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October ²⁸ 7, 1994

The Honourable Bud Wildman
Ontario Minister of Environment and Energy
135 St. Clair Avenue West
Toronto, ON M4V 1P5
via fax -- 16 pages to 323-4682

Dear Mr. Wildman:

Through the good offices of Mr. Rohan Gaghadar of your Ministry, and by agreement with Mr. Ron Maruska of Ontario Hydro, I have received a copy of Ontario Hydro's August 23rd or 26th submission to your Ministry concerning the potential impact to Ontario Hydro of reducing the Ontario Drinking Water Objective for tritium, as recommended by your Advisory Committee on Environmental Standards, "ACES". Parts of that submission are an extremely helpful contribution to this important discussion. Unfortunately, and as we predicted in our earlier submission to you, there are many other parts that we believe are either wrong, or incomplete, or otherwise misleading, as a basis for your decision.¹ Most importantly, we believe that Hydro's "bottom line" conclusion -- that meeting even the 100 Bq/L objective on a "not to be exceeded" basis (which would in practice be a weekly basis) would have enormous costs, on the order of more than a billion dollars -- flows largely from these errors and omissions.

In short, as we predicted, Hydro's submission presents an "ad terrorem" forecast of how Hydro would respond to the imposition of tritium standards at 100 Bq/L or 20 Bq/L. If either of these standards were actually imposed, we are completely confident that Ontario Hydro would find much cleverer and cheaper ways to meet those standards than the ones outlined (and roughly costed) in their submission. We ourselves make several major cost-saving suggestions below to improve Hydro's unnecessarily extravagant proposals, but we do not pretend to have put in the time or effort to perfect the ideal "least-cost" solution.

In addition, several parts of Ontario Hydro's submission indicate, inadvertently, how appropriate and important it is for the Ontario government to intervene now, while Ontario Hydro is making decisions that may either increase or decrease tritium emissions.

We continue to recommend, along with ACES, that a proper process should be initiated to make the difficult decisions about significant tritium emissions reduction from Ontario Hydro's nuclear stations. The present process -- which is providing, as
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input for your decision, a combination of Ministry staff reports, Ontario Hydro submissions to Ministry staff, independent submissions to Ministry staff and to you, and informal contact in multiple directions, including contact between myself and your staff, your Ministry staff, and numerous Ontario Hydro staff -- is certainly interesting for its participants, but it is not adequately public or legitimate, or thorough enough or well enough funded, to ensure that the resulting decision will be either the best decision possible, or widely regarded as properly and legitimately made.

We urge you, again, to consider taking two actions now: unilaterally implementing a first-step, relatively low-cost tightening of the ODWO for tritium (we recommend, with the ACES report, 100 Bq/L on a "not to be exceeded" basis -- practically, a weekly basis), and simultaneously initiating a more formal and thorough process for making the more difficult and expensive decisions concerning further reductions of public exposure to tritium. (We have recommended a further reference back to ACES for that more formal and thorough process, but we can envision several acceptable alternative processes.)

On the continuing assumption that you are likely to decide part or all of this matter without further public input other than submissions of this kind, we make the following comments in response to the submission by Ontario Hydro.

Ontario Hydro is wrong to imply that it would be prohibitively expensive to meet a 100 Bq/L tritium standard, on a weekly basis.

On page 2, Ontario Hydro states that "Ontario Hydro would require further tritium reduction actions to meet this level [i.e., 100 Bq/L] as recommended by ACES (i.e., if it were not applied as an annual average)." Ontario Hydro provides Table 2 and figures 2 to 11 to document the proposition that weekly exceedences of 100 Bq/L levels of tritium are frequent and unavoidable without further, and presumably expensive, tritium reduction actions.

We do not believe that the data support the claim.

First, it is important to remember that most water treatment plants in Ontario -- notably all of those near Pickering -- are inter-connected to a kind of water "grid". As a result, individual plants can generally be closed, at least for a short period, without in any way inconveniencing water consumers, who simply receive water from a different WTP. That is in fact what happened in August 1992, when the Ontario government ordered one or more WTPs near Pickering nuclear station closed. No water uses were curtailed as a result, nor did any water tanker cars or trucks filled with bottled water move into the region.

Further, there is at least one precedent for Ontario Hydro, by agreement with the Ontario government, to spend money to provide "alternative water supplies" -- indeed, permanent supplies -- to

Pickering station does have another very large tritium leak, we believe that low-cost or no-cost alternative water supplies will almost surely be available. Most of all, should such an unanticipated leak occur, we do not see why the station's neighbours should have to drink that tritium, as they did in 1992, and as they surely will next time, unless you act on the ACES recommendations.

Even if "de-tritiation" is needed, Ontario Hydro apparently has not analyzed the least-cost "de-tritiation" technology.

Having implied, misleadingly, that major (and expensive) abatement is the only way Ontario Hydro could live with the imposition of a 100 Bq/L tritium standard on a weekly basis, Ontario Hydro's submission goes on to "prove" that that abatement would necessitate the expenditure of over a billion dollars -- surely enough to give any Minister of the Environment and Energy pause, especially during this very trying period for the finances of Hydro and its customers. Fortunately, this *ad terrorem* case is misleading in two regards: (1) As outlined above, the 100 Bq/L proposed interim standard can be met with much more modest measures, most of them already in place, and (2) Even if de-tritiation of the water Hydro pumps into the lake is eventually required (e.g., to meet the proposed year-1999 20 Bq/L standard, on a weekly basis), we believe it can be accomplished at far lower cost than Ontario Hydro has suggested.

On page 7, Ontario Hydro's submission says that "The only feasible method of removing [the tritium in the 'Active Liquid Waste Management System' or ALW] is by vacuum distillation" -- and that 15 new large vacuum distillation plants would have to be built, whose cost they estimate (p. 8) "could exceed a billion dollars".³ Hydro's second and third conclusions, on page 10, repeat those claims.⁴ As we indicated in our March 10th submission to ACES, we believe that the facilities Ontario Hydro now uses to extract heavy water from Lake Huron water in the Bruce Heavy Water Plant (which use first the so-called "Girdler Sulfide process", and then very large vacuum distillation units) are a much more appropriate least-cost choice, both because we believe their 2-step technology is more appropriate and cost-effective for this job, and because large parts of the BHWP are available for about \$500 million less than the 15 new vacuum distillation plants Hydro has proposed for "well over \$500 million" of capital cost (pp. 7-8).

More specifically, the entire remaining BHWP has already been written off by Hydro, as being totally surplus to Hydro's own needs, and will most likely be completely idle and shut down by mid-1997, when Ontario Hydro and AECL finish producing heavy water for export to South Korea -- heavy water which is actually even surplus to the needs of South Korea!

Moreover, we believe that Ontario Hydro has artificially inflated the operating cost of its proposed (15) vacuum distillation units

through the use of electricity for process heat. We will deal with this latter point first, then return to the Bruce Heavy Water Plant.

The use of electricity for process heat in Ontario Hydro's submission

We were very surprised to see, on Ontario Hydro's "Figure 26 -- Schematic of the Proposed Waste Water Detritiation [Process]", that they propose using an electric evaporator and two electric reboilers at each vacuum distillation unit. We understand that the existing vacuum distillation facilities at Hydro's nuclear stations (i.e., the Heavy Water Upgraders), like those at the BHWP, use steam from the nearest reactor rather than electricity. Since nuclear generating stations turn steam into electricity at only 29-31% efficiency, the use of electricity in the process would more than triple the thermal energy costs of the process, which are a significant component of its operating costs. Indeed, at page 8, Ontario Hydro's submissions says "Operating costs ... are expected to be many millions of dollars because of the high energy usage required by this system. [emphasis added]" We can frankly see no reason to use Ontario's most expensive source of thermal energy, other than to inflate the operating costs of tritium emissions abatement.⁵

Some background on the Bruce Heavy Water Plant:

The remaining facilities at Bruce Heavy Water Plant (BHWP "B") consist of two "enrichment" units (each consisting of three successive phases using the "Girdler-Sulfide" process), both of which are designed to feed into one "finishing" unit (using the vacuum distillation process) which is roughly similar to one of the large vacuum distillation units described in Ontario Hydro's submission to MOEE.

Currently, one of the two Girdler-Sulfide "enrichment" units is shut down indefinitely, and is being maintained, just in case Ontario Hydro ever decides to restart it. The other is temporarily running, along with the (single) Vacuum distillation "finishing" unit, to extract heavy water for sale to South Korea pursuant to a secret agreement between Ontario Hydro and AECL. The entire Bruce Heavy Water Plant is planned to shut down at the fulfillment of that contract in mid-1997, absent future export sales.

In fact, from testimony presented at the Ontario Energy Board's HR22 hearing, it appears that AECL now owns a stockpile of heavy water, paid for by the Canadian taxpayer, that is large enough to satisfy the South Korean contract without any heavy water from Ontario Hydro. Presumably, AECL involved Ontario Hydro in the present contract in order to postpone the shutdown of Canada's last heavy water plant -- a shutdown that would be extremely injurious to AECL's remaining prospects of selling future CANDU reactors.

In short, we believe that Ontario Hydro could, if necessary,

"reappropriate" the entire Bruce Heavy Water Plant "B", even before the fulfillment of the South Korean contract in mid-1997, without damage to any party -- especially if the BHWP were kept running for tritium emissions abatement.

The plan to use the BHWP for de-tritiation:

With some modifications, we believe that the currently idle Girdler-Sulfide "enrichment" unit at BHWP "B" could likely effectively replace 14 of Hydro's proposed 15 vacuum distillation units. Simply put, the need for 15 units is not based on the tremendous quantity of tritium (or deuterium) that needs to be distilled out of the Active Liquid Waste water -- in fact, the output volumes involved are quite small, compared to the capacity of even one such unit -- but is based on the tremendous quantity of "light" (i.e., ordinary) water that the tritium and deuterium are diluted into.⁶ But the Girdler-Sulfide "enrichment" unit -- if modified to optimize tritium extraction and to allow the same tritiated water to make multiple passes through its first phase before being rejected to Lake Huron -- could reduce that enormous volume to a much smaller one, which could be handled by a single vacuum distillation unit.⁷

In short, absent convincing technical arguments to the contrary -- and Hydro has provided none -- we continue to believe that it should not be very expensive for Ontario Hydro to filter its unfiltered pump-outs of radioactive liquid wastes. (The filters are actually installed, but virtually never used, as discussed at the end of this submission.) That filtered but still-tritiated water should then be an acceptable -- even an advantageous -- feedstock for Ontario Hydro's heavy-water plant at Bruce Since the waste water would usually contain much more heavy water [i.e., more deuterium] than raw Lake Huron water (the heavy-water plant's normal feedstock), there should be a savings in energy, H₂S losses, etc.⁸

The extracted tritiated heavy water could either be returned to a nuclear generating station or sent to the Darlington Tritium Removal Facility, depending on its tritium concentration -- i.e., the ratio of tritium to deuterium. The remaining "light water" could, we would hope, be sufficiently detritiated for direct discharge into the environment.⁹

The total capital cost of this scheme could be, to a first approximation, zero, and certainly not one or more billions of dollars, even if relatively major design changes to BHWP are appropriate.

The operating costs of our proposed alternative should consist of some transportation and storage costs (roughly zero for Bruce A and B, somewhat higher for the perhaps 60,000 m³/y which would have to travel from Pickering and Darlington),¹⁰ and some energy costs in the form of steam from Bruce A, all of which might well be offset by the value of the heavy water, and possibly the

tritium, extracted.¹¹

In short, we are confident that Hydro, given the right incentives, could do much better at designing an efficient, least-cost program to abate tritium emissions from the Active Liquid Wastes at their stations. We would of course be happy to review and discuss any further design suggestions Ontario Hydro may propose, or any technical objections to our proposals that Ontario Hydro may raise. (As mentioned above, we would prefer to do so in a more open process than the present one. And in one where the polluter, and not the charity, funds independent expertise.)

Ontario Hydro's lack of detailed tritium-source data is an unfortunate anachronism -- a legacy of the regulatory vacuum we have described, combined with Hydro's own historic lack of environmental leadership. But it is no excuse to permit above-acceptable cancer risks.

On page seven, Ontario Hydro says that good tritium-source characterization data "has not been collected to date because it was not needed, i.e. the total amount of tritium collected in ALW ... falls well below the operating target of 1% of the maximum AECS release limit."

First, it is unfortunate that past Ontario governments, by exempting Ontario Hydro's radioactive emissions from the provisions of Ontario's MISA water-pollution-prevention law, have allowed this data vacuum to persist this long. But surely this is long enough.

Secondly, since the "maximum AECS release limits" for Ontario Hydro's stations are so astronomically high (based on maximum tritium concentrations ranging from 210,000 Bq/L at Pickering to 1,200,000 Bq/L at Darlington, as confirmed in Hydro's Table 1), that it is not surprising that Ontario Hydro has never exceeded 1% of those limits.¹²

The "maximum AECS [annual] release limits" for Darlington, for example, at 5.3 quintillion Bq/year¹³ is 22 times larger than the annual amount of tritium produced in the entire Darlington station. It is also significantly larger than the maximum amount of tritium the Darlington station could ever contain, even after 40 years of operation, and even without use of the Tritium Removal Facility. In short, these limits are meaningless for this discussion because they do not limit anything. They obviously bear no relationship to the use of "best available technology, economically achievable".¹⁴

Thirdly, Ontario Hydro's own Task Force on Sustainable Energy Development, in its recommendation 6.3, called on Ontario Hydro Nuclear to set voluntary targets for reducing emissions from nuclear generation. Ontario Hydro Nuclear has chosen to set no targets for reduction of radioactive emissions, a decision which

they told the Ontario Energy Board "will be reviewed by year end".¹⁵ From Ontario Hydro's August submission on tritium in drinking water, it seems that they still haven't taken the first step.

Hydro's incentives to abate tritium emissions are misstated -- and are falling, not rising.

On page 7, Ontario Hydro indicates that "procedures have always been in place to minimize the loss of D₂O (and thus tritium), not only to keep emissions low, but also for economic reasons as D₂O is very costly (nominally about \$400 per kg).

- The statement suggests that "keeping emissions low" has been Ontario Hydro's most important reason to minimize heavy-water losses. But several Ontario Hydro officials have informed me over the years that preserving expensive heavy water has always been the primary motivation -- not surprisingly, given the AECB's regulatory approach to "keeping emissions low", as discussed above.
- Heavy water, as discussed above, is now officially a surplus commodity to Ontario Hydro, and is also in surplus in Canada and globally. Buyers are limited to builders of new CANDU reactors (only South Korea and Romania) and of new hydrogen bombs (all self-supplied or outlaws). Sellers include Ontario Hydro, AECL (which still has heavy water stockpiled from its old production on Cape Breton), Russia and the U.S., especially as hydrogen bombs are dismantled and not replaced. Any financial incentive Ontario Hydro had to abate heavy water (and tritium) emissions is *decreasing*, along with the actual financial value of heavy water, while the best evidence shows that the estimated cancer-causing effectiveness of those emissions is *increasing*.

The discussion of moderator heat exchangers is misleading.

- Page 9 discusses the option of adding a "closed loop" to Ontario Hydro's moderator heat exchangers. We believe another option should also be explored that we believe is likely to be much simpler and less expensive for retrofit of existing stations: replacing some or all of the existing single-walled heat exchangers with double-walled heat exchangers. The gas-filled space between the two surfaces could be sampled, or dried/drained, or both, thereby eliminating the proposed problem of the "contaminated secondary loop" -- which in any case, as indicated above, we believe to be much less of a problem than Ontario Hydro claims.¹⁶ It is hard to believe that a double-walled heat exchanger would be unable to fit into the space designed for a single-walled heat exchanger -- although thermal efficiency would admittedly drop somewhat, all other things equal.¹⁷
- As page 6 makes clear, "aging moderator heat exchangers are

being inspected, repaired and/or replaced." We understand that several moderator heat exchangers are indeed being replaced in the very near future. Ontario Hydro will naturally install single-walled, open-loop replacement heat exchangers if left to their own devices. But the cost of installing "best available" heat exchangers is obviously much lower when heat exchangers are being replaced than at any other time. Ontario Hydro should not be allowed to squander this "opportunity cost" -- and to raise the future cost of cancer risk reduction in the process.

Misleading significance is imputed to natural radiation levels -- especially levels of Carbon-14.

On p. 11 of the submission, Ontario Hydro states the following:

For carbon-14, the natural background level of about 250 Bq/kg-c already exceeds the maximum concentration that would be allowed for a lifetime risk level of 5 in a million for consuming milk, fruits and vegetables. For the risk level of one in a million, natural background levels would exceed the maximum allowable concentrations for the consumption of milk, fruits, vegetables and fish.

In context, this statement is clearly intended to justify continued exposure of Ontarians to higher risk levels from artificial radioactivity that is emitted by Ontario Hydro -- as if any government that tried to keep tritium cancer risks below 5 in a million would first have to redesign the planet -- or at least ban the consumption of milk, fruits, vegetables and fish!

The inference, of course, is nonsensical, because environmental and public-health regulations routinely control controllable risks to levels far below the level of uncontrollable risks, and so they should. For example, the "natural background" risk of fatal cancer, in a lifetime, is in the range of 25% -- 250,000 per million -- yet drinking water standards generally attempt to keep the cancer risks from carcinogenic chemicals down to 1 per million. Even the "natural background" risk of fatal cancer from natural background radiation alone, according to the scientific consensus or "establishment", is on the order of 1% or 10,000 per million.¹⁸ It is not at all amazing that Ontario Hydro has discovered that some parts of that risk (including Carbon-14 in the food chain) exceed one in a million, or even 5 in a million. If Ontario Hydro has an effective way to decrease any of these natural risks, they should certainly propose them for consideration by health and environment officials. But that is not what is under discussion here. What is under discussion here is one of Hydro's ways of increasing those cancer risks.

Ironically, Hydro justifies the present double standard for cancer prevention by insisting that the public demands consistent regulations!

On p. 10 of their submission, Ontario Hydro states the following:

If the 100 Bq/L limit is chosen for tritium [even on an annual average basis], and with it the risk basis of 5 in a million, it would be inconceivable that the same risk basis should not be applied to each radionuclide emitted. The potential health effects from exposure to tritium are no different than for other radionuclides, and the public would expect consistent regulations for all exposures.

On its face, it is ironic and amusing to see Ontario Hydro using this line of argument, since it invokes the same sensible principles that are driving the tightening of tritium standards. By substituting only a few words, we can paraphrase the logic of ACES and of Energy Probe:

If the risk basis of 5 [or 1!] in a million is chosen for carcinogenic chemicals like NDMA, it would be inconceivable that the same risk basis should not be applied to tritium, and each other radionuclide emitted. The potential health effects from exposure to tritium are no different than for the other carcinogens, and the public would expect consistent regulations for all exposures.

Apparently, Ontario Hydro believes that their version of the quote embodies great wisdom, but would find no wisdom at all in our minor rewrite of it.

In fact, the public, whatever they expect or want, has obviously never received consistent regulation for all exposures to carcinogens, or even for all exposures to radionuclides. However, we believe, and Ontario Hydro apparently agrees, that public awareness of, and concern with, these issues is growing, and that the public is increasingly likely to demand consistent, and stringent, regulation -- witness, for example, the public response to ACES on tritium in drinking water. Indeed, Mr. Wildman, what has placed this challenging decision on your desk is precisely the historic inconsistency of regulation, with AECB permitting cancer risk levels that no environmental regulator would tolerate.

But from a purely practical (or political) point of view, it is not inconceivable that different risk bases should be applied to different carcinogens, partly because protection of health and the environment in Canada is such a patchwork quilt of jurisdiction. It is therefore not necessary for you to back away from this sensible reform for fear that you would simultaneously have to reform the rest of the world, or even all the other regulations governing radiation exposure -- as dearly as Energy

Probe would like to see those regulations reformed.

For example, earlier Ontario governments have taken the position, in MISA regulations, that Ontario does not have, or would not exercise, direct jurisdiction over environmental emissions of radionuclides into Ontario surface and ground waters.¹⁹ In the drafts of the Clean Air Program, Ontario was prepared to take a similar position with respect to airborne emissions of radionuclides. While Energy Probe continues to object to these instances of "jurisdictional hide-and-seek", they do suggest that the Ontario Drinking Water Objective for tritium represents an unusual instance of inescapable provincial jurisdiction over public exposure to (and therefore emissions of) a radionuclide. Unfortunately, we would not expect the federal Atomic Energy Control Board to be any more impressed or influenced by Ontario's interpretation of acceptable risks for carcinogens next year than they were last year.²⁰ Of course, Energy Probe will continue to work for regulations that are consistent and rational and that accord with the wishes of the public -- but we are realistic enough to realize that there is still an enormous way to go before we get there.

Some thoughts on an improved ACES process

In a recent (September 29) presentation to ACES on their review of the Clean-Up of Contaminated Sites, we recommended a revision to the ACES process that might help eliminate the kind of difficulty the tritium ODWO process posed to ACES, and now to you -- specifically, an ACES recommendation made without meaningful or relevant prior analysis by MOEE staff (in this case, of the socioeconomic impacts of the ODWO that ACES recommended). Since it is within your powers to implement our suggestion, we repeat it here:

In our view, it is unfortunate that ACES apparently cannot refer a proposal back to the Ministry asking them to remedy an obvious or important deficiency. As a result, the ACES subcommittee on tritium was left to make decisions about the socioeconomic impacts of their proposal without Ministry staff guidance -- a deficiency Ministry staff is essentially trying to rectify now, for the Minister's decision. Similarly in this matter, if this subcommittee should agree with Energy Probe that the radioactive-contaminated sites should be incorporated into this process, you will have to make recommendations essentially without Ministry staff guidance. That lack places a very difficult and unfortunate burden on both ACES and those public participants who suggest more than minor changes to the Ministry staff proposal.

We would suggest that ACES ask the Minister for the power to refer questions or deficiencies back to Ministry staff for rectification, either in the first

stage of a two-stage process (like the FEARO process, where the panel can refer an Environmental Impact Statement back to a proponent with a deficiency statement)²¹ or even during an ongoing, one-stage process (in the interests of a speedy process).

In the alternative, perhaps MOEE staff, in preparing a *Rationale Document*, should be asked to include socio-economic analysis of a range of reasonable alternatives, and not just a single preferred alternative. That process, of course, would parallel the requirement that the proponent of an undertaking reviewed under the *Environmental Assessment Act* demonstrate that the undertaking is the preferred alternative compared to both "alternative ways of carrying out the undertaking" and "reasonable alternatives to the undertaking".

We hope these further comments have been helpful, and we continue to be available to assist you and your staff in making the best and best informed decision possible in this matter. In that regard, we make one final observation:

Energy Probe got the chance to see Ontario Hydro's misleading submission to you virtually by accident.

The sequence that led to our receiving a copy of Ontario Hydro's submission was as follows: Ontario Hydro's Ron Maruska asked MOEE's Rohan Gaghadar to send him a copy of my earlier submission, on behalf of Energy Probe. As a courtesy (or possibly out of concern for the Freedom of Information and Protection of Privacy Act), Mr. Gaghadar phoned me first to see if I objected. I consented, on condition that I could also get a copy of Ontario Hydro's submission, to which Mr. Maruska consented.

I can only speculate that if Mr. Maruska had not asked Mr. Gaghadar for my submission, I would have had no opportunity to see Ontario Hydro's submission.

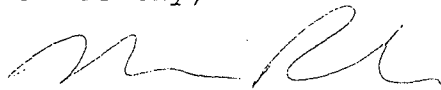
Of course, even if I had never seen that submission, your own Ministry's capable staff might have found all the failings and weaknesses I have found in Ontario Hydro's submission (and more). But I have at least two reasons to fear that they might not have: (1) It seems clear from Ontario Hydro's submission itself that its author (Mr. Maruska) did not expect his submission to be subjected to intense scrutiny, and I understand him to have some experience in these matters; and (2) My numerous telephone discussions with your Ministry staff on this issue lead me to believe that they are very well intentioned and extremely competent, but that the whole field of radioactivity and radioactive emissions from nuclear reactors is one that they deal with hardly at all, and therefore have little expertise in.

In short, I would like once again to offer the assistance of Energy Probe's experience and expertise to you and your staff and

your Ministry staff in making this very important decision. I also hereby request that, to the extent permitted by the law and by your own need for confidentiality, we be sent copies of any submissions that you or your staff or your Ministry staff have received on this matter from Ontario Hydro or AECL or AECB or the Royal Society or any other organizations opposed to the tightening of tritium standards. I would especially be interested in seeing any response to this submission from Ontario Hydro, and would hope that that response would be in writing and not by closed-door meeting.

I am sure we agree that this is too important a decision to be made on the basis of erroneous information.

Sincerely,



Norman Rubin
Director, Nuclear Research
and Senior Policy Analyst

P.S. I have recently received a copy, in a plain brown wrapper, of an AECB submission to your Ministry on this matter, which I believe simultaneously distorts the facts and issues and typifies the historical approach of the dominant agency that has left a regulatory vacuum around the emissions of persistent toxic substances that happen to be radioactive. I plan to submit some comments on it to you in the near future.

CC:

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Notes

(1) For our prediction, see especially pages 17-18 of our earlier submission, Reliance on pollution-control data controlled by the polluters.

(2) Figure 8 shows that the Scarborough WSP either reached or trivially exceeded the 100 Bq/L level for one week in 1987 -- presumably as the result of another moderator heat exchanger failure in that year.

(3) According to Hydro's submission, § 3.2.1 at page 4-5, the ALW "normally contributes 40%-70% of the total tritium emissions, with most of the remainder from the [Reactor Building Service Water -- primarily the Moderator Heat Exchanger] effluent."

(4) On pages 8-9, it is similarly claimed that "Option 3: boiler blowdown recovery" to abate waterborne tritium emissions would end up increasing airborne tritium emissions unless and until this water could be detritiated, which, we are told, "requires a new vacuum distillation process described above". Similarly, "Option 4: Closed Loop Cooling for Heat Exchangers" also "would require eventual detritiation via the vacuum distillation process described above."

(5) In fact, the operating costs have been overstated by more than a factor of three, because Ontario Hydro generally has some surplus, or "non-power-curtailling" nuclear steam available, whose costs would be very close to zero. It is true that most or all of the nuclear steam supplied recently from Bruce-A has been "power curtailling" steam -- i.e., it is supplied at the expense of electricity generation -- but when Ontario Hydro finishes solving the "fuel-string relocation" problem that led to the current derating of the Bruce-A reactors, some surplus steam will again be available for the BHWP.

(6) Of course, the much more elegant and economical first step here is "source reduction" or "source separation": Some of the liquid waste streams in Hydro's generating stations are presumably far removed from contact with heavy water (and tritium), while others are much more likely to be contaminated with tritium. Separating these into separate "streams" would, we believe, produce one large body of waste water that was effective "detritiated at source", and another, smaller body of waste water that was in need of real detritiation.

(7) As discussed above, that vacuum distillation unit could be the existing one at BHWP "B". If not, it could be a single new one. Or the job could probably be shared among the existing vacuum distillation units ("Heavy Water Upgraders") at the various nuclear stations. Bruce "A", for example, will presumably have one serving only three reactors in less than a year, when Unit 2 is shut down.

(8) Energy Probe's March 10, 1994, submission to ACES, page 7, footnote 2. (The passage in square brackets was added here for

clarity.)

(9) We have been in touch with two very cooperative engineers at Ontario Hydro to elaborate parts of this proposal. One of the outstanding questions that has not yet been answered is the maximum efficiency of the BHWP's enriching units at concentrating tritium, as opposed to deuterium. We are told that optimizing tritium extraction would entail a change in the liquid-to-gas (i.e., water to H_2S) ratio in the enriching units, and that the maximum concentration factor for tritium through those units would be less than 1000-fold (the ratio currently achieved for deuterium), but it is far beyond the scope of this submission, or the present process, to determine the potential, or the effort required to achieve it.

(10) Of course, if Hydro's "Option One: Pollution Prevention Studies" could decrease the amount of mixing of light-water-based wastes and heavy-water-based (and therefore tritiated) wastes, as appears likely, this tritium removal (or any alternative tritium abatement or removal) becomes easier and cheaper.

(11) Another existing technology that Ontario Hydro should have to assess -- especially if it insists that the BHWP technology is unsuitable or unavailable -- is the Darlington Tritium Removal Facility or TRF, technology that is designed to discriminate between deuterium and tritium, with a combination of vapour-phase catalytic exchange and cryogenic distillation. (AECL has developed a liquid--phase catalytic exchange process that might have advantages over the vapour-phase process.)

(12) Even these limits, unlike emission limits under most environmental laws, are only applied after Ontario Hydro artificially dilutes its more concentrated emissions into the million-gallons-per-minute pumped stream of lake water called the "CCW" or "Condenser Cooling Water".

(13) Ontario Hydro's Table 1 presents it as " $5.3E+06$ TBq/y", where " $5.3E+06$ " means 5.3 million, and 1 TBq = one trillion (or " $1E+12$ ") Becquerels. According to our calculations, Darlington station produces approximately 241,000 TBq of tritium per year. We estimate its maximum achievable inventory at approximately 2.1 million TBq, less than half its annual release limit from AECB!

(14) That slogan, abbreviated with the acronym "BATEA", is of course the slogan of the MISA program. Unfortunately, the AECB's 1% "operating target", to which they apply the slogan "ALARA", for "[keeping emissions or exposures] As Low As Reasonably Achievable, social and economic factors taken into account", bears no relationship to the English-language meaning of that phrase.

(15) Exhibit (Interrogatory Response) 4c.6.2 at the recently concluded HR22 hearing of the Ontario Energy Board.

(16) Alternatively, filling a secondary loop not with light water but with pure heavy water (either virgin heavy water or heavy

water straight from the Darlington TRF) would also provide a cheap solution to the contamination problem. Even after some leakage into the secondary loop, this heavy water would still contain less tritium than the moderator heavy water: When the leak was fixed, the heavy water could be put into the moderator (lowering its tritium levels), and replaced with newly detritiated moderator heavy water from the TRF.

(17) This drop in thermal efficiency just means that more lake water would have to be pumped through the heat exchangers to dissipate the same heat from the moderator, and does not seem to be a high-cost problem: Specifically, it would appear that Ontario Hydro has quite a bit of spare moderator heat exchanger capacity, since it is not unusual for it to operate with at least one moderator heat exchanger shut down for repair. There may also be opportunities to increase the efficiencies of the heat exchangers in other ways -- increasing flow rates, for example.

(18) For example, at the risk coefficient adopted by ICRP -- 5% risk of a fatal cancer per Sievert -- and taking natural background radiation at somewhere between 2 and 3 milliSievert (mSv), over 70 years, we get a total exposure of .14 Sv to .21 Sv, times 5% equals a lifetime fatal cancer risk between 0.7% and 1.05%, or 7000-10,500 fatal cancers per million.

(19) In fact, we understand that your own Government is currently perpetuating that exemption for uranium refiners.

(20) Indeed, we understand that AECL still has not inserted a condition into the license for AECL's Chalk River Nuclear Laboratories that would insist that Chalk River adhere to the existing MISA regulations -- i.e., for non-radioactive pollutants!

(21) This process is also similar to one aspect of the process used in Ontario hearings under the Environmental Assessment Act, Consolidated Hearings Act, and Ontario Energy Board Act -- where intervenors get to receive answers to written interrogatories before engaging in cross-examination. [note from original quote]