"Dismantling Nuclear Structures Provides Jobs and Business Opportunities"

a memoir presented to

The Minister of Energy and Resources,
Madame Martine Ouellet

and

The Parliamentary Committee on Agriculture,
Fisheries, Energy and Natural Resources

on

Impacts Related to the Decommissioning of the Gentilly-2 Nuclear Generating Station

by

Le Regroupement pour la surveillance du nucléaire
(Canadian Coalition for Nuclear Responsibility)

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Le Regroupement pour la surveillance du nucléaire

Le Regroupement pour la surveillance du nucléaire (RSN) – also known as the Canadian Coalition for Nuclear Responsibility (CCNR) – is a non-profit pan-Canadian organization based in Montreal.

Founded in 1975, RSN is dedicated to education and research on all issues related to nuclear energy, whether civilian or military – including non-nuclear alternatives – especially those pertaining to Canada.

RSN has intervened in environmental assessment hearings and provided testimony at public inquiries in every province and territory of Canada, and RSN researchers have given expert testimony in courts of law in both Canada and the USA.

RSN has disseminated technical information in laymen's language on such topics as uranium mining, reactor safety, radioactive waste management, proliferation of nuclear weapons, health effects of atomic radiation, and non-nuclear energy strategies.

RSN regularly provides information on nuclear issues, as requested, to journalists, researchers, communities and decision makers.

In Quebec, RSN has been a major player on nuclear issues for almost forty years. Here are a few highlights of RSN activities in the province:

- RSN submits a substantial position paper on nuclear power and alternative energy to the government of René Lévesque, two years before the government declares a moratorium on any new nuclear reactors in Quebec;
- RSN provides speakers for a series of public meetings in the Eastern Townships and Vermont opposing the US DOE proposal to locate a high-level nuclear waste repository in the Northeast USA, culminating in Premier Bourassa's declaration that Quebec will never allow a permanent nuclear repository on Quebec territory or on its borders;
- RSN provides educational materials related to a district-heating nuclear reactor to be donated by AECL to the CHUS (Centre Hospitalier de l'Université de Sherbrooke), resulting in a unanimous decision by the CHUS' Board of Directors to reject AECL's offer;
- RSN participates in the Public Debate on Energy held under the auspices of the Quebec government, leading to the creation of the Régie de l'Énergie.
- RSN intervenes in two separate BAPE Hearings on nuclear waste storage faculties at Gentilly, leading to a recommendation that the government of Quebec establish a clear policy for the long-term management of radioactive wastes generated by the Gentilly-2 nuclear reactor, before any approval is given for the refurbishment of G-2;

Le Regroupement pour la surveillance du nucléaire wrote to the Minister and to the secretary of the Parliamentary Commission, asking for an opportunity to participate in these hearings. RSN regrets that we were not given a chance to present our views directly to the Commissioners and answer questions put to us by the Commissioners.

Summary and Recommendations

Le Regroupement pour la surveillance du nucléaire urges the National Assembly and/or the Government of Quebec to set clear policy guidelines for Hydro-Quebec to follow in the final decommissioning of the Gentilly Nuclear Generating Station at Bécancour.

RSN is convinced that is not in the best interests of Quebec society to delay the final decommissioning of the Gentilly Nuclear Generating Station for 40 years or more. There are compelling reasons for dismantling the radioactive structures as soon as possible.

1. If the task is postponed for decades, the prospects for providing hundreds of local jobs for the current generation of workers in the Mauricie region will be lost.

2. If there is no continuity of nuclear-related activities for a 40-year period, Quebec may no longer possess enough technical expertise in the nuclear field to carry out the task of demolishing large radioactive structures in a safe and cost-effective manner.

3. If the final decommissioning is postponed 40 years, Quebec will lose the opportunity of becoming a world leader by developing the skills, tools, and management expertise to dismantle defunct nuclear reactors; there is no doubt that dismantling these highly radioactive structures will become a multibillion dollar industry during the 21st century.

4. The cost for the long-term management of irradiated nuclear fuel – as well as the cost for the perpetual storage and monitoring of radioactive wastes from the dismantlement of the Gentilly-2 reactor – will likely grow faster than any return on investments; thus funds put aside for final decommissioning will become increasingly inadequate as time goes by.

5. In 40 years time, the federal government will have less incentive than it does today to actively participate in the dismantlement of the Gentilly-1 and Gentilly-2 reactors and to pay a substantial part of the cost of the final decommissioning of the Gentilly site.

Accordingly, RSN makes the following recommendations:

Recommendation 1: That the Quebec Government instruct Hydro-Quebec to prepare for the final decommissioning of the Gentilly Nuclear Generating Station site as soon as possible, with a minimum of delay.

Recommendation 2: That the Quebec Government initiate negotiations with the federal government to begin the final decommissioning of the G-1 reactor utilizing federal funds and employing a Quebec work force, as part of the Nuclear Legacy Liabilities Program.

Recommendation 3: That the Quebec Government pursue negotiations with the federal government for Ottawa to become an active participant in the dismantling of the Gentilly-2 reactor and to pay a fair share of the cost of that project.

Recommendation 4: That the Quebec Government hire two or more nuclear consultants that are independent of the Canadian nuclear establishment – including Hydro-Quebec, AECL, CNSC, SNC-Lavalin, NWMO and Canada's nuclear utilities – to monitor the final decommissioning of the Gentilly site, report to the government on progress and potential problems, and provide advice to government on how best to protect the health and safety of workers, the public and the environment, and prevent cost overruns.

Why is Dismantling a Nuclear Reactor Difficult?

In a word, the answer is “radioactivity”.

Dismantling a radioactive structure such as a nuclear reactor core is a challenging task, because the structural materials themselves have become highly radioactive. Although these materials were not radioactive when the plant was first built, they have been transformed into radioactive materials due to prolonged exposure to neutrons.

Neutrons are tiny subatomic projectiles produced by the nuclear fuel. When a neutron strikes a non-radioactive atom, it transforms it into a radioactive atom. This process is called “activation”. Materials in the core area of the reactor have become “activated”.

So even after all the irradiated fuel has been removed from the reactor, and all the radioactively contaminated water has been drained from the core, what is left behind is still very radioactive and hence, potentially, very dangerous.

Radioactive atoms are dangerous because they are unstable. Every radioactive atom will eventually disintegrate, at some unpredictable moment. At the moment of disintegration, the disintegrating atom emits a burst of “atomic radiation”. It is precisely at the moment of disintegration that biological damage is done if living cells are exposed to the resulting atomic radiation. Shielding is used to reduce or eliminate such exposures.

There are three main types of atomic radiation: alpha, beta, and gamma. Gamma rays are the most penetrating of the three, and the most necessary to shield against. Gamma rays are a lot like x-rays, but more powerful. Gamma radiation is the easiest form of atomic radiation to detect and measure using a radiation monitor of some kind. External irradiation by gamma rays is often described as “whole body radiation”.

Alpha and beta radiation are not made of rays, but of high-velocity projectiles given off by disintegrating atoms. These alpha and beta “particles” are much less penetrating than gamma rays or x-rays, but they can seriously damage living cells with which they come in contact. Alpha radiation and beta radiation are primarily internal hazards, because the inhalation or ingestion of an alpha-emitting or a beta-emitting radioactive material is the normal way by which life-threatening biological damage is done by these relatively non-penetrating types of atomic radiation.

During the dismantlement of the core of a nuclear reactor, workers must be shielded from the penetrating gamma radiation , and protected from inhaling or ingesting radioactive materials : gases, vapours and dust. Workers must also be prevented from contaminating their skin, hair or clothing with radioactive materials. And, of course, radioactivity must not be accidentally dispersed into the environment through contaminated effluents, or through radioactive dust being tracked or vented or flushed offsite.

Terminology: The unit of radioactivity is the Becquerel, indicating that one radioactive disintegration is taking place per second. The half-life of a radioactive element (radionuclide) is the time required for half of the atoms to disintegrate.

Why postpone the dismantlement?

Postponement is sometimes due to procrastination. It can be caused by an unwillingness to undertake a necessary but unappetizing task. Hopefully this is not Hydro-Quebec's motivation for announcing a period of "dormancy" for 40 or 50 years before even beginning the dismantlement of Gentilly-2.

One reason often given for delaying the dismantling of a nuclear facility is to permit the gamma radiation levels to decline significantly, so that workers will be able to spend longer periods of time at work without exceeding the regulatory limits on permissible radiation exposures. The decline in gamma radiation levels is primarily due to the relatively rapid disintegration of atoms of cobalt-60, one of the most powerful gamma emitters created inside the reactor core. Cobalt-60 has a half-life of 5.27 years, so in 40 years, the amount of cobalt-60 will be reduced by a factor of 200 just due to natural radioactive decay (i.e. disintegrations of radioactive atoms). The resulting reduction in gamma radiation levels offers advantages to workers and management.

However, until recently, Hydro-Quebec was prepared to send workers into the core area of G-2 for the purpose of refurbishment. No delay was then intended; the work would begin as soon as possible. Those working on refurbishment would face the highest levels of gamma radiation, with no reduction due to radioactive decay over a 40-year period.

To refurbish the reactor, workers would have had to extract hundreds of radioactive calandria tubes and pressure tubes from the core of the reactor vessel – the calandria. In addition, they would have had to remove hundreds of contaminated feeder pipes that are attached, from the outside, directly to the radioactive fuel channels inside the core.

Clearly, the refurbishment would have required a partial dismantling of the core of the reactor. Yet Hydro-Quebec never considered it necessary to demand an extensive delay before starting the refurbishment. So why does Hydro-Quebec insist that a 40-year delay is now needed before beginning the dismantlement of the reactor?

Hydro-Quebec has already spent over 900 million dollars preparing for refurbishment, without actually doing the refurbishment work. We should not waste that investment. If Hydro-Quebec was prepared to go ahead with the refurbishment, then it should be equally ready to go ahead with at least a partial dismantlement of the core of Gentilly-2. So why not go ahead and dismantle the core now? Why wait for decades before doing so?

The refurbishment plans call for the use of shielded cages, specially built to protect the workers from the harmful effects of gamma radiation. These cages allow the workers to carry out their tasks without having to wait decades for the gamma levels to decline. The same shielded cages can be used by workers during dismantlement of the reactor core.

If it was "safe" to refurbish Gentilly-2 a year ago, then it is also "safe" to begin dismantling it now. Workers are eager to do the job now, not 40 years from now. Local businesses want to see economic activity today, not 40 years hence. Nuclear experts, fully familiar with the details of the plant and accustomed to working in a radioactive environment, are on hand now, but most of them will be long gone in 40 years time.

Postponing this task, in our view, is not a responsible course of action (or inaction).

Some Radiological Risks do not Diminish with Time

In a reactor that is shut down, as previously noted, the level of gamma radiation diminishes as the years go by. However, Hydro-Quebec's refurbishment plans show that high gamma radiation can be dealt with; it isn't necessary to wait. Gamma radiation is easy to measure, and worker exposures are kept low by shielding and specialized tools.

There are other radiological risks associated with defunct nuclear reactors that are unrelated to gamma radiation. One example is invisible radioactive dust that gives off no gamma radiation and is therefore difficult to detect, contain and control.

During a lengthy shutdown, the structure of a nuclear reactor begins to deteriorate and corrosion occurs. As a result, demolition following a lengthy shutdown may stir up far more radioactive dust than would have been the case if demolition had occurred immediately after shutdown. Radioactive dust can contaminate workers and also lead to offsite radioactive contamination of the environment.

When the Pickering reactors in Ontario were being retubed about twenty-five years ago, it was discovered one day that workers had been carrying radioactive dust home on their clothing for a period of several weeks without anyone's knowledge. The dust was an invisible powder, an aerosol, made of a solid radionuclide called carbon-14. This radioactive dust was so fine that it stayed suspended in the air of the reactor building for days at a time, attaching itself to surfaces of all kinds, including clothing, skin and hair.

Carbon-14 emits a very weak form of non-penetrating "beta radiation" – harmless outside the body, but damaging to living cells when ingested or inhaled – and it emits no gamma radiation. These weak radioactive emissions did not register on the radiation monitors normally used at the Pickering nuclear power plant, so the problem escaped detection until more sophisticated and sensitive monitoring equipment was brought in.

Eventually, bedclothes and furniture from some of the workers' homes had to be confiscated, packaged and stored as radioactive waste. Prior to this incident, no one in the Canadian nuclear industry suspected the existence of radioactive carbon-14 dust. It is not encountered during the normal operation of the reactor. It is only when workers start taking things apart that this fine radioactive powder is stirred up and released to the air.

Another example of worker contamination from radioactive dust occurred three years ago at the Bruce Nuclear Generating Station, during refurbishment. Because the measured gamma radiation levels were very low, workers were told that they did not need to wear respirators or protective clothing on the job. Unknown to the workers, however, there was an invisible radioactive dust, an aerosol of plutonium, hanging in the air as they went about their work. This dust came from old pipes being cut apart, disturbing the corroded interior and releasing countless tiny particles of radioactive contamination into the air.

Plutonium emits alpha radiation, but no gamma radiation. Alpha radiation is difficult to detect, like the beta radiation given off by carbon-14 dust. Those emissions did not register on the radiation monitors normally used at the Bruce nuclear power plant, so the contamination escaped detection until more sophisticated equipment was brought in.

Meanwhile, hundreds of workers were inhaling alpha-emitting dust on a daily basis for several weeks. Some of that dust will remain lodged in the workers' lungs for years to

come, irradiating them internally long after they have left the site. Most of them were not permanent employees at the plant, but local tradesmen – welders, pipe fitters, and so forth.

It is important to realize that a 40-year shutdown of the plant would not have diminished these worker contamination threats. Carbon-14 has a half-life of 6000 years, and plutonium-239 has a half-life of 24,000 years. These radionuclides are not going to disappear or even noticeably diminish in a mere 40 years. Thus the risk of radioactive dust contaminating workers will in no way be reduced by waiting for 40 years before starting the dismantlement of the reactor. In fact, due to plant aging and corrosion, the radioactive dust problems could be worse after 40 years than they are after 4 years.

In short, reduction of radiological risks does not justify postponing dismantlement.

Towards a strategy of "immediate dismantlement"

The French Nuclear Safety Authority (NSA) recommends that all nuclear reactors in France be subject to a policy of "immediate dismantlement". The goal is to move smoothly and without delay from the operational phase to the dismantling phase shortly after shutdown, so as to reduce or eliminate radiological risks as rapidly as possible and to take advantage of the experience of staff who operated the plant for so many years.

Such a policy of immediate dismantlement is advocated by the International Atomic Energy Agency (IAEA), and has been adopted by a number of other countries, such as the USA, Sweden, Spain and Germany. However, some jurisdictions – including those that have not updated their nuclear decommissioning plans for many years – are still planning to wait for several decades before undertaking the dismantlement of a defunct nuclear reactor. Quebec, and the rest of Canada, belongs to this latter category.

The NSA cites several drawbacks to the older strategy, involving a period of inaction for 40 years or more. First and foremost, it imposes an unfair burden on future generations to deal with a perplexing problem for which they get no compensating benefit. And as the years go by, uncertainties multiply. Are adequate funds available to do the job? Is there sufficient expertise? Has interim monitoring been adequate to prevent radioactive contamination of the environment during the long shut down? Does anyone remember how the plant was built, or which parts of it were already contaminated before shutdown? Are the onsite cranes and other equipment still functional? Is the infrastructure sound?

Globally, it is expected that 300 nuclear reactors will be shut down over the next 20 years. Each of these plants will very likely require more than a billion dollars in dismantling costs. It is evident that a very lucrative multi-billion dollar market in radioactive demolition services is just around the corner. If Quebec wants to benefit from the experience of dismantling the Gentilly-2 reactor, by developing an expertise in the emerging field of radioactive demolition, it is obviously advantageous to acquire the necessary expertise as soon as possible. "Immediate dismantlement" is the way to go.

Why not start by dismantling Gentilly-1?

The Gentilly-1 reactor has already been shut down for 35 years. The gamma radiation levels in G-1 are therefore far less than they are in G-2, so workers can gain experience in radioactive demolition work at G-1 without confronting the high gamma levels at G-2.

Moreover, the Gentilly-1 reactor operated for a total of only 180 days spread over a seven-year period (from 1970 to 1977). The quantity of new radioactive material that is created in a nuclear reactor depends on the total amount of fuel that has been used; thus the inventory of radioactive materials at G-1 is much less than it would have been if the plant had run continuously for decades. For example, the total amount of carbon-14 and plutonium at G-1 is a small fraction of the corresponding amount at G-2.

So, the radiological risks due to penetrating gamma radiation as well as the radiological risks from non-penetrating alpha and beta radiation are much less at G-1 than at G-2.

Evidently it would make good sense to begin the final decommissioning of the Gentilly site by dismantling the Gentilly-1 reactor core, where the radioactive challenges are greatly reduced compared with Gentilly-2. Workers would gain valuable experience by taking apart this smaller and less radioactive structure, a task that would prepare them to dismantle the larger, more radioactive core of the Gentilly-2 reactor a few years later.

Meanwhile, the time taken to dismantle G-1 would allow the gamma radiation levels in G-2 to diminish by quite a bit, making the eventual dismantling of G-2 easier for workers than the planned refurbishment would have been.

And this could all be done at the expense of the Canadian government, for the Gentilly-1 reactor is owned by the federal government through its crown corporation, Atomic Energy of Canada Limited (AECL). Ottawa has accepted that it has a responsibility to dismantle the G-1 reactor under the Nuclear Legacy Liabilities Program (NLLP).

NLLP was set up to pay for the decommissioning, decontamination and environmental restoration of radioactively contaminated facilities / sites owned by AECL. Such activities are estimated to cost about $7 billion in total, spread over a period of 70 years. So far $520 million has been allocated. To date, these federal funds have only been used to dismantle small nuclear facilities such as laboratories and test reactors, and to decontaminate contaminated sites at Chalk River Nuclear Laboratories in Ontario.

If Quebec wants to obtain its share of this NLLP federal funding in a timely fashion, thereby taking advantage of the G-1 demolition to assist in preparing for the G-2 demolition, RSN believes that now is the time to do so. The Quebec government should immediately enter into negotiations with Ottawa for this purpose.

If such negotiations fail for any reason, RSN believes it would still be advisable for Quebec to proceed to the “immediate” dismantlement of G-2. However, there are

substantial benefits for both Quebec and Ottawa to proceed to the dismantlement of G-1 as soon as possible, and every effort should be made to bring this about.

In the next section we will discuss the Gentilly situation from Ottawa's perspective.

Ottawa's interest in the Gentilly site – past, present and future

The Gentilly nuclear complex was created at the instigation of the federal government.

The G-1 reactor was built by AECL, and is still federally-owned. G-1 was a technical and financial fiasco. It never contributed any useful electricity to the Quebec electrical grid. It was a highly unstable reactor design that only functioned intermittently.

G-1 was built at the Gentilly site in Quebec in order to promote the expansion of nuclear power outside of Ontario. Nuclear power received billions of dollars in federal subsidies; it did not look good for it to be seen as an Ontario-based technology, benefitting only that province at the expense of others.

The LaPrade heavy water plant, next door to G-1, was also built by AECL. It too was a fiasco; it was never finished and did not produce any heavy water – much to the displeasure of René Lévesque's government, which had been counting on LaPrade to provide up to 1000 jobs in the region. The LaPrade plant is listed as one of AECL's "nuclear liabilities" under the federal NLLP program, although it is not radioactive.

The Gentilly-2 reactor was constructed in response to a federal program offering to pay half the cost of the first nuclear reactor built in any province outside Ontario. The Point Lepreau reactor in New Brunswick, with a design very similar to that of Gentilly-2, was built under the same conditions, at the same time, and in response to the same federal cost-sharing program. Although the cost of construction for both Gentilly-2 and Point Lepreau escalated from an estimated $300 million to over $1.2 billion, Ottawa only paid half of the original cost estimate – about $150 million for each province –not half of the final price tag, which would have been four times greater.

The CANDU-6 reactors built in Quebec and New Brunswick served as showcases for AECL's sales of CANDU reactors to South Korea, Argentina, Romania and China. In other words, the two reactors built in Canada were a part of AECL's marketing strategy. Historically, then, the Gentilly-2 reactor can be seen as a joint federal-provincial project that was originally conceived as a 50-50 venture. RSN believes that it makes sense for Quebec to negotiate a similar cost-sharing with Ottawa for the dismantlement of G-2.

However much it may be argued that Ottawa has an ethical obligation to assist in the dismantling of the Gentilly-2 reactor, since it persuaded Quebec to build G-2 in the first place, there is no legal obligation for Ottawa to provide such assistance. But there are some other inducements that might be brought to bear.

The fact that Canada has nuclear reactor clients in several other countries, utilizing the same CANDU-6 design as the Gentilly-2 reactor, guarantees that whatever happens at Gentilly-2 will be subject to international scrutiny. All CANDU customers – domestic and foreign – belong to the CANDU Owners Group (COG) where technical matters affecting the maintenance and operation of CANDU reactors are discussed. It is a sure bet that dismantlement of Gentilly-2 will arouse keen interest among members of that group.

Thus the federal government has a vested interest to ensure that the G-2 dismantlement proceeds as smoothly as possible. If anything goes wrong it could reflect badly on the CANDU option. Ottawa might want to invest in G-2 dismantlement to protect the brand.

In a more positive vein, it can be pointed out to Ottawa that specialized tools, techniques and strategies developed for the dismantlement of G-2 will be applicable to all other CANDU-6 reactors. Thus the federal government stands to benefit by marketing the appropriate expertise to overseas clients at a later date, having first demonstrated such expertise here in Quebec.

Just as the initial construction and subsequent operation of Gentilly-2 served as a model for selling CANDU-6 reactors overseas, the successful dismantling of Gentilly-2 in a timely fashion will serve as a model for marketing decommissioning services overseas.

On the negative side, if Ottawa refuses to share in the cost of dismantling G-2 and also refuses to be involved in the actual dismantling operation, it will not look good for Canada's reputation at home or abroad. It will appear that Ottawa is shirking its responsibility. Sooner or later Ontario's reactors will have to be dismantled too, so that province's government will also have an interest in monitoring the dismantling of G-2 and observing the federal government's participation or lack of participation.

On a pragmatic level, it is indisputable that the federal government already has an intimate involvement with the Gentilly nuclear site. AECL owns the G-1 reactor – together with the irradiated nuclear fuel from the G-1 reactor that is currently stored in dry canisters onsite, as well as other miscellaneous radioactive wastes that were produced at G-1 during the reactor's seven years of intermittent operation.

We know that Ottawa is obligated to dismantle the G-1 reactor. It is also responsible for its share of the low, medium and high-level nuclear waste stored on the Gentilly site. So it should be made clear to Ottawa that some degree of close cooperation between the two levels of government will be needed sooner or later vis-à-vis the Gentilly site.

This realization, combined with concern for Canada's international reputation in the nuclear fields, may induce Ottawa to work out a cost-sharing collaborative approach to the dismantling of the Gentilly-2 reactor. It is certainly worth trying for this.

The Need for Independent Oversight and Advice

The Ontario government recently announced that it is hiring two independent consultants to oversee the planned refurbishment of the four Darlington nuclear reactors. Experience with previous CANDU refurbishment operations in New Brunswick, in South Korea and at Bruce has convinced Ontario that the public interest demands independent oversight to keep costs from ballooning and to ensure that the work is carried out to the highest standards, avoiding costly blunders such as those that took place at Point Lepreau.

In a similar spirit, RSN strongly advises the government of Quebec to hire two or more outside consultants to oversee the dismantlement of the G-1 and G-2 reactors. The role of such consultants would be to report to government on progress and any potential problems related to the dismantlement of Quebec's nuclear facilities, and to advise the government of measures that can be taken to improve protection for the health and safety of workers, local residents and the environment, and to prevent cost overruns.

To avoid conflicts of interest, these consultants should be independent of the CANDU industry and the Canadian nuclear establishment; thus they should not have ties to AECL, CNSC, NWMO, SNC Lavalin, or any of the Canadian nuclear utilities.

Le Regroupement pour la surveillance du nucléaire knows of a number of suitable candidates for such positions. Bernard Laponche from France is one such person. He is a nuclear engineer with extensive experience and a commentator on nuclear issues with exceptional communication skills. He is well-qualified to provide useful advice and to monitor the on-going dismantlement of Quebec's nuclear facilities.

> *Né en 1938, Bernard Laponche est ingénieur de l'École Polytechnique de Paris (1957), Docteur ès sciences (physique des réacteurs nucléaires) et Docteur en économie de l'énergie (prospective énergétique)1.*
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> *B. Laponche a participé à l'élaboration des premières centrales nucléaires françaises en tant qu'ingénieur au Commissariat à l'énergie atomique (Service de physique mathématique à Saclay de 1961 à 1973 et Département des programmes de 1977 à 1979) et responsable syndical à la CFDT dans les années 70 (Syndicat du CEA puis Confédération). Il découvre alors les conditions de travail des salariés de la Hague et prend conscience des dangers de l'atome, qu'il juge moralement inacceptable2.*
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> *B. Laponche a été ensuite Directeur des programmes, puis Directeur général, de l'Agence française pour la maîtrise de l'énergie (AFME) de 1982 à 1987.*
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> *En 1988, B. Laponche a créé avec Florence Rosenstiehl le bureau d'études ICE (International Conseil Energie) consacré aux études et activités de conseil en politiques de l'énergie et de maîtrise de l'énergie.*
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> *En 1998 et 1999, B. Laponche a été conseiller technique de Dominique Voynet, ministre de l'aménagement du territoire et de l'environnement, pour les questions énergétiques et la sûreté nucléaire.*
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> *Depuis l'an 2000, il exerce des activités de consultant dans les pays de l'Europe et du Bassin méditerranéen, notamment pour le compte de l'Agence de l'environnement et de la maîtrise de l'énergie (ADEME) et de l'Agence française de développement (AFD)3. En tant que consultant, il travaille aussi pour la Russie et la Chine.*

RSN is in a position to propose other candidates on request – independent persons with great competence in the nuclear field, and possessing a high degree of personal integrity.