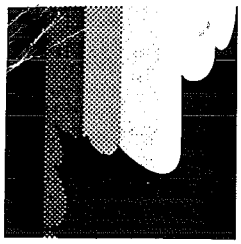

152

Canadian Environmental Law Association
L'Association canadienne du droit de l'environnement

243 Queen Street W., 4th Floor, Toronto, Ontario M5V 1Z4, telephone (416) 977-2410

Publication #152
ISBN# 978-1-77189-577-4

REGULATORY CONTROL OF NUCLEAR SAFETY

SUBMISSIONS OF
THE CANADIAN ENVIRONMENTAL LAW ASSOCIATION

TO

THE ONTARIO NUCLEAR SAFETY REVIEW

Steven Shrybman
Counsel

September, 1987

ACKNOWLEDGEMENT

Research for this brief was carried out by
Y. Skof, LLB

CONTENTS

INTRODUCTION

There are two temptations that we have not resisted in preparing these submissions. The first is to reiterate the recommendations of the two other inquiries into nuclear safety conducted during the last decade in this province,[1] particularly where those recommendations are yet to be acted upon. The second, to draw upon our own submissions on the subject of nuclear power regulation.

Another important source that we have drawn upon is Bill C-14[2]: the Nuclear Control and Administration Act introduced 10 years ago this November by then Minister of Energy, Mines and Resources, Alistair Gillespie, with the following words:

> Rapid growth and increasing complexity of the nuclear industry, both nationally and internationally, have overtaken the existing legislation which was created in the immediate post-war period when interests and priorities were very different.[3]

Bill C-14 subsequently died on the Order Paper and was not subsequently introduced.

A great many events having to do with nuclear power generation have, of course, transpired since that time, including Three Mile Island and Chernobyl. Yet virtually nothing has happened to reform a regulatory system described as anachronistic and obsolete a decade ago.

We have in the brief that follows attempted to provide a critical evaluation of the nuclear regulatory regime from system planning through licensing, standard setting, enforcement and emergency planning. Because of the central role played by the Atomic Energy Control Board, we have addressed the present structure composition and role of the Board in the concluding segment of our brief.

RECOMMENDATIONS - SUMMARY

System Planning

1. THAT THE RISKS OF NUCLEAR POWER BE ASSESSED PURSUANT TO THE ENVIRONMENTAL ASSESSMENT ACT DURING THE SYSTEM PLANNING STAGE, PRESENTLY BEING UNDERTAKEN BY ONTARIO HYDRO, BEFORE ANY COMMENTMENT IS MADE TO ADDITIONAL NUCLEAR CAPACITY.

Approvals

2. THAT THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO REQUIRE THE AECB TO CONDUCT PUBLIC HEARINGS TO DETERMINE SITE SELECTION, DESIGN OR OPERATIONAL LICENSES.

3. THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO PROVIDE DETAILED PROVISIONS CONCERNING NOTICE, PROCEDURE, ACCESS TO INFORMATION AND INTERVENOR FUNDING IN A MANNER THAT WILL FACILITATE THE BROADEST AND MOST EFFECTIVE PARTICIPATION IN THE BOARD'S PROCEEDINGS.

4. THAT A BROAD DEFINITION OF THE ENVIRONMENT BE ADOPTED, AND THE REGULATORY CRITERIA FOR THE APPROVAL PROCESS BE DELINEATED IN A PRECISE MANNER TO GUIDE THE BOARD'S APPROVAL PROCESS.

5. THAT REGULATIONS TO THE ACT BE PROMULGATED SPECIFYING IN DETAIL THE REQUIREMENTS OF LICENCE

APPLICATIONS, PARTICULARLY REGARDING MATTERS OF NUCLEAR SAFETY, AND PRECLUDING THE BOARD FROM ISSUING A LICENCE UNTIL REGULATORY REQUIREMENTS ARE SATISFIED.

Radiation Standards

6. THAT FORMAL NOTICE AND COMMENT PROCEDURES BE ADOPTED WITH RESPECT TO THE ESTABLISHMENT OF RADIATION STANDARDS. FOR THOSE STANDARDS THAT WILL BEAR MOST CRITICALLY UPON THE SAFE DESIGN, PUBLIC HEARINGS SHOULD ALSO BE POSSIBLE. ADEQUATE RESOURCES MUST BE AVAILABLE TO FACILITATE INFORMED COMMENT.

Monitoring/Enforcement

7. THAT THE ATOMIC ENERGY CONTROL ACT AND ALL OTHER FEDERAL AND PROVINCIAL STATUTES CONCERNING THE REGULATION OF CANDU REACTORS BE AMENDED TO SPECIFICALLY BIND THE CROWN IN RIGHT OF CANADA AND THE PROVINCES.

8. Whatever the will or good faith of Ontario Hydro, compliance is difficult when rules are uncertain and too flexible. Even the best corporate citizen will often seek the least costly route of compliance. With the supply and economic pressures that Ontario Hydro is often subject to, the incentive to resist the regulatory demands of the AECB are substantial, particularly when the regulator has

unfettered discretion to modify those requirements and to do so without constraint or supervision.

THAT REGULATORY CERTAINTY BE THE FIRST AND NECESSARY PRECONDITION TO ENSURE COMPLIANCE WITH REGULATIONS INTENDED TO REQUIRE THE SAFE OPERATION OF A CANDU NUCLEAR REACTOR.

9. No enforcement of regulation is possible if requirements are not clear and certain. While some flexibility and discretion may be necessary and perhaps even desirable in the nuclear regulatory system, the present regime is, we believe, situated very much at one extreme of the spectrum. Given the bewildering mix of guidelines, consultative documents, advisory papers that constitute AECB design "requirements," enforcement by way of prosecution would not be possible.

THAT REGULATIONS SHOULD BE DRAFTED IN A MANNER TO FACILITATE THEIR ENFORCEMENT, INCLUDING BY WAY OF PROSECUTION.

10. The inclination to take a vigorous approach to compliance would be more pronounced with a Board more capable of maintaining an objective perspective on the activities of Ontario Hydro. There is a need to ensure that appointees to the Board are qualified and committed to the regulatory task before them.

THAT MEMBERSHIP IN THE BOARD SHOULD BE EXPANDED TO INCLUDE A MORE DIVERSE ARRAY OF VIEWS, DISCIPLINES AND PERSPECTIVES.

11. THAT THE COMPLEMENT OF BOARD INSPECTORS BE SUFFICIENT TO ENSURE ADEQUATE MONITORING BY COMPETENT PERSONNEL. UNANNOUNCED INSPECTIONS ARE ESSENTIAL AND SHOULD BE MANDATED BY REGULATION. IT MAY ALSO BE DESIRABLE, AS THE MINISTRY OF THE ENVIRONMENT HAS RECENTLY DONE, TO TRUST ENFORCEMENT TO THOSE SPECIFICALLY TRAINED IN THE AREA. THE BOARD MUST ALSO HAVE READY ACCESS TO THE LEGAL STAFF NECESSARY TO EFFECT MORE FORMAL ENFORCEMENT STRATEGIES, INCLUDING PROSECUTIONS WHERE NECESSARY.

12. THAT MONITORING AND OTHER DATA BE MADE READILY AND FREELY AVAILABLE TO THOSE INTERESTED, INCLUDING LOCAL MONITORING COMMITTEES, INTEREST GROUPS AND THE MEDIA. THE OBLIGATION OF THE BOARD TO ADOPT A PROACTIVE APPROACH IN THIS REGARD SHOULD BE ESTABLISHED BY STATUTE. THE PROSPECT OF ALL MATTERS OF NON-COMPLIANCE QUICKLY COMING TO LIGHT SHOULD PROVIDE A MEANINGFUL INCENTIVE TO OBSERVE ALL REGULATORY REQUIREMENTS.

13. THAT PENALTIES BE SUFFICIENTLY SEVERE TO ACT AS A DETERRENT. BILL C-14 PROPOSED RAISING THE MAXIMUM FINES FROM $10,000 TO $100,000. THOSE RECOMMENDATIONS ARE, OF COURSE, NOW OVER 10 YEARS OUT OF DATE. IN ADDITION, A MORE CREATIVE APPROACH TO THE ENFORCEMENT PROVISIONS OF THE ACT AND THE CHARACTER OF THE PENALTIES THAT MAY BE IMPOSED

IS ALSO NECESSARY. RECENT AMENDMENTS TO THE ENVIRONMENTAL PROTECTION ACT OF ONTARIO OFFER AN ILLUSTRATION OF THE APPROACH THAT CAN BE ADOPTED WHEN ENFORCEMENT BECOMES THE SUBJECT OF SERIOUS ATTENTION.

Emergency Planning

14. THAT THE MATTER OF EMERGENCY PLANNING BE MADE A FORMAL REGULATORY REQUIREMENT UNDER THE ATOMIC ENERGY CONTROL ACT, AND THAT EXPLICIT REQUIREMENTS BE ESTABLISHED WITH RESPECT TO MONITORING AND NOTICE.

15. THAT EMERGENCY PLANNING BE CARRIED OUT IN ONTARIO ON THE BASIS OF A WORST CASE SCENARIO THAT CONTEMPLATES AN ACCIDENT IN THE ORDER OF SERIOUSNESS OF THREE MILE ISLAND OR CHERNOBYL.

16. THAT EFFORTS BE MADE, INCLUDING THE PROVISION OF INTERVENOR FUNDING, TO ENSURE THE BROADEST PARTICIPATION OF ALL THOSE INTERESTED IN THE DEVELOPMENT OF EMERGENCY PLANS.

The Atomic Energy Control Board

17. THAT THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO PROVIDE THAT THE BOARD CONSISTS OF NOT LESS THAN NINE MEMBERS OF WHOM NOT LESS THAN FOUR SHALL BE APPOINTED ON A FULL-TIME BASIS. ADDITIONAL APPOINTMENTS MAY FROM TIME-TO-TIME BE MADE, BUT IN A MANNER THAT MAINTAINS THE BALANCE OF EXPERTISE

REQUIRED BY THE AMENDMENTS OF THE ACT SETTING OUT BOARD MEMBER QUALIFICATIONS.

18. THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO PRESCRIBE MINIMUM QUALIFICATIONS OF BOARD MEMBERS BY:

(a) MAKING INELIGIBLE FOR APPOINTMENT ANYONE WITH A BUSINESS ASSOCIATION WITH THE NUCLEAR INDUSTRY;

(b) DELINEATING PROCEDURES NECESSARY TO DETERMINING MATTERS OF CONFLICT OF INTEREST AS MAY ARISE;

(c) PROVIDING THAT NO MORE THAN ONE-THIRD OF THE MEMBERS OF THE BOARD AT ANY TIME SHALL HAVE BEEN EMPLOYED IN THE FIVE YEARS PRECEDING THEIR APPOINTMENT BY A NUCLEAR INDUSTRY RELATED BUSINESS, AGENCY OR DEPARTMENT;

(d) PROVIDING THAT NO BOARD MEMBER WITHIN 18 MONTHS OF LEAVING THE BOARD ACCEPT EMPLOYMENT WITH A NUCLEAR RELATED BUSINESS;

(e) PROVIDING THAT THE SELECTION OF BOARD MEMBERS OFFER A BALANCE OF EXPERTISE IN THE AREAS THE AREAS OF HEALTH, PHYSICS, ECONOMICS, ENVIRONMENTAL PROTECTION, ENGINEERING, ETHICS AND LAW.

19. THAT AN APPOINTMENTS PROCEDURE BE ESABLISHED THAT WOULD, INTER ALIA, PROVIDE FOR THE PUBLICATION OF

ALL PROSPECTIVE NOMINATIONS AND FOR REVIEW AND RATIFICATION BY A STANDING COMMITTEE ON APPOINTMENTS.

20. THAT THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO PROVIDE THAT THE BOARD REPORT TO THE MINISTER OF THE ENVIRONMENT OR THE MINISTER OF NATIONAL HEALTH AND WELFARE WITH RESPECT TO ITS REGULATION OF HEALTH, SAFETY, SECURITY AND THE ENVIRONMENTAL ASPECTS OF NUCLEAR POWER.

21. THAT SECTION 7 OF THE ACT ALLOWING THE MINISTER OF ENERGY, MINES AND RESOURCES TO DIRECT THE BOARD IN ITS PURPOSES BE RESCINDED.

22. THAT THE ACT BE AMENDED TO IMPOSE A POSITIVE OBLIGATION THAT THE AECB ACT AS A SOURCE FOR, AND DISSEMINATE, INFORMATION AND MATERIAL CONCERNING HEALTH, SAFETY AND ENVIRONMENTAL MATTERS IN RELATION TO NUCLEAR ENERGY.

23. THAT A PUBLIC DOCKET BE ESTABLISHED CONCERNING ALL AECB REGULATORY ACTIVITIES WITH RESPECT TO A PARTICULAR NUCLEAR FACILITY AND BE MADE ACCESSIBLE TO ANY INTERESTED PERSON.

24. THAT THE ACT BE AMENDED TO ARTICULATE THE PURPOSES OF THE BOARD BEING TO ENSURE THE PRESERVATION OF THE HEALTH AND SAFETY OF PERSONS AND TO PROTECT THE ENVIRONMENT FROM THE HAZARDS ASSOCIATED WITH PRODUCTION, POSSESSION AND USE OF PRESCRIBED SUBSTANCES.

25. THAT THE ACT BE AMENDED TO REQUIRE THAT THE BOARD REFUSE, REVOKE OR AMEND ANY LICENCE OR CERTIFICATE GRANTED WITH RESPECT WITH A NUCLEAR ENTERPRISE THAT THREATENS HARM TO THE HEALTH OR SAFETY OF PERSONS OR TO THE ENVIRONMENT.

I. QUESTIONS

In carrying out this analytical review of the nuclear regulatory regime we have attempted to address the following questions:

1. ARE THE RISKS INHERENT IN NUCLEAR POWER GENERATION, RISKS THAT WE AS A SOCIETY WISH TO ACCEPT?

2. IS THE ANSWER TO QUESTION 1 TO BE INFLUENCED BY THE AVAILABILITY (OR LACK THEREOF) OF ALTERNATIVES THAT POSE FEWER RISKS, OR THAT ARE MORE COST EFFECTIVE, OR MORE ECOLOGICALLY VIABLE?

3. IF OUR PRESENT NUCLEAR SYSTEM IS TO BE MAINTAINED (AND POTENTIALLY EXPANDED) HOW CAN WE BEST REGULATE IT:

   (A) WHO SHOULD MAKE DECISIONS ABOUT RISK AND SAFETY?

   (B) WHAT DECISION-MAKING PROCESSES SHOULD THEY ADOPT?

   (C) WHAT CRITERIA SHOULD GUIDE THE PROCESS?

   (D) HOW CAN COMPLIANCE BEST BE ENSURED?

II. FIRST PRINCIPLES

1. SAFETY/RISK

As many have noted and virtually all would agree, to speak of safety in terms of absolutes is misleading. A judgment about the "safety" of the CANDU nuclear system is a determination that the risks presented by the system are acceptable in the circumstances. As a general proscription, the safety of a particular endeavor is fundamentally and essentially a relative proposition that cannot be answered but with reference to the context (circumstances) within which the endeavour is undertaken.

As to the matter of the acceptability of that risk, the essential issue is "acceptable" to whom -- those who must bear the potential adverse consequences? those who are to be the beneficiaries of the undertaking? or those charged with the responsibility of balancing the public interest the costs and the benefits for society at large. The answer must, in our view, include all three. Because the issue before us concerns the activities of a provincial Crown corporation, providing energy services to all Ontarians, and because the impacts of nuclear power are equally far reaching, the three constituencies are, at least in theory, closely identified.

The circumstances that will frame the context within which acceptability will be determined must include a

consideration of the alternatives available for meeting the objectives or satisfying the purposes of the endeavour. For example, where there are two ways to achieve the same goal, and even where the risks associated with one course may be nominal, those risks may be unacceptable where the other course presents virtually no risk at all.

Not only is such a comparative approach rational, but it as well obviates the necessity of making judgments that are difficult, if not impossible, to justify morally. That is, are the economic, social and other benefits to be derived from a course of action sufficient to justify an increase in mortality in those exposed to the adverse consequences of the endeavour, and if so what additional degree of mortality is acceptable?

Attempts to address the matter of safety without coming to grips with the threshold issue of whether the risks of nuclear power are acceptable, given alternative means for accomplishing the same objectives, are destined to result in unsatisfactory results. The economic and social determinants of the equation, such important factors in the regulatory equation, are absolutely fundamental to the matter of whether nuclear power will be undertaken in the first place. It is the failure of earlier reviews to satisfactorily address the issue of safety in this broader context that has made necessary this third assessment of CANDU reactor safety to be undertaken in the last decade.

There is simply, in our view, no elegant way to determine the acceptability of the risks associated with nuclear power that is not fully informed by social, environmental and economic realities. The only satisfactory measure of the potentially catastrophic consequences of nuclear power is one that measures the costs of that endeavour compared and compares them with those associated with alternative means of providing energy service needs.

For those who doubt the influence of supply and economic issues to an assessment of nuclear safety, consider the risks of nuclear power in a context where:

- nuclear generation is not already a component of the electric system,

- adequate supplies of electrical power exist for the foreseeable future.

Need is clearly a fundamental and unavoidable element of the safety/risk equation.

2. ENERGY POLICY AND PLANNING

There is in the articulation of the issues of interest to the Ontario Nuclear Safety Review an understandable emphasis on the CANDU nuclear system as it presently exists. There is no explicit reference to the CANDU system as it came to be, or as it may be expanded. In our view however, a judgment about the safety of the present system must be informed by an understanding and

assessment of the planning and approvals process that led to the establishment of the system in the first place.

We may anticipate in response to this suggestion, a reluctance to embark upon an analysis that some may argue is beyond the confines of this review, and that is more appropriately the subject of a broader inquiry concerning electrical energy policy and planning. The two antecedents to this review, the Royal Commission on Electric Power Planning (RCEPP) and the Macdonald Select Committee, did precisely that. That is, the matter of nuclear safety was considered within the context of a broader assessment of Ontario Hydro affairs. Indeed, the same is true, albeit to a lesser extent, of the present review, arising as it does from the recommendations of the most recent Select Committee of the Ontario Legislature convened to consider electrical energy policy and matters. The relationship of this review then to the deliberations of the committee is one that should bear upon present deliberations.

We strongly believe that an attempt to hive off the matter of nuclear safety from the planning and approvals process introduces at the outset of the inquiry a limitation that would fundamentally undermine the utility of this review for the following reasons:

1. Matters of risk and safety cannot be and are not evaluated in a vacuum. As Torrie notes, "It is impossible to separate the question of risk from

nuclear power production from the complex and controversial question of its necessity."[4] As the preceding discussion has argued, without comparing nuclear energy with its alternatives, the results of this inquiry will be no more satisfactory than the conclusions on the same subject of RCEPP or the Macdonald Select Committee.

2. A conclusion that the present system is safe will inevitably provide a justification or a rationale for expanding it. During the course of his deliberations, Arthur Porter concluded that:

> With declining low growth and resulting diminishing prospects for a large nuclear program, it is our belief that the licencing of new facilities will not be a major aspect of nuclear generation in Ontario during the next decade. Instead, attention should be focused increasingly on the management of existing plants, and on compliance with regulations. (RCEPP Final Report, p.77)

Unfortunately that decade has passed with little progress having been made to accomplish the regulatory reforms he advocated.

With the recent, and arguably inevitable, indications that additional nuclear facilities will soon be on the public agenda in this province, it is important that this inquiry not ignore the implications of its conclusions upon the looming public debate.

3. The majority of the issues highlighted by this review are matters within the federal jurisdictional domain. However, the focus of these deliberations is not, of course, the nuclear system in Canada or even in Ontario, but rather only the nuclear system as it is engendered by Ontario Hydro's CANDU generation stations. In considering the regulatory role of the AECB, it is absolutely essential to continue to keep in mind the fact that AECB's role only arises upon the initiation of the provincial Crown corporation whose expansion plans must be specifically approved by a provincial Cabinet. It is important that the role of the provincial government and the instrument of its policies, Ontario Hydro, be made explicit where matters of safety are considered in each of its various facets, from reactor planning to enforcement of federal regulation.

   It would be ironic for a provincial inquiry into nuclear safety to skirt those matters, such as the provincial environmental assessment process, that bear so fundamentally upon the matter of safety and that are within the provincial jurisdictional domain.

4. As our analysis of the regulatory role of the AECB will advance, economic and supply issues often determine the positions of the AECB and Ontario Hydro and on occasion dictate the regulatory approach taken by the former. However, AECB's regulatory jurisdiction arises years into the

planning and approvals process that will fix economic and supply realities, and thus indirectly AECB's regulatory options. The issuance of the Bruce "A" licence, described in detail by the Macdonald Select Committee and in other submissions prepared for this review, provides an unfortunate illustration of how fundamental that influence can be. The matter of risk, if for no other reason, should be an important and explicit element in the planning and approvals process.

Neither is it, in our view, appropriate to vest in the AECB a regulatory role with respect to the policy and planning of a provincial Crown corporation. Rather the matter is appropriately addressed at the provincial level under the auspices of provincial legislation and where a full and public hearing of economic, supply and other issues, that will so greatly influence the AECB's role, can take place.

5. The approach we advocate is, we believe, consonant with the recommendations of the Porter Commission on the matter of nuclear decision-making:

> • The central issue in Ontario's electric power system, as perceived by the people, is the role nuclear power should play. Many people appear largely to discount the scientific and technological data and information relating, for example, to the safety of nuclear power stations and the ultimate disposal of high-level radioactive wastes.

- Novel and imaginative ways are needed of involving the public in decisions relating to nuclear power, and, indeed, in energy and environmental problems, in general. At the same time, understandable information relating to these decisions must be available. Further, and most important, because the complexity of the health, social, and political dimensions of nuclear power are at least as important as the technology, the information base should be biased towards the socio-political implications.

- There should be a determination on the part of government to ensure that decision-making is more open, and, unless national and public security implications dictate otherwise, all information relating to nuclear power systems should be made available to the public.

- Ontario Hydro and the government should ensure, to provide a sound basis for decision-making, that future hearings relating to nuclear power have a primary commitment to the candid exploration of the issues. To facilitate this openness, legitimate public interest groups concerned with the major nuclear issues should be supported financially.

- To inspire more confidence, especially in those who are most affected by nuclear power decisions, quantitative and qualitative assumptions should be open to public scrutiny. (RCEPP Final Report, p. 77)

6. Finally, should we fail to require a public determination of the risks engendered by nuclear power during the planning stages, subsequent site approval or licensing hearings will likely then be co-opted with a debate about generic issues that have remained unaddressed. This is precisely the scenario that has played itself out in the United

States, where intervenors in Nuclear Regulatory Commission hearings on site approval have insisted on using those hearings as a forum to raise generic issues because the policy setting process failed to engender public participation.

It is for these reasons that we begin our substantive submissions with a consideration of the planning and approvals process, and specifically with the important contribution that the Environmental Assessment Act can make in determining whether the risks associated with the CANDU system are ones that we as a society should accept. Before getting there, however, it is appropriate to consider one other principle that has guided our approach to this issue.

3. ACCOUNTABILITY

The concept of accountability is, in our view, the single most important test of nuclear regulatory and decision-making processes. An accountable nuclear power system is one that is responsive and responsible to the people of Ontario and Canada. It is fundamental to the notion of accountability that ultimate control or authority rest with those to whom the account is being rendered. Ontario Hydro is not accountable, when it may choose to disregard the advice or direction it receives from a regulatory agency.

When applied to the planning, design and operation of a system as complex as Ontario Hydro's CANDU nuclear system, the notion of accountability is multi-faceted.

The particular mechanism of accountability to be adopted must vary with the nature of the institution or constituency to which an account must be made. Thus, Hydro must, with respect to different matters, account to either the Legislature, various regulatory institutions, its customers or the public at large. The AECB, on the other hand, should in its regulatory role reflect societal norms with respect to risk and safety and should therefore account to the community at large. Yet other mechanisms of accountability are appropriate for those who politically direct the activities of Ontario Hydro or the AECB. Whatever the particular configuration however, there are certain essential elements that must in all cases be present.

The first is that an accountable organizational structure should separate responsibility for policy formulation and commercial activity from regulation and enforcement. For example, the AECB, as a regulatory institution, should operate independently of political control, particularly from those responsible for promoting the undertaking subject to its regulation. Similarly, the environmental assessment of proposed nuclear reactors requires regulation that should also be exercised free from political influence. On the other hand, a system for energy policy and planning must be accountable to the political process. It is important therefore to match the regulatory mechanism to the particular character of the matter with respect to which accountability is needed.

As has been argued elsewhere,[5] Ontario Hydro is free to exercise decision-making authority with respect to a variety of matters virtually free from any regulatory control whatsoever. Also problematic is the fact the AECB does not have the independence enjoyed by many other regulatory agencies with far less difficult agendas.

The second element of an accountable system requires that authority and responsibility be clearly and precisely defined by legislation. In a society committed to the rule of law, it is vital that the rules by which its citizens and institutions are to govern themselves be clearly and unambiguously defined. They cannot ebb and flow with the particular inclination of public officials or the political views of the day. In our view, public confidence in aregulatory regime largely depends upon the establishment of explicit rules of consistent application. Further, absent clear regulatory requirements, the task of enforcement is substantially undermined.

Thirdly, regulatory institutions must have sufficient resources if they are to effectively carry out their respective mandates. Not only must government, regulators and the public have access to pertinent information, but each must as well have the tools and skills necessary to analyze and assess that data. The imbalance of resources that has traditionally characterized this domain has also created a mystique of authority that has repeatedly daunted those who must weigh competing and very divergent views offered by

Ontario Hydro on the one hand, and its critics on the other.

It will be no progress at all to bolster existing regulatory controls in theory alone. Clear legislative language must be complemented by the human and informational resources necessary to bring theory to practice.

The fourth is that public participation should be considered an essential component of an accountable regulatory system. Much has been written concerning the utility of public participation in the energy policy planning and implementation process. The RCEPP consideration of this issue is to be found in chapter 12 of its final report, and offers an excellent analysis of the rationale for and benefits to be derived from broadening the scope of meaningful public involvement in the regulatory process. In its report, the Commission characterized energy problems as increasingly "problems of decision-making rather than technology and systems operations." The Commission concluded that the diverse social, economic, environmental and ethical dimensions of energy issues necessitated a pluralistic approach to energy policy formulation and implementation.[6]

The Commission went on to discuss three basic concepts and principles that informed its views as to the role of public participation. The first concerned the risks, both to human health and social institutions, that arise in the energy area. The determination of acceptable risks was, in the Commission's view,

essentially a "value judgment that should be made by politicians, social scientists, the general public and lawyers, as well as by scientists and engineers."[7] The second addressed the problems associated with the virtual monopoly on technical information enjoyed by Ontario Hydro and government. In consequence, the debate between Hydro and its critics was, in the Commission's view, undemocratic and a disservice to both sides. The result of this was, as the Commission noted, a tendency of "policy makers...to ignore criticisms coming from the public which they deemed to be uninformed, and there will be a tendency for the public to reject policies and decisions that they cannot verify."[8]

Thirdly, the Commission described the utility of public participation as providing decision-makers with the benefit of diverse points of view. A properly functioning regulatory system must, the Commission argued, be capable of responding quickly to emergency situations, capable as well of correctly anticipating predictable events. Public participation would then add significantly to the responsiveness and resilience of the system.[9]

Public participation is clearly a two-way street. From informal consultation sessions to the participatory rights offered before a variety of administrative tribunals, public discussion and debate provides an invaluable opportunity to provide information to the community at large and to local and special interest groups. Where the public is given a meaningful oppor-

tunity to influence the decision-making process, public participation can also become an important mechanism of accountability. We are simply no longer content as a society to entrust problematic social, economic and technical matters to the private deliberations of experts and public officials. Experience shows that nothing is so likely to provoke scepticism and mistrust as a decision-making process closed to public view and participation.

Going the other way on this two-way street is also a vital flow of information and criticism. Participatory processes are often regarded by regulators and others as a nuisance that must be endured to allay the concerns of an uninformed public. This view is unfortunate and fails to recognize the enormous contribution that public involvement has made to the quality of a diverse array of regulatory processes.

The area of energy system planning and control offers an excellent illustration. Few would debate the value of the contribution made in this domain by a variety of public interest groups and individuals motivated by a desire to promote resource conservation, protect public health and the environment and foster democratic and accountable regulatory processes. Many of the recommendations of the Macdonald Select Committee and RCEPP directly reflect the submissions of public interest groups and spokespersons who have appeared before them. Even where decision-makers have preferred more traditional views, few would deny the invaluable contribu-

tion to the debate made by those who challenge the conventions.

III. SYSTEM PLANNING

Pursuant to sections 4 and 5 of the Power Corporations Act, responsibility for long-range strategic corporate planning, the process that will determine Ontario Hydro's commitment to nuclear energy is vested in the utility's Board of Directors. Currently, no regulatory control or oversight whatsoever is exercised with respect to this seminal stage of the planning process. Neither is Ontario Hydro's planning undertaken within the context of an overall electrical energy plan developed by the province, for there is none. Rather, the role of the Ministry of Energy is reactive, with government involvement occurring only after the review and assessment process has been concluded. It is lamentable that the role of government, at least in the incipient stages of the electrical system planning process, appears to be upon invitation by Ontario Hydro.[10]

Ontario Hydro is currently engaged in a long range strategic planning process that it describes as a Demand Supply Option Study (DSOS). While Ontario Hydro has been solicitous of some public comment during the DSOS process, the public role is limited, no resources are provided and again public participation occurs only upon invitation by Ontario Hydro, which is of course entirely free to ignore any of the input it receives.

Section 23 of the Power Corporations Act does accord the Cabinet the responsibility of approving any

projects that Ontario Hydro may wish to pursue in consequence of its planning process. However, no other oversight or regulatory authority is currently exercised with respect to these early but critical stages of the planning process. Thus with respect to the present Demand Supply Option Study, no formal opportunity exists to debate or evaluate Ontario Hydro's judgments concerning nuclear power and the advantages and risks it may present.

Neither can Cabinet's authority be considered an adequate mechanism of accountability for several reasons. The first is that Cabinet is an executive institution suited to policy determinations, not the detailed affairs of a large electrical utility. The allocation of these decision-making functions to Cabinet fails to match regulatory function, with an institution suited by character and resources to the task. The result is that the qualified and independent judgment that must be exercised with respect to these matters, so clearly of major importance to the people of Ontario, is simply not provided for in the existing arrangement.

Many have recognized the need to expand participatory rights to the AECB's approval and regulatory process. However, even were these recommendations to be implemented, the jurisdiction of the AECB arises at a point too far along in the planning and approvals to allow an unconstrained decision by the Board as to the safety of the proposed facility. While the Board will in theory be entitled to deny the applicant a licence, the

economic and supply imperatives are such that the only real decision before the Board concerns the terms and conditions of approval, and not the approval itself. Rather, the fundamental task of the Board is to regulate or manage the risks that the nuclear station may present. It will not, and arguably should not, determine the threshold issue of whether the inevitable risk of the undertaking is one that we wish to accept in the first place.

That determination must, as we have argued, be made far earlier in the planning process. Once a substantial investment of time and resources has been made to a nuclear undertaking it is simply too late to effectively address the issue that should have been determined before that commitment was made. The recent Select Committee's deliberations on Darlington offer a rather extreme example of the case in point.

The time to deal with the basic question of safety and risk and nuclear power is during the early stages of the planning process. Unfortunately, this has never taken place in Ontario. In consequence, public concerns about nuclear safety have remained unaddressed. Concerns that do not appear to have been satisfied by successive reviews of nuclear safety, all of which have concluded that:

1. The present system is acceptably safe, (leaving unarticulated how the matter of acceptability was determined); and that

2. Reforms are needed to the regulatory system (recommendations that are subsequently ignored).

It may simply be that the people of Ontario have little faith that, short of a catastrophe, any real opportunity exists but to continue with a multi-billion dollar system on which we are all presently dependent.

While it is conceivable that this scenario, now playing itself out again with the DSOS soon to be released, may continue for some time without catastrophic environmental or public health consequences. The process hardly represents a rational or democratic approach to a matter of such great public concern.

The alternative is to establish a process that will allow an effective opportunity to address the issue of risk and safety at a stage in the planning process where real options exist. Then should a decision to proceed result, we will do so with a knowledge that the risks of nuclear power have been fully identified and an informed and democratic decision made to accept them.

It is our submission that the Ontario environmental assessment process offers the appropriate regulatory regime for addressing, inter alia, the risks of nuclear power during the system planning process. In fact, the wording of the Act clearly indicates that its provisions apply to "a proposal, plan or program" in respect to enterprises or activities, as well as to the enterprise or activity itself.[11] We believe that

Ontario Hydro's Demand Supply Option Study is for that reason subject to the present provisions of the Act, a point that Ontario Hydro apparently disputes.[12]

Before we describe the environmental assessment process and argue the case of its suitability for addressing the threshold issues of nuclear safety, we should recognize the constitutional uncertainty concerning the applicability of this provincial statute to a matter subject to federal regulation under the Atomic Energy Control Act. While a constitutional argument certainly exists that the province does not have the authority to require compliance with the Act, it is entirely unlikely in our view that a provincial Crown corporation would challenge the competence of the province to regulate its affairs. In addition and in so far as system planning is concerned, it should be noted that no jurisdiction arises in the AECB at this early stage. And for that reason no conflict between provincial and environmental legislation and the Atomic Energy Act should arise. We will deal with jurisdictional issues further in part IV of this brief.

1. THE ENVIRONMENTAL ASSESSMENT PROCESS

The Environmental Assessment Act of Ontario is the most comprehensive statute of its kind in Canada. But since its proclamation in 1976, the Act has unfortunately had only a limited application to Ontario Hydro matters. Hydro was successful, after mounting a vigorous campaign, in having the Darlington nuclear generating station exempt from the Act, and Ontario Hydro has

subsequently used that exemption to argue (in current proceedings before the Divisional Court) that the establishment of a tritium removal facility at the Darlington site was similarly excused from satisfying the Act's requirements. To date the environmental assessment process has been used only, with respect to Hydro matters, for the purposes of transmission line siting and certain routine activities.

Under the Act, "environment" is defined in an holistic fashion and includes:

> (i) air, land or water,
>
> (ii) plant and animal life, including man,
>
> (iii) the social, economic and cultural conditions that influence the life of man or a community,
>
> (iv) any building, structure, machine or other device or thing made by man,
>
> (v) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from the activities of man, or
>
> (vi) any part or combination of the foregoing and the interrelationships between any two or more of them.

One important advantage of this expansive definition of the environment is that it provides a clear direction to avoid the externalization of costs, impacts or risks associated with a particular undertaking.

The substantive requirements of the Act are set out in section 5(3), which provides:

> (3) An environmental assessment submitted to the Minister pursuant to subsection (1) shall consist of,
>
> (a) a description of the purpose of the undertaking;
>
> (b) a description of and a statement of the rationale for,
>
> (i) the undertaking,
>
> (ii) the alternative methods of carrying out the undertaking, and
>
> (iii) the alternatives to the undertaking;
>
> (c) a description of,
>
> (i) the environment that will be affected or that might reasonably be expected to be affected, directly or indirectly,
>
> (ii) the effects that will be caused or that might reasonably be expected to be caused to the environment, and
>
> (iii) the actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment,
>
> by the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking; and
>
> (d) an evaluation of the advantages and disadvantages to the environment of the

> undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking. R.S.O. 1980, c. 140, s.5.

Another major facet of the environmental assessment process is the review and public hearing requirements that it mandates. Section 7 requires the Minister to circulate for review any assessment that he or she receives, allowing other government ministries and agencies to articulate any concerns or comments they may have regarding to the undertaking. The Minister must subsequently publish and give notice of the receipt of environmental assessment and completion of the Ministry review to appropriate parties. Any person may consequently request of the Minister that a hearing be convened before the Environmental Assessment Board to examine the adequacy of the environmental assessment and determine the matter of project approval.

We are strongly of the view that the planning methodology contemplated by the Act is vital to a thorough and comprehensive assessment of all of the risks, costs and benefits associated with the nuclear option. To illustrate: the Act provides a methodology for answering the following questions: What are the risks associated with the CANDU nuclear system? How do those risks compare with alternative means for providing energy service needs? Which system planning option will create more employment? Which will minimize the release of contaminants to the environment? Which is more amenable to democratic control and accountable institutions? Which will most reliably meet the energy

service needs of Ontario citizens? Which will create the greatest demand upon the provincial economy?

In its final report the RCEPP strongly endorsed the utility of the environmental assessment process as essential to electrical system planning and concluded that the Act provides an important tool to "integrate the development of energy policies with social and environmental policies associated with energy."[13]

We have before us a unique opportunity to apply to the system planning process the lessons we have learned during the last decade. In particular, with respect to anticipated plans to expand the CANDU system, the environmental assessment process offers a methodology that requires a rational and comprehensive assessment of the risks and safety of the nuclear option. Adopting the process now may well obviate the need to carry out three more reviews of the matter of nuclear safety during the next decade.

2. RECOMMENDATIONS

Accordingly, we recommend:

1. THAT THE RISKS OF NUCLEAR POWER BE ASSESSED PURSUANT TO THE ENVIRONMENTAL ASSESSMENT ACT DURING THE SYSTEM PLANNING STAGE, PRESENTLY BEING UNDERTAKEN BY ONTARIO HYDRO, BEFORE ANY COMMENTMENT IS MADE TO ADDITIONAL NUCLEAR CAPACITY.

IV. APPROVALS

1. SITE SELECTION

Subject to jurisdictional caveats, the selection of a site upon which to establish a nuclear reactor is subject to regulation at both the provincial and federal level. Ontario Hydro will at first instance need Cabinet approval for the aquisition of property on which to establish the facility. Subject to the comments on jurisdiction noted above, approval pursuant to the provisions of the Environmental Assessment Act must also be obtained.

In addition, site approval must be obtained from the AECB which will require Hydro to submit a Site Evaluation Report, which is to include a description of the nuclear generating station, present and future population figures, and information about land and water uses, water sources and movement, weather, seismology and geology. The design of the reactor must be described in enough detail to permit an analysis of the acceptability of the site for that particular reactor design. The AECB staff then prepares a review of the Site Evaluation Report, which is submitted to the Board to assist it in reaching its decision.[14]

In contrast with the Ontario environmental approval process, it has not been the practice of the Board to consider broad environmental impact issues or the

social and economic implications of building a reactor at a particular site.

Recent proposed changes to the Atomic Energy Control Regulations recommend that a new section be added dealing specifically with the site licence to clarify AECB's role in the site approval process. Pursuant to this proposed amendment Ontario Hydro would be prohibited from preparing a site for construction until it had obtained a site licence, thus limiting expenditures on a project until AECB had an adequate opportunity to conduct an initial review.[15]

No public hearing is required with respect to AECB's deliberations in this regard, and it has not been the practice of the Board to convene one.

Should federal funding or land be involved it is conceivable that the federal Environmental Assessment and Review Process (EARP) might also come into play. Because the EARP process is not required of federal or provincial Crown corporations and because the provincial environmental assessment process is more comprehensive, it is not likely that an Ontario Hydro undertaking would ever be subject to EARP review.

2. DESIGN

As with the site approval process the design of a nuclear facility is subject to regulation at both the federal and provincial levels. In this instance, several approvals from various agencies must be

acquired before construction begins. However, predominant regulatory authority in matters of nuclear design is exercised by the AECB. Once the decision is made to go nuclear, the AECB has the primary task of determining what design measures are necessary in order to manage the risk presented by a nuclear generation station in a manner it deems acceptable.

The regulatory criteria articulated for the issuance of construction and operating licences are sketched in only the broadest of terms. Neither are the principles nor criteria upon which such licences are granted given any formal articulation. Rather the regulatory approach and philosophy of the Board must be discerned from certain "consultative" and "advisory" documents that have been developed and revised over the years.

The underlying regulatory philosophy in Canada is one that posits certain limits for radiation exposure that the reactor design must meet. Ontario Hydro, as designer of the CANDU system, is relatively free to develop any design that meets those stated exposure limits. In contrast, the U.S. model specifies the operating components of the reactor in significant detail, and only then goes on to estimate expected radiation doses in the event of an accident.

The AECB has over the years utilized five principles to implement its regulatory philosophy.

1. reference dose limits, coupled with a maximum frequency of system failure;

2. the defence in depth principle;

3. the ALARA principle;

4. a new approach to reference dose limits, which was used on a trial basis in the licensing of the Darlington reactor; and

5. a probabilistic risk assessment.

Because of their critical bearing upon the matter of nuclear safety, we will consider each of these principles and their limitations.

(a) Reference Dose Limits

The AECB's first siting guide, which came out in November, 1964, set maximum dose limits for both single failure and dual failure accidents. A single failure accident is a process system failure which could lead to fuel failure or radioactive releases in the event that a safety system fails to function. A dual failure is the concurrent failure of both a process system and a safety system. The reference dose limits at the reactor site boundary for a single accident was made equivalent to the maximum annual dose for normal operations, one-half rem. Coupled to this dose limit was a requirement that a single process failure should not occur more than once in every three years. Population dose limits are also set, but the limiting factor

in the design of a reactor tends to be the individual dose limit.

Similarly, for a dual failure, the maximum individual dose limit was set at 25 rems, and the maximum probability for this type of accident was set at once per 3,000 years. The maximum dose limit of 25 rems was chosen as a tolerable, once-in-a-lifetime dose for an individual. No maximum dose limit was set for a triple failure (which would be defined as a serious process failure coupled with the failure of two special safety systems) because the occurrence of such an event was considered too improbable.[16]

There are several difficulties with this particular approach to regulating nuclear safety. First, the dose limits appear to have been chosen rather arbitrarily. Equally problematic are other shortcomings of this approach, which has been criticized because:

1. no differentiation is made among single or dual failure accidents that have different probabilities and different consequences;

2. the equation fails to treat external events explicitly;

3. it fails to deal with low probability events; and

4. it is inadequate to deal properly with safety system impairment.[17]

AECB has apparently recognized these shortcomings and is in the process of revising its approach (see below).

(b) Defence in Depth

The principle of defence in depth requires the establishment of multiple barriers to the release of fusion products and articulates specific requirements for special safety systems. Process equipment, protective devices and containment systems must each exist independently of the other. In a CANDU reactor such and approach would include:

1. two independent, rapid and diverse reactor shutdown systems;

2. a means for injecting coolant; and

3. a means for containing any radioactive material that may be released from the primary cooling system.[18]

This principle is essentially an adjunct of the reference dose limit regulatory model.

(c) ALARA

This principle directs Ontario Hydro to keep radioactive discharges as low as reasonably achievable, social and economic factors being taken into account. The definition is so utterly vague that it could support virtually any judgment about the degree of

safety design appropriate, and represents little more than an invitation to Ontario to do its best.

(d) Revised Reference Dose Limits

Recently, an expanded analysis of reference dose limits has been applied to the licensing of the Darlington nuclear reactor. This approach is detailed in Consultative Document C-6 entitled, "Proposed Regulatory Guide: Requirements for the Safety Analysis of Candu Nuclear Power Plants." Instead of simply postulating two categories of accidents (the single failure/dual failure approach), five different categories of accidents are described, each having a maximum permissible individual reference dose limit. A list of predetermined postulated accidents was examined by the AECB staff, and each of these accidents was placed into one of the five accident categories based on the staff's judgment of the accident's probability of occurrence. Since this latest approach is still experimental, both the single failure/dual failure approach and the evolutionary approach documented in Consultative Document C-6 are being used in the Darlington licensing process.[19] While this expanded list of categories was designed to address some of the difficulties which were encountered by the traditional single failure/dual failure approach, fundamental problems remain, problems which have frequently resulted in significant disputes between AECB and other agencies.

First of all, considerable uncertainty exists in defining reliability and availablility targets and choosing the appropriate methods for demonstrating compliance with those targets. A safety system may be technically "unavailable" but still be able to adequately perform its required functions.

Secondly, it is not always clear which accident sequences must be analyzed in a safety analysis.

Thirdly, uncertainty exists regarding to the deterministic requirements for safety-related design features in nuclear power plants. In approving the design of a number of reactors, the AECB has gradually developed a notion of "acceptable safety-related design features," indicating a willingness to forego what appeared to be rather definite and critical requirements.[20]

(e) Probabilistic Risk Assessment

Finally, the technique of probabilistic risk assessment is used to verify the safety of the reactor's design. The main tools in probabilistic risk assessment are the event tree and the fault tree. In the first step of probabilistic analysis, potential initiating events which may have harmful consequences are identified. A typical initiating event is loss of coolant. Once an initiating event is chosen, an event tree analysis is carried out. The event tree identifies any system which will mitigate the effects of the initiating event. Next, one assumes that each of the mitigating systems

fails, and the resultant fuel damage for each failure is noted. Fault tree analyses are then carried out. In the fault tree, all systems that could affect the reliability of the mitigating functions are identified. When the event trees and fault trees are integrated, the frequency of the various types of fuel damage can be calculated. The results of a probabilistic risk assessment may be useful for identifying event sequences which had previously been ignored, or event sequences that have a relatively high frequency of occurrence.

There are however several limitations with probabilistic risk assessment because of the incomplete information base that is used in the analysis. The United States' Government Accounting Office has identified the following difficulties:

> - [probabilistic risk assessment] analysis may not have identified all events that could start or direct the cause of an accident.
> - sufficient and reliable data may not be available to model and quantify the behaviour of plant systems and accident processes.
> - analysts may not make the best assumptions where data are lacking.
> - computer models may not realistically represent plant behaviour and accident processes.[21]

The product of the model is of course only as good as the data used to drive it. In this instance, the GAO criticisms seriously undermine confidence in that data.

(f) Decisions About Risk

In design development, questions of safety and risk are resolved by the AECB by using a probabilistic risk equation (as distinguished from the fault tree analyzing probabilistic risk assessment). The model posits that the risk of any detrimental occurrence is obtained by multiplying the probability of the occurrence times the perceived consequences of that event. The implication of this analysis is that any nuclear accident can pose an acceptable risk, no matter how grave its consequences, as long as the probability of its occurrence is sufficiently low.

This fundamental risk equation is subject to criticism on two levels:

1. difficulties in the application of the equation to real-life situations cast into considerable doubt the results obtained by using the equation; i.e. even within its own philosophical limits, the model may simply not be capable of application to the risks of nuclear power, and

2. the equation, itself, may be unacceptable for determining the safety of nuclear reactors because it fails to address the proper questions.

Many scientists have conceded the mathematical risk equation is of limited use for events having a very low probability. In this type of circumstance the result-

ing risk estimate can only be described as highly speculative. There is also considerable debate as to how validly probability predictions can be made. Hafele has pointed out that, in the nuclear energy debate, one is dealing with hypothetical situations. The usual scientific "process of iteration between theory and experiment" cannot be carried out. Therefore arguments about nuclear safety remain theoretical and inconclusive.[22]

Indeed where empirical data does exist, higher than predicted failure rates for process and safety systems are demonstrated, further undermining confidence in probability estimates which AECB supports for major nuclear accidents.[23]

However, the more fundamental criticism of AECB's mathematical approach to evaluating risk is that this definition of risk fails to address the proper questions.

To begin, this "scientific" definition of risk fails to reflect public perceptions about risk, a finding that is not surprising in light of the fact that the AECB has no real obligation to account to the general public. The fact that its "scientific" definition of risk is at odds with the ordinary person's view is apparently one that the Board has been willing to concede.[24] Nevetheless and notwithstanding its internal limitations, the AECB remains steadfast in its commitment to this "scientific equation." An equation which is not

particularly reliable when applied to low probability events with potentially devastating consequences.

Furthermore, the reduction of questions of safety and risk to a mathematical equation enables the AECB to skirt important social questions bearing on the issue. These questions include the extent of our social obligation to future generations, and the inability of the scientific formulation to reflect the true sensibilities of the general public toward nuclear energy.

In fact, in our view, the AECB is asking itself the wrong questions in analyzing safety issues. Steven Raynor and Robin Cantor suggest that rather than trying to decide "How safe is safe enough?", the AECB should be asking "How fair is safe enough?"[25] In other words, since no definite scientific answers exist with respect to what is an acceptable risk, it is important that the process used to determine what is an acceptable risk is perceived as fair.

While a technical approach may be useful for making engineering decisions about competing designs, this type of assessment is "largely irrelevant to societal technical choices."[26] Furthermore, in simplifying the concept of risk in this manner, attention is focused on improving probability analyses and educating the public to understand their implications. In pursuit of these goals, technically trained persons have lost sight of the fact that risk is a multifaceted phenomenon. Public decisions about risk may not be based on the

probability of an occurrence at all, but simply upon the magnitude of its consequences.

The alternative is a much broader notion of risk, which accepts the technical risk equation for technical decisions, but which addresses social concerns about equity and trust in choosing the technological applications that pose an acceptable risk to society. Thus decisions of acceptable risk become validated because of the process by which they are reached. A fair process must ensure that:

1. the procedure used to obtain the collective consent to a particular risk is acceptable to those who will suffer the potential consequences;

2. those who would be affected by a disaster are satisfied with the principle that would be used to apportion liability in the event of an accident; and

3. the institutions which regulate the technology are worthy of trust.[27]

Rather than facilitate informed public debate the risk equation becomes an important rationale for excluding those affected by the decision-making process. At present, only technical professionals, trained to evaluate the probabilities and consequences associated with a particular engineering design, are allowed to play an influential role in assessing the risk of a nuclear reactor.

In our view, the industry and AECB approach to assessing the risks associated with nuclear reactors is artificial and unreliable. The only "acceptable risk" to the public should be one which the people have through a fair and democratic process demonstrated a willingness to accept .

Further on the subject on the AECB's approach to design approval, the Board has demonstrated a disconcerting willingness to waive compliance with its own design criteria and principles:

1. Reactors No. 1 and 2 at the Pickering A NGS have been judged as having a "safe enough" design, even though they each possess only one fast emergency shut-off system. Current AECB official guidelines require two such systems. Nonetheless these two reactors were relicensed in late 1986. Since AECB guidelines do not have the force of law, the AECB has the discretion to license nuclear reactors which do not meet its design guidelines in full.[28]

   This ruling is especially significant in the aftermath of the Chernobyl accident. An AECB analysis of that accident concluded that the safety of the Pickering A reactors should be re-examined in light of the Chernobyl disaster, with particular attention to accidents involving the failure of a

reactor control system or a loss of coolant coupled with the unavailability of the shut-down system.[29]

2. Nuclear reactors at Pickering continued in operation although reliability and availability criteria for process and safety systems were not met in the reactor's early years of operation. Similarly, when the Bruce NGS began operation it also failed to meet availability standards for its shut-down, emergency core cooling and containment systems.[30]

3. Ontario Hydro is required to make conservative assumptions in its safety analysis where knowledge is incomplete. Experience has, shown, however, that it does not necessarily do so. For example, when the emergency core cooling system of the older CANDU reactors were developed, the designers assured the AECB that the system would be able to prevent significant fuel failure, even if conservative assumptions were made. Unfortunately, it turned out that these systems would not in fact be able to prevent fuel failures following a loss of coolant accident. Thus it appears that the original estimates were not conservative, and failed to incorporate an adequate safety margin.[30]

Finally, no public hearing is required, nor is it the AECB's practice to convene one as an element of the design approval process.

3. CONSTRUCTION

In order to obtain a construction licence, Hydro must prepare and submit a Safety Analysis and a Quality Assurance Program to the AECB for the Board's approval.[32] As we have described, this Safety Analysis will estimate the amount of radioactive materials which could be released in the event of various hypothesized accidents.

A great deal, of course, depends upon the design and quality of reactor components. The Quality Assurance Program developed by Ontario Hydro must include a program for component parts at the design, procurement, manufacture, construction, commissioning and operation phases. The Quality Assurance Program must also contain a component classification system, and a detailed periodic inspection program for pressure-retaining components and containment vessels.[33]

Although the regulation of components in nuclear reactors is a federal responsibility under the Atomic Energy Control Act, the AECB cooperates with provincial departments which would otherwise have had jurisdiction over certain components. For example, pressure-retaining components are generally regulated by the Ontario Ministry of Consumer and Commercial Relations (MCCR) under the Boilers and Pressure Vessels Act. In the case of these components, the AECB has chosen to approve the classification of components, while the MCCR ensures that the relevant codes and standards are properly applied. An audit of Ontario Hydro's quality

assurance programs for pressure-retaining components in nuclear reactors, is undertaken jointly by the AECB and the MCCR. In the event of a conflict, it is conceded that AECB's authority prevails. A draft agreement, dated March, 1985, entitled "General Liaison Procedures between the staff of the Atomic Energy Control Board and staff of the Pressure Vessels Safety Branch, Technical Services Division, Ministry of Consumer and Commercial Relations," sets out the respective duties of the AECB and the MCCR.

The Canada Standards Association also plays an important role by developing concensus "standards" for nuclear reactor components.[34] CSA standards for nuclear components are created by a consensus decision reached by a group of technical experts. Often American standards that have obtained long-standing acceptance are used as base technical documents, and may be incorporated into the CSA standards. For example, in the CSA N285 series most of the American Society of Mechanical Engineers pressure vessel code has been incorporated into the Canadian standards. The standard setting decision is a technical one, arising from the consensus of technical experts representing manufacturers, users, consultants, and regulatory authorities. The opportunity for public participation is minimal, and at the discretion of the CSA. There appears to be little perceived need to provide the general public with the same opportunity for input that is offered to manufacturers, users, consultants and regulatory authorities.

All the standards prepared by the CSA are voluntary. They have no regulatory force until they are adopted as requirements by federal or provincial regulatory agencies. However, the CSA standard setting process is an important one that will significantly influence the quality of reactor components. The Canada Standards Association is essentially unaccountable for the standards it sets, except insofar as poor standards would harm its reputation.

Because of the provisions of the Nuclear Liability Act neither are component manufacturers liable (read accountable) for the quality of their products in the event of a nuclear accident. Once components are integrated into a reactor, Ontario Hydro, as operator of the nulcear facility, becomes the sole party liable for any off-site damage caused by the failure of these components, because the Act provides that "no other person is liable for any injury or damage attributable to a breach of the duty imposed upon an operator by this Act."[35] Thus the liability of component manufacturers is limited to on-site damage and perhaps contractual warranties. While Ontario Hydro must then assume responsibility for ensuring that the components used in building the reactor meet the designated standards. The liability is limited to $75,000,000, approximately the same amount of liability coverage that an average sample of a hundred car owners would possess.[36]

The overall lack of accountability may explain the inadequacy of AECB's past oversight activities with

respect to component quality. For example, Reactor No. 2 at Pickering was put into operation in 1971, with the expectation that it would last for approximately 30 years. However, in August, 1983, a pressure tube burst in the reactor core, causing a leak of radioactively contaminated water. No pressure tubes were pulled out for inspection during the first 12 years of the reactor's operations. A more recent incident involving a pressure tube failure at Unit 2 at Bruce was blamed by Hydro on poor quality control by the manufacturer. Both events cast serious doubt upon the adequacy of the quality assurance and inspection programs that were approved by the AECB for the plant.

4. OPERATION

In order to obtain an operating licence Ontario Hydro must submit an impressive list of documents, including:

1. Safety Analyses and Completion of the Detailed Design: These documents are updated versions of the ones which are prepared for the construction approval.

2. Commissioning Program: Ontario Hydro will describe its proposed commissioning program, detailing the tests which will be used to support the assumptions used in and the results of the safety analyses.

3. Report on Commissioning Activities: These reports include the results of commissioning tests, as

well as descriptions of any unforeseen events that occurred during testing.

4. Operating Policies and Principles: These documents include operating procedures, operating manuals, testing programs for safety systems, and a preventative maintenance program. These policies and procedures will eventually become conditions of the operating licence.

5. Radiation Protection Measures: Included in this document will be a description of the plant policy on radiation protection, radiation protection and monitoring equipment, decontamination facilities, and radiation protection training programs.

6. Emergency Plans: Ontario Hydro must prepare a detailed on-site emergency plan and cooperate with external organizations in the development of an off-site emergency plan.

7. Quality Assurance Program: By this stage the procurement and construction Quality Assurance Programs are already in place and are being monitored by AECB staff. Quality Assurance Programs for commissioning and operation must be approved by AECB staff prior to the commissioning and operation of the plant.

8. Safeguards Program: This program documents the manner in which Ontario Hydro plans to comply with safeguards requirements stipulated by the Interna-

tional Atomic Energy Agency as well as any further requirements imposed by the AECB.

9. Security Plan: This plan outlines the measures to be taken to prevent the theft or unauthorized use of nuclear material and to ensure the physical security of the nuclear facility.

10. Safety Report: This document is a summary of all activities undertaken and documents prepared in pursuit of the operating licence.

11. Formal Application for Provisional Operating Licence: This application consists of a formal request to the senior project officer at the AECB, the Safety Report, and a list of commissioning or other activities which must be completed before the provisional operating licence can be granted.

12. Completion Assurance: Ontario Hydro must provide the AECB with assurances that the design has been completed, conforms to the Safety Report, and all required codes, standards and regulations have been respected. The utility must certify that the facility was constructed in accordance with the submitted design, and that commissioning was carried out according to the terms of its commissioning program. Finally, Ontario Hydro must provide the AECB that all activities which required completion at the time of the application for the provisional licence have been completed.

13. Application to Acquire Fuel and Heavy Water.

14. Application to Load Fuel and Heavy Water.

Once all the required documentation has been received and AECB staff have verified that all prerequisite activities have been completed, a provisional operating licence may be issued. In theory, a full operating licence will not be issued until AECB staff is satisfied that the reactor can operate safely at full power.

However, theory and reality do not always coincide. Previous licensing decisions raise serious doubts about the AECB's ability to adequately regulate Ontario Hydro.

The most notorious illustration of the Board's willingness to ignore its own criteria occurred with respect to the issuance of the Bruce "A" licence, which was the subject of extensive comment by the Macdonald Select Committee. In that instance the AECB granted Ontario Hydro a licence to operate the nuclear facility even though some of the "required" documentation was yet to be submitted. It appears that the Chairman of Ontario Hydro pressed the President of the AECB for the licence in order to avoid the negative economic consequences that would be caused by a delayed start-up of the reactor. When the documentation was finally completed, it showed that the reactor would fail to meet AECB criteria if it were operated above 63% of full power. Nonetheless, the AECB gave Ontario Hydro permission to

operate at 88% of full power merely asking Ontario Hydro to work towards the installation of an emergency cooling system to cure the identified design defect. The Select Committee concluded:

> The Committee is confident that the public has the right to expect that the process of licensing the largest nuclear complex in the world would be carried out with far more precision and adherence to the regulatory requirements that [sic] has been the case.[37]

Yet full compliance with AECB "requirements" for Bruce "A" remained outstanding as recently as 1986.[38]

5. OTHER APPROVALS

Under the Environmental Protection Act, Ontario Hydro may not construct any plant that could discharge radiation or another contaminant into any part of the natural environment other than water, unless it has obtained a certificate of approval. Ontario Hydro may be required to submit plans and specifications for the plant in its application for a certificate of approval.[39] Permits to take water are required under the Ontario Water Resources Act.[40] Hydro also needs a certificate of approval for its cooling water discharge system under this Act.[41]

Before permits to take or discharge water are granted by the Ministry of the Environment, the Ministry of Natural Resources must be satisfied that these actions will not violate the provisions of the Fisheries Act. Ontario Hydro also endeavours to comply with the

Ministry's "Once-Through Cooling Using Great Lakes Water" policy for near-shore thermal discharges.[42]

Although the Minister for Fisheries and Oceans is the Minister responsible for the Fisheries Act, responsibility for the enforcement of section 33 of the Act has been delegated to the federal Department of the Environment.[43] (In Ontario, actions pursuant to the Fisheries Act are referred to Ontario's Ministry of Natural Resources.[44])

Approval of plans and specifications of the nuclear generating station will also be sought if its operation is likely to result in the discharge of deleterious substances into fish-inhabited waters or the harmful alteration of fish habitat.[45]

6. RECOMMENDATIONS

Some of the criticisms we have noted suggest that reforms are necessary to the structure, independence and composition of the AECB. Because of the central role the Board plays throughout the regulatory process, we have addressed our comments on the Board in part IX below.

Several of the recommendations that follow are similar to those included in Bill C-14, tabled in the federal Parliament almost a decade ago. We take this opportunity to suggest that they be revived, and offer suggestions that would, in our view, improve them.

As virtually all the recommendations that follow pertain to the federal domain, we address our remarks accordingly and invite the ONSR to second our suggestions.

Should a generic approval to establish a CANDU facility be obtained pursuant to the environmental assessment process, then a subsequent and site-specific hearing should be convened to address site, facility design and operational (which will be dealt with below) matters. That hearing might combine provincial and federal approvals.

(a) The Licensing Hearing

As we have noted, neither the Atomic Energy Control Act nor the Atomic Energy Control Regulations require the Board to hold a public hearing before granting a construction approval or an operating licence. While the AECB has recently developed a policy on public participation, it leaves little room for meaningful public input. Entitled "Atomic Encergy Control Board Policy and Procedures on Representations and Appearances" (May 17, 1983), it describes the procedure to be followed by an interested party wishing to make representation or appearance with respect to licensing matters.

An "interested party" is defined as a licence applicant, a member of the public, or a public interest group. Anyone wishing to address the Board on a licensing matter must submit a request for an appearance to

be reviewed by AECB staff. With respect to that representation the AECB staff will make "recommendations concerning the extent to which views expressed in the representation warrant consideration." The President of the Board will then decide whether a response to a representation is warranted or whether an appearance will be granted. Thus the Board retains complete discretion with respect to the representations it will consider or the appearances it will permit.

In describing the factors which influence the acceptance of representations and requests for appearances, the Board has made it clear that it is willing to consider only matters which fall within a limited, technical scope. R-76 states:

> The following factors will be considered in determining whether a representation is forwarded to Board members or whether an appearance is granted:
>
> (1) Relevance to the matter in question and to the AECB's particular interest in health, safety and security.
>
> (2) Whether or not the submission is substantive and whether or not its substance has been previously considered.
> The AECB bases its decisions primarily on scientific and technical analyses. Unsubstantiated views do not carry the same weight. If information has been previously considered by the AECB or other regulatory agencies and either accepted or discarded then it will not likely merit reconsideration.
>
> (3) The particulars of the submittors, including the places of residence and how the submittors are affected.

> Where time, duplication of information or other factors necessitate the limiting of the numbers of appearances on a given matter, the AECB will generally give priority to persons residing closest to the facility.

Matters will only be considered if the AECB deem them to be relevant. Where the public and the AECB differ as to the relevance of certain issues, public input will be denied. The paternalistic language of the policy and the proclaimed disinterest in matters "unscientific" and "untechnical" should discourage anyone who is not technically trained or who does not have the resources to hire professional technical experts to advance his or her position. However, the Board will not provide any financial assistance to persons who wish to hire technical experts for an appearance, as R.76 clearly states: "An interested party is responsible for its own expenses associated with an appearance." Furthermore national or provincial groups which may have the resources to make a technical submission could be excluded from the process if they are deemed to not be personally affected by the proposed nuclear reactor, proximity to the facility actually being articulated as a determining factor.

Should a person be able to surmount all of these hurdles and be granted an appearance before either the President or AECB staff, he or she is only entitled "to make a summary presentation and detail the essence of the representation which was the basis for the appearance being granted." The time limit for the

presentation, and questions and comments by the AECB is generally 15 to 30 minutes. The "hearing," if one is lucky to be granted an audience, is conducted in an informal manner.

This "participatory" process is obviously and dramatically out of step with any contemporary notion of fair or democratic procedure. It ignores or denies virtually all of the principles of natural justice that have been the legal test of administrative and judicial fairness for several decades. The parochial views of R-76 clearly reveal a strong bias that little is to be gained by submitting the licensing process to public criticism or debate.

Neither is the Board's position with respect to labour involvement in the decision-making process more enlightened. Only very recently (October, 1986) has the Board articulated a policy on the role of labour in licensing matters. In a consultative document, "Proposed Regulatory Statement: Input to the AECB Licensing Process from Unions and Worker Representatives." The process outlined in the document is solely a consultative process, with no legislative basis. The first paragraph of the consultative document reads:

> The Atomic Energy Control Board (AECB) will ensure that workers employed by an AECB licensee have access on request to all information in the possession of the AECB that is related to their safe work environment and will provide them with the opportunity to comment on, and influence those aspects of their work environment that are subject to AECB regulatory control.

In the first step of the consultative process the AECB will ensure that the representative of workers of an AECB licensee have timely access to all information in the AECB's possession relating to their occupational health and safety. This lofty goal, however, is immediately qualified by the fact that the disclosure of such information will be governed by the provision of the Access to Information Act and the Privacy Act. Access to information is apparently a privilege not a right, and the Board's policy is procedural not substantive.

Accordingly, we recommend:

2. THAT THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO REQUIRE THE AECB TO CONDUCT PUBLIC HEARINGS TO DETERMINE SITE SELECTION, DESIGN OR OPERATIONAL LICENSES.

3. THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO PROVIDE DETAILED PROVISIONS CONCERNING NOTICE, PROCEDURE, ACCESS TO INFORMATION AND INTERVENOR FUNDING IN A MANNER THAT WILL FACILITATE THE BROADEST AND MOST EFFECTIVE PARTICIPATION IN THE BOARD'S PROCEEDINGS.

4. THAT A BROAD DEFINITION OF THE ENVIRONMENT BE ADOPTED, AND THE REGULATORY CRITERIA FOR THE APPROVAL PROCESS BE DELINEATED IN A PRECISE MANNER TO GUIDE THE BOARD'S APPROVAL PROCESS.

5. THAT REGULATIONS TO THE ACT BE PROMULGATED SPECIFYING IN DETAIL THE REQUIREMENTS OF LICENCE APPLICATIONS, PARTICULARLY REGARDING MATTERS OF NUCLEAR SAFETY, AND PRECLUDING THE BOARD FROM ISSUING A LICENCE UNTIL REGULATORY REQUIREMENTS ARE SATISFIED.

V. RADIATION STANDARDS

The thrust of the nuclear regulatory regime is to ensure that exposure of workers and the public to ionizing radiation be kept within "acceptable" limits, both during the day to day operation of a CANDU nuclear reactor and in the event of a failure or accident.

The current Atomic Energy Control Regulations state that any person operating a nuclear facility must ensure that no person receives a dose of ionizing radiation which exceeds that specified in the Schedule, or such lower permissible dose which may be prescribed by a medical adviser of the AECB for any particular atomic radiation worker.[48] In the event that an atomic radiation worker is subject to a dose which exceeds regulatory limits, he or she is required to refrain from work which may result in further significant exposures to ionizing radiation, unless he or she first obtains the approval of the AECB or one of its designated officers.[49]

Any person in charge of a nuclear generating station must report to an AECB-appointed inspector for that station, within 24 hours, any incident which results or is likely to result in the receipt by any person of a dose of ionizing radiation in excess of the regulatory limits. The person in charge must also take all appropriate preventative measures to limit any exposures to ionizing radiation resulting from such an incident, and comply with any instructions received

from the inspector. A complete report of the incident must then be forwarded to the AECB, the inspector, and any radiation safety advisory who may have been appointed for that plant. Finally, if the incident actually results in someone receiving a larger than acceptable dose of ionizing radiation, a copy of that report must be sent to the designated medical adviser.[50]

The total dose received by a person who is an atomic radiation worker may not exceed 50 mSv (5 rem), while the dose received by any other person is limited to 5 mSv (½ rem) per year. Further dose limits are also set for specific organs and tissues, as well as for pregnant nuclear station workers.[51]

As a matter of stated policy, the AECB bases its maximum permissible doses of ionizing radiation (found in the Atomic Energy Control Regulations) on recommended standards of the International Commission on Radiological Protection, recognizing that international body as the most knowledgeable authority.[52] The AECB then derives maximum release limits for various classes of radioactive substances from these maximum permissible dose limits.[53]

The ICRP is an international organization of radiological protection experts which publishes recommendations for maximum permissible doses for atomic radiation workers and members of the general public.

The ICRP has recently revised its approach to determining radiation standards and has developed new concepts to reflect an evolving understanding of the effects of ionizing radiation upon the human organism. Proposed amendments to the current regulations reflect these recent ICRP recommendations.[54] It is notable however that the AECB has not adopted the important ICRP recommendation that exposure limits for the general public be reduced from .5 to .1 rem.

However, a number of criticisms may be made of the ICRP approach:

1. The ICRP limits are set for permissible doses of radiation. A difficulty with this concept is that the received radiation dose is not a measurable quantity. Dose can only be estimated by measuring a person's exposure to radiation.[55] For these reasons, the setting of dose limits, rather than exposure limits, has been criticized.

2. There are very significant limits to the scientific knowledge upon which dose limits are based, among these being uncertainties concerning chemical metabolism and the appropriate dose response curve for non-stochastic effects at low doses or low-dose rates.[56]

3. The influence of the cost-benefit analysis that ICRP carries out to compare human health costs of radiation exposure with other economic and social costs.

The ICRP is accountable to neither the Canadian government nor the Canadian public. Its recommendations have no legal force within Canada until they are adopted by the AECB. While Canadian delegates participate in ICRP affairs they are often drawn from the AECL, a federal Crown corporation dedicated to the development and promotion of nuclear reactors.

Public participation must, in our view, be considered an essential component of the standard setting process. Standards, by their very nature, are judgements about which risks are acceptable. There are no certain answers when it comes time to set a specific standard. As D.M. Halton has stated:

> Ionizing radiation is a "toxic agent," and... the experimental determination of the dose exposure that will not cause any biological harm is impossible. Existing scientific procedures cannot scientifically validate a dose or an exposure level which will unequivocally protect against chronic disease.[57]

Another concern about leaving standard-setting exclusively in the hands of scientists and physicians is the tendency of scientific standards to "emphasize the limitations of false positives." In other words scientists will tend to consider a substance safe until sufficient evidence has been collected to prove that it is unsafe.

Although standards may be based on the best available scientific information, judgments must also be made

about the appropriate safety factors to be incorporated in assigning a value to the standards, and the best methods for assessing the costs and benefits associated with each suggested standard. In spite of the fact that these questions go beyond scientific investigations, scientists have generally been given the sole responsibility for setting standards. Only very recently has the AECB recognized the value of soliciting public and worker input in the setting of maximum permissible radiation doses.

D.M. Halton advocates the participation of workers in the development of standards. Those who are governed by certain standards give a social validity to those standards when they can meaningfully participate in the standard-setting process. He has written:

> In both fields [i.e. in occupational toxicology and in health physics] there is what we might call "professional soverignty." That is to say, those with knowledge in the field have a jurisdiction over evaluating pertinent data and arriving at judgemental values which form the basis for standards. The difficulty with a professional sovereignty system is that the people who decide on the standards are rarely found in the population that has to work by those standards. The work force, those people most effected [sic] by the standards have little or no input into what those standards should be or how they are implemented. In other words, not only do systems of radiation protection and workplace chemical protection, as practiced by ICRP and ACGIH [American Conference of Governmental Industrial Hygienists], lack scientific validity in some areas, but they have no social validity either.[58]

Recently, the federal government has issued a Regulatory Reform Strategy which endorses the value of meaningful public input into proposed regulatory amendments. One of the Guiding Principles of this Strategy (announced on February 13, 1986) states:

> The public has an important role to play in the development of regulation, and the government will increase public access and participation in the regulatory process while simplfying procedures and restricting legalities to a minimum.[59]

The Citizen's Code of Fairness, forming part of this initiative also states:

> The government will encourage and facilitate a full opportunity for consultation and participation by Canadians in the federal regulatory process.

These principles are bolstered by the Regulatory Programs Reform Initiatives (March 6, 1986) and the Regulatory Process Action Plan (May 27, 1986). Regulatory Initiative number 41 states:

> The Minister of Energy, Mines and Resources is to consider:
>
> - ways to increase the transparency and openness of the Atomic Energy Control Board's practices and procedures;
>
> - the composition of the Board; and
>
> - the desirability of expanding the number of members to include more permanent members representing industry, labour and the public.

The Process Action Plan of the Regulatory Reform Strategy goes on to detail the requirements of a public consultation process. It states:

> All departments and agencies must consult with the public on regulatory policies, objectives, rules, methods and approaches to program delivery and compliance.

The AECB is now required to give early notice of all regulatory initiatives in its Regulatory Agenda (at least six months before any action is taken), and to pre-publish its draft reulations (at least thirty days in advance of their implementation). Explanatory notes must accompany both the draft and final recommendations, and must contain:

- the policy objective of the regulation
- the need for the regulation
- the content of the regulation
- changes from the existing regulation
- the timing of consultation and implementation of the regulation
- results of previous consultations
- a summary of the impact analysis, and
- identification of contact person(s).

Exemptions from these requirements may be granted by the federal Cabinet only in emergency circumstances.

The reforms are certainly a step in the right direction. Problems remain however regarding access to information and availability of resources in the absence of any formal (regulatory) expression of the consultation process.

RECOMMENDATIONS

Accordingly, we recommend:

6. THAT FORMAL NOTICE AND COMMENT PROCEDURES BE ADOPTED WITH RESPECT TO THE ESTABLISHMENT OF RADIATION STANDARDS. FOR THOSE STANDARDS THAT WILL BEAR MOST CRITICALLY UPON THE SAFE DESIGN, PUBLIC HEARINGS SHOULD ALSO BE POSSIBLE. ADEQUATE RESOURCES MUST BE AVAILABLE TO FACILITATE INFORMED COMMENT.

VI. MONITORING/ENFORCEMENT

1. MONITORING

Monitoring is, of course, a vital element of the regulatory regime and an absolutely essential safeguard of the system. Monitoring mechanisms will perform the function of determining compliance and of identifying any problems as they arise.

Ontario Hydro is required to monitor and control radioactive releases from its CANDU nuclear reactors, in accordance with the terms of its operating licence. Ontario Hydro's monitoring program includes measurements of radiological, thermal and chemical emissions. It also must monitor odour, noise, fish loss and review of its conventional waste management practices.[60]

Ontario Hydro sets an operating target for radiological emissions of 1% of AECB's derived emission limit. (As described above, this derived emission limit is calculated by the AECB and is based on the maximum permissible dose limits listed in the Atomic Energy Control Regulations. Emissions, unlike doses, are realatively easy to measure.)

Cooling water emissions from nuclear generating stations are to meet guidelines set by the Ministry of the Environment. The temperature of these thermal emissions are reported to the Ministry of the Environment in the form of daily average temperatures. The

Ministry of the Environment is concerned about the effect of changes in water temperature in aquatic biota. Where any thermal discharge is anticipated, an advance approval regarding the permissible increase in water temperature must be obtained from the Ministry of the Environment, pursuant to the Ontario Water Resources Act.[61]

Ontario Hydro also monitors the discharge of chemicals into water or on land. Emissions are classified as either "chronic chemical emissions" or "unplanned emissions." Chronic emissions are expected from the normal operation of the plant and are discharged in accordance with certificates of approval or sewage works approvals obtained from the Ministry of the Environment. Chronic chemical emissions from nuclear power plants generally involve the following chemicals: phosphates, hydrazine, morpholine, sulphuric acid, sodium hydroxide, and chlorine.

The federal Department of National Health and Welfare also monitors off-site releases from nuclear power plants and has established monitoring networks around all operating reactors. Monitoring is carried out to measure tritium releases to the air, external gamma radiation (which indicates the presence of large noble gas releases), as well as the contamination of drinking water, particulate matter and precipitation near the reactor site. Milk is also monitored in some areas.

The purpose of Health and Welfare's monitoring program is to measure ongoing releases from the nuclear power

plant and to assess the effect that these releases may have on the public. This monitoring function is not intended to be an early warning system for a nuclear reactor accident.

The Ontario Ministry of Health does not possess the facilities and expertise to conduct radiological monitoring. However, it does conduct population-based epidemiological studies, which may signal a health problem requiring further study. The Ministry's cancer registry system records any diagnosed case of cancer in Ontario and the location, age and sex of the victim. The congenital anomaly system will record similar information for birth defects. A region with a significantly high concentration of birth defects or cancer may be targeted for a second level study.[63]

Ontario Hydro is accountable to the AECB for its monitoring program, since it must comply with its operating licence conditions. Furthermore, where duplication exists, monitoring results provided by Ontario Hydro can be verified by comparing them to the results obtained by the Department of National Health and Welfare.

According to the Memorandum of Understanding between the Atomic Energy Control Board and the Department of the Environment (June 22, 1981), it is the responsibility of the Department of the Environment to:

> develop, establish or adopt standards, criteria and objectives for the permissible concentration in the natural environment of

> radioactive substances and other toxic substances specifically related to the production, possession and use of nuclear energy...

The federal Department of Fisheries and Oceans conducts research projects relating to the effects of nuclear power plants on fish, including the effects of radioactivity in the water, thermal pollution, and cooling water intakes. However, enforcement of the Fisheries Act in Ontario's Great Lakes is primarily the responsibility of designated employees of the Ministry of Natural Resources.

The Ontario Ministry of the Environment requires Ontario Hydro, a provincial Crown corporation, to comply with the terms of the Environmental Protection Act and the Ontario Water Resources Act, insofar as these laws are binding on the Crown.[64]

The Ministry of the Environment has also established unenforceable guidelines relating to the radioactive contamination of its water resources. In Water Management: Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment (1984), Provincial Water Quality Objectives are set for radionuclides and water discharge temperatures. Furthermore, drinking water quality guidelines for radionuclides are estalished in the publication entitled Ontario Drinking Water Objectives (1983).

The Ministry of Labour conducts a monitoring program for radioactive substances, on behalf of the Ministry

of the Environment. Water samples are collected and the air is monitored for the presence of tritium and other fission products. This sampling program is ongoing, but not continuous, with sampling stations located at the Bruce and Pickering nuclear generating stations. The Ministry of the Environment is advised if any unusual releases are detected.[65]

As to the reporting requirements that Ontario Hydro must observe, Part III of the Atomic Energy Control Regulations is entitled "Records and Inspections." Where a licence has been granted to operate a nuclear facility, the licensee must keep records of:

1. the nature and location of prescribed substances at that plant;

2. the persons who handle these prescribed substances;

3. the operation and maintenance activities at the nuclear generating station; and

4. the doses of ionizing radiation received by workers and other persons as a result of the plant's nuclear energy generation.

The AECB may require the licensee to deposit these records with any specified person or agency. Destruction of any records is prohibited, unless prior written authorization has been obtained from the AECB.

An inspector may be appointed to inspect any nuclear facility while it is under construction or in operation, to inspect any records held by the licensee of a nuclear power plant or to ensure that the nuclear generating station complies with the terms of any international agreement by which Canada is bound. An inspector is appointed for a particular purpose, a specified area and a defined period of time. He is entitled to inspect, at all reasonable times, any place that relates to the area under his jurisdiction.

In the event of the loss or theft of a prescribed substance, an occurrence which results in any person being exposed to a radiation dose exceeding regulatory limits, or any other breach of the regulations or a licensing condition, an inspector is given certain powers. He may require the licensee to prepare a report outlining the circumstances of the event and any mitigating action taken in response thereto. He may also order the licensee to take actions aimed at minimizing the consequences of the event or remedying the breach of regulatory or licensing conditions.

Under the new proposed Atomic Energy Control Regulations, the list of necessary records has been expanded to include "all records necessary to show the design, siting, construction or development, testing, commissioning, operation, maintenance, and decommissioning of a nuclear facility." The powers of inspectors have also been enlarged and set out in greater detail. An inspector will have the power to inspect any plan, drawing, document or other record relating to the

design, siting, construction, testing, commissioning, operation, maintenance or decommissioning of a nuclear facility, and to make copies thereof. He is also given powers to interview any person who may reasonably be expected to have information relating to the purpose of his inspection and, provided that the proprietary interests of Ontario Hydro are protected, he may take measurements or photographs of the facility, carry out tests on the premises and remove samples from the plant.[66]

It is apparent that a good deal of data is acquired concerning emissions and impacts concerning day-to-day operations of the CANDU system. The data must, of course, yield information of value to the regulatory process, a matter that we have not explored within the context of this brief. It is also fundamental that once acquired monitoring data is effectively utilized to ensure compliance and to ensure further that when problems arise they will be quickly addressed.

2. ENFORCEMENT

If the design and operating requirements imposed upon Ontario Hydro are to assure CANDU reactor safety, those requirements must, of course, be observed and enforced. However, a number of problems with the present enforcement regime are apparent.

(a) Provincial Legislation

The first issue relating to the enforcement of provincial legislation is the validity of the legislation when applied to a CANDU reactor. To begin with, provincial and environmental legislation should specifically bind the Crown. The Environmental Protection Act of Ontario does, the Ontario Water Resources Act of Ontario doesn't and should be amended.

The importance of this reform was made clear by the Ontario High Court in the case of R v. Eldorado Nuclear Ltd. (1982), 32 O.R. (2d) 243. In that case the court found Eldorado to be immune from prosecution for violating a permit issued under the Ontario Water Resources Act, notwithstanding the requirement of its operating licence that it satisfy provincial permit requirements. The court also held that, if a breach of provincial law is to have such a fundamental effect as to take away immunity, that intention would have to be more explicit than a general condition in an operating licence requiring compliance with provincial laws.

Although this case was decided with respect to a federal Crown agency, it is submitted that the same reasoning would apply to Ontario Hydro (a provincial Crown agency). The current prohibition against the discharge of polluting material into water is contained in section 16 of the Ontario Water Resources Act. It refers only to a "municipality" or a "person." As Justice Carley of the County Court remarked in the Eldorado case, this provision "failed to expressly

state that the Crown either in the right of Canada or in the right of Ontario was to be bound." The Act should be amended.

Even should this impediment be removed, there is considerable doubt about the applicability of provincial legislation to a nuclear reactor. And it is virtually certain that the application of provincial and environmental legislation would be deemed unconstitutional where the effect of its application is to prevent the reactor from operating.

Another difficulty that arises with respect to provincial criteria is that they are precisely that: guidelines, not enforceable standards. Indeed, there are at present in Ontario no standards whatsoever with respect to discharges of contaminants to water.[67]

(b) Federal Legislation

As we have noted, the Atomic Energy Control Act does not specifically bind the Crown. While there is judicial authority to suggest that the Act would apply to the CANDU system by "necessary implication," amendment to the Act would resolve any doubt and is long overdue. The very fact that such a fundamental point could be left unresolved for so many years can hardly inspire public confidence in the vigilance of federal regulators. We have for that reason reiterated a reform advanced 10 years ago in Bill C-14 that would resolve any doubt about the matter.[68]

Other more practical problems raise serious concerns about the enforcement options available to the AECB. While the Act and the regulations accord to the Board certain enforcement powers, the failure of the Board to resort to them may suggest they are effectively unavailable. Section 19 of the Act makes it an offence for anyone to contravene the Act or the regulations and provides a maximum fine of $10,000 or a term of imprisonment not to exceed five years. The monetary penalties are, of course, nominal and the provision fails to specifically state that it is an offence to contravene or fail to observe the conditions or terms of any licence or approval.

In addition to the possibility of prosecution, the Board may use its licence issuing authority and its authority to write terms and conditions of that licence as a way to encourage compliance with its regulations and guidelines. However, in the past, when such action would have appeared appropriate, no such enforcement activity was forthcoming.[69] Rather serious disputes between Ontario Hydro and the AECB concerning matters of the safe design and operation of the CANDU system appear to be resolved informally, often in favour of Ontario Hydro.[70]

At a more mundane level, the regulations are far from explicit in terms of the authority of the Board to amend, revoke or alter the licences or approvals it may issue. The regulation is not drafted in the format or with the precision appropriate or necessary to an enforcement regime. The impression created is that the

enforcement provisions of the regulations are largely decorative and not intended for use. One is left to conclude that compliance will be determined by the persuasive devices of the AECB and Ontario Hydro. It is not surprising that when serious differences have arisen between Ontario Hydro and the Board the latter has given ground. The Board simply does not possess the resources or the political clout of this large provincial utility.

The weaknesses of the present regime are disturbing and undermine confidence in the safe operation of the CANDU system and the ability and authority of regulatory institutions to effectively insist upon that safe operation.

Finally, on this subject we are concerned about reductions in the complement of AECB staff from 285 in 1986 to 263 in 1991 when more reactors may be in service.[71]

RECOMMENDATIONS

Accordingly, we recommend:

7. THAT THE ATOMIC ENERGY CONTROL ACT AND ALL OTHER FEDERAL AND PROVINCIAL STATUTES CONCERNING THE REGULATION OF CANDU REACTORS BE AMENDED TO SPECIFICALLY BIND THE CROWN IN RIGHT OF CANADA AND THE PROVINCES.

8. Whatever the will or good faith of Ontario Hydro, compliance is difficult when rules are uncertain

and too flexible. EVen the best corporate citizen will often seek the least costly route of compliance. With the supply and economic pressures that Ontario Hydro is often subject to, the incentive to resist the regulatory demands of the aecb are substantial, particularly when the regulator has unfettered discretion to modify those requirements and to do so without constraint or supervision.

THAT REGULATORY CERTAINTY BE THE FIRST AND NECESSARY PRECONDITION TO ENSURE COMPLIANCE WITH REGULATIONS INTENDED TO REQUIRE THE SAFE OPERATION OF A CANDU NUCLEAR REACTOR.

9. No enforcement of regulation is possible if requirements are not clear and certain. While some flexibility and discretion may be necessary and perhaps even desirable in the nuclear regulatory system, the present regime is, we believe, situated very much at one extreme of the spectrum. Given the bewildering mix of guidelines, consultative documents, advisory papers that constitute AECB design "requirements," enforcement by way of prosecution would not be possible.

THAT REGULATIONS SHOULD BE DRAFTED IN A MANNER TO FACILITATE THEIR ENFORCEMENT, INCLUDING BY WAY OF PROSECUTION.

10. The inclination to take a vigorous approach to compliance would be more pronounced with a Board more capable of maintaining an objective perspect-

ive on the activities of Ontario Hydro. There is a need to ensure that appointees to the Board are qualified and committed to the regulatory task before them.

THAT MEMBERSHIP IN THE BOARD SHOULD BE EXPANDED TO INCLUDE A MORE DIVERSE ARRAY OF VIEWS, DISCIPLINES AND PERSPECTIVES.

11. THAT THE COMPLEMENT OF BOARD INSPECTORS BE SUFFICIENT TO ENSURE ADEQUATE MONITORING BY COMPETENT PERSONNEL. UNANNOUNCED INSPECTIONS ARE ESSENTIAL AND SHOULD BE MANDATED BY REGULATION. IT MAY ALSO BE DESIRABLE, AS THE MINISTRY OF THE ENVIRONMENT HAS RECENTLY DONE, TO TRUST ENFORCEMENT TO THOSE SPECIFICALLY TRAINED IN THE AREA. THE BOARD MUST ALSO HAVE READY ACCESS TO THE LEGAL STAFF NECESSARY TO EFFECT MORE FORMAL ENFORCEMENT STRATEGIES, INCLUDING PROSECUTIONS WHERE NECESSARY.

12. THAT MONITORING AND OTHER DATA BE MADE READILY AND FREELY AVAILABLE TO THOSE INTERESTED, INCLUDING LOCAL MONITORING COMMITTEES, INTEREST GROUPS AND THE MEDIA. THE OBLIGATION OF THE BOARD TO ADOPT A PROACTIVE APPROACH IN THIS REGARD SHOULD BE ESTABLISHED BY STATUTE. THE PROSPECT OF ALL MATTERS OF NON-COMPLIANCE QUICKLY COMING TO LIGHT SHOULD PROVIDE A MEANINGFUL INCENTIVE TO OBSERVE ALL REGULATORY REQUIREMENTS.

13. THAT PENALTIES BE SUFFICIENTLY SEVERE TO ACT AS A DETERRENT. BILL C-14 PROPOSED RAISING THE MAXIMUM

FINES FROM $10,000 TO $100,000. THOSE RECOMMENDATIONS ARE, OF COURSE, NOW OVER 10 YEARS OUT OF DATE. IN ADDITION, A MORE CREATIVE APPROACH TO THE ENFORCEMENT PROVISIONS OF THE ACT AND THE CHARACTER OF THE PENALTIES THAT MAY BE IMPOSED IS ALSO NECESSARY. RECENT AMENDMENTS TO THE ENVIRONMENTAL PROTECTION ACT OF ONTARIO OFFER AN ILLUSTRATION OF THE APPROACH THAT CAN BE ADOPTED WHEN ENFORCEMENT BECOMES THE SUBJECT OF SERIOUS ATTENTION.

VII. PHYSICAL SECURITY

The Physical Security Regulations under the Atomic Energy Control Act describe the security systems, equipment and procedures which must be available at Canadian nuclear generating stations.[72] These regulations are intended to implement Canada's responsibilities as a signatory to the Convention on the Physical Protection of Nuclear Materials.[73] Safeguards programs have also been designed to ensure that Canada complies with its obligations under the Treaty on the Non-Proliferation of Nuclear Weapons, which requires safeguards to be applied to certain prescribed substances used in the production of atomic energy.[74] Furthermore, Part IV of the Atomic Energy Control Regulations sets out rules for the non-disclosure of certain information and the designation of protected places. Ontario Hydro is required to submit security plans for a nuclear facility for the AECB prior to obtaining an operating licence from the AECB.

The International Atomic Energy Agency was created in 1957 to promote the development of peaceful uses of atomic energy and to establish safeguards to prevent the proliferation of nuclear weapons. In 1969, Canada ratified the Treaty of Non-Proliferation of Atomic Weapons. Article III of this Treaty requires Canada, and other non-nuclear weapon contries, to accept IAEA safeguards over all their nuclear activities. In compliance with this article, Canada has negotiated a safeguards agreement with the IAEA, which authorizes IAEA inspectors to inspect Canada's nuclear facilities.

As part of its safeguarding functions, Canada has developed the Canadian Safeguards Support Program, which is jointly administered by the AECB and Atomic Energy of Canada Limited. This program is designed to develop safeguards equipment and approaches for CANDU nuclear reactors. Further initiatives were undertaken by the IAEA, following the accident in Chernobyl. In the summer of 1986, representatives from 62 countries and 10 international organizations met at IAEA offices to draft two new conventions relating to safety: one dealing with notification and information measures related to a nuclear accident which may have trans-boundary effects, and one concerned with the provision of assistance to a country suffering the effects of a nuclear accident.[75]

On September 23, 1980, Canada signed the Convention on the Physical Security of Nuclear Materials. In order to fulfill Canada's obligations under this agreement, the AECB has passed the Physical Security Regulations under the Atomic Energy Control Act. These regulations outline several security requirements applicable to nuclear generating stations.[76]

Notwithstanding these requirements, however, criticisms have been made of present physical security arrangements. In particular, the suggestion has been made that each nuclear generating station in Ontario should be subject to a full security assessment and a new security plan should be developed that would adequately protect the plant from unauthorized activities by hostile parties.[77]

Part IV of the Atomic Energy Control Regulations deals with security measures. Section 13 prohibits anyone from disclosing information relating to the properties of fissionable materials which may be used for nuclear weapon development. Furthermore, the AECB may order any place to be designated as a protected place for the purpose of keeping secret certain information relating to atomic energy or for the protection of persons or property. Entry to a designated protected place is restricted to those persons who comply with the terms and conditions of the AECB order.

Finally, the AECB requires Ontario Hydro to submit security plans when it applies for an operating licence. According to subsection 9(1) of the Atomic Energy Control Regulations, the AECB may require that Ontario Hydro's application for an operating licence include:

> (c) a description of the measures to be taken to ensure the physical security of a nuclear facility.

An obligation that Ontario Hydro maintain adequate physical security measures will usually be included as a term of the operating licence.

The IAEA is responsible for auditing and inspecting Ontario Hydro's CANDU nuclear reactors to ensure that Canadian obligations under the safeguards agreement and the Treaty on the Non-Proliferation of Nuclear Weapons continue to be met. Violations are to be reported to the United Nations Security Council.[78]

Ontario Hydro's obligations regarding physical safeguard measures required by the IAEA will be clarified by the new proposed Atomic Energy Control Regulations. Ontario Hydro staff will be obliged to cooperate with the IAEA inspector, provide him with any relevant records, permit him to take samples and assist him in the installation, removal, maintenance or operation of safeguards equipment. The AECB will also have the power to issue directions to Ontario Hydro to install, remove, modify or operate safeguards equipment.[79] Ontario Hydro may also be directed to comply, to the Board's satisfaction, with safeguard measures included in an IAEA safeguards agreement of documents issued by the AECB in accordance with the conditions of Ontario Hydro's licence.[80]

The details of physical security arrangements obviously are not to be the subject of public review. However, even in this area the issue of adequate security should be. While we concede that public participation and access to information must be limited to protect security, it is absolutely essential that security concerns do not, as they have, remain the rubric for denying effective supervision and access to information including material that bears tangentally, if at all, upon the physical security of the nuclear station. To deny such access is to deny a means of accountability that may have more devastating consequences.

VIII. EMERGENCY PLANNING

1. IN THEORY

Currently it is the practice of The Atomic Energy Control Board to require Ontario Hydro to develop a detailed on-site emergency plan and to cooperate with other organizations in the creation of off-site contingency plans, as part of its application for an operating licence for a nuclear facility.

Again no formal or regulatory foundation exists, the matter of emergency planning is addressed only by way of consultative documents; i.e. by guidelines and recommendations rather than legal requirement. Two such guidelines are consultative document C-45, entitled "Guidelines for Off-Site Contingency Planning," and the Advisory Committee on Radiological Protection's publication, "Recommendations on Criteria for the Protection of the Public in the Event of a Nuclear Emergency."

The Atomic Energy Control Board has agreed to assist the province in the development and implementation of emergency planning. AECB will provide technical advice and assistance, allow the province to review any on-site and off-site emergency plans submitted as part of a licensing application for a nuclear facility, notify the province should it become aware of an existing or imminent emergency situation and participate in provincial nuclear emergency training exercises. The

Board also provides technical advice and laboratory facilities for the federal emergency plan.[81]

Ontario Hydro's obligations include the development of an on-site contingency plan, and cooperation in the development of off-site contingency plans. Ontario Hydro is also assigned a number of responsibilities under the Province of Ontario, Nuclear Emergency Plan. These responsibilities include monitoring functions, research programs, planning and public education, the provision of personnel and other operational assistance and participation in the development and execution of nuclear emergency training exercises. The provincial Nuclear Emergency Plan also gives the Premier of Ontario (or other designated Executive Authority) the power to oversee on-site emergency actions taken by Ontario Hydro.[82]

The Province of Ontario bears the primary responsibility for developing an off-site emergency plan for nuclear reactor accidents in Ontario. The Ministry of the Solicitor General has primary authority for ensuring that an adequate Nuclear Emergency Plan exists for the Province of Ontario. The plan is reviewed and approved by the Emergency Planning Committee of Cabinet. This committee, which is chaired by the Solicitor General, is also required to monitor "the state of emergency preparedness in Ontario and the state of emergency planning in the ministries and agencies of the Provincial government." Finally, the plan is accepted by Cabinet and adopted by the passage of an Order in Council.[83]

The provincial Nuclear Emergency Plan consists of the Master Plan, several (draft) site-specific plans and a transborder nuclear emergency plan. Site-specific plans are in various stages of preparation for the reactors at Pickering, Bruce, Rolphton, Chalk River, Darlington, as well as for the Enrico Fermi 2 nuclear reactor in Michigan, U.S.A. These plans are not expected to be completed before 1988, and will require several years for their implementation.

One important premise of the emergency planning process is that it be justified on a cost-benefit basis. As the plan states:

> The more severe a postulated accident, the less likely its occurrence. An appropriate balance shall be struck between risk and cost when assessing the level of emergency planning and preparedness required.

Public education programs to inform those individuals who are most likely to be affected by a nuclear emergency, are also required to be cost-effective.

(A more detailed description of the provincial emergency plan is attached as Appendix "A".)

The Federal Nuclear Emergency Response Plan (Off-Site) was developed by the Department of National Health and Welfare, and outlines the measures that will be taken by the Government of Canada to protect the health and safety of the public in the event of a nuclear

emergency within its jurisdiction. That is, the federal plan will be activated in a situation where a nuclear reactor accident in Ontario is likely to affect another province or the United States, or where the Province of Ontario requests federal assistance.[84]

As noted, primary responsibility for the safety of Ontario residents following a nuclear reactor accident lies with the Government of Ontario. The Federal Nuclear Emergency Response Plan (Off-Site) will only come into play if the province requests assistance from the federal government or federal action is required. However, even then Annex A-1 to the Plan indicates:

> The requirement to undertake a federal response to a nuclear emergency does not automatically presume federal control. Control will remain vested in that level of government, or in that department, which has the legal responsibility to deal with the consequences of the emergency.

Municipalities also have important emergency planning obligations pursuant to the Emergency Plans Act, according to section 3(1):

> The council of any municipality may pass a by-law formulating or providing for the formulation of an emergency plan governing the provision of necessary services during an emergency and the procedures under and the manner in which employees of the municipality and other persons will respond to the emergency.

The provincial Cabinet may also require the municipality to develop a plan for certain specified emergencies, such as a nuclear reactor accident, section 3(4) provides:

> The Lieutenant Governor in Council may designate muncipalities that shall have an emergency plan respecting the type of emergency specified in the designation, and where so designated, a municipality shall formulate or provide for the formulation of the emergency plan.

This designation is contained in the Province of Ontario, Nuclear Emergency Plan for the following municipalities: Region of Durham, Metropolitan Toronto, County of Bruce, Township of Bruce, Township of Kincardine, Village of Tiverton, County of Renfrew, Township of Rolph, Buchanan, Wylie and McKay, Township of Head, Clara, and Maria, Village of Chalk River, Town of Deep River, County of Essex, Township of Malden and the Town of Amherstburg.

A municipal emergency plan is administered by the Municipal Control Group. It generally assigns responsibilities to the local or regional public health department, police force, social services, works department, school boards, ambulance services and fire departments.[85]

The municipal emergency plan will come into operation when an emergency situation arises (and possibly before the declaration that an emergency exists). The declaration of the existence of an emergency may be made by

either the head of municipal council or the Premier of Ontario. In the event that the Premier declares an emergency, the Premier has the power to direct and control the activities of the municipality within the emergency area.[86]

2. IN PRACTICE

The influence of the nuclear industry and Ontario Hydro upon the emergency planning process has obviously been substantial. In our view, an analysis of the basic assumptions that underly present emergency plans reflect an industry bias that the essential task of emergency planning is to persuade the community that no real risks exist.

Again there has been a substantial and largely successful effort to co-opt the debate by defining essential issues of emergency planning as technical ones requiring resolution by a group of scientific and technical experts. In particular Provincial Working Group #3 was chosen in 1983 to examine the technical bases of the plan. No public input was sought by the working group.

Some of the specific decisions relating to safety and risk, which were made by the group, were:

1. Defining the upper limit accident which should be used as the basis for detailed emergency planning;

2. Setting the Protective Action Levels for sheltering, evacuation and the banning of food and water consumption;

3. Establishing the size of the contiguous zone, primary zone and the secondary zone; and

4. Establishing the point at which radiation levels are low enough to allow evacuees to return to their homes.[87]

In response to the first question, the group decided that:

> An effective dose of 25 rem (250 mSv) at the nuclear power plant boundary should be the hazard defining the upper limit for detailed emergency planning in Ontario.[88]

This 25 rem limit is the design basis limit set for a dual failure accident discussed above in part 4. Since the working group concluded that "experience has shown that Candu reactor systems are operating better than required by the Design Basis," it decided that it was not necessary to carry out a detailed emergency planning for a triple failure, life-threatening nuclear accident. In other words, the premise of the emergency planning process is that an uncontrolled major release of radiation, such as the one that occurred at Chernobyl, is simply too unlikely to plan for.

The working group gives several reasons to support its decision. Those reasons cannot in our view stand up

under scrutiny. The group concluded that emergency planning is generally not carried out for events that have a probability of occurrence of less than once in a hundred years, and that an accident resulting in radiation doses of 25 rem at the reactor boundary would be expected to occur much less frequently, namely once in 3,000 reactor years. Furthermore, the group argued evacuation plans developed for the less serious dual failure accidents could probably be applied to more serious accidents.

The working group conceded, however, that risk estimates are simply estimates, since no direct method of verifying these assessments is available. As we have noted above in relation to reactor design, a great deal of the risk estimate equation is founded upon questionable assumptions and incomplete data. It is also important to note that the group's findings in 1983 do not correspond to the findings of the Interim Report on Nuclear Power in Ontario arising from the Royal Commission on Electric Power Planning (1978). In that report, the Commission accepted evidence which suggested that the probability of a dual failure accident at a CANDU nuclear reactor could be approximately 100 times greater than the theoretical levels.[89]

A consideration of the rationale offered by the working group for the protective action levels (PALs) it chose and incorporated into the provincial Nuclear Emergency Plan also raises serious doubt about the validity of its conclusions on appropriate action levels. PALs represent lower and upper dose limits for which pro-

tective action is advised. Lower dose limits represent those levels of exposure that justify protective measures. Upper dose limits require protective action.

For sheltering, a lower PAL of 0.1 rem and an upper PAL of 1 rem were recommended. The working group noted that in the event of an accident where a person would be expected to receive an effective dose of radiation of 1 rem, sheltering could reduce the dose to the individual to ½ REM. That is, the annual recommended ICRP limit for members of the general public from the normal operation of a nuclear power plant. The rationale for the lower limit of 0.1 rem was based on the fact that natural background rates in radiation across the province varied by more than this amount. The validity of the group's decision depends upon the soundness of its assumptions that the effects of an acute exposure to a certain amount of radiation is the same as chronic exposure over the course of a year to a much smaller amount.[90] In our view that assumption is not substantiated and does not represent a prudent approach to emergency planning.

For evacuation measures, lower and upper PALs of 1 rem and 10 rem were chosen. The lower level was justified by the finding that differences in background radiation across the province can result in differences of up to 10 rem in the radiation dose received by an individual over his or her lifetime. Furthermore, since radiation exposure from a nuclear reactor accident is expected to occur less than once in a lifetime, evacuation at a lower radiation level would not be justified. The

upper limit of 10 rem was based on the effect that a few extra lethal cancers may be expected in the population at that radiation level, although the increase in cancer would not be statistically significant. Secondly, evacuation could be justified, the group argued, on a cost-benefit basis because it is unlikely that many areas would have to be evacuated and there is little risk that someone will be injured during an evacuation. Thirdly, 10 rem is approximately equal to the lifetime differential in natural background radiation experienced by people living in different parts of Ontario. Again the group's recommendations depend almost entirely upon the validity of the parallel that draws between acute and chronic exposures, a parallel that in our view is simply not justified.[91]

The limits for the contiguous zone (3 km radius), the primary zone (10 km) and the secondary zone (50 km) were also arrived at by the working group. In its worst case scenario (25 rem at the reactor boundary) a dose of approximately 10 rem for areas within 3 km of the plant (the contiguous zone), and a dose of 1 rem at approximately 9 km from the plant (supporting a primary zone radius of 10 km). The secondary zone limit was chosen on the basis that one might receive a thyroid dose of 0.15 rem within this area (in which case ingestion control would be recommended). Rationale for not extending the secondary zone beyond this point included a statement that "This recommendation is made with the realisation that the plans developed for the proposed Secondary Zone could be extended outwards if necessary."[92]

Finally it was suggested that evacuees should be allowed to return if the additional radiation dose for the year would be less tha 0.5 rem, but should not be allowed back to their homes if the total additional projected dose from the accident would exceed 10 rem over the next 50 years. The lower limit of 0.5 rem per year corresponds to the ICRP recommended annual limit for members of the public. The upper limit of 10 rem corresponds to the requirement for evacuation should the radiation dose from the accident exceed 10 rem.[93]

We believe that it is very apparent that the "scientific" decisions of Working Group #3 appear to have been made on rather loose criteria, and engender a great deal of non-scientific judgment, including cost-benefit analyses. There is no justification for excluding the public from this important decision-making process.

Furthermore, many of the working group's decisions have come under scrutiny following the nuclear reactor accident which occurred in Chernobyl. Among other matters it is now even more apparent that faith in mathematical probabilities associated with the occurrence of different types of nuclear accidents is unwise, since these calculations fail to quantify human behaviour (including deliberate hostile actions) in a meaningful manner.

Another result of Chernobyl has been the establishment, in early 1987, of Provincial Working Group #8 by the

provincial Cabinet "to examine the issue of an appropriate level of emergency planning and a preparedness in Ontario for dealing with nuclear emergencies." In its terms of reference the working group is asked to consider one of the principles of the provincial Nuclear Emergency Plan, which reads:

> An appropriate balance shall be struck between risk and cost when assessing the level of emergency planning and preparedness required.[94]

In particular the working group is asked to define the radiation situation which would define the upper limit for detailed emergency planning, and to decide whether any new or modified mitigating measures should be added to the provincial Nuclear Emergency Plan. Of significance is the requirement that:

> The Working Group shall make publicly known the fact of its constitution and the subject of its deliberations, and shall receive and consider relevant submissions from all affected and interested parties, including members of the public.[95]

Thus the accident at Chernobyl and the need for a renewed public confidence in nuclear industry has had at least some small effect in increasing public input into the contingency planning process. However, important criticism have already been raised about the group's composition and the lack of funding to citizen representatives wishing to make submissions.

Unfortunately, the opportunities for public participation in off-site nuclear emergency planning still remain minimal.

3. RECOMMENDATIONS

Addordingly, we recommend:

14. THAT THE MATTER OF EMERGENCY PLANNING BE MADE A FORMAL REGULATORY REQUIREMENT UNDER THE ATOMIC ENERGY CONTROL ACT, AND THAT EXPLICIT REQUIREMENTS BE ESTABLISHED WITH RESPECT TO MONITORING AND NOTICE.

15. THAT EMERGENCY PLANNING BE CARRIED OUT IN ONTARIO ON THE BASIS OF A WORST CASE SCENARIO THAT CONTEMPLATES AN ACCIDENT IN THE ORDER OF SERIOUSNESS OF THREE MILE ISLAND OR CHERNOBYL.

16. THAT EFFORTS BE MADE, INCLUDING THE PROVISION OF INTERVENOR FUNDING, TO ENSURE THE BROADEST PARTICIPATION OF ALL THOSE INTERESTED IN THE DEVELOPMENT OF EMERGENCY PLANS.

IX. THE ATOMIC ENERGY CONTROL BOARD

We have dealt with several aspects of the Board's authority from licensing to enforcement. We have not to this point, however, directly addressed the Board's structure or composition. We do that here, and address several other matters relating to the Board's authority and responsibility that it seemed appropriate to deal with in this concluding portion of our brief.

1. COMPOSITION

It is a consistent criticism of the Board that it has neither the human resources nor the independence to exercise adequate oversight with respect to the many matters subject to its purview, including Ontario Hydro's CANDU system. Currently the Board is composed of one full-time and four part-time members. Pursuant to this arrangement, the person man hours are too few, and the expertise of the Board too limited.

In response to these criticisms, a study team under Erik Neilson's Task Force on Program Review recommended that the Board should be composed of more permanent members representing the interests of industry, labour and the general public.[97] This view reflects the conclusion reached by the Macdonald Commission that the technical membership of the Board should be supplemented by members drawn from the general public. Then the Board could truly balance technical considerations with public concerns.[98] Bruce Doern has also stated

that the scope of the Board's inquiries could be expanded to consider the full extent of its regulatory mandate if a larger and more representative Board were put into operation. He argued that the Board membership should include persons with a knowledge of law, health, physics, environmental science and organized labour.[99]

Z. Domaratzki and T.J. Molloy of the AECB have stated that, because of the present limit of one full-time and four part-time members, Board membership is effectively restricted to those persons with technical expertise. It is submitted that the Board's focus on "technical matters" is an unconvincing argument for the exclusion of broader public participation in nuclear safety issues.[100] In fact it is patently clear public policy issues are decided under the guise of scientific solutions, with important social and ethical considerations simply remaining unarticulated. It would be more honest and productive to canvass these issues openly.

Again there is a strong concensus among those who have reviewed the present regime that reform is necessary. Bill C-14 included important reforms to address the shortcomings. We reference those reforms and take this opportunity to expand upon them.

As did section 6 of the Bill, we believe that the complement of Board members be expanded. Bill C-14 mandated a board with no fewer than nine and no more than 13 members. We agree with the notion of requiring a minimum number of Board members because the Board

must have the benefit of significantly diverse and comprehensive analytical perspectives to adequately address the complex matters that it must consider. Indeed as we recommend, the qualifications of Board members should be a matter of statutory definition.

However, we see no necessity to limit by statutory provision the maximum number of Board members as long as the balanced approach to the Board's composition is maintained. If the functions of the Board are to be expanded as Bill C-14 advanced and as we propose, it may well be desirable and indeed even necessary for the Board to take on additional members from time to time to perform specific functions. For example, should the Board be charged with the responsibility of conducting licensing hearings, or site selection hearings, it may be desirable to appoint part-time members with the specialized skills necessary to the role of public adjudication. Further, should it be desirable to consolidate provincial and federal siting hearing requirements, it may be desirable to cross appoint a member of the provincial Environmental Assessment Board for that purpose. It is important then to allow sufficient flexibility in the number of Board appointees to allow for such eventualities.

Section 10 of the Bill prescribed minimum qualification for Board membership in order to ensure that those appointed would be objective and independent. Individuals with vested interests in nuclear industry related businesses could not be appointed. Neither could a majority of the Board members have been employed during

the five years preceding their appointment by a corporation, agency or department, etc. engaged in nuclear endeavours. The provision also prescribed the Board members' ability to become engaged in or associated with a nuclear industry business within 18 months of leaving their appointed position on the Board. We support these provisions and believe them to be necessary if the Board is to be objective and independent.

Our recommendations in this regard, however, would limit to no more than one-third the Board's complement with previous industry loyalties. The 50% restriction of Bill C-14 did not provide, in our view, a sufficient safeguard.

More important however, is the need for legislative amendments that make it mandatory for appointments to the Board to provide it with the breadth of expertise necessary to an informed decision upon the complex and varied issues of policy, health, ethics, engineering, ecology and the law that routinely confront this institution. To put it tritely, Board members must be qualified as well as independent.

Finally, the appointments process itself should be a public one that provides notice of the proposed nomination of prospective Board members and allows an opportunity for comment.

2. INDEPENDENCE

Atomic energy is a public enterprise in Canada with both federal and provincial governments actively engaged in promotional and supportive activities. Apart from Ontario Hydro the Canadian nuclear industry is dominated by federal government enterprises including Atomic Energy of Canada Ltd. and Eldorado Nuclear Ltd. AECL carries out nuclear research, development, marketing and promotional activities. Eldorado carries out mining milling activities and operates the only uranium refinery in Canada. Both Crown corporations report to the Minister of Energy, Mines and Resources. So does the AECB.

Thus the Minister exercises both regulatory and promotional duties; the conflict between these rules is patent, as is the potential casualty-nuclear safety.

The most direct way to address this issue is to separate those aspects of ministerial responsibility and vest them in different ministers of the Crown. Thus the AECB should report to the Minister of the Environment or the Minister of National Health and Welfare with respect to its regulatory role concerning health, safety, security and the environmental aspects of nuclear power. Indeed it may be wise to establish an entirely separate legislative regime to deal exclusively with these issues.

Under section 7 of the Act presently, the Board must comply with any general or special directions given by the Minister with reference to carrying out its purposes. The clear import of this in terms of Board independence is apparent. Any direction that is to be given to the Board should, in our view, be by way of formal amendment to the Act or its regulations. There is absolutely no justification, in our view, for circumventing the consititutional authority of Parliament or established procedures for regulatory amendment. This is particularly true with respect to matters of such far reaching public concern as the matter of nuclear safety. Section 7 of the Act should be rescinded.

3. ACCESS TO INFORMATION

Under the Act, all information is secret unless the Minister or the Board decide to make it public. Pursuant to its provisions the public has no right to information on nuclear power and any information made available must first be approved by the Minister and the Board. There is virtually as much legislative language in the Act swearing those associated with its endeavours to secrecy as there is language directing the Board in the regulatory tasks before it. The statute, substantially unamended since its proclamation in 1946, proclaims an approach not surprising for an era when matters nuclear were very much issues of national security. The Act has since that time grown increasingly anachronistic as contemporary nuclear issues in Canadian society are now those of energy

policy and planning and not national defence, and as our society has grown increasingly democratic in its practices and expectations.

Yet until very recently the entire regulatory process of the Board was effectively closed to the public. Since that time the Board has made some progress, albeit slow and halting, in the direction of greater openness. In January, 1981, the AECB instituted a consultative process enabling members of the public to comment upon new or amended regulations, safety criteria and regulatory guidelines prior to their adoption. Consultative documents are developed for proposed regulatory changes, and the public is generally given 90 days to comment on the proposals. Interested persons may keep abreast of proposed regulatory changes by requesting AECB's Regulatory Agendas, which are used twice a year. These agendas contain the proposed regulatory amendments and the reasons for contemplating these changes.

The fundamental problem here, however, is not that of Board policy or the attitude of its members, but rather the statutory prohibitions engendered in its outmoded enabling legislation.

Again provisions of Bill C-14 were intended to address this problem. In addition to mandating public hearings as an adjunct to the licensing process, the Bill also defined as among the objects of the Board the responsibility to act as a source of "information for the

public on health, safety and environmental matters." We support that proposal.[101]

In addition, section 36 of the Bill obliged the Board to make available for inspection and copying by the public all documents in its possession not exempted from disclosure by the regulations. The failure of the Act to delineate the ambit or scope of those prospective regulations was, of course, problematic. The notion of an affirmative obligation to disclose its record was not. We support the latter and believe that any claims to confidentiality should be dealt with pursuant to the procedures since established under access to information legislation to guide and determine the right of the public to such access.

4. THE BOARD'S MANDATE

We have left the most important matter for the last, and that is the primary purpose to be served by the Board in exercising its various functions. We can, we trust, agree that the most important function of the Board is to, as Bill C-14 stated a decade ago:

> ENSURE THE PRESERVATION OF THE HEALTH OF SAFETY OF PERSONS AND TO PROTECT THE ENVIRONMENT FROM THE HAZARDS ASSOCIATED WITH PRODUCTION, POSSESSION AND USE OF PROSCRIBED SUBSTANCES.

The Atomic Energy Control Act should, in our view be amended to similarly provide and the Board should be

explicitly obligated to refuse, revoke or amend any licence where such harm is threatened.

5. RECOMMENDATIONS

Accordingly, we recommend:

17. THAT THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO PROVIDE THAT THE BOARD CONSISTS OF NOT LESS THAN NINE MEMBERS OF WHOM NOT LESS THAN FOUR SHALL BE APPOINTED ON A FULL-TIME BASIS. ADDITIONAL APPOINTMENTS MAY FROM TIME-TO-TIME BE MADE, BUT IN A MANNER THAT MAINTAINS THE BALANCE OF EXPERTISE REQUIRED BY THE AMENDMENTS OF THE ACT SETTING OUT BOARD MEMBER QUALIFICATIONS.

18. THAT THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO PRESCRIBE MINIMUM QUALIFICATIONS OF BOARD MEMBERS BY:

    (a) MAKING INELIGIBLE FOR APPOINTMENT ANYONE WITH A BUSINESS ASSOCIATION WITH THE NUCLEAR INDUSTRY;

    (b) DELINEATING PROCEDURES NECESSARY TO DETERMINING MATTERS OF CONFLICT OF INTEREST AS MAY ARISE;

    (c) PROVIDING THAT NO MORE THAN ONE-THIRD OF THE MEMBERS OF THE BOARD AT ANY TIME SHALL HAVE BEEN EMPLOYED IN THE FIVE YEARS PRECEDING

THEIR APPOINTMENT BY A NUCLEAR INDUSTRY RELATED BUSINESS, AGENCY OR DEPARTMENT;

(d) PROVIDING THAT NO BOARD MEMBER WITHIN 18 MONTHS OF LEAVING THE BOARD ACCEPT EMPLOYMENT WITH A NUCLEAR RELATED BUSINESS;

(e) PROVIDING THAT THE SELECTION OF BOARD MEMBERS OFFER A BALANCE OF EXPERTISE IN THE AREAS THE AREAS OF HEALTH, PHYSICS, ECONOMICS, ENVIRONMENTAL PROTECTION, ENGINEERING, ETHICS AND LAW.

19. THAT AN APPOINTMENTS PROCEDURE BE ESABLISHED THAT WOULD, INTER ALIA, PROVIDE FOR THE PUBLICATION OF ALL PROSPECTIVE NOMINATIONS AND FOR REVIEW AND RATIFICATION BY A STANDING COMMITTEE ON APPOINTMENTS.

20. THAT THE ATOMIC ENERGY CONTROL ACT BE AMENDED TO PROVIDE THAT THE BOARD REPORT TO THE MINISTER OF THE ENVIRONMENT OR THE MINISTER OF NATIONAL HEALTH AND WELFARE WITH RESPECT TO ITS REGULATION OF HEALTH, SAFETY, SECURITY AND THE ENVIRONMENTAL ASPECTS OF NUCLEAR POWER.

21. THAT SECTION 7 OF THE ACT ALLOWING THE MINISTER OF ENERGY, MINES AND RESOURCES TO DIRECT THE BOARD IN ITS PURPOSES BE RESCINDED.

22. THAT THE ACT BE AMENDED TO IMPOSE A POSITIVE OBLIGATION THAT THE AECB ACT AS A SOURCE FOR, AND

DISSEMINATE, INFORMATION AND MATERIAL CONCERNING HEALTH, SAFETY AND ENVIRONMENTAMATTERS IN RELATION TO NUCLEAR ENERGY.

23. THAT A PUBLIC DOCKET BE ESTABLISHED CONCERNING ALL AECB REGULATORY ACTIVITIES WITH RESPECT TO A PARTICULAR NUCLEAR FACILITY AND BE MADE ACCESSIBLE TO ANY INTERESTED PERSON.

24. THAT THE ACT BE AMENDED TO ARTICULATE THE PURPOSES OF THE BOARD BEING TO ENSURE THE PRESERVATION OF THE HEALTH AND SAFETY OF PERSONS AND TO PROTECT THE ENVIRONMENT FROM THE HAZARDS ASSOCIATED WITH PRODUCTION, POSSESSION AND USE OF PRESCRIBED SUBSTANCES.

25. THAT THE ACT BE AMENDED TO REQUIRE THAT THE BOARD REFUSE, REVOKE OR AMEND ANY LICENCE OR CERTIFICATE GRANTED WITH RESPECT WITH A NUCLEAR ENTERPRISE THAT THREATENS HARM TO THE HEALTH OR SAFETY OF PERSONS OR TO THE ENVIRONMENT.

APPENDIX A

PROVINCIAL EMERGENCY PLANNING

A nuclear emergency plan is intended to protect persons from external and internal radiation exposure. Radioactive substances may enter the body through inhalation or the ingestion of contaminated food or water. Protective measures which may be employed in the event of an accident include: restricted entry into the affected area, the use of protective equipment, the taking of iodine pills to prevent the absorption of radioactive iodine by the thyroid, sheltering, evacuation, the removal of deposited radioactive material and controlling the consumption of contaminated food and water.

The decision to implement certain protective measures is based on the Protective Action Levels (PALs) which are included in the nuclear emergency plan. For each recommended protective action a lower and an upper PALs level is set. When an emergency situation arises, it is first necessary to determine the highest projected radiation dose expected to be received by the most exposed person from the most exposed group. The group most likely to be exposed to the highest radiation level (i.e. the "Critical Group") is defined in terms of age, sex or dietary habits. Once an estimate is obtained for this most exposed individual, it is compared against the upper and lower PALS level. If it falls below the lower PALs figure, the protective action is not justified; if it falls above the upper

PALs level the protective action should be taken unless serious risks are involved in its implementation. A value which falls in between the upper and lower PALs values leaves the decision about taking action in the hands of the emergency decision-maker. Generally protective action will be taken, unless some reason exists for deferring the action. The following are examples of some Protective Action Levels (PALs) which have been set for certain protective measures:

Measure	Lower Level (effective dose)	Higher Level (effective dose)
Sheltering	0.1 rem	1.0 rem
Evacuation	1.0 rem	10.0 rem
Banning Food/ Water Consumption	0.05 rem	0.5 rem

The area surrounding a nuclear reactor is divided into three circular zones for planning purposes: the contiguous zone (3 km radius), the primary zone (10 km radius) and the secondary zone (50 km radius). The greatest degree of planning occurs for the contiguous zone. For the primary zone (which includes the contiguous zone) planning is needed to protect persons from the initial radioactive plume which may result from a reactor accident, including appropriate evacuation measures. Planning in the secondary zone (which includes the contiguous and primary zone) is aimed at preventing radiation exposure from the ingestion of contaminated food and water.

The emergency plan is divided into two phases of operation. In Phase I (The Emergency Plan) one must give warning of the nuclear reactor accident, take measures to prevent population exposure to the escaping radioactive plume, stop consumption of contaminated food and water, and finally cease protective actions as appropriate. In Phase 2 (The Follow-up Phase) steps are taken to deal with food and water contamination, restoring the area and paying compensation to injured individuals.

During the first stage all emergency measures are implemented by the Provincial Operations Centre, under the direction of the Premier of Ontario or the Solicitor General. A Provincial Information Centre is also created to liaise with other agencies, the media and the public. An ingestion monitoring organization is brought into operation as well. In Phase 2, the Phase 2 Advisory Committee advises the provincial Executive Authority (i.e. the Premier or the Solicitor General) regarding the ingestion control and restoration measures which should be taken. The Ingestion Monitoring Organization determines the appropriate ingestion control measures to be taken on the basis of field monitoring results. Finally, the Technical Support Section will analyze ingestion and restoration field monitoring results, prepare dose projections and provide technical assistance to the Phase 2 Advisory Committee.

Under the provincial plan nuclear emergency, the initial notifications of an emergency is the responsibility of staff of the nuclear facility:

> A nuclear facility shall make an initial notification to the prescribed Provincial and municipal authorities whenever its emergency response capability is significantly affected, or upon the occurrence (or the probability of the occurrence) of a substantial degradation or malfunction of a process system with potential offsite effects. (Section 3.2)

This initial notification must contain a preliminary assessment of the potential danger, by classifying the emergency within one of the three notification categories described in the Province of Ontario, Nuclear Emergency Plan. Both the provincial and municipal plans will generally be activated upon notification of a nuclear emergency. A state of emergency may be officially declared by either the Premier of Ontario or the head of the municipal council in the affected municipality.

It is the responsibility of the Emergency Planning Office of the Ministry of the Solicitor General to ensure the effective coordination of nuclear emergency planning in Ontario. It is this office's role to facilitate provincial inter-agency and inter-ministry coordination in both emergency planning and operations. The Emergency Planning Office must also consult with federal and municipal institutions involved in nuclear emergency planning, such as Health and Welfare Canada and the designated municipalities.

The Ministry of the Solicitor General must implement, administer and update the Nuclear Emergency Plan. It must coordinate and provide assistance to provincial ministries and agencies and designated municipalities in the development of their own detailed sub-plans for carrying out their respective responsibilities in the event of a nuclear emergency. Furthermore the Ministry must:

> Monitor and assess the operational readiness and effectiveness of all elements of the emergency management organization, including those of municipalities, Provincial ministries and agencies, nuclear facilities and facility operators, and make recommendations for improvement, where necessary.

The Emergency Plans Act, 1983 further stipulates that all municipal emergency plans which deal with nuclear facilities must be approved by the Solicitor General, and he may make any modifications he considers necessary to ensure that such plans conform to the Province of Ontario, Nuclear Emergency Plan. Finally, periodic training drills are conducted by the Ministry, by simulating a nuclear emergency situation.

The Province of Ontario, Nuclear Emergency Plan requires the Solicitor General to set up four standing committees in order to "maintain optimum standards in nuclear emergency planning and preparedness." These committees are the:

1. Plan Review and Preparedness Committee, which reviews the province's state of preparedness for dealing with a nuclear emergency;

2. Technical Advisory Committee, which provides advice on technical matters relating to nuclear emergencies;

3. Technical Sub-committees, which provide advice on meteorology, dosimetry, radioactive emissions, protective measures, computer applications and other relevant matters; and

4. Regional Nuclear Preparedness Committees for each designated nuclear facility, which review the local state of preparedness for responding to a nuclear emergency.

Finally, when a nuclear emergency arises, the staff of the Provincial Operations Centre will include representatives from the federal government and municipalities located in the primary zone.

FOOTNOTES

1 Ontario, Royal Commission on Electric Power Planning (Chairman: Arthur Porter), Interim Report on Nuclear Power in Ontario (The Royal Comission on Electric Power Planning, 1978)

Ontario, Royal Commission on Electric Power Planning (Chairman: Arthur Porter), Vol. I: Concepts, Concusions, and Recommendations (The Royal Commission on Electric Power Planning, 1980)

Ontario, Select Committee on Ontario Hydro Affairs, The Safety of Ontario's Nuclear Reactors: Final Report (June, 1980)

2 Nuclear Control and Administration Act, Bill C-14 (30th Parliament, 3rd session, 1977)

3 Information EMR, news release: "Nuclear Control Act Tabled," 7/59

4 Ralph D. Torrie, Operational Characteristics and Hazards of CANDU Nuclear Power Reactors (London: Greenpeace Reactor Study, August, 1986)

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35 Nuclear Liability Act, R.S.C. 1970, c. 29 (1st Supp.), as am.

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37 RCEPP, Final Report, supra note 1, p. 40

38 T. Schrecker, "The Atomic Energy Control Board: Assessing its Role in Reactor Safety Regulation," for ONSR, September, 1987, p. 9

39 Environmental Protection Act, R.S.O. 1980, c. 141, s. 8

40 Ontario Water Resources Act, R.SO. 1980, c. 361, s. 20

41 Ibid.

42 Ontario Hydro, Report #85355, Design and Development Division Master Project Requirements for NGS

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45 Fisheries Act, s. 33(1)

46 Bill C-14, supra note 2, s. 22

47 Ibid., s. 20

48 Regulations to the Atomic Energy Control Act, CRC, Vol. III, c. 365, p. 2325, as amended, s. 19(3)

49 Ibid.

50 Ibid.

51 Ibid., Schedule II and notes

52 The AECB reviews, and generally accepts, ICRP recommendations regarding radiological protection. Other international sources of information considered by the AECB orginate from: the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (NEA, OECD), the International Labour Organization (ILO) and the World Health Organization (WHO). The AECB will also consult with Health and Welfare Canada in the development of new standards for radiation protection at nuclear generating stations.

53 Macdonald Select Commitee, supra note 1, p. 15

54 Proposed Regs, supra note 15, p. 43

55 D.M. Halton, Monserco Limitd, "Comparison of the Rationale Used in Seting Occupational Exposure Standards for Ionizing Radiation and Hazardous Chemical Substances," AECB-0214 (Ottawa, December, 1986)

56 Ibid., pp. 92-93

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60 Ontario Hydro, NGD Annual Environmental Summary, 1986, pp. 1-3

61 Ontario Hydro, Report #85355, Design and Development Decision Matter Project Requirements for NGS

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63 Personal communications, Y. Skof with Dr. Lesbia Smith, Ontario Ministry of Health, July, 1987

64 See discussion infra, Part VI, s. 2, Enforcement

65 Personal communication, Y. Skof with Mr. Taipow of the Ministry of Labour, July, 1987

66 Proposed Regs, supra note 15, ss. 56, 57 and 73

67 Currently, the Province of Ontario has no regulatory standard. See Ontario, Ministry of the Environment, Ontario Drinking Water Objectives (Toronto: Ministry of the Environment, 1984), and Ontario, Ministry of the Environment, Water Management (Toronto: Ministry of the Environment, 1984) pertaining to the discharge of contaminants to water, however this shortcoming is presently being addressed under the Municipal Industrial Strategy for Abatement Program

68 Bill C-14, supra note 2, s. 4

69 See discussion infra, Part IV, Approvals, Design

70 Macdonald Select Committee, supra note 1, pp. 39 and 40, concerning the issuance of the Bruce "A" licence

71 Z. Domaratzki and T.J. Molloy, "Nuclear Regulation -- In Time With the Times" (1987)

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74 Ibid.

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79 Proposed Regs, supra note 15, s. 67

80 Ibid., s. 69

81 Ontario, Nuclear Energy Plan, Part I (Master Plan) (Toronto: Ministry of the Solicitor General, 1986). Adopted by Order in Council, June 12, 1986

82 Ibid., Appendix 8, Annex O

83 Emergency Plans Act, S.O. 1983, s. 8

84 Canada, National Health and Welfare, Federal Nuclear Emergency Response Plan (Off-Site) (Ottawa: National Health and Welfare, 1984). This document is presently being updated.

85 Emergency Plans Act, supra note 83, s. 8

86 Ibid., s. 7

87 Province of Ontario Report of Provincial Working Group No. 3, April, 1984

88 Ibid., p. 3

89 Supra, note 23

90 Provincial Working Group No. 3

91 Ibid.

92 Ibid., p. 24

93 Ibid.

94 Provincial Nuclear Emergency Plan, supra note 81

95 Instruction to Provincial Wroking Group No. 8, Annex B

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98 Macdonald Select Committee, supra note 1, p. 43

99 G. Bruce Doern, The Atomic Energy Control Board (Ottawa: Minister of Supply and Services Canada, 1977)

100 See discussion in Part II of this brief

101 Bill C-14, supra note 2, s. 20(b)