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Systematic Science and Best Practices In Federal Environmental Assessment

Submission to Canada's Expert Panel for Reform of the *Canadian Environmental Assessment Act*

Prevent Cancer Now is pleased to follow up our submission on scoping of the mandate of the Expert Panel – Review of Environmental Assessment (EA) Processes, with observations and recommendations to the panel. Here we build upon and pull together arguments regarding best practices and scientific evidence through the lens of human health, while recognizing heartily that human health is cradled in the ecosystem. Several have spoken well and clearly on the need to include Human Impact Assessment (public health community), elements of evidence applicable to human health and more broadly in the EA process (e.g. Evidence for Democracy), and transparency and accountability of science (e.g. Prof. Scott Findlay). We present recommendations and explanations within a narrative EA progression.

Begin at the beginning

Behind every Environmental Assessment (EA) is an aspiration; an objective. It may be to recover or transport resources, or to build infrastructure such as a dam.

Rather than apply bandaid conditions on a predefined project, the federal government and interested parties should initiate conversations, with incentives put in place to start Environmental Assessment (EA) as early as feasible. Early consultation would identify potential needs (e.g. getting resources to market) to scope *all* possible options.

The first question is, "is this a worthwhile objective?" This may be depicted as self-evident in some cases, but need and best means to achieve an end must be examined.

Some possible questions might include:

A. Does Canada or the world truly require this resource right now, or should development be postponed?
B. What are the transportation needs to be met by a proposed roadway connecting particular destinations?

Build on comprehensive, transparent considerations

If the decision is that yes, indeed, the objective is in Canada's best interest, the next consideration is the feasibility of various options to meet the objectives. Following on with the sample questions:

A. If public consultation and proponent submissions convincingly argue that resources do indeed need to be developed or extracted, what is the responsible rate to develop and to manage these resources? What is the final product to be transported? For example, a partial solution may be to impose constraints on the composition of the material being transported, to eliminate components posing the greatest risks to ecosystems and human health in the case of a spill. For that reason, *Prevent Cancer Now* argues that bitumen must be upgraded before shipping, to

substantially reduce risks when spills occur (this would also keep jobs in Canada and result in a higher grade/priced product).

B. If we vastly improve public transit, and if rail supplements trucking, will we need more lanes of asphalt? If yes, what is the optimum routing to protect natural features?

Ultimately, Canadians are best served when the optimum solutions are implemented, to achieve broadly desirable long term objectives, with minimum hazards and risks to the environment and citizens. Shorter term gains must be rigorously assessed against realistic long term liabilities, with transparent disclosure of data and uncertainties.

Require high standards and transparency for data and analyses

Environmental assessments are data driven, and this data should be freely available in useful formats (e.g. spreadsheet rather than pdf) so that the information can be incorporated into and considered in the context of environmental health information infrastructure (EHII). This would be in essence a "scientific commons" – a platform populated with data regarding environmental and population health. This includes data on air, water, product composition, analyses of response effectiveness in the case of malfunctions, and projected end of life conditions and remediation / rehabilitation plans. It is anathema to scientists and to citizens alike that chemical analyses may be withheld as confidential business information, when there is potential for spills or releases into the environment.

The EA should require that **all environmental sampling and analyses follow best practices**, in terms of documentation, chain of custody, use of accredited laboratories meeting strict standards and quality control, and clear reporting of values and detection limits (a number of related terms refer to slightly different values such as "limit of quantitation"). For example, air quality data was reported as uniformly "zero" only because laboratory methods were too insensitive to detect contamination at harmful levels, in the Alberta Energy Regulator Peace River Proceeding. We are certain that such unscrupulous "evidence" is common. A laboratory that had been involved – the one Canadian lab in an international company – was shut down following airing of its Canadian Detection Limit Policy at the Proceeding, "… our goal is to protect our clients' interests by preventing false positive results."

The dose *doesn't* make the poison – account for endocrine disruption and cellular signalling

Fundamental aspects of our development, health, behaviour, who we are and what we pass on to our offspring are all governed by miniscule quantities of cellular signalling chemicals. Many are hormones, in the "endocrine system." Not surprisingly, look-alike chemicals in the environment can also latch onto hormone receptors, and block or flip a "cellular switch." Endocrine disrupting chemicals (EDCs) affect how and when cells grow, repair themselves and die. EDCs may contribute to hormonally-induced birth defects, chronic conditions ranging from diabetes and obesity to infertility and cancers (e.g. breast, ovary, testes, prostate, thyroid), and possibly even gender dysphoria. For vulnerable populations, there may be no "safe" level of exposure.

It is often assumed that higher doses cause greater effects; what is known as a "monotonic" dose response. This is not true for many chemicals, where different (sometimes even opposite) effects are seen at low doses. The industry testing supplied to regulatory authorities is generally restricted to higher doses, to accommodate "uncertainty factors." Thus, endocrine disrupting effects may be missed.

At the forefront of early scientists urging actions on EDCs in the 1990s was Theo Colborn (1), author of "Our Stolen Future" (2) and founder of the TEDX website http://endocrinedisruption.org/. The Endocrine Disruptors Action Group is a new, related effort by Canadian scientists (3). In the meantime, large groups of scientists and medical experts and the World Health Organization have

repeatedly presented compelling reviews and called for urgent attention to low dose biological effects that are not predicted by high dose observations (4)(5)(6). These are now seen to have profound and expensive impacts on health in North America (7), including male reproduction (8). **The European Union is considering approaches to EDCs, whereas Canada has no systematic approach to identify and respond to EDCs, nor does it have an action plan.**

Endocrine disruptors commonly encountered in EA include polyaromatic hydrocarbons (PAHs) in petrochemicals, PCBs and older pesticides along with persistent contaminants contaminating military installations, and modern ingredients of plastics and a multitude of products

Child health is a critically important investment in the future. Throughout the 20th century, life spans increased with the advent of antibiotics and diverse improvements in public health such as drinking water and air quality, and food availability. Now, chronic disease is overtaking the young, and in the US, the predicted corner has been turned, with children projected to die at a younger age than their parents (9). EDs are probably one key to developmental, metabolic and carcinogenic processes. (Contrary to some public messaging, not only the allure of electronic screens fostering sloth and obesity are at the root of the chronic disease.)

Systematic Data Collection and Curation to Ensure the Hypothesis of Sustainable Development Transpires

These concerns illustrate the **need for more extensive, systematic data collection beyond a small number of criteria contaminants**. For example, reduced sulphur compounds (RSCs) can be highly toxic, but hydrogen sulphide is often the only RSC measured or tracked in relation to petrochemical developments. Emissions related to bitumen operations will typically include large quantities of other RSCs (carbon disulphide and carbonyl sulphide), which may exert similar and prolonged adverse effects. These RSCs are generally not measured, and their levels trigger no actions.

Ongoing data acquisition, curating and surveillance will be essential to support nimble responses, to avert or minimize adverse effects in the face of malfunctions, or an increasingly volatile climate and changing environment. Environmental Health Information Infrastructure should house such data, to facilitate research, and one day, potential modelling of results of various response options.

Decisions, hopefully grounded in high quality scientific data and analyses, should be followed and managed in the long term with comparable data.

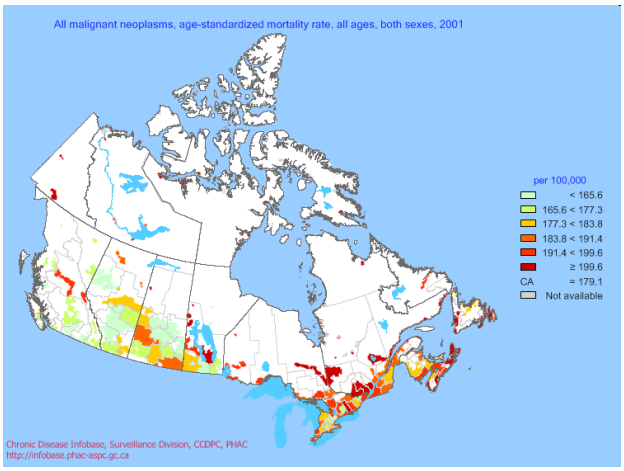
Plan for failures

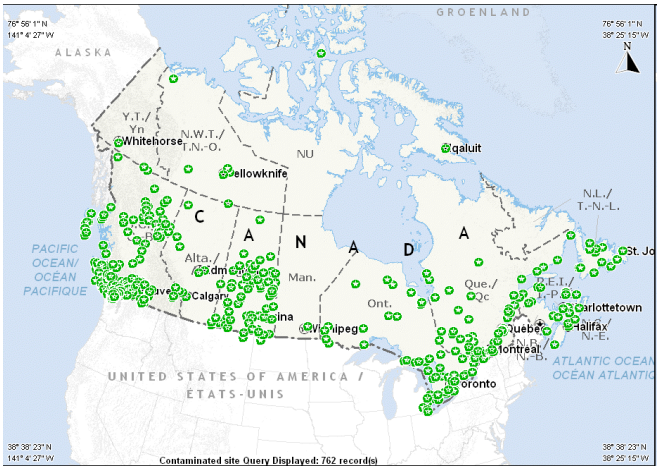
Fail to plan, and plan to fail. Dams get breached, storms strand and damage tankers, pipelines leak, trains derail, and as long as such endeavours are undertaken, unfortunate events will happen. Again, this is why *Prevent Cancer Now* advocates “detoxing” petrochemicals before shipping. EA must include scoping potential adverse events and ramifications, and detailing impacts and potential responses. Measures and guarantees, both legal and monetary, must be in place for unfortunate events, and for end of life of a development.

Plan for end of life

Canada’s landscape is littered with toxic sites such as mines that were developed then abandoned. Investors made their money, the community remains contaminated, and all Canadians are left with is the long term toxic mess and high costs of containment and remediation. Many (though far from all!) of these are in remote areas, affecting Aboriginal lands and livelihoods. The two maps below, of cancer incidence in 2001 (this type of map is not available for later dates), and of contaminated sites, clearly indicate, for example, the correlation between cancer and arsenic contamination from the Giant Mine on Great Slave Lake, Northwest Territories. Arsenic stabilization will be required in perpetuity.

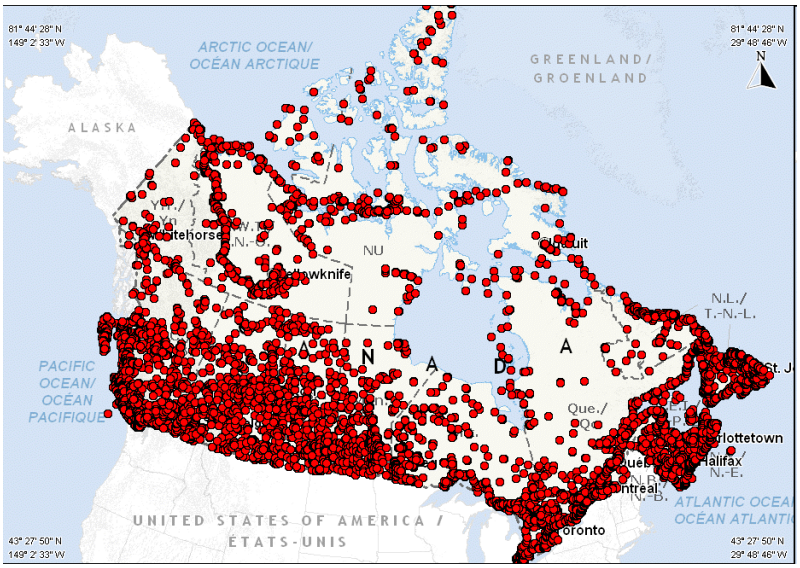
Figure 1. Maps of Cancer Mortality (2001, previous PHAC infocubes) and Canadian Contaminated Sites (Treasury Board, also previously downloaded)





Canada has many toxic sites, many of which were abandoned by multinational companies and became the responsibility of the Crown. Treasury Board accounting considers toxic sites long term liabilities. It is crucial to the long term health of the environment, citizens and the economy that economic boom (often bolstered with subsidies, as for the resource industries) is not followed by long term costs to future generations.

Figure 2. Federal Contaminated Sites (downloaded from Treasury Board website during the 2000s)



Scientific Processes: Hazard, Exposure and hence Risk determinations

Canadian regulatory decision-making is currently configured to be primarily risk based. This approach is used in assessments of pesticides, and non-ionizing radiation by Health. Risk determinations hinge on both hazard and exposure assessments.

Hazard assessment ascertains various “adverse” effects to human health or the environment. This is a two-step process, with biological effects being identified, and then judged as to “adversity.” Recognize that it may be impractical or intractable to identify “safe” or “threshold” exposure levels for some outcomes, such as cancer and endocrine disruption.

Risk is estimated based upon hazard, and exposures – matters of considerable uncertainty as well.

Hazard is an important metric for decision-making, being highly relevant, and associated with clearer mathematical certainty than risk. Hazard in the context of epidemiological everyday or occupational exposures is in fact a form of risk, even if exposures are not quantified to the precision necessary to determine exposure limits.

No person or ecosystem is exposed to a single toxicant. Greater efforts must be exerted to extend scientific considerations beyond single agents, and to recognize synergisms and low dose effects.

Scientific Processes: Systematic methods and related electronic infrastructure

Systematic methods are essential to handle and to assess rigorously large quantities of complex scientific information. Systematic review facilitates transparency, independence and public confidence. Ultimately, systematic review is the only method by which evidence can be compiled, presented and weighed, to truly carry out what Canadians are promised – “weight of evidence” assessments. This term rings hollow today, when neither the evidence nor the weighing (including “grading” of individual studies) is presented. “Authoritative reviews” from other jurisdictions should only be referenced if they meet rigorous standards for conduct and reporting.

Modern approaches to systematic scientific review that largely mirror established practices for medical interventions have been delineated by the US National Toxicology Program (10) and others. MacKenzie Ross et al. discussed the challenges and advantages of a large systematic review of neurotoxicity from low level, chronic organophosphate (insecticide) exposure (11), concluding that rigorous methodology minimizes bias, improves transparency, yields the most robust conclusions, and that the existing database facilitates rapid updating. Systematic methods have not been evident in Canadian reviews of pesticides, radiofrequency radiation (Safety Code 6), nor chemicals in general commerce. That said, in its current Strategic Plan Health Canada’s Pest Management Regulatory Agency lists procurement of the necessary modern electronic infrastructure to support regulatory review (12).

A Parliamentary Standing Committee on Health report made recommendations including that systematic review be instituted and used to compile the first comprehensive assessment of hazards of non-ionizing radiation such as from electricity infrastructure and wireless communications, under Safety Code 6 (13). The Health Canada position stated in Safety Code 6, that the only “established” health effects are shocks from low frequencies and heating from microwave radiation, is founded on very poor and selected scientific review. This was heavily contested by international scientists and physicians during the Parliamentary hearing, indicating genetic, reproductive, developmental, neurological and carcinogenic harms, as well as interactions between environmental toxicants and non-ionizing radiation.

Systematic review should become the mainstay practice to determine hazards, exposures and risks under CEPA, CEAA, PCPA, F&DA, CCPSA, Fisheries Act and whenever else scientific, evidence-based decision-making is required in government operations. Onerous up-front work pays off because once existing research and data are compiled and reviewed, updating the electronic database is quick and easy, facilitating rapid responses to new knowledge.

Environmental data (broadly defined to include emissions and concentrations in environmental compartments, to foods and consumable items) **should be systematically assembled within environmental health information infrastructure**, to facilitate future research and assessments.

Systematic scientific review should be used for questions central to an EA. Actual data must be used, not merely conclusions from studies or other reviews. The methodology, assumptions and limitations should be factored into grading of study quality for the final weighing of evidence, but all data should be incorporated in analyses.

Ongoing scientific follow-up – were decisions correct? *Test hypotheses*

When an EA reaches the conclusion that it is reasonably certain that a project does not pose an unacceptable risk to human health or the environment, this is in fact a hypothesis. The responsible, scientifically credible action is to test this hypothesis, but this follow-up is rare.

Even if there is follow-up, it might not address the most important issues, such as the aforementioned RSCs or other neglected issues. The Canadian Committee of Ministers of the Environment prepare guidelines for water, soil and air quality, and provinces generally adopt these values. Most substances – even drugs and pesticides – that end up in the environment are not subject to guidelines. There are few accredited Canadian labs to undertake the required assessments, and these labs offer analyses of only a limited subset of chemicals of concern. Thus routine analyses of many toxicants are not available.

Without commercial labs, or benchmarks to guide sensitivity of laboratory methodologies, Canadians are flying blind, trusting commercial interests that the tens of thousands of chemicals in commerce and being released as a result of projects that underwent EA are not harming or building up in the environment or human population. The costs and resources required to broach post-development monitoring of the environment and populations may render this approach impractical. This is another reason to use common sense approaches to choose only the least-toxic, most sustainable means to achieve ends.

Vulnerable Populations

Assessments must account for the fact that some populations in Canada are more vulnerable than others. Their vulnerability can be the result of geography (e.g., Indigenous communities in close proximity to toxic manufacturing, mining or polluted water systems), of age (e.g., babies and young children, the frail elderly), gender (e.g. pregnant women) or income (e.g., low income people who are more likely to live in more polluted areas and toxic housing, and are more likely to consume traditional foods that may have been impacted; people who work in largely low-income jobs with high chemical exposures, and of medical conditions such as chemical sensitivities.

The health and prosperity of all Canadians is protected when vulnerable members of the population are accounted for in environmental assessments, including workers, women of reproductive age, pregnant women and the fetus, babies and children, the elderly, people with chronic illnesses including environmental sensitivities, Indigenous people and all poor and marginalized populations. In some instances there will be no safe level of exposure. Effects may not be monotonic with dose, requiring environmentally relevant levels in experimental testing.

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