENC '94
Lyon, France
contact: Dr. Peter Feuz
European Nuclear Society
Monbijoustrasse 5,
P.O. Box 5032
CH 3001, Berne, Switzerland
Fax: 41-31-22-9203 |
| May 17-19 | Annual Meeting on Nuclear Technology
Stuttgart, Germany
contact: Dr. K.G. Bauer
INFORUM GMBH
Bonn, Germany
Fax: 49-228-5072-19 | October 12-14 | Simulation Symposium
Chalk River, Ontario
contact: Peter Laughton
AECL Research,
CRL Chalk River, Ont.
Fax: 613-584-1108 |
| May 30 - June 2 | International Conference on Nuclear System Thermalhydraulics
Pisa, Italy
contact: N. Spinks
AECL Research, CRL
Tel.: 613-584-3311 | October 19-21 | 3rd International Containment Conference
Toronto, Ontario
contact: D. Pendergast
AECL-CANDU
Tel: 905-823-9040
Fax: 905-823-8006 |
| June 5-8 | CNA/CNS Annual Conference
Montreal, Quebec
contact: Kathy Murphy, CNA/CNS
Fax: 416-979-8356 | | |
| June 13-15 | 2nd International Steam Generator and Heat Exchanger Conference
Toronto, Ontario
contact: D. Lister, UNB
Tel.: 506-453-5138 | | |

1995

March ??

CNA/CNS Student Conference
Ottawa, Ontario
contact: Sylvie Caron
CNA/CNS office
Toronto, Ontario
Tel.: 416-977-6152 xt18
Fax: 416-979-8356

May 1-5

CANDU Thermalhydraulics Course
Hamilton, Ontario
contact: Prof. M. Shouki
McMaster University
Hamilton, Ont.
Tel. 905-525-9140 Ext. 24881

May ??

International Conference on Isotopes
Beijing, China
contact: Prof. Wang Dexi
Chinese Nuclear Society
P.O. Box 2125
Beijing, China, 100822
Fax: 85-27185

May 16-18

Annual Meeting on Nuclear Technology
Nuremburg, Germany
contact: Dr. K.G. Bauer
INFORUM GMBH
Bonn, Germany
Tel.: 49-02-28-507-0
Fax: 49-02-28-5072-19

May 23-June 3

5th Topical Meeting on Tritium Technology in Fission, Fusion and Isotopic Applications
Ispra, Italy
contact: E.G. Price
AECL CANDU,
Mississauga, ON
Tel.: 905-823-9040 ext. 3066
Fax: 905-823-8821

May 29-31

Topical Meeting: Managing Plant Life
Nice, France
contact: Dr. Serge Charbonneau
Paris, France
FAX (33.1).42.96.01.02

June 4-7

CNA/CNS Annual Conference
Saskatoon, Saskatchewan
contact: Sylvie Caron
CNA/CNS office
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Tel.: 416-977-6152 xt18
Fax: 416-979-8356

September 10-15

NURETH-7 — International Meeting on Nuclear Reactor Thermalhydraulics
Saratoga, NY
contact: Dr. Michael Z. Podowski
Rensselaer University,
Troy, NY,
Tel.: 518-276-6403
Fax: 518-276-4832

September 17-23

International Topical Conference on the Safety of Operating Reactors
Seattle, WA
contact: Dr. Daniel E. Simpson
ANS Inc, Richland, WA
Tel.: 509-527-1665

September 25-29

GLOBAL '95, on the Back End of the Nuclear Fuel Cycle
Versailles, France
contact: Dr. J. Y. Barre
CEA, Saclay Gif-Sur-Yvette,
France
FAX (33.1). 69.08.90.93

September ??

International Conference on Waste Management
Manitoba
contact: C. Vandergraaf
AECL Research,
WL Pinawa, Manitoba
Tel. 204-753-2311 Ext. 2592.

October ??

Fourth International Conference on CANDU Fuel
Pembroke, ON
contact: Dr. Peter Boczar
Chalk River Laboratories
Tel.: 613-584-3311

November ??

3rd Conference on CANDU Maintenance
Toronto, ON
contact: Mr. Tim Andreef
Ontario Hydro
Tel.: 416-592-3217
Fax: 416-592-7111

book reviews

(continued from page 31)

human beings, modernity is characterized by grandeur as well as by misère. Only a view that embraces both can give us the undistorted insight into our era that we need to rise to its greatest challenge."

Where Saul's presentation is unfettered, urgent and dramatic, Taylor's is perhaps more measured and methodical. It seems to me, though, that they are saying the same thing: there are signs aplenty that

Voltaire's bastards are hard at work, and we should think about getting the bastards before they get us.

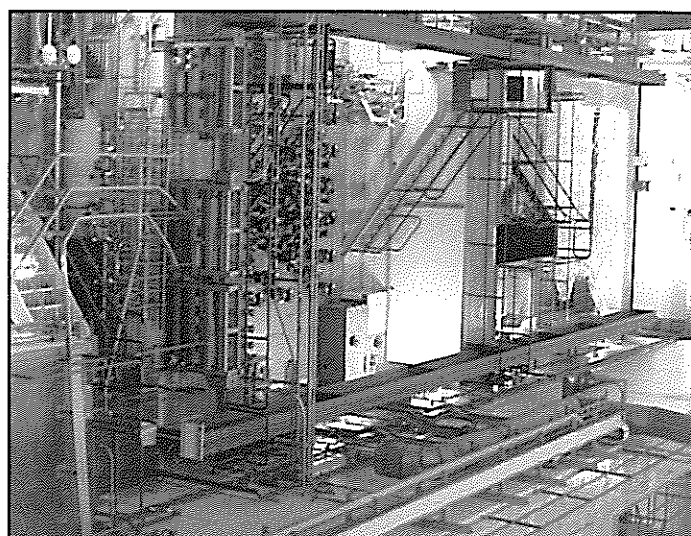
"Voltaire's Bastards" is an excellent book — well-written, wide-ranging and packed with thought and reflection. At some points it seems to be factually wrong. In some areas it is ludicrous. But it very much deserves to be read. Pondered. Screamed at. Admired. Considered.

Needed: Volunteers are sought to operate the library at the CNA/CNS office on Front Street West in Toronto. The staff reduction at the office (see last issue) has left the CNA/CNS office without a librarian. A possible solution would be for a few Toronto based members (retired or otherwise available) to offer (say) a day a week to run the library. This could be an excellent opportunity to keep aware of nuclear activities in Canada and around the world while providing a needed service to fellow CNS members and the CNA. If you are interested or just wish more information contact any member of the CNS executive (see the inside back cover).

More Darlington photos



Unit 1 control panel, showing several alarms while in the shutdown state, with unit 2 in the right background.



View of reactor deck of Unit 1.

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