

**(DE)CONSTRUCTING KNOWLEDGE/POWER IN
CHEMICAL RISK GOVERNANCE**

THE SOCIO-SPATIAL CONSTRUCTION AND NEGOTIATION OF
KNOWLEDGE, POWER AND INFLUENCE IN THE GOVERNANCE
OF ENVIRONMENTAL HEALTH RISKS FROM TOXIC
CHEMICALS IN CANADA

By

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TITLE: The socio-spatial construction and negotiation of knowledge, power and influence in the governance of environmental health risks from toxic chemicals in Canada

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ABSTRACT

Environmental health effects from chemicals are an example of risks associated with modern, industrialized, technologically advanced, capitalist society. In Canada approximately 23,000 substances have been in commercial use despite never being assessed for their risks to human health and the environment. The assessment, management and regulation of environmental health risks from “existing” chemical substances can be viewed as an emerging and contested domain of governance whereby an increasing number of diverse stakeholders are seeking to shape its constituent actors, rule systems, knowledge inputs, and orientation. Using a multi-method case-study of Canada’s Chemicals Management Plan, this thesis examines how governance and decision-making rationales, knowledge inputs, influence, and authority become constructed, negotiated and (de)legitimized in practice, and the role and significance of “space” in these processes. Sources of data include scientific, policy and legal documents, participant observation and key informant interviews. Findings reveal that stakeholders divergently interpret evidence and exploit scientific uncertainties using various tactics that (de)legitimize particular claims and policy prescriptions to favour their interests. This has significant implications for how “precaution” and “weight-of-evidence” are operationalized. The concepts of “scale-frames” and “boundary-work” reveal how stakeholders construct and spatially bound political and epistemic legitimacy and authority through contested definitions and rationales of accessibility, inclusion and exclusion. To gain the influence and legitimacy that is needed for effectively shaping environmental health policy stakeholders must (re)define the jurisdictional *and* epistemic spaces in which knowledge, evidence and rationales are created and institutionalized. Bringing contested modes of subject-making around expertise and technical capacity to the fore assists in explaining why particular forms of knowledge production and interpretations of evidence are

adopted while others are downplayed. This in turn perpetuates particular kinds of risk assessment and management tools and approaches that benefit some and marginalize others. Prevailing “governmentalities” are supported by, and mutually reinforce, broader neo-liberal political-economic ideals and interests.

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PREFACE

The papers that comprise this thesis were based on research designed, conducted, transcribed, coded and analyzed exclusively by Sara Edge under the guidance and supervision of Dr. John Eyles. As the supervisor and co-author Dr. Eyles contributed significant feedback and editorial assistance for all written manuscripts comprised within this dissertation.

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LIST OF ABBREVIATIONS

BPA (Bisphenol A)

CEN (Canadian Environmental Network)

CEPA (Canadian Environmental Protection Agency)

CMP (Chemicals Management Plan)

ECHA (European Chemical Agency)

EU (European Union)

NGOs (Non-Governmental Organizations)

NIH (National Institute of Health)

NTP (National Toxicology Program)

OECD (Organization for Economic Cooperation and Development)

PbiT (Persistent, Bioaccumulative, Inherent Toxicity)

REACH (Registration, Evaluation and Authorization Program)

SNAc (Significant New Activity Notifications)

UK (United Kingdom)

UNEP (United Nations Environment Program)

US (United States)

WHO (World Health Organization)

CHAPTER 1

Introduction

Research Context

Evolving Trends in the Governance of Environmental Health Risks

The seminal work of Beck’s “risk society” (e.g 1992, 2006) postulates that universal, high-consequence risks that threaten human and ecological health have become a defining feature of industrialized, technologically advanced, capitalist societies and hence a central object of governance. Science and risk assessment have become regarded as integral, often mandated components of environment and health politics, agenda-setting and decision-making (see Harrison & Hoberg, 1994; Morone & Lohrer, 2002; Driedger & Eyles, 2003; O’Riordan 2004). Hegemonic epistemologies and methodologies driving these processes have involved positivist modes of reasoning (e.g. statistical probabilities, modeling, causal explanations, and expert judgments). The overarching goal has been the construction of credible and rational decisions that are able to stand in the face of uncertainty and fiscal limitations by divorcing them from competing ideologies (Doern & Reed, 2000; Fischer, 2005). Nevertheless, scientific determinism and a pre-eminent reliance on top-down, expert-driven approaches has become increasingly contested due to growing public distrust of industry and government, recognition that science itself is socially influenced, and the many scientific uncertainties that raise questions over who should be burdened by, or benefit from, the limits of our knowledge and understanding (Beck, 1992; Driedger & Eyles, 2003; Eden et al, 2006; Scott, 2009). Consequently, many liberal democracies are increasingly investing in collaborative governance arrangements involving state and non-state actors in an attempt to enhance capacity to address complex problems (Lemos & Agrawal, 2006; Reed & Bruyneel, 2010). Such shifts are enabling conventional, marginal and

newly emerging stakeholders to challenge and defend entrenched assumptions, boundaries and values around where, how, and by whom, society's risks should be governed. These actions are thought to assist in generating a plurality of 'knowledges' and perspectives, thereby exposing dominant paradigms, while encouraging the identification and creation of viable policy alternatives (Dale, 2005).

Managing Risks from Chemical Substances in Canada

The assessment and management of environmental health effects arising from toxic chemicals represents one of the most difficult and contentious challenges facing modern, industrialized societies. Chemical substances are used to manufacture numerous products that provide substantial benefits to society in the form of increased productivity, life-saving technologies, and everyday conveniences (e.g. automobiles, paper, textiles, toys, electronics, medical supplies, building materials, and food packaging) (Ministry of Environment, 2008; Canadian Plastics Industry Association, 2009). Nevertheless, there are growing concerns over the environmental and human health effects of long-term, chronic exposures given contaminants are found in our air, soils, water, consumer products, and bodies, with some biomonitoring studies detecting small concentrations of certain contaminants in nearly every human or organism tested (see Calafet et al, 2008; Scott, 2009; Bushnik et al, 2010). The ubiquitous nature of contaminants and associated risks has enhanced public awareness and media attention, generating heated scientific and political conflicts (Jasanoff, 1986; Brown, 1992). For the hundreds of *new* chemicals introduced into commerce every year, nation-states around the world including Canada, the United States and many European countries have been evaluating their safety for decades, adopting various regulatory controls to minimize risk. Nevertheless, many chemicals have been in use long before any comprehensive environmental legislation was in

place. Until very recently, Canada alone had some 23,000 “existing substances” (as they are commonly referred to), in widespread commercial use despite never being assessed for their toxicity and exposure risks to human health and the environment. This number is far greater in the US and Europe (Government of Canada, 2007).

The assessment, management and regulation of environmental health risks from existing chemical substances already highly entrenched in commerce can be viewed as an “emerging” and contested domain of governance whereby multiple stakeholder interests seek to shape its constituent actors, rule systems, knowledge inputs, and orientation. Both positive and negative impacts of chemical use in addition to the societal distribution of determined risks and benefits must be considered. This is extremely controversial as the risks and benefits are often intangible, with little agreement on how they should be valued (Jasanoff, 1986). Compounding the problem is the fact that decisions must be made on the basis of uncertain and contentious scientific evidence. With respect to chemical risks, uncertainties exist over exposure levels, pathways, low-dose effects, health endpoints to be assessed, relevance of animal toxicological findings for humans, cumulative and synergistic effects, and determination of sensitive species and sub-populations.

Research Objectives

This thesis explores how governance and decision-making rationales, knowledge inputs, influence, and authority become established in practice through socio-spatial disputes and negotiations of stakeholders engaged in chemical management in Canada.

Accordingly, the specific objectives are to:

- i) Examine how political and scientific assumptions, values, beliefs, goals, and claims are socially constructed by different governance stakeholders with respect to:
 - a) conceptualizing environmental health ‘risks’ from chemicals as policy problems

- b) determining which evidence and expertise is “legitimate” for informing decision-making, and
 - c) determining which techniques and approaches to endorse for facilitating policy objectives and interventions
- ii) Examine the role and significance of “space” in constituting chemical governance processes and practices
 - iii) Consider implications for the sustainability and equity of chemical governance processes and outcomes

This will be accomplished through a case-study of Canada’s Chemicals Management Plan (CMP). Launched in 2006 the CMP is dedicated to improving health and environmental protection from a wide range of potentially hazardous existing substances through a scientific program of risk assessment and management aimed at reducing adverse exposures (Government of Canada, 2010). Under the CMP the Government of Canada is mandated to work with stakeholders and make information publicly accessible to enable civic engagement and commentary on risk assessment and management decision-making processes (Government of Canada, 2010). The CMP established a Stakeholder Advisory Council, and an expert panel called The Challenge Advisory Panel. All of these activities are embedded within pre-existing and emerging international negotiations and agreements. For example Canada has bi-lateral relationships with the EU, Australia and the United States; is heavily involved with chemical management initiatives coordinated under the Organization for Economic Cooperation and Development (OECD); and privy to international treaties such as the Basel, Rotterdam and Stockholm Conventions.

Theoretical Framework

Knowledge, Power & Governance

The number of stakeholders and perspectives involved in decision-making has increased as ongoing experimentations with more integrative, collaborative, and deliberative approaches unfold within various policy systems. Coinciding is the expansion of ‘governance’ scholarship. Governance is understood as the social coordination of established and emerging institutions and actors (governmental, non-governmental, private sector, civil society, scientists); and the rule systems under which political objectives are negotiated and shaped by knowledge assumptions, norms, and resource availability (e.g. Dean, 1999; Edge & McAllister, 2009). Collaborative modes of governance do not replace or supersede existing national regulatory and policy frameworks. Rather, they represent additional layers of influence interacting with these more ‘established’ modes of authority, resulting in an increasingly complex and tangled web of power (Meadowcroft, 2002; Pollock & Lerner, 2008).

The utility of an analysis of governance lies in its ability to explain:

- i) the type of authority or agency involved in shaping societal behaviours and attitudes
- ii) the forms of knowledge and techniques depended upon for decision justification
- iii) how governed ‘entities’ are conceived
- iv) the value intentions underlying political objectives; and
- v) the consequences that arise from resulting decisions

(Dean, 1999; Walt, 2008).

A focus on governance assists in addressing the research objectives by contributing a better understanding of how the policy system surrounding the management of chemicals and environmental risks develops, and the ways in which its regimes of practices are maintained and transformed.

A growing trend in the social sciences has been the recognition of knowledge structures (e.g. science, religion, etc) as communicative systems interacting reflexively with societal contexts (Delanty, 2002). Much of this scholarship is inspired by the work of Michel Foucault, who is known for his analyses of power and knowledge as socially embedded processes (1966, 1969, 1975). His work is particularly concerned with how knowledge and experience are constructed within the context of societal networks, power relations and material and historical contexts. Foucault asserts the interdependent nature of ‘power/knowledge’. That is, while power is dependent on and makes use of knowledge, it also (re)creates, legitimates and shapes knowledge through the very structures, discourses and institutions through which it is produced and exercised. As a constructor and valuator of ‘truth’ and ‘reality’, knowledge becomes the mediator of power (Pedynowski, 2003). In Foucault’s later works he began to replace his notion of power-knowledge with the term ‘governmentality’. This term refers to a form of power that sets out to structure or guide the actions of others through organized practices, techniques, mechanisms, and institutions that essentially govern the conduct of people (Dean, 1999; Schofield, 2002; Evans, 2003). The intent is to enhance legitimacy and support for governmental principles, goals, or political programs. This type of power is normative, rather than physically coercive.

Following Foucault, opportunities for practicing and extending one’s knowledge/power are not equally accessible as human action is highly differentiated in the scope and scale of its effects (Gregson, 2005). Those with the greatest competence, expertise, and status are afforded additional rights when creating a body of knowledge or evidence-base. This is not necessarily a product of the individuals themselves, but stems from greater acknowledgement given to particular social positions that are constituted as powerful. ‘Knowledge/power’ as a theoretical

perspective allows us to question who develops a particular knowledge claim, what conditions enable such development, who benefits from its acceptance, and who is able to build upon this acceptance in order to further claims of their own (McCarthy, 2007).

With respect to chemical risk assessment and management specifically, conflicting viewpoints between and amongst expert and lay communities exist with respect to definitions of data quality, appropriate methodologies, acceptable measures of statistical significance, and the appropriate relationship between findings and public policy (Brown, 1992; Pompay & Williams, 1996; Kemshall, 2000; Driedger & Eyles, 2003; Carolan, 2004). The boundaries which limit that which is considered to be legitimate, expert or lay knowledge are, in themselves, socially constructed and shaped by politics and power relations (Gieryn, 1983; Latour, 1987; Brown, 1992; Kemshall, 2000; Driedger & Eyles, 2003). There is need for further inquiry into these formative processes. This dissertation explores how inequalities may be reinforced or resisted through epistemic communities and procedures.

Space, Scale & Boundaries

This research also examines how these processes unfold across space, and the degree to which knowledge/power and geography are mutually constituted. In other words, how do spatial concepts such as ‘scale’, ‘boundaries’, etc, determine the relational flows of knowledge/power, and to what degree does knowledge/power influence the construction and manifestation of space?

Traditionally, scale was treated as a fixed and nested hierarchy of bounded spaces of differing size (e.g., local, national, global). These spaces have served as different levels of analysis for investigating political processes (Delaney, 1997). However, with increased activity

of state and non-state networks emerging at sub, and trans-national spaces, the notion of scale as fixed and hierarchical has been undermined (Delaney, 1997). Scales are not merely arenas *containing* political activity; rather politics *constitute* particular scales and spatial relations (Mansfield & Haas, 2006). Scale is increasingly understood as socially constructed with the acts of defining, contesting, and institutionalizing the boundaries within which knowledge, power and authority are exerted characterized as the “politics of scale” (Marston, 2000; Leitner et al, 2007; Reed & Bruyneel, 2010).

Thomas Gieryn’s investigation of ideological and epistemological ‘boundaries’ between science and non-science is also particularly relevant given the technocratic nature of chemical risk assessment and management. He refers to the challenge of boundary interrogation and classification as the ‘problem of demarcation’ (1983). His work emphasizes the many characteristics of science attributed by scientists themselves that are not necessarily inherent or unique, but rather part of ideological efforts to distinguish their work from non-scientific intellectual activities for the purposes of monopolizing expertise, resources, and power. The boundaries around ‘science’ can be drawn very conservatively or, at times, much more extensively depending on the agenda of those doing the drawing (Jasanoff, 1987). Constructed boundaries are always shifting and continuously renegotiated.

Geographical and sociological conceptions of space, scale and boundaries are relevant in that they help to explain processes through which the demarcation and valuation of knowledge and power occurs, while illuminating implications for the governance of chemicals and environmental health risks such as the inclusiveness of debate.

Methodology

Research Design

This dissertation involved a multi-method case-study of the nested bounded system of chemical management in Canada (Crabtree & Miller, 1999). To fully comprehend the issues it was necessary to collect and analyze a substantial amount of very technical scientific, legislative and policy related information in addition to understanding their interconnections with stakeholder claims, beliefs and tactics. The thesis was therefore restricted to a single case-study design, as it is known for enabling thick description and in-depth analysis of context which often becomes lost or diluted within a multi-case study design (Crabtree & Miller, 1999; Yin, 2008). Particular emphasis is placed on the Government of Canada's Chemicals Management Plan (CMP), with Chapters 2 and 3 focused on an embedded analysis of Bisphenol A, one of the more contentious, high profile substances reviewed under the CMP. These cases were chosen as specific illustrative examples of how emerging systems of environmental health risk governance are being constituted and the role of "space" within these processes. While the international context is generally beyond the scope of this thesis, the case, data, and resulting interpretations are inherently situated within the broader global political economy and other risk governance initiatives unfolding internationally (e.g. through the Organization for Economic Cooperation and Development, or REACH, Europe's chemicals management program).

Qualitative researchers face unique challenges with respect to ensuring that their interpretations of data are in-fact credible, trustworthy, and valid. Therefore, in order to support reliability, external and convergent validity the researcher employed thick descriptive and multiple sources of data (Lincoln & Guba, 1986; Baxter & Eyles, 1997; Yin, 2008). The multiple data sources included key informant interviews, government policy and legal documents, interest group publications, popular media, scientific publications, web-sites and list-

serves from key stakeholders. Participant observation of international stakeholder and expert meetings hosted by the World Health Organization and the United Nations Food and Agriculture Organization, and national webinars on the CMP process provided additional sources of information. All data was collected and analyzed over approximately two years between January 2010-and December 2011.

Data Sources

Many of the documents analyzed were easily accessible through the Government of Canada's comprehensive web-based information portal on the CMP. This site provided access to i) key pieces of legislation (e.g. the Canadian Environmental Protection Act ,1999), ii) policy documents (e.g. Canada Gazette, reports outlining risk assessment and management proposals and conclusions, evaluation reports authored by various stakeholders on the CMP processes), and iii) background information (e.g. minutes from stakeholder and expert advisory panel deliberations, Notices of Objection and government responses, etc). These sources of information provided valuable context to the narratives and accounts derived from key informant interviews. The process of locating pertinent documents and comparing their content with stakeholder interpretations was iterative. Key informant interviews resulted in stakeholders identifying other key policy documents used to inform their own positions and arguments that the researcher was not initially aware of. Once these documents became known to the researcher they were also independently analyzed. Examples of documents identified through the interview process include:

- Principles and Guidelines for the Effective Use of Science and Technology Advice in Government Decision Making (Government of Canada, 2000)

- A Framework for the Application of Precaution in Science-based Decision Making About Risk (Government of Canada, 2003)
- Improving the Quality of Risk Assessments in Canada Using a Principle-Based Approach (Forristal et al, 2008)

In total, fifteen key informant interviews were conducted. Participants were selected purposefully based on their ability to inform an understanding of the research problem and achieve maximum variation to capture different stakeholder perspectives and differences within stakeholder categories (Crabtree & Miller, 1999). Three representatives were from government, three from industry, five from environment and/or health NGOs, and four independent scientists. Many of the informants also served in an advisory capacity to government through participation in expert and stakeholder consultations. They possessed a range of different, and in some cases overlapping, “types” of expertise including technical and scientific (e.g. toxicology, epidemiology, neurology, endocrinology), regulatory or legal, analytical/philosophical, in addition to skills such as policy development and reform, lobbying, knowledge translation and communication. Recruitment occurred until saturation emerged (Crabtree & Miller, 1999). All interviews were approximately 1-1.5 hours in length, audio recorded and transcribed by the researcher.

Data Analysis

Interview transcripts and other data were coded using a thematic coding scheme facilitated by the qualitative software package NVivo, and analyzed using a discourse analytic approach (Gee, 1999; Hajer & Verteeg, 2005). Coding was done through an iterative process involving pre-figured codes derived from existing theoretical models and conceptual lenses (e.g. governmentality, subjectivity, scale, boundary-work, capacity building, etc), while also allowing

for emergent codes derived inductively from the data (e.g. contested definitions of precaution, risk, vulnerability, etc).

Discourse analysis is devised from interpretive or social constructionist traditions that emphasize *how* various knowledge and “truth” assertions are made and situated in relation to social interests and power relations (Hajer & Versteeg, 2005). Under such an approach the analyst must identify groups of stakeholders and policy “artifacts” (e.g. language, objects and actions) that together demonstrate how a policy and the policy process itself is “framed” or understood (Yanow, 2000), and the spaces in which this occurs. Attention was given to how key words, terms, statues and principles were being treated and defined within policy documents and stakeholder narratives, and how this might contrast with other stakeholders’ ideas, proposals and interpretations of policy outcomes. Discourse analysis assists in unveiling underlying rationales, assumptions, judgments and contentions held and communicated by stakeholders in persuasive ways that enact particular socio-political perspectives, values, identities, relationships, interests, and actions (Gee 1999). It is an effective tool for constructing and communicating alternative interpretations of reality and reflecting upon how various knowledge assertions relate to broader social interests and power relations (Yanow, 2000).

Key informants were provided with draft papers so that they had the opportunity to ensure that the researcher’s interpretations were plausible, relevant and accurate (Baxter & Eyles, 1997), although not all of the informants chose to act on this opportunity and did not provide further comment.

Dissertation Outline

This thesis is comprised of five chapters. Following this introduction, chapters 2 to 4 include manuscripts that have been submitted for review for journal publication or (in case of the

latter) are in the midst of preparation for submission. Collectively these chapters address the research objectives outlined above. There is very little overlap in the literature reviewed for each chapter, however all three draw from the same data set, methodological approach, and case-study on chemical management in Canada. Chapters 2 and 3 place particular emphasis on the substance Bisphenol A, one of the more contentious, high profile substances reviewed under the Chemical Management Plan (CMP).

Through a focus on Bisphenol A (BPA) Chapter 2 discusses the ways in which different stakeholders divergently interpret evidence on chemical risks and exploit scientific uncertainties. It examines various tactics employed by stakeholders to legitimize and advocate particular scientific and political claims and policy prescriptions that are favourable to their interests. Particular attention is given to “weight-of-evidence” and “precaution”, two mandated yet ambiguously defined principles that have become increasingly customary within national and international agreements. Chapter 2 discusses factors within the Canadian context that influence the trajectory of claims-making disputes.

Chapter 3 examines how stakeholders construct and spatially bound political and epistemic legitimacy and authority through contested definitions and rationales of accessibility, inclusion and exclusion. This chapter pays significant attention to the second primary objective of this dissertation as it develops and interrogates the usefulness of a spatial analytical approach in interpreting stakeholder discourses, and deconstructing how elements of governance emerge, transform, become institutionalized and/or marginalized.

Using a governmentality approach, Chapter 4 examines the degree to which the increased engagement of NGOs in Canada’s Chemicals Management Plan is resulting in different forms of expertise and evidence underpinning decision rationales, techniques of assessment and

management predominantly drawn upon, and ultimately challenges to the existing status quo of unfettered market access. Chapter 4 also examines how NGO engagement and influence within governance deliberations is situated within and constrained by broader neo-liberal political-economic ideals, objectives and practices.

Finally, Chapter 5 summarizes the key findings from the preceding chapters, and identifies the primary substantive, theoretical, methodological and applied policy contributions of this research. The chapter concludes with a reflection on remaining knowledge gaps and implications for future research.

CHAPTER 2

Message in a bottle: claims disputes and the reconciliation of “precaution” & “weight-of-evidence” in the regulation of “risks” from Bisphenol A (BPA) in Canada

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Abstract

This paper examines scientific and political controversies surrounding the assessment and management of environmental health risks from the substance Bisphenol A (BPA). The Government of Canada recently declared the substance toxic and implemented a ban of baby bottles containing BPA to reduce infant exposures despite objections from industry, some scientists and policy-makers in other jurisdictions that the current weight-of-evidence does not justify these measures. BPA was reviewed under Canada's Chemicals Management Plan whereby the government is legally obligated to use a scientific weight-of-evidence *and* precautionary approach. However questions remain over how to reconcile the two. We examine contested claims and related efforts undertaken to have particular interpretations of weight-of-evidence and precaution legitimized through a critical discourse analysis of policy documents, reports, position papers and interview transcripts from key stakeholders. We discuss various factors within the Canadian context that influenced the trajectory of claims-making disputes, including how "weight-of-evidence" and "precaution" were employed, and reconciled. We advance understandings of why Canada became the first national government to declare BPA toxic, an internationally contentious, albeit increasingly precedent setting, policy response. We also identify the need for better integrating precautionary ideals into the *production* stage of science, and weight-of-evidence reviews. We argue advancing the reconciliation of precaution and weight-of-evidence within risk decision-making requires enhancing the transparency and democratic scrutiny of expert-driven assessments given that the boundaries between that which is normative vs. objective, technical vs. political, scientific vs. precautionary, are not always distinct or agreed upon.

Introduction

In April 2008, Health Canada released a risk assessment of the chemical substance, Bisphenol A (BPA), one of the highest volume chemicals produced worldwide. They concluded the general public need not be concerned as estimated exposure levels fall below regulatory safety standards, and adverse health effects are not expected. However, they felt the margin of safety was too small for infant exposures and thus a precautionary response warranted. Consequently in March 2010, the Government of Canada made, what was at the time, an anomalous decision to formally prohibit the advertisement, sale and importation of polycarbonate plastic baby bottles containing BPA to reduce infant exposure. Additionally, in October 2010 the government formally categorized the substance as “toxic” under the Canadian Environmental Protection Act, despite objections from industry, some scientists and policy-makers in other jurisdictions that the current weight-of-evidence does not justify these precautionary measures.

Given its ubiquitous nature and significant uncertainty around exposure and health effects, BPA has generated substantial public and scientific controversy. It was reviewed under Canada’s Chemicals Management Plan (CMP), a federal initiative to manage potential health and environmental risks from chemicals. Under this plan the government is legally obligated to use a science-based, weight-of-evidence approach *and* employ precaution (CEPA, 1999) as is increasingly customary within national and international agreements. Yet questions remain over how to reconcile these principles (Foster et al, 2000; Adams, 2002). This paper explores factors directing Canada’s policy decision. It examines how context may determine which “evidence” is employed, how “precaution” is operationalized, and how each approach is distinguished and reconciled within stakeholder arguments and decision-making. We place particular emphasis on

scientific and political claims, interests, and related efforts undertaken to have particular interpretations of weight-of-evidence and precaution legitimized. Our discussions thus help us better understand why Canada became the first national government to declare BPA toxic and ban it from baby bottles, an internationally contentious, albeit increasingly precedent setting, policy response.

Science, precaution & environmental health policy-making

Science and risk assessment have become regarded as integral, often mandated components of environment and health politics, agenda-setting and decision-making (see Harrison & Hoberg, 1994; Morone & Lohrer, 2002; Driedger & Eyles, 2003; O’Riordan 2004). Yet “science” is not homogeneous, rather a composition of diverse epistemic cultures with distinct origins, networks, motivations, and opinions (Pedynowski, 2003). Scientific evidence is uncertain in itself (see Drieger & Eyles 2003 on water quality, and Shostak 2004 on genomics) and a variable basis for the support of, often opposing, claims by different stakeholders. With respect to chemical risks, uncertainties exist over exposure levels, pathways, low-dose effects, health endpoints to be assessed, relevance of animal toxicological findings for humans, cumulative and synergistic effects, and determination of sensitive species and sub-populations. These uncertainties and growing public skepticism over science and industry’s objectivity are encouraging more actors to engage in the governance of chemicals, and for many, increasingly endorse precaution (e.g. Burger, 2003; Iles, 2007).

In its most basic form, the precautionary principle is intended to permit policy and regulatory action even when existing evidence of harm to human health or the environment is uncertain, inconclusive, or absent (see Raffensperger & Tickner, 1999; Foster et al, 2000; Wiener & Rogers, 2002). It is endorsed in numerous national laws, international treaties and

declarations (see United Nations Environment Programme, 1992; CEPA, 1999; Raffensperger & Tickner, 1999; European Commission, 2000). Yet, none indicate how the principle should be operationalized in practice or how much evidence is needed to trigger implementation (Adams, 2002). Frequently voiced criticisms include arguments that science-based risk assessment procedures are already precautionary through incorporated safety margins, or that the precautionary principle is not scientifically sound because it advocates decision-making without adequate scientific justification which can stifle innovation (Kriebel et al, 2001).

The claims and interpretations of evidence and precaution from industry, environmental health organizations, science entrepreneurs and social justice activists, are played out, often through advocacy coalitions (Sabatier 1987, Jenkins-Smith & Sabatier 1994), vying for particular policy direction. The knowledge and interpretations used to formulate various stakeholder positions and claims have been identified in many case studies on different policy and management issues including acid rain, bovine growth hormone treatment, biodiversity (Hannigan, 1995), tritium releases in Ontario (McMullan & Eyles 1999), marine policy in California (Weible, 2006), the tobacco industry (Davis 2007) and plastics industry (Markowitz & Rosner 2002; Ali, 2003; Iles, 2007). The case of BPA contributes to these literatures and demonstrates how Canada overcame evidence claims disputes to lead world opinion on the need for precaution, banning BPA from baby bottles as a step towards protecting the most vulnerable.

Methods

A critical discourse approach reveals the ways in which governance stakeholders position “factual” information in persuasive ways that enact sociopolitical perspectives, interests, relationships, and actions (Gee 1999). Discourses provide a unified set of words, symbols, and metaphors that allow us to construct and communicate a coherent interpretation of reality.

Discourse analysis has gained much currency in examining environmental issues (e.g. Hajer, 1997; Muhlhausler, 2006), especially in recent years about climate change (e.g. Carvalho, 2007, Hulme 2008).

Textual documents were analyzed to establish divergent discourses and perspectives. These included peer reviewed scientific papers, policy statements, press releases/commentaries, reports, position papers, briefings from key committees, and websites of stakeholders engaged in the BPA science-policy arena. Additionally, 13 key informant interviews were conducted (upon standard ethics approval) with stakeholder representatives from government, industry, environment and health NGOs, and science, many of whom also served in an advisory capacity to government. Participants possessed a range of different, and in some cases overlapping, “types” of expertise including technical and scientific (e.g. toxicology, neurology, endocrinology), regulatory or legal, and/or analytical/philosophical. Texts and interviews were coded using a thematic coding scheme facilitated by the qualitative software package NVivo. Predominant themes arising included how the “risks” of BPA were characterized, the knowledge sources utilized and viewed as appropriate to inform decision-making and establish credibility, and the bases underlying policy prescriptions.

The Case: Bisphenol A in Canada

Bisphenol A (BPA) is one of the highest volume chemicals produced worldwide. In 2008, global production was over 5.2 million metric tons, with a projected 5% growth in demand expected each year (ICIS Chemical Business 2009). It is used to manufacture polycarbonate plastics and resins. The resin is applied to most food and beverage interiors to prevent metal contamination (Health Canada 2008) while polycarbonate plastics are used in a wide range of products including digital media, electronics, electrical and sports equipment, automobiles,

medical devices, etc (Canadian Plastic Industry Association 2009). BPA has been measured in surface, and groundwater, sediments, landfill leachate, biota and humans implying high and/or continuous inputs into the environment (Health Canada 2008). Some biomonitoring studies suggest more than 90% of the population is exposed (Calafet et al 2008; Bushnik et al, 2010). BPA has been identified as an endocrine disruptor (Maffini et al 2006). Observed health effects within laboratory animals include changes in rates of growth and sexual maturation, hormone levels in blood, decreased fertility, suppressed immune function, changes in brain chemistry and behavior including increased hyperactivity, aggressiveness, and impaired learning (see Vom saal & Hughes, 2005). Lang et al. (2008) report associations with cardiovascular disease, diabetes and liver-enzyme abnormalities.

BPA was reviewed under Canada's Chemicals Management Plan (CMP) put forward in December 2006. This plan was a long time in inception. Based on legislation passed in 1999 under the Canadian Environmental Protection Act (CEPA), some 23,000 substances in commercial use never evaluated for their toxicity had to be "categorized". Seven years later a formal "Challenge Program" was enacted for the substances deemed of highest concern due to their potentially persistent, bioaccumulative, toxic nature, and high likelihood of human exposure. Each chemical underwent a screening risk assessment carried out by Health Canada and Environment Canada. All assessments were released for public commentary so interested parties could challenge the interpretation of, or contribute towards, the existing evidence-base. The CMP established a third party scientific committee and a stakeholder advisory group to assist with the procedures and provide feedback on the Government's application of precaution and weight-of-evidence.

In 2008 Health Canada conducted a risk assessment of BPA indicating that most Canadians need not be concerned because health effects occur at much greater levels than to what people are exposed. Yet some studies (despite many flagged uncertainties) suggest infants and fetuses are particularly sensitive at exposure levels disconcertingly close to those where adverse effects have been observed in animal studies. Additionally, there is evidence of potential long-term adverse hormonal, developmental and reproductive effects in aquatic and terrestrial organisms at exposure levels currently found in the environment (Government of Canada, 2008). Consequently the Government of Canada championed a precautionary response proposing to reduce infant exposure by banning the importation and sale of polycarbonate baby bottles containing BPA, developing alternative infant formula packaging and pollution abatement plans with industry (largely through voluntary measures), and formally declaring BPA ‘toxic’ under CEPA (Government of Canada, 2008).

At this time Canada was the only country in the world to take regulatory action on this chemical. The decision contrasted with other risk assessments carried out by the US Food & Drug Administration - (recently pressured to re-examine their position), and the Japan National Institute of Advanced Industrial Science and Technology. In September 2010, The European Food Safety Authority concluded that based on existing evidence the established ‘tolerable daily intake’ remains safe. Yet, months later the European Union Executive Commission enacted a ban of BPA from baby bottles. Hence, there is considerable inconsistency with respect to perceived risks and policy responses despite access to the same evidence-base.

BPA: Scientific Uncertainties & Contested Interpretations of the Weight-of-Evidence

Science assessing *human* health effects from *low doses* of exposure is particularly contentious. For fifty years, the safety of BPA and chemicals in general, was predicated on the

presumption of a monotonic dose–response relationship (Vogel 2009). That is, the higher the dose, the greater the effect, suggesting that at a particular low dosage hazardous effects become minimal or non-existent. However, a growing body of research on endocrine disruption is challenging this assumption and associated methodological practices (e.g. Welshons et al, 2003), despite significant resistance and criticism from industry and some segments of the scientific community.

As explained by vom Saal & Hughes (2005), the U.S. Environmental Protection Agency (EPA) considers “low-dose” effects as effects reported at doses lower than those used in traditional toxicological studies conducted for risk assessment purposes. Controversy exists between reports claiming effects from BPA at low doses, and others, disputing these claims (Vogel 2009). In 2000, the EPA asked the National Toxicology Program (NTP) - a US government program providing scientific information to government agencies, NGOs, and the public on chemical toxicity- to investigate the low-dose issue. They concluded there was “credible evidence” for low-dose effects below current safety standards (NTP 2001). In response to this, the chemical industry commissioned its own university research which found weak and irrelevant effects (Gray et al, 2004).

A tit-for-tat scientific battle emerged. Vom Saal & Hughes (2005) disputed the integrity of these findings, concluding that out of 115 studies involving low doses, 94 reported significant effects. They argue that source of funding is highly correlated with positive or negative findings with ninety percent of government funded studies reporting significant effects at low doses, while 0% of industry funded studies reported significant effects. Others with industry ties argue that those concluding that the weight-of-evidence supports the low dose hypothesis are failing to

critically assess the rigor and quality control of existing studies (Goodman et al, 2006; BPA Global Group, 2009).

In 2006 The U.S. National Institute of Health (NIH) convened a panel of international experts to analyze BPA risks which assertively concluded that the wide range of adverse effects of low doses in laboratory animals (e.g. increases in prostate and breast cancer, uro-genital abnormalities in males, early onset of puberty in girls, metabolic disorders, and neurobehavioral problems) is “great cause for concern” for potential similar adverse effects in humans (Vom Saal et al, 2007, p.136). Yet the NTP’s revisit (2007) was more circumspect stating only “some” level of concern regarding neurological effects for fetuses, infants and children, and “minimal concerns” regarding effects on the mammary gland, and early onset of puberty (BPA Global Group 2009; Ericson 2008). However, it was discovered that some consultants working for the NTP had previously done work for BPA manufacturers Dow and BASF, raising concerns over potential conflicts of interest (Layton & Lee 2008).

In 2008 Health Canada’s conclusion from its risk assessment embraced a more precautionary stance, stating sufficient evidence suggests that periods of early development are sensitive to BPA, and while exposure levels are below those known to cause effects, the margins of safety calculated for infant exposures were too close for comfort. Interviews with government scientists involved in carrying out the risk assessment reveal concerted effort to underscore the fact that the science itself compelled their use of precaution, not political pressure:

“For the neurodevelopmental effects there were uncertainties within that dataset, but there were really clear flags of potentially what I would call severe or irreversible effects, so when you do see those flags than even in the presence of uncertainty I think it is appropriate to bring precaution into your decision-making...So it’s not just precaution in the sense of you know better safe than sorry, it’s precaution based on what you’re seeing in the database” (“Catherine” risk assessor, government)

“If you take the weight-of-evidence approach, there are several different studies that point in a certain direction, and we felt there was sufficient information, albeit uncertain, to warrant action to protect infants and young children” (“Kimberly”, risk assessor, government)

“We generally apply a safety margin of about 500. And this particular substance only had a safety margin of about 2. And when you’re dealing with babies you know you’re probably safer to go to a 1000 than 500, regardless, 2 is not enough” (“Gordon”, risk assessor, government)

Many scientists from outside of government concur that despite remaining uncertainties, potential adverse effects must be taken very seriously. Nevertheless other scientists feel that the inconclusive, inconsistent and uncertain dataset precludes the government’s regulatory actions from being justified through, or characterized as, a science-based, weight-of-evidence approach:

“The regulatory decision was a political decision, not a scientific decision. The data available at the time, and still, does not support the conclusion reached... It can be framed within the context that they were acting on the precautionary principle, which is fine, I have no problem if the decisions are framed in those contexts... However, I am completely antagonistic, and in fact an opponent of someone coming out and saying that it was done on the basis of science... We agree that there’s something going on here, we can’t explain it. Some people are saying...well it doesn’t matter that you can’t explain it, regulate. And others of us are saying we need to figure this out. It does not mean we’re failing to take the precautionary principle...but where do you draw the line? There are other things that we have on the market that are far more toxic than BPA that we are doing nothing about. So if we’re going to take action, let’s start there. Let’s protect human health” (“Robert”, academic reproductive toxicologist)

In addition to highlighting contested interpretations of evidence and its policy implications, these narratives from within scientific circles point towards existing tensions around that which is distinguished as a “weight-of-evidence” versus “precautionary” approach, and how they differ characteristically. The two are often believed to be discrete and mutually exclusive, the former typically characterized as objective and technical, and the latter normative. However, within risk assessment these distinctions are not so simple, suggesting the approaches may be better characterized as a continuum of normative-factual matters open to dispute and negotiation. These sentiments are reflected by some of the independent experts called upon by Government to evaluate its application of weight-of-evidence and precaution:

“(Precautionary principle) is often viewed as a kind of...imposition of politics and ethics on the science which sort of has the effect of qualifying the science and compromising the science in the interests of the political. And I argue very strongly that the proper use of the precautionary principle in fact, is a way of handling endemic uncertainty questions in science itself”
(“Christian”, academic government advisor)

“To my mind it’s very clear operationally what the two critical elements of the precautionary principle are, ...one is what the null hypothesis is, and the second is what is the evidentiary standard above which point you would reject the null hypothesis. So really when you debate how precautionary you want to be, it’s a debate about what’s the null hypothesis, and what’s the evidentiary threshold?... Scientists don’t actually understand that very well, this is why you get into this ridiculous debate about science based versus precautionary decision-making. Well that dichotomy is completely false. The only difference between the two is one of two things. What is your null and what is your evidentiary threshold...It’s not as if science in itself is uncontaminated. How do we know if the investigators were being precautionary in their studies?...Every scientist works with a type 1 error rate of statistical significance of 0.05. But what’s the basis for that? There’s no science that tells you have to be 95% sure before you reject your null hypothesis. We have just chosen that arbitrarily because we’ve decided we want to be really conservative...it’s completely normative (“Steven”, academic government advisor)

In the discussion we return to exploring potential implications of a rigid polarized conception of evidence and precaution in comparison to more nuanced understandings. Yet first we discuss the tactics through which other stakeholder interest groups interpret, dispute and communicate scientific uncertainties in efforts to (de)legitimize evidence, arguments around precaution, and related policy goals.

Stakeholder strategies for contesting risk and (de)legitimizing evidence & policy prescriptions

Key interest groups and networks interested in BPA have emerged. On a general level, we can isolate two groups according to similarities in discourses and expressed interests– a pro-business/economic and a pro-health one, (although the former often asserts it is pro-health as well). Actors (e.g. BPA Global Group, Canadian Plastic Industry Association, Dow Chemical Manufacturers, etc) affiliated with the pro-business coalition typically frame the use of BPA as technically safe and beneficial to society. In contrast actors aligned with a pro-health orientation

(e.g. Environmental Defence, Canadian Environmental Law Association, Canadian Partnership for Children’s Health & Environment, Learning Disabilities Association, etc) redefine the substance as a public health and environmental hazard, and are committed to reducing and/or eliminating exposures. Moral hazard and the need for precaution and protecting the most vulnerable are prevalent themes throughout their discourse. In contrast, the “pro-business” coalition is concentrated around securing profits, jobs and economic well-being. Member groups possess readily available resources to lobby decision-makers. Despite these advantages the pro-health coalition’s discourse focused on public health protection, especially for infants and children, is a powerfully persuasive rhetoric. In anticipation, industry continues to proclaim the safety of its products and their commitment towards developing the safest alternatives.

These stakeholder groups utilize various tactics including catchy slogans, press releases, personal attacks, and propaganda-filled websites to disseminate their positions on evidence and policy. The use of science is key. Both groups provide numerous links to studies and news stories favouring their position, whereas opposing evidence is almost never provided. Similar to other cases, (e.g. Hannigan, 1995; McMullan & Eyles, 1999) the plastics industry’s use of a scientific argument is marked by a reassured, sober tone utilizing technical vocabulary. The rational assessment and management of risks is endorsed. The overriding message is that despite BPA being one of the most extensively tested materials today, scientific findings merely reinforce the conclusion that human exposure is very low and there remains no *direct* evidence of adverse health effects. A proof versus prudence policy preference is advocated wherein in the absence of conclusive proof BPA should be considered safe for humans (see Layton & Lee 2008, Canadian Plastics Industry Association 2009). Under circumstances where “some” or “minimal” concern is identified, the limitations of laboratory animal studies, and experimental risk

assessment designs are underscored (e.g. BPA Global Group 2009a, 2009b). Industry groups focus on the fact that Canadians have not been encouraged to alter dietary practices, the ban is applicable to baby bottles alone, which “proves” consumer use is safe and the decision based on unwarranted media hype, parental fears and politics, *not* science. Industry supporters also draw upon discourses of precaution but instead stress the health, safety and convenience factors associated with continued use of BPA, or the hazards that would arise if it was banned:

“As for replacements (for bottles), there’s glass and stainless steel. But you know full well, with glass you’re going to break it one day and it makes a horrible mess and it can hurt people. Stainless steel is a bit more hazardous in my eyes, it breaks things...The other one people talk about is can liners for food. And I’m afraid there is no substitute right now for BPA...that keeps metals away from foodstuffs, because if they mix together it can be pretty poisonous. If industry could have developed something that worked better, they would have...One day they may, and great, but until that does happen, give me BPA because you do not want to get botulism and food poisoning” (“Trevor” industry scientist & government advisor)

The provision of life-saving medical equipment, automotive parts, and other convenience items that preserve a good quality life, are also flagged as outweighing any so-called “negligible” risks associated with low-dose exposures over a lifetime (Ericson 2008, Canadian Plastics Industry Association 2009). Industry challenges opposing claims and concerns about human health risks by labeling them as “myths,” “misinformation” or “scare-stories” derived from “inferior” and “inaccurate” science compared to the more “prominent”, “comprehensive” studies that demonstrate no direct relationship between exposure and adverse health effects (see BPA Global Group, 2009a, 2009b).

Members affiliated with the pro health coalition employ a wider range of strategies, ranging from attempts to utilize scientific authority (e.g. Environmental Defence measuring pollutant levels within the blood of Canadians) to appealing to the public’s moral indignation. The pro health coalition has predominantly focused on infant health and development as a way to

capture the attention of the public and media and advance their own precautionary discourse. For example, Environmental Defence stormed the front lawn of the Ontario Legislature in 2007 in a “Ban Toxics Baby!” rally. This involved hundreds of parents and daycare professionals with children in tow, carrying signs reading “Don’t Pollute Me” and “Wah! Ban Toxics” (Environmental Defence 2009a). Images and discourses of innocent children appeal to decision-makers, voters, and retailers to reflect a commitment to social responsibility through employing precaution extensively:

“We would hope that the government continues to look at ways to improve how they define the precautionary principle...I think the government would say with respect to BPA, phasing it out of baby bottles is based on precaution. I would say based on precaution you would extend that phase-out to other products, particularly food and beverage packaging” (“Tonya”, environmental NGO representative)

So whose storyline on protecting health and well-being is believed when the authority of science is used to support disparate claims for precaution? A discourse focused on the vulnerability of babies seems to have been effective in shifting the “weight of value” so to speak, within the Canadian context, as reflected by a government representative involved in implementing the ban from baby bottles:

“You have a certain set of values you bring to the table in making these decisions, a certain amount of risk you are willing to take or not take. The Canadian opinion on this one was that this was something that we felt that there were numerous alternatives out there for. Why in this particular situation if there is any hint of a risk would you want to put up with it, when this is babies that you are talking about?” (Kimberly, risk assessor, government)

This sentiment is expressed by one of the same government regulators that depicted the justification for implementing precaution as scientifically driven. In contrast, the above quote expresses a more value-based rationale. On a surface level this may appear contradictory. However, we interpret these tensions as evidence that previous understandings of the approaches

as diametrically and characteristically distinct are being challenged and called into question, when put into practice.

Discussion

Towards a Reconciliation of Precaution & Weight-of-Evidence?

Canada's Chemical Management Plan and underlying legal framework are predicated on a scientific weight-of-evidence, precautionary approach. Increasingly both approaches are invoked within national and international agreements. They have been conventionally depicted as distinct, albeit complementary in nature, with precaution understood as an ethical supplement to technical, objective assessment. One consequence of this distinction is that the tasks of assessing risk and interpreting weight-of-evidence remain delegated to "experts", while more democratic or political discussions around the appropriate use of precaution are generally not enabled until later stages of risk management decision-making. Indeed, health, environmental and industry stakeholders all express a need for more transparent communication and disclosure of the assumptions, value judgments and estimations built into scientific studies and weight-of-evidence reviews (see Edge & Eyles, forthcoming). Much of this rests upon increased recognition of the inherently normative elements of science, particularly when navigating uncertainties. It can be argued that polarized conceptions of the relationship between science and precaution, expertise and politics, preclude the influence and statutory intent of precaution from being extended into the *production* of scientific knowledge and evidence, beyond its mere interpretation after the fact (see also Adams, 2002). This can stifle the depth, degree and extent of reconciliation between science-based and precautionary rationales within risk decision-making. It could also be argued that precaution is already built into the production of evidence through applied safety margins in risk assessment, or standard significance values and

confidence intervals that measure potential error in a study's findings. However, as Kriebel et al (2001) point out, these do not always capture other errors related to choice of variables, analytical models, biases, etc. There is much room within research to improve upon the ways in which uncertainties are characterized and communicated to scientists, stakeholders and the lay community. This is also true with respect to communicating the value judgments and assumptions that are employed to account for such uncertainties.

In the final section we explore broader factors involved in shaping the trajectory of scientific and political claims-making disputes that resulted in a specific reconciliation of precaution and weight-of-evidence for the particular case of BPA, within the particular context of Canada.

Why in Canada? Contextual factors shaping the construction of “evidence”, “risk”, “precaution” and regulatory response

It would seem these scientific and stakeholder arguments could appear in similar form in any Western society. Despite this, the toxicity of BPA and the decision to ban it from baby bottles remains contentious. In March 2011, EU outlawed BPA in baby bottles, followed by China in September 2011 (Chinese TV News, 2011). BPA in baby bottles remains a contentious issue at the state and federal levels in the U.S. Such an issue does not appear to be on the horizon in India. Yet more countries and companies are leaning toward a partial and/or voluntary removal or move towards alternatives despite conflicting evidence and several government commissions deeming BPA to be safe (Entine 2010). So what is special about the Canadian context that enabled the Government to implement precaution in a particular way for this particular case that now appears to be diffusing into other policy and jurisdictional contexts?

Firstly, despite the significance of science, stakeholder discourses, particularly convincing precautionary narratives focused on protecting the most vulnerable, they alone do not

establish policy outcomes. As Wiener & Rogers argue, in risk regulation many different variables are at play, thus no single ‘thick’ theory is fully explanatory. It is important to consider an array of potential explanatory hypotheses as they may be illuminating in concert (2002). Most societies regard science as a necessary means for informing policy. But as Miller (2004) notes, its involvement takes different methodological and institutional forms in different societies. Thus the uses of science and its interpretations are in many ways culturally dependent, shaping how arguments are legitimized as credible (or not) within governance and regulatory processes (Iles, 2007). This has been shown through analyses of differences in regulatory philosophies and responses to biotechnology in the U.S., U.K., and Germany (Jasanoff 2005), and for bovine spongiform encephalopathy in Germany, the Netherlands and the U.S. (Kalogeras et al 2008). Societies choose what they worry about based on how issues of concern impact their livelihoods and supporting institutions (Wildavsky & Dake 1980). There are cultural variations in risk perception and management (Wiener & Rogers, 2002). Furthermore, the principles which guide policy may also vary between nations, particularly with respect to how and what uncertainties are perceived or treated. Canada can be said to have applied the precautionary principle with respect to BPA but some countries do not formally use it (e.g. U.S., China). Other jurisdictions apply it in different ways as an overarching principle (E.U.) or as one dimension of broader sustainability objectives (e.g. Australia) (Peel 2007, Scott 2009). Canada applied the principle in a quite specific way and one which reflects Canadian debates. There certainly appears to be a dilution of the approach within recent risk decision-making policy and practice relative to earlier conceptualizations in the Rio Declaration and in CEPA itself (UNEP, 1992; CEPA, 1999). For example, strategies that are more cost-effective and least trade-restrictive are preferred, resonating from the highest level – the Privy Council, advisor to the Prime Minister and Cabinet.

Consequently economic and international obligations are often placed above those of health and the environment (see Government of Canada, 2001; 2003; CELA 2002.):

The regulation is a lot driven by economics, and you basically have to ask yourself the question, are there alternatives, is there a viability here for phasing in a substitute? Is the substitute safer?... Are there going to be job losses in Canada, are you too far out ahead of other nations?... We must ensure that the Canadian industry and economy is still competitive relative to other nations. My sense is that as the economy starts to rebound, we'll start to take a more aggressive approach" ("Gordon", risk assessor, government)

Thus cultural context and the modification of the meaning or operationalization of 'precaution' by a business-friendly government further determines how science is used, how discourses are shaped and which are seen as plausible. Current emphasis on plasticizers in *baby bottles alone* means that much of industry's agenda remains unchallenged even within a political culture that upholds precaution as a guiding principle. Indeed Canadian Gazette (2009) notes how little this ban costs industry. In fact, industry gained a new market as replacement bottles were bought and costs downloaded to consumers.

Additionally, Canada has a dispersed system of expertise and selective public engagement and consultation with stakeholders often represented by established elected or appointed interests (Lenihan & Alcock 2000). Canada's Chemicals Management Plan engages interested parties through the appointed Stakeholder Advisory Council and Scientific Advisory Panel. This formally extends debates around the evidence-base beyond the confines of toxicological experts to a wider range of expertise. Stakeholder consultation has the goal, often unstated, to come to a consensus on policy direction, although direction may be shaped by strength of argument, interests, available evidence, and the accessibility of engagement processes to different groups. Government is heavily reliant on industry data and their experts. According to The Canadian Environmental Network (which facilitates NGO engagement with the federal government), many groups find the science intimidating, and face significant capacity challenges

particularly with so many chemicals being rapidly reviewed under the CMP in a short period (CEN, 2010). Consequently it was strategic for Environmental Defence (an NGO who provided technical support to other NGOs to enable broader engagement with the CMP), to concentrate heavily on BPA as a poster child for broader issues around better product safety legislation and chemical safety evaluation processes (Environmental Defence, 2010; “Kassandra”, NGO representative). These campaigns heightened the public and political profile of BPA.

There is also political context to consider. Timing, state of the economy and political dynamics within and between political parties and other interests are also relevant. In 1999 it was ruled that the 23,000 substances already in commercial use that had never undergone risk assessment must be “categorized” within a seven year time limit for review (CEPA, 1999). This time expired with a Conservative Minority government in power. By the end of 2006 and prior to economic downturn, Canadian public opinion polls identified the environment as the most important issue, with a fivefold increase in support unfolding over a year (CTV News, 2007). The needs of political leaders cannot be ignored with the Canadian prime minister, perceived as economically liberal and socially conservative, being the person to announce the “Plan” in 2006 and its tight public health protective timeline of three years. The “Plan” allows regulators to find substances toxic unless proven otherwise. This apparent shift in the burden of proof is revolutionary for regulatory policy and allows regulators to take action on *suspected*, not just proven risks (Scott 2009). Yet as we have noted there remain uncertainties on how precaution and risk evidence are defined and valued, making the possibility of remedial action more contestable. Furthermore Scott (2009) contends that despite BPA being *declared* toxic, it is the regulatory *action* that follows which best indicates the government’s actual commitment to precaution and health protection. Proposed risk management measures included: a ban on the

importation, sale and advertising of baby bottles containing BPA; reducing levels of BPA in infant food packaging to “as low as reasonably achievable”; working voluntarily with industry to develop alternatives; conducting further research; and developing proposals to deal with the release of BPA into the environment (Environment Canada & Health Canada 2008). Many questions remain with respect to the consequences of these decisions. Does the bottle ban alone adequately reduce exposures for all vulnerable populations? Will this decision set precedent for other consumer products or regulatory jurisdictions? Will “precaution” be operationalized consistently?

Conclusion:

Scientific controversies and uncertainties surrounding the assessment of risks from bisphenol A provide insightful grounds for examining how, which, and why political actors utilize available resources to construct and (de)legitimize claims around evidence, the operationalization and application of precaution, and appropriate policy responses. In order to understand how weight-of-evidence and precaution are defined and valued in particular policy contexts it is necessary to understand the way in which scientific knowledge is created and used by those seeking to make or influence decisions. This includes identifying what is deemed relevant, and the particular objectives and interests being served. This paper explores various factors within the Canadian context that influenced the trajectory of claims-making disputes and negotiations, thereby shaping which “evidence” was employed, and how and where “precaution” was implemented in the regulation of BPA. It also examines tensions around distinguishing weight-of-evidence and precaution, both legally mandated within Canadian law, and how stakeholders and decision-makers attempted to reconcile the two within this particular case. We thus gain a better understanding of why Canada became the first national government to declare

BPA toxic and ban it from baby bottles, an internationally contentious, albeit increasingly precedent setting, policy response. On a more general level we also identify the need for greater attempts to integrate precautionary ideals into the *production* stage of science, and weight-of-evidence reviews, not just risk management decisions undertaken after a risk has already been ascertained by experts. In many cases, this is already occurring, but there remains need to enhance the accessibility, transparency and democratic scrutiny of expert-driven assessments given that the boundaries between that which is normative vs. objective, technical vs. political, scientific vs. precautionary are not always clear, distinct or agreed upon.

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CHAPTER 3

(Re)configuring spaces of legitimacy: using boundary-work and scale-frame spatial analytics to interpret policy discourse & practice in the governance of environmental health risks from toxic chemicals

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Abstract

Transformative spaces of influence are emerging whereby diverse stakeholders challenge the assumptions and interpretations of an “evidence-base” demarcating where, how, and by whom environmental health risks from chemicals should be governed. This suggests need for analyzing how political and epistemic legitimacy is constructed by stakeholders through contested parameters of inclusion/exclusion. Through a case-study of Bisphenol A (BPA) risk management in Canada we examine the role of space in shaping how legitimacy, expertise, evidence and authority are exercised and contested using “scale-frames” and “boundary-work” as explanatory concepts. Textual documents and key informant interviews reveal disputes over ‘scaling’ perceived risk problems, constituent variables, requisite expertise, evidence and interventions. It is imperative to elucidate techniques and norms of evidence production as it is *these* spaces which influence how regulatory principles become operationalized, benefiting some while marginalizing others. Stakeholders seeking to shape policy must (re)define and access jurisdictional *and* epistemic spaces in which knowledge, evidence and rationales become institutionalized.

Introduction

This paper analyzes contentious politics and issues of legitimacy in the assessment and management of environmental health risks from toxic chemical substances in Canada. We integrate distinct literatures on “politics of scale”, “scale-frames” and “boundary-work” to:

- i) examine the socio-political production of “spaces” in which legitimacy, rationale, expertise, power, and authority are exercised and contested by stakeholders involved in environmental health research and policy-making
- ii) assess the usefulness of a spatial analytical framework for deconstructing how elements of governance emerge, transform, become institutionalized and/or marginalized

Legitimacy is defined as the approval and empowerment of actors, institutions, processes and policies, by those subject to them. It is conditional and discursively determined through continuous acts of maintenance and contestation (Connelly et al, 2006; Geary & Jeffrey, 2006).

Governance is understood as the social coordination of established and emerging institutions and actors (governmental, non-governmental, private sector, civil society, scientists); and the rule systems under which political objectives are negotiated and shaped by knowledge assumptions, norms, and resource availability (e.g. Dean, 1999; Edge & McAllister, 2009).

Our discussions are grounded in a case-study of recent political and scientific controversies surrounding the assessment and management of environmental health risks from the chemical substance Bisphenol A (BPA). Specifically we examine how risk evidence and policy prescriptions are interactively constructed, and legitimized by different stakeholders involved in the BPA debate using “scale-frames” and “boundary-work” as explanatory concepts. BPA is one of the highest volume chemicals produced worldwide, with a projected 5% annual growth in demand (ICIS Chemical Business, 2009). It is used to manufacture polycarbonate

plastics and resins. The resin is applied to most food and beverage interiors to prevent metal contamination, and the plastics are used in a wide range of products (e.g. digital media, medical devices, sports equipment, etc). Controversy exists over safe levels of human exposure, and its potential to cause adverse reproductive, neurological and developmental health effects (Health Canada, 2008). The case of BPA is situated within the broader context of the Government of Canada's Chemical Management Plan (CMP), a program dedicated to improving health and environmental protection from a wide range of hazardous chemicals through an economically sustainable, science-based regulatory regime (Government of Canada, 2010). In 2010, Canada became the first country in the world to formally declare BPA toxic, despite significant backlash. Chemical management has also become a high profile issue internationally. Consequently at multiple scales we are witnessing an emergence of transformative spaces of influence, political action and authority that are reshaping the knowledge inputs and interpretations underpinning the evidence-base from which risk policies are developed. This suggests need for analyzing the discourses of various stakeholders to discover how they construct and spatially bound political and epistemic legitimacy and authority through contesting accessibility, inclusion and exclusion. The case serves as a window into broader power dynamics unfolding within transforming geographies of environmental health risk governance.

We begin with a brief background on the general science-policy context, followed by a summary and integration of key literatures comprising our analytical framework. We then describe our methods before turning towards details of the BPA case-study. This is followed by discussions of the results and concluding insights.

Background to Research Problem

The Science-policy context: shifting trends in the governance of environmental health risks

Hegemonic epistemologies and methodologies within environmental health risk assessment and management center around scientific evidence, and positivist modes of reasoning (e.g. statistical probabilities, modeling, causal explanations, and expert judgments). The goal is to make credible and rational decisions stand in the face of uncertainty and fiscal limitations by divorcing them from competing ideologies (Doern & Reed, 2000; Fischer, 2005). Nevertheless, scientific determinism is increasingly contested due to growing public unease, recognition that science itself is socially influenced, and many uncertainties about who should be burdened by, or benefit from, the limits of knowledge and understanding when decisions still have to be made (Beck, 1992; Driedger & Eyles, 2003; Eden et al, 2006; Scott, 2009). Conflicting viewpoints exist between different experts, stakeholders, decision-makers and lay communities with respect to data quality, appropriate methodologies, and interpreting public policy implications (Brown, 1992; Driedger & Eyles, 2003; Carolan, 2004). The management of environmental health risks involves many specialized realms of scientific expertise (e.g. toxicology, epidemiology, endocrinology, etc), in addition to policy and legal expertise. Furthermore, lay epidemiology civic and NGO science are increasingly present yet by and large lack formal recognition (Brown, 1992; Eden et al, 2006).

In addition to transcending scientific or epistemological expert boundaries, adverse environmental health exposures and their production are not necessarily confined to politically delineated jurisdictions and administrative boundaries. This is particularly challenging for governance given inconsistent rules and laws, difficulties in determining who is responsible for what, and how problems and solutions are to be defined. Debates have certainly been concerned with the free-rider problem and how to deal with the past as well as present production of

exposures (Heitzig et al, 2011). Adding to this complexity is the fact that many liberal democracies are increasingly – at least in terms of policy development if not practice - undergoing shifts from state-centered “command and control” approaches to decision-making towards collaborative multi-stakeholder arrangements involving state and non-state actors at multiple scales and geographies of governance (Lemos & Agrawal, 2006; Edge & McAllister, 2009; Reed & Bruyneel, 2010). Such shifts enable conventional, marginal and newly emerging stakeholders to challenge and defend entrenched assumptions, boundaries and values around where, how, and by whom, society’s health risks should be governed.

Conceptualizing a framework for analysis:

i) Spatial politics & “scale-frames” (constructing jurisdictional & political spaces of legitimacy and authority)

As a means of delineating the actors, ideas, interests, and interrelationships involved in the assessment and management of chemicals in Canada we draw from the idea of “framing”. Frame analysis shows how people make sense of social policy problems by emphasizing certain aspects of a perceived reality and making them more salient in a communicating context (Entman, 1993). These frames are interactively disseminated to advance particular “facts” comprising policy problem definitions, causal interpretations, moral evaluations, and interventions so they become accepted by others, and perhaps most importantly, those in positions of power (Entman, 1993; Fischer, 2003; Van Leishout et al, 2011). The idea of “frames” has been extended to consider the importance of *space* in shaping power dynamics involved in contentious policy settings through the concept of “scale-frames” (Kurtz, 2003).

Traditionally, scale was treated as a fixed and nested hierarchy of bounded spaces of differing size (e.g., local, national, global). However, with increased activity of state and non-

state networks emerging at sub, and trans-national spaces, the notion of scale as fixed and hierarchical has been undermined (Delaney, 1997). Scales are not merely arenas *containing* political activity; rather politics *constitute* particular scales and spatial relations (Mansfield & Haas, 2006). Scale is increasingly understood as socially constructed with the acts of defining, contesting, and institutionalizing the boundaries within which knowledge, power and authority are exerted characterized as the “politics of scale” (Marston, 2000; Leitner et al, 2007; Reed & Bruyneel, 2010).

Drawing from theories of framing and scale a small but growing number of scholars have developed the concept of “scale-frames”, to emphasize the role of socially constructed *spaces* and *spatial relations* in shaping policy processes, power struggles, and related outcomes. This work documents how “scale-frames” reflect the ways in which political actors make sense of policy problems through emphasizing where, and how, the boundaries or scope of a problem and its potential solutions are defined and drawn. Governance actors strategically draw these boundaries in ways that situate themselves at the center of power (Kurtz, 2003; Termeer & Kessener, 2007; van Lieshout et al, 2011; Dewulf et al, 2011). Scale-frames therefore elucidate how, where and why actors draw meaningful linkages between the scale at which a problem is experienced (e.g. body, neighbourhood, ecosystem, region, nation, planet, etc), and the scale at which it could be politically addressed (Kurtz, 2003; Mansfield & Haas, 2006; Griffin, 2009) presupposing particular kinds of solutions while dismissing others. They are a means of influencing which actors, values and issues become legitimized or excluded within policy and decision-making (Kurtz, 2003; Mansfield & Haas, 2006; Dewulf et al, 2011; van Lieshout et al, 2011).

While scale-frame analyses reveal contested stakeholder perceptions over how a policy problem is constituted and related disputes over the spatial extent of proposed interventions, less attention has been given to contestations around the socio-spatial nature and production of knowledge and expertise fundamentally driving those very processes. The following section explores the need for (re)considering the importance of epistemic space in gaining or maintaining legitimacy, influence and authority.

ii) Extending the boundaries of scale-frames: (boundary-work and the construction of epistemic spaces of legitimacy and authority)

The role of epistemology, particularly the *socio-spatial* production and acceptance (or rejection) of evidence, knowledge and underlying methodologies in shaping power and policy, has been under-explored in politics of scale literatures. Likewise, with little exception (e.g. Mansfield & Haas, 2006; Griffin, 2009) focus on the societal treatment of scientific expertise and uncertainty within contested scalar narratives of stakeholders involved in environmental health policy disputes is also lacking. Contested scale-frames are often presented as different interpretations of the *same* “objective” scientific information for the purposes of advancing different interests. Yet, the boundaries demarcated around that which is constituted as “legitimate information” are also at issue, including who gets to decide on those boundaries, as this dictates how problems and solutions become scaled and defined. As Mansfield & Haas (2006) argue scale-frames do not draw from a static terrain of knowledge and uncertainty, rather they are significantly involved in creating that terrain. In other words, scientific understandings of health problems do not merely act as context for political disputes. Science itself is also embroiled in scalar and boundary politics whereby different stakeholders (including scientists) shape political outcomes through interpreting and imposing differing spatial interrelationships that underpin and characterize “evidence” and “uncertainty”, through demarcating what is valid

or irrelevant, in or out. This affects what is known, which research agendas are most likely to be funded in the future, and ultimately that which is constituted as legitimate knowledge. This is critical given environmental health policy and regulation is increasingly predicated upon prevailing ideologies of “evidence-based” decision-making (CEPA, 1999; Doern & Reed, 2000; OECD, 2011). Failing to consider where, and how, the boundaries which determine what knowledge is legitimized from an evidence-base are drawn, risks obscuring many defining elements of a policy debate including key interests.

There lies promise for deepening understandings of the spatial nature of knowledge and evidence and their role in shaping power and legitimacy through building upon the concept of “boundary-work” explored predominantly within science and technology studies (e.g. Gieryn, 1983; Kleinman & Kinchy, 2003; Eden et al, 2006). Such work describes the processes through which actors and organizations establish territorial limitations around epistemic authority, including the individuals and forms of knowledge/expertise deemed legitimate representatives of that authority.

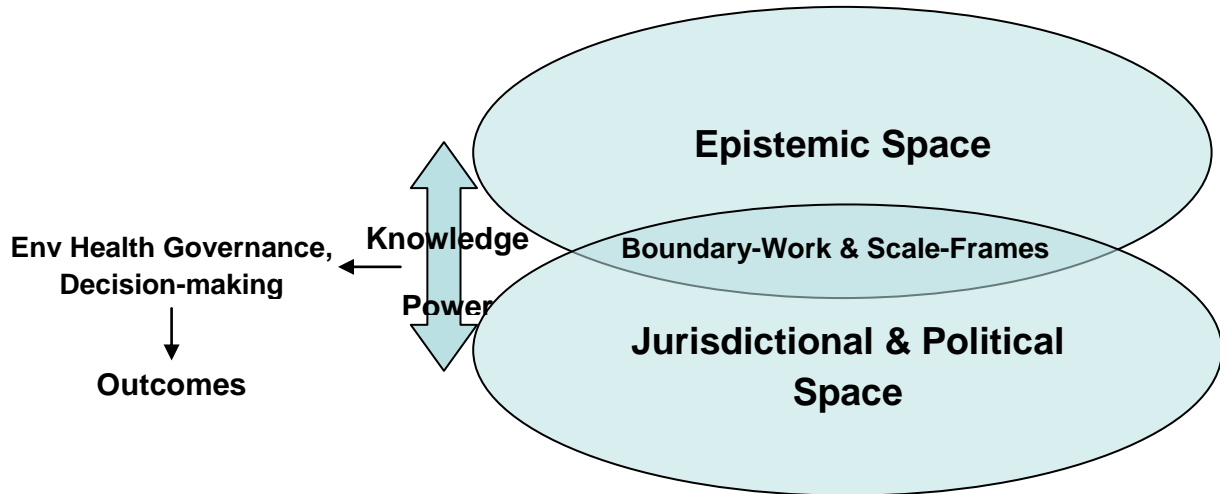
Boundaries between authority and non-authority are drawn varyingly by actors in ways that enhance their own influence. Gieryn (1983) emphasized the many characteristics of science (e.g. impartiality) attributed by scientists themselves that are not *necessarily* inherent or unique, but reflective of ideological efforts to distinguish their work from “non-science” or junk science to monopolize expertise, resources and power. This notion has gained much currency as others have interrogated the uncritical pre-eminence of science in policy and championed the need for recognizing underlying social and political influences (e.g. Jasanoff, 2003; Fischer, 2005). The supremacy of scientific knowledge is reinforced by many public institutions and actors (e.g. government bureaucracies, universities, industry and NGO representatives). Those who are able

to interpret and wield scientific data are most successful in gaining access to, and navigating decision-making circles and processes (Griffin, 2009; Eden & Bear, 2010). The boundaries around ‘science’ can be drawn very conservatively or extensively depending on the agenda of those doing the drawing (Jasanoff, 1987). Constructed boundaries are always shifting and continuously renegotiated. Our case-study emphasizes “boundary-work” unfolding *within* environmental health science and *between* experts called upon to interpret a policy evidence base as central scale-frames for understanding chemical risk problems and solutions are renegotiated.

iii) Contested spaces & boundaries of legitimacy & authority

We emphasize a need for paying close attention to spatial politics around science to better understand how power and decision-making logics underlying jurisdictions of environmental health policy are transformed and/or reinforced. One could argue that “politics of scale” and related “scale-frames” are essentially akin to “boundary-work”. However, the former body of literature tends to emphasize *jurisdictional and political spaces of authority* (and those included or excluded therein), while the latter concept tends to be used when exploring access granted to *epistemic spaces of authority*. Both spaces are maintained by social and institutional networks, power relationships, and prevailing norms and practices. We argue that in order for governance stakeholders to gain the influence and legitimacy to truly shape environmental health policy, they must (re)define the jurisdictional *and* epistemic spaces in which knowledge, evidence and rationales are created and institutionalized (see Fig. 1).

Figure 1: Conceptual framework: “contested spaces & boundaries of legitimacy & authority”



We further propose that paying attention to the “scale-frames” and/or “boundary-work” of governance stakeholders allows one to characterize how authority and legitimacy are spatially constituted and how their accessibility is contested. We suggest that thinking about environmental health science, policy and politics in spatial terms is useful for understanding many tangible consequences with respect to who does (and does not) become affectively engaged in risk governance, the information they draw from, what becomes institutionalized, and who absorbs associated health risks and benefits.

Methods

To examine our research question (upon standard ethics board approval), we drew from multiple data sources (e.g. government policy and legal documents, interest group publications, popular media, scientific publications, web-sites and list-serves from key stakeholders).

Additionally, participant observation of international stakeholder and expert meetings, and national webinars on the Chemical Management Plan (CMP) process provided additional sources

of information. Finally, 13 key informant interviews were conducted reflecting a range of stakeholder perspectives including that of government, industry, environment and health NGOs, and scientists. Many of the informants also served in an advisory capacity to government through participation in expert and stakeholder consultations. They possessed a range of different, and in some cases overlapping, “types” of expertise including technical and scientific (e.g. toxicology, epidemiology, neurology, endocrinology), regulatory or legal, analytical/philosophical, in addition to skills such as policy development and reform, lobbying, knowledge translation and communication. The key informants were asked a series of open-ended questions about how they characterize the “risks” of BPA, which knowledge sources they utilize and view as appropriate to inform decision-making, how they communicate and interact with other stakeholders, and where their actions tend to be concentrated. To be clear, the concepts of scale-frames and boundary-work were not explicitly discussed within the interviews. Their importance as explanatory concepts became affirmed throughout the analytical process.

Interview transcripts and other data were coded using a thematic coding scheme facilitated by the qualitative software package NVivo, and a discourse analytic approach. Discourse analysis is devised from interpretive or social constructionist traditions that emphasize *how* various knowledge and “truth” assertions are made and situated in relation to social interests and power relations (Hajer & Versteeg, 2005). Discourse is defined as “an ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena, produced and reproduced through an identifiable set of practices” (Hajer & Versteeg, 2005:175). Analysing language, *and* customary institutional practices and techniques of analysis (Dean, 1999) reveal struggles for control over meaning in policy-making and the spaces in which this occurs (Richardson & Jensen, 2003). They also reveal the ways in which language, text, and

symbols are used by stakeholders to define and make sense of policy problems and conceivable interventions. Discourse analysis assists in unveiling underlying rationales, assumptions, judgments and contentions held and communicated by stakeholders in persuasive ways that enact particular socio-political perspectives, values, identities, relationships, interests, and actions (Gee 1999). It is an effective tool for constructing and communicating alternative interpretations of reality.

The case of BPA: controversial management of environmental health risks in Canada

The level of risk posed by BPA exposure and appropriate management measures continues to be a contentious scientific and political question globally. A range of studies have observed health effects within laboratory animals including changes in rates of growth and sexual maturation, hormone levels in blood, decreased fertility, suppressed immune function, changes in brain chemistry and behavior including increased hyperactivity, aggressiveness, and impaired learning (see Vom saal & Hughes, 2005). Lang et al. (2008) have reported associations with cardiovascular disease, diabetes and liver-enzyme abnormalities. Nevertheless, science determining human health risks from low doses of exposure remains contentious. In 2008 Health Canada conducted a risk assessment of BPA concluding most Canadians need not be concerned as adverse effects are thought to occur at much greater levels than what people are actually exposed to. Nevertheless, they felt there was sufficient evidence to suggest that the margin of safety was too small for infant exposures and determined a precautionary response was warranted (Health Canada, 2008). Consequently the Government formally declared the substance ‘toxic’ under Canada’s Environmental Protection Act, and enacted a complete ban of the importation and sale of baby bottles containing BPA. This was despite objections from industry, some scientists and other jurisdictions around the world that these actions were not

supported by the weight-of-evidence, and that BPA is safe until more evidence surfaces to justify regulatory action.

BPA is one of the substances reviewed under Canada's Chemicals Management Plan (CMP) the federal government's initiative to manage potential health and environmental risks from chemicals used in Canada. "Science-based decision-making" is a prominent guiding principle within the CMP, and the *Canadian Environmental Protection Act, 1999* (Canada's primary legal tool for assessing and managing chemicals) (CEPA, 1999; Government of Canada, 2010). The government is also obligated to apply a weight-of-evidence approach and the precautionary principle (CEPA, 1999). Under CEPA a substance is only deemed toxic *if* levels of exposure based upon current commercial use, have the potential to cause harmful effects to the environment or human health. In other words, assessment determinations of toxicity are *exposure* driven, not based on *inherent* hazard (CEPA, 1999). Government is heavily dependent upon industry data to inform their risk assessments.

All assessments were released for public commentary, providing opportunity for industry and other interested parties to challenge the interpretation of, or further contribute towards, existing evidence on a substance's safety and management. The CMP also established a Stakeholder Advisory Council, and an expert panel called The Challenge Advisory Panel. The former is a multi-stakeholder committee that provides opportunity for members to offer advice to the government on the implementation of the CMP, and discuss issues of concern among different stakeholder groups (e.g. Aboriginals, Consumers, Environment & Health NGOs, Industry Associations). Meanwhile, the expert panel is comprised of independent experts knowledgeable in various areas including chemical policy, chemical production and economics, environmental and health risks, biological sciences, environmental law, health care, etc. This

panel is charged with considering specific questions around how the government applies the precautionary principle and weight-of-evidence. The panel provides advice only. Final decision-making authority remains the responsibility of the Government (Government of Canada, 2010). Chemical management activities at the national level are embedded within international negotiations and agreements. For example Canada has bi-lateral relationships with the EU, Australia and the United States; is heavily involved with chemical management initiatives coordinated under the Organization for Economic Cooperation and Development (OECD); and privy to international treaties such as the Basel, Rotterdam and Stockholm Conventions.

Findings

The BPA chemical management debate is marked by the boundary-work and scale-framing of stakeholders with respect to defining: a) environmental health risk policy problems, b) potential interventions, c) legitimate knowledge, expertise and authority. These in turn shape the operationalization and execution of health risk assessment and management decisions, and associated outcomes.

i) Scale-frames & boundary-work in defining the environmental health policy problem

Contrasting understandings of the health risks associated with BPA, are related to spatially defined boundaries constituting that which is deemed “relevant”, “necessary”, indeed “legitimate” for establishing and ultimately addressing environmental health risk policy problems. Those who have lower perceptions of (or higher tolerances for) risks, tend to limit scientific investigation, complexity, and uncertainty by drawing tight, conservative boundaries around the settings and mechanisms in which risk is ascertained. Narratives along this vein emphasize the laboratory (a metaphor for controlled science) as the most appropriate space or

scale within which risk should be established as it tests for adverse effects from *known* and isolated sources of exposure, as exemplified by a toxicologist with industry ties:

“It comes down to dose response which can be ascertained in lab experiments, and I would say that the gap between the level that you will be exposed to and the level that would cause an effect is sufficiently large for you not to worry about it” (industry, background toxicology)

Within a laboratory setting, risk variables are seemingly easier to isolate, manage, and estimate appropriate margins of safety, namely a “safe” dose for human exposure. Within this smaller scale-frame, stakeholders have a greater propensity to justify the continued, albeit controlled, use of a chemical. An underlying rationale is the notion that we cannot undermine trade or competitive economic advantage if conclusive scientific evidence does not exist:

“You have to conclude essentially whether it is nasty or not. Risk assessments in most jurisdictions are based on exposure, not just inherent toxicity. You have to operate on risk given it’s a World Trade Organization issue. Because if you operate on hazard or inherent toxicity, you’d be considered as applying a non-tariff trade barrier. We all have to demonstrate through science, what it is, and why we’re instituting a regulation. And if you don’t you’re going to be in trouble. They’ll take you to the WTO court, and likely win” (government, risk assessor)

Given the high costs and controversy associated with disrupting the economic status quo through imposing regulatory control, it is more politically feasible to make decisions that fall within the boundaries of being scientifically sound, evidence-based, objective, manageable, justifiable, and consequently less open to dispute.

In contrast, those who question the status quo assessment, management and characterization of environmental health risks cast far wider scale-frames around a policy problem. Through enhancing complexity and creating uncertainties, the boundaries demarcating where epistemic authority rests, or that which is considered rational, become blurred and open to challenge. This is illustrated below in a narrative questioning the pre-eminence of a weight-of-evidence, exposure-based approach to defining risk:

“But we don’t know everything there is to know about exposures. We don’t know about what’s in sewage sludge that’s being applied to farmer’s fields, and we don’t know if BPA is taken up into plants and vegetables, what’s in air, in water, in soil...consumer products...and so on. It hasn’t been scientifically examined. And then add it all up and make all of these assumptions. So the database for exposure is very weak in most cases” (health NGO, background neurobehavioural)

The significance of cumulative effects from multiple exposures along with the lifecycle of a chemical and its metabolites and by-products may also be emphasized:

“I worry about the phthalates in babies’ chewing toys...little crackly drinking bottles that everybody is carrying around in the sun, parabens in almost every cosmetic, flame retardants, pesticides. These are all mildly estrogenic... any one of them on its own may not give you enough exposure, but collectively... these things all add up... I do think that that is the direction that science has to go because almost every study you look at is just looking at one substance in isolation” (academic scientist, background neuro-endocrinology)

Political actors employing these scaled understandings feel that “inherent toxicity” should be more prominently factored into risk assessments and management responses to protect public health given knowledge limitations around ascertaining accurate realities of exposure.

Nevertheless, prevailing practice continues to align with an exposure-based approach outlined under CEPA and the CMP.

ii) Scale-frames & boundary-work in defining appropriate environmental health policy solutions and interventions

Stakeholders’ perspectives of proposed policy interventions varied around who in society is affected and how, which social and economic trade-offs are most important, and whether constraints are surmountable. One type of boundary-work emphasizes the primacy of public health protection. It suggests that the safety of the most vulnerable remains inadequately accounted for within prevailing tools of risk governance (e.g. assessment methodologies, management responses). The Government of Canada’s position is that their prime objective in implementing the baby-bottle ban is protection of the most vulnerable (i.e. young infants) particularly from *potential* adverse neurobehavioural health effects. Yet some suggest the fetus

was not adequately addressed in the assessment and management strategies. Despite multiple data gaps these respondents argue that protecting the most vulnerable requires expanding the scale of management to encompass reducing dietary exposures amongst women of reproductive age, removing BPA from *all* food and beverage packaging, and working towards the eventual phase-out of the chemical entirely:

“If you look at the definitions of the precautionary principle in CEPA there is this whole limiting factor about being “cost-effective”, so that’s always a problem. We would hope that the government continues to look at ways to improve how they define the precautionary principle...I think the government would say phasing it out of baby bottles is based on precaution. I would say based on precaution you would extend that phase-out to other products (environmental NGO, background law & policy).

Other concerns point to certain groups being marginalized outside prevailing boundaries defined by the CMP. For example, focus is restricted to the general population, and does not consider the realities of workers in occupational settings. Additionally, others argue low income individuals, particularly those reliant on food banks and cheap canned goods are more likely to experience higher levels of exposure than the general population and have less purchasing power to buy alternative products.

In contrast, for others from industry, government and science, their scale-framing did not place health protection as the primary or exclusive centre within their proposed interventions. Their boundary-work cleaves closely around questions of feasibility, the consequences of implementing regulatory restrictions and policy change, and the importance of considering how consistent the response is with those arising at other spaces of jurisdiction:

“In general we do a health risk assessment strictly driven by the science, and we look at exposure, safety levels and margins...what the impact is, and what needs to be managed. Then you take that science conclusion, and apply it to the making of a regulation. And the regulation it’s a lot driven by economics, and you basically have to ask yourself the question, are there

alternatives, is there a viability here for phasing in a substitute? Is the substitute safer?... Are there going to be job losses in Canada, are you too far out ahead of other nations?... We must ensure that the Canadian industry and economy is still competitive relative to other nations. My sense is that as the economy starts to rebound, we'll start to take a more aggressive approach" (government, risk assessor)

Or in the words of a reproductive toxicologist:

"Some people are willing to say well it doesn't matter that you can't explain it, regulate. And others of us are saying you can't explain it, thus we need to figure this out. It does not mean we're failing to take the precautionary principle, but where do you draw the line? Do we suddenly turn around and say we're going to ban lipstick? Videogames? There are other things on the market far more toxic than BPA that we are doing NOTHING about. So if we're going to take action, let's start there. Let's protect human health (academic scientist, background reproductive toxicology).

The Government's current position is that based on the weight-of-evidence available to date, levels of BPA within food and beverage packaging do not pose a risk to the health of the "average" consumer. Consequently impacting trade and the economy through mandatory labeling or removal of BPA from dietary products remains unnecessary. However, they state a commitment towards monitoring new information as it materializes to determine whether new guidelines become warranted. With respect to infant formula cans specifically, the government is working with industry to develop voluntary codes of practice to reduce levels of BPA to "as low as reasonably achievable" (Government of Canada, 2008). This kind of policy discourse is less legally binding than opponents of the chemical would desire. Hence, the location and firmness of boundaries demarcating the most "appropriate", "feasible", and "precautionary" scale of management intervention within the face of uncertainties and global economic dependencies, remain contested.

iii) Scale-frames & boundary-work in defining legitimate environmental health knowledge, expertise and epistemic authority

Boundary tensions observed as being fundamental to shifting spaces of “legitimate” authority include disputes over the role, merit and distinction between i) technical, scientific expertise, ii) “non-stakeholder” expert advice, iii) and stakeholder knowledge.

As previously discussed, science-based, weight-of-evidence principles of decision-making are prominent within the CMP and CEPA 1999, and reflected at global scales through ongoing efforts of the OECD’s Chemicals Committee to foster internationally compatible science-based risk assessment methods (OECD, 2011). Multiple key informants from government stressed that the CEPA legislation was intentionally written to distinguish a boundary between risk assessment activities and management. The former is to be solely guided by science with no politics or economic considerations factoring in until the management phase. The assessment relies on technical forms of expertise including toxicology, endocrinology, epidemiology, etc. Yet, boundary tensions exist around whether, and how, the assessment and interpretation of scientific evidence should be exclusively allocated to technical experts, and the role and place of other types of expertise. The tentative boundary between objectivity and normativity drives this debate:

“If you do a toxicological study and you expose animals to different concentrations and you’re trying to build your dose-response curve...you’re testing various hypotheses about the shape of that curve, and you have an evidentiary threshold for the rejection of the associated null hypothesis...Every bit of science deduced has normative elements in it. It’s not as if science in itself is uncontaminated. How do we know if the investigators were being precautionary in their studies?...Every scientist works with a type 1 error rate of statistical significance of 0.05. But what’s the basis for that? There’s no science that tells you have to be 95% sure before you reject your null hypothesis. We have just chosen that arbitrarily because we’ve decided we want to be really conservative. But we could choose 90% or 80% or anything we want... (Assessing risk) its a debate about what’s the null hypothesis, and what’s the evidentiary threshold. The null can either be that the chemical in question is NOT toxic, unless demonstrated otherwise, or that it IS toxic unless its demonstrated to a certain level of evidence that it is not...Then the question becomes how much evidence do you need in order to reject your null?...Neither of those elements are scientific, they are completely normative...and therefore there’s no reason why public opinion should not impact these” (academic, government advisor, background biology)

Many respondents stressed that there remains need for illuminating the fine-grained details, assumptions and value judgments built into scientific risk assessments, particularly with respect to data quality and estimated margins of safety and exposure. Otherwise, the process remains a black-box, as reflected by an NGO representative:

“Specifically with BPA we knew there was going to be a lot of information available, but we didn’t know where the data gaps were going to be... the quality of data...how to validate industry data... Would you consider model data as opposed to experimental data? Analogues? What kind of model data would you look at?... So we look at how do we improve the process so there is greater transparency and accountability? How do you apply the precautionary approach in this context? We do question how margins of exposures are applied....This is the kind of information we would like to see... We think that even if it’s a technical issue...the opportunity should be there to allow for public interest groups to participate... So going back to the principles of what’s engrained in CEPA. If you’re promoting pollution prevention, if you’re applying the precautionary approach, and if your intent really is to prevent rather than have to only typically be reactive, are you doing that with the approach you’re taking?...And even now with consultations the discussions never really focus on the technical stuff... The Government really doesn’t want to revisit those issues” (environmental NGO, background law & policy)

This statement reveals that NGO stakeholders endorse a science-based approach, but want more accessibility and transparency. Similar points were raised by industry. For NGO representatives, the degree to which the statutory principle of precaution is exercised *within* a science-based approach is key for protecting human health. Industry likewise wants to know how and where boundaries of precaution are drawn, and how weight-of-evidence is interpreted. Their formal position filed through a “Notice of Objection” to the Ministers of Health and Environment is that a science-based approach does *not* support the conclusion to list BPA as toxic and ban it from baby bottles (Polycarbonate/BPA Global Group, 2009). Others serving in an advisory capacity also articulated that epistemic space and its key processes remain nebulous.

“What is usually said is ‘using a weight-of-evidence approach what we determined is blah, blah, blah’. But of course this begs the question of what was really going on, which is never made clear... There’s two different methods you can use. One is a relative method, so that you don’t care about the total amount of science that has been done on this, all you care is whatever the amount of science that has been done, how much of it is consistent with the null. Versus an

absolute standard for weight-of-evidence where there has to be some threshold of total evidence that has to be achieved before you do anything.... And the difference between those two is enormous... and yet there's a lot of implicit decisions being made... we need criteria around when one approach might be more appropriate over the other" (academic, government advisor, background biology)

While science remains dominant, other forms of expertise are increasingly drawn upon to evaluate where the non-normative and normative boundaries of science lie and their appropriate treatment. In addition to those with expertise in toxicology, the government appointed scientific advisory panel contains individuals who understand the regulatory process, manufacturing (what is feasible to change or not), environmental law, broader philosophical issues, and those with the skills to critically analyze regulations and policies for logical inconsistencies. As a manager explained the government intentionally attempted to appoint independent experts, *not* stakeholders. However they also conceded that many on the panel carried a particular political bent that shaped their analytical lens, raising questions over the degree to which a boundary can be drawn between stakeholder and non-stakeholder expertise.

Other narratives reflected controversy around the merits of NGOs contributing and interpreting evidence and translating knowledge to enhance the capacity of the public to engage in technical issues. This is not always welcomed:

"An advocacy group like (" ") that gets five of their friends and measures the contaminants in their bodies is an absolute joke. It's not science. To me it shouldn't even be reported on. I think it has huge harm. One advocacy group's pronouncement often creates anxiety and stress in the lay public who have no way of interpreting, and eventually because nothing bad happens, stop listening. It also has a much more profound impact and that is on how resources are utilized. We have a finite amount of resources as we all know... there are chemicals that are a greater risk for public health, than BPA" (academic scientist, background reproductive toxicology)

Controversy also surrounds existing and significant government dependencies upon industry science. While most believe the burden of proof within risk assessment should indeed

rest on the chemical's proponent, many remain concerned with limitations around government's capacity to validate that information:

“It must be tremendously daunting to people at Health Canada and Environment Canada. Because they must feel the same way that I do with some frustration that the data they're getting from industry is sometimes under suspicion, or probably its incomplete, or skewed in one way or another. And they can't go out and check it, they need a lot more people and resources to do that” (health NGO, background neurobehavioural)

“Relying on industry data is a HUGE problem...we just sort of sit there and say well we just have to put the burden of proof onto industry, and then its good...And then all of a sudden we're reviewing industry studies and trying to decide what to do on the basis of industry studies and its like...wait a second. This sucks! (academic, government advisor, background law)

Others exhibit a different view:

“What drives me up the wall is when industry does an expensive study it gets slammed because it was funded by industry. The assumption is that the researchers are completely open to influence, peddling, cheating and lying. Whereas the cheaper study done in the university without quality control is much more ‘trustworthy’” (industry, background toxicology)

Finally for others the importance of evaluating the science itself, and not the source was paramount:

“The NGOs absolutely despise me using sources from industry, but in my opinion, as long as they meet OECD guidelines I have absolutely no objection in using it. And it depends on the work, usually if it is a highly commercialized substance, industry does have the bulk of the information” (government, risk assessor)

“At the end of the day there are no short cuts and it is the science that counts. If you have a problem with the methodology. Fine. If there is a weakness in the experimental design, or interpretation or analysis of data. Fine. Then bring that up and let's sit down and talk about that. But the simple knee-jerk reaction to say well these are funded by industry and these are not just doesn't hold water for me” (academic scientist, background reproductive toxicology)

Conclusions

The overall goal of this paper was to examine the role of “space” in shaping how, and whose, knowledge claims, decision-making rationales and authority become legitimized within systems of environmental health risk governance (with particular focus on the chemical BPA).

Our case contributes to existing work on “scale-frames” predominantly situated within studies of contentious environmental issues, and extends the concept into *environmental health* policy realms. Our conclusions reinforce existing studies suggesting that scale-frames are useful explanatory tools for understanding how political actors make sense of policy problems through emphasizing where, and how, the boundaries or scope of a problem and its potential solutions are defined and drawn (Kurtz, 2003; Termeer & Kessener, 2007; van Lieshout et al, 2011; Dewulf et al, 2011). Discourses of environment and health NGO representatives, and others advocating the primacy of public health protection, demonstrate that a broadening of scale-frames strategically enhances complexity and uncertainties, enabling the justifiable interrogation of science, technical authority, methods and rationales. Secondly our findings reflect attempts by scientists and government officials charged with assessing health risks and suitable interventions to maintain manageability by tightening the boundaries around the spaces in which risk is ascertained and controlled. Previous works also indicate wider scale-frames are characteristic of participatory policy development, while expert driven approaches tend to be more reductionist to ensure problems are tractable (Mansfield & Haas, 2003; Bijlsma et al, 2011).

Within scale-frame theory little attention has been given to teasing out the fine-grained nature and production of knowledge and expertise fundamentally driving the constraints within which problems and solutions are defined. Richardson & Jensen (2009) advocate for greater focus on commonly used techniques of analysis that construct particular forms of knowledge and rationality as “givens” obscured from critical gaze. Mansfield & Hass (2006) notably demonstrate that science is not merely a static and “objective” backdrop to policy controversies whereby stakeholders divergently interpret a “unified” body of evidence through contested scale-framing. Indeed, boundaries imposed around knowledge deemed “legitimate”, “scientific”,

“factual”, or “uncertain”, are in themselves immersed in, and constituted by spatial politics.

There remains a divide between scale-related research emphasizing the significance of jurisdictional power, and other works analyzing the importance of information flows (Kok & Veldkamp, 2011). We argue that stakeholders seeking to shape policy, must (re)define and gain access to both jurisdictional *and* epistemic spaces in which knowledge, evidence and rationales are created and institutionalized (see Fig. 1). Through merging scale-frame theory (largely situated in human/political geography, environmental studies), with boundary-work analyses (founded in science and technology studies) we are able to better understand how key statutory principles, methodologies, rationales and values underlying environmental health policy operate in practice determining the social distribution of risks.

The move towards multi-scaled, multi-stakeholder decision-making, signals a transformation of actors accessing spaces in which knowledge inputs and interpretations comprising an evidence-base are negotiated, and institutionalized. Nevertheless, our results demonstrate the degree to which this boundary expansion has resulted, or will result, in a *formalized* redistribution of power and influence in practice remains tentative and contested. For many stakeholders it is not merely about having more political attention focused on chemical risks or jurisdictional spaces available to carry out assessment activities. Rather representatives from environment, health, and industry all expressed a desire for being able to have the access and capacity to challenge prevailing epistemic practices, fine-grained norms and assumptions built into risk assessments. With that may come the power and authority to shape regulatory change.

The Government of Canada’s appointment of independent experts to a Challenge Advisory Panel (to evaluate how precaution and weight-of-evidence are wielded), signals an

awareness of the normative elements inherent within their science-based assessment approach. Yet many stakeholders feel improvements are needed to enhance the transparency of technical details and the openness of dialogue around their interpretation, as it is *these* spaces which dictate the ways in which regulatory statutes and practices of environmental health risk governance become operationalized, benefiting some while marginalizing others (e.g. fetuses, workers, low-income individuals, etc). With respect to ascertaining health risks from BPA and other chemicals, key contested principles include precaution, weight of evidence, margins of safety, margins of exposure, evidentiary thresholds, null hypotheses, burdens of proof, quality of data, etc. and how they are defined and implemented. Failing to open these discussions risks the boundary marking science as an impartial generator of knowledge for evidence-based decision-making, becoming overshadowed by another demarcating it as an inadvertent reinforcement of the status quo due to opaque processes limiting democratic scrutiny of normative assumptions built into methodologies and assessments. Our results also raise questions around the fuzzy boundaries between that which is considered “stakeholder” expertise associated with particular interests, and “non-stakeholder” expertise (the kind purportedly drawn upon within the Challenge Advisory Panel). Must it always be independent, academic analysts involved in dissecting how key risk policy principles are operationalized within assessment practice, or can/must stakeholders and public interest groups be involved in this process? Can a boundary realistically be drawn between the two? What are the implications?

Enhancing transparency would enable greater reflection upon whether fundamental policy principles are living up to their intention, and improve their rigor as meaning and implementation challenges become clarified through practice. In other words moving towards multi-stakeholder decision-making across scales of jurisdiction holds potential for reconfiguring

who and what is deemed “legitimate” shapers of environmental health and chemical management policy. However, if epistemic practices and scientific knowledge inputs remain opaque, opportunities for formalizing these shifting spaces of legitimacy beyond policy, and into practice, are undermined.

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CHAPTER 4

Contested governmentalities of chemical management: NGO stakeholder enrollment, subjectivity & influence and the neo-liberal risk governance agenda

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Abstract

In many respects the assessment and management of environmental health risks from chemical substances can be viewed as an “emerging” and contested domain of governance. In Canada, approximately 23,000 “existing substances” were in widespread commercial use despite never being assessed for their toxicity and exposure risks to human health and the environment with this number being far greater in the US and Europe. Given this legacy and recognized limitations of scientific determinism and expert-driven approaches, governments are increasingly investing in participatory, multi-stakeholder, collaborative approaches. Thus a range of governance stakeholders are increasingly involved in deliberating the constitution of institutional spaces, rule systems, knowledge inputs and entrenched assumptions that determine where, how, and by whom chemical or environmental health risks should be governed. Using a governmentality approach this paper interrogates whether the increased engagement of NGOs in chemical governance in Canada is resulting in tangible changes to the forms of expertise and evidence underpinning decision rationales, and the techniques of assessment and management most commonly drawn upon to govern chemical use and the social distribution of risks and benefits. Secondly, it examines how NGO engagement in these deliberations is situated within broader political-economic contexts. Findings suggest that evolving and contested modes of subject-making around NGO expertise and technical capacity in part explain why particular forms of knowledge production and interpretations of “evidence” are adopted while others are downplayed. Prevailing risk rationales and techniques of assessment and management reinforce, and are supported by, engrained neo-liberal ideals and objectives that circulate through power and production relations existing between modern administrative states, mega-science and industry.

Introduction

In many respects the assessment, management and regulation of environmental health risks from chemical substances can be viewed as an “emerging” and contested domain of governance whereby multiple stakeholder interests seek to shape its constituent actors, rule systems, knowledge inputs, and orientation (Edge & Eyles, forthcomingA). Granted, for the hundreds of *new* chemicals introduced into commerce every year, nation-states around the world including Canada, the United States and many European countries have been evaluating their safety for decades, adopting various regulatory controls to minimize risk. Nevertheless, many chemicals have been in use long before any comprehensive environmental legislation was in place. Until very recently, Canada alone had some 23,000 “existing substances” (as they are commonly referred to), in widespread commercial use despite never being assessed for their toxicity and exposure risks to human health and the environment. This number is far greater in the US and Europe (Government of Canada, 2007). These substances are used to manufacture numerous products that provide substantial benefits to society in the form of increased productivity, life-saving technologies, and everyday conveniences (e.g. automobiles, paper, textiles, toys, electronics, medical supplies, building materials, and food packaging) (Ministry of Environment, 2008; Canadian Plastics Industry Association, 2009). Nevertheless, there are growing concerns over the environmental and human health effects of long-term, chronic exposures given contaminants are found in our air, soils, water, consumer products, and bodies, with some biomonitoring studies detecting small concentrations of certain contaminants in nearly every human or organism tested (see Calafet et al, 2008; Scott, 2009; Bushnik et al, 2010).

Enhanced public awareness and media attention over the ubiquitous nature of chemical exposures, associated environmental health risks, and wide-ranging uncertainties has generated heated scientific, political and legislative conflict over recent decades (e.g. Jasanoff, 1986;

Brown, 1992; Harrison & Hoburg, 1994; Coburn, 2002; Iles, 2007; Scott, 2009; Edge & Eyles, forthcomingB). Accordingly the assessment and management of risks from existing substances and the reduction of exposures to “acceptable” levels has increasingly become a high profile, contemporary challenge for multi-scale systems of governance involving diverse stakeholders (MacKendrick, 2010; Turnheim & Tezcant, 2010). Both positive and negative impacts of chemical use must be weighed, in addition to the societal distribution of determined risks and benefits. This is extremely controversial as risks and benefits are often intangible, with little agreement on how they should be valued (Jasanoff, 1986). Furthermore, decisions must be made on the basis of uncertain and contentious scientific evidence (Beck, 1992; McMullan & Eyles, 1999; Fischer, 2005; Edge & Eyles, forthcomingB).

Governance theory and practice has exposed limitations of exclusively or preeminently relying on scientific determinism and expert-driven approaches to inform decisions on risk characterization and societal distribution (e.g. reductionism, inability to deal with complexities, contested findings and uncertainties, lack of consideration for lay knowledge, incommensurable value judgments, temporal and spatial inequalities) (e.g. Brown, 1992; Corburn, 2002; Pidgeon & Butler, 2009). Within and across various literatures (e.g. risk society, environmental justice, governance, science and technology studies), there is a convergence of calls for participatory, multi-stakeholder, collaborative approaches to address these identified shortcomings (Jasanoff, 2003; Diduck, 2004; Fischer, 2005; Edge & McAllister, 2009). Consequently a growing number of governance actors (e.g. regulatory agencies, scientists, representatives from industry, environment and health NGOs, etc.) are increasingly involved in deliberating the constitution of institutional spaces, rule systems, knowledge inputs and entrenched assumptions that determine

where, how, and by whom chemical or environmental health risks should be governed (Fischer, 2005; Edge & Eyles, forthcomingA).

Despite increased consensus over the need for multi-stakeholder engagement and deliberative governance, questions remain over the degree to which such shifts are producing tangible differences in risk governance processes and outcomes (e.g. Dorsey & McDaniels, 2001; Chilvers & Burgess, 2008; Reed & Bruyneel, 2010). Interrogations along this vein require a fine-grained focus on the nature and production of the often opaque, taken for granted methods and techniques of assessment and management practice. There is also need for exploring how such methods and techniques both shape, and are reinforced by, particular subjectivities of authority, expertise, capacity, forms of logic and “evidence” which in turn shape prevailing understandings of environmental health risk problems and policy solutions (Ekers & Loftus, 2008; Richardson & Jensen, 2009; Edge & Eyles, forthcomingA).

Accordingly, using a governmentality approach (described below) this paper examines Canada’s Chemicals Management Plan to:

- i) explore how and whether shifts towards multi-stakeholder engagement are resulting in different risk governance subjectivities, knowledge inputs, techniques, and outcomes
- ii) explore how risk assessment and management deliberations are enacted within broader neo-liberal political-economic contexts to improve understandings of how and why particular governance practices and norms are transformed, while others remain resistant to change, and
- iii) identify related implications for the sustainability and equity of decision-making processes and outcomes

Launched in 2006, Canada’s Chemicals Management Plan (CMP) is dedicated to improving health and environmental protection from a wide range of potentially hazardous existing substances through a scientific program of risk assessment and management aimed at reducing

adverse exposures (Government of Canada, 2010). A comprehensive review of existing substances is also now underway through the Registration, Evaluation and Authorization (REACH) program in Europe. These efforts reflect broader global commitments to achieve sound chemical management by the year 2020 as proclaimed under the “Strategic Approach to International Chemicals Management” framework which endorses transparency, public engagement and multi-stakeholder collaboration to achieve effective and efficient chemical governance (UNEP & WHO, 2006). Accordingly the Government of Canada has committed to working with stakeholders and making information publicly accessible to enable civic engagement and commentary on risk assessment and management decision-making processes (Government of Canada, 2010). Canada has become a global leader in developing strategies for collecting and evaluating an unprecedented amount of information and data required for the systematic assessment and management of existing substances. We interrogate the techniques, rationales, practices, roles and expectations, driving these processes, to understand how chemical risk governance is being constituted in Canada, potentially setting precedence internationally. This is particularly true due to bilateral efforts with the EU, US, and Australia, and international efforts under the Organization for Economic Cooperation and Development (OECD), to share workloads, exchange data, and harmonize assessment and management approaches so that no country is placed at a competitive economic (dis)advantage (“Gordon”/government regulator).

This paper focuses primarily on the perspectives and experiences of environmental and health NGOs involved in the CMP, and their interactions with governmental, industry and scientific stakeholders. While industry perspectives are touched upon throughout as a point of contrast, a detailed analysis of industry engagement is beyond the scope of this paper. Given that the status quo in managing risks from existing substances is unfettered market access we

concentrate on identifying and explaining whether, how, and the degree to which NGO input and involvement is resulting in tangible risk governance transformations.

Our analysis is informed by reviews of government policy, background and legal documents, in addition to evaluation reports, position papers, web-sites and list-serves from key NGO stakeholders engaged in the CMP. Participant observation of international stakeholder and expert meetings, and national webinars on the Chemical Management Plan (CMP) process provided additional sources of information. Finally, 13 key informant interviews were conducted with government, industry, environment and health NGO representatives, and scientists. We employ a discourse analytic approach and draw upon stakeholder narratives to demonstrate how policy problems are understood and how underlying rationales and assumptions enact particular perspectives, values, identities, relationships, interests and actions (Gee, 1999; Hajer & Verteeq, 2005).

In the first section we discuss and justify “governmentality” as our analytical lens along with previous works that have examined how “risk” is used to govern populations in specific ways that align with particular political objectives and values. Section two provides insight into the subjectivities and identities of NGO stakeholders involved in the CMP process and how these in turn perpetuate particular boundaries of expertise and forms of knowledge production (Edge & Eyles, forthcomingA). In section 3 we highlight the techniques, tools and approaches that have thus far become most prominent within Canada’s CMP program in an attempt to clarify which “governmentalities” are being fostered and/or relegated in chemical management practice. We then conclude with a discussion of how prevailing governmentalities relate to broader societal and political-economic ideals.

1. Risk as a Mode & Mentality of Governance

The seminal work of Beck's "risk society" (e.g. 1992, 2006) postulates that universal, high-consequence risks that threaten human and ecological health have become a defining feature of industrialized, technologically advanced, capitalist societies and hence a central object of governance. He and others argue that struggles over the ability and power to define, manage, and distribute risks has "replaced the distribution of wealth as the central axis of conflict in contemporary society" (Best, 2008, p.258). Others, drawing upon the concept of "governmentality" shift attention away from risks *themselves* as objects of governance towards the underlying mechanisms, techniques and rationalities through which risks are defined, managed and distributed (e.g. Dean, 1999; Best, 2008; Pidgeon & Butler, 2009), or the specific ways through which "risk" is used to govern and discipline populations (Zinn, 2006; Pidgeon & Butler, 2009). Various tools or techniques serve to structure and manage the conduct of citizen populations through "calculative rationalities" that deploy statistical and probabilistic modes of reasoning to simplify and quantify complex problems so that they become more tractable (Rose, 1999; Pidgeon & Butler, 2009). For example, risk assessment, seeks to identify in predominantly quantitative terms, the likelihood and severity of potential consequences from a particular action, occurrence or exposure so that appropriate management responses can be generated (Turnheim & Tezcan, 2010).

Governmentality then is concerned with the "*how*" of governing, or how conduct and beliefs are shaped through the enactment and perpetuation of dominant rationales that enhance the legitimacy of particular principles, policy objectives or programs (Kothari, 2001; Zinn, 2006). This includes:

- i) the mechanisms, technologies and tools through which authority and decisions are exercised,
- ii) the episteme of government or acceptable forms of knowledge, expertise and evidence employed/rejected,
- iii) the subjectivities through which governing operates (i.e. identities, capacities, roles and attributes of those who are to govern and be governed), and
- iv) how all of the above relate to broader societal values and goals

(Foucault, 1991; Dean, 1999; Agrawal, 2005; Rutherford, 2007, Turnheim & Tezcan, 2010)

Risk rationales or governmentalities have been linked to broader neo-liberal objectives and ideals that include “governing at a distance”, dismantling the welfare state, minimal regulatory intervention, an emphasis on efficiency, consumer choice, personal responsibility, “good citizenship”, and market mechanisms (e.g. Rose, 1999; Rose, 2000; Masuda et al, 2008). Interrelationships between risk and neoliberalism have been explored within various contexts including private insurance, health systems management, biomedicine, the penal justice system, (see Foucault, 1975; Zinn, 2006; Rutherford, 2007), and to a lesser yet increasing extent within the context of environmental health risk governance. Examples include the regulation of organic agriculture (Gibbon, 2008), reducing risks from greenhouse gas emissions (Pidgeon & Butler, 2009), and toxic chemicals through management initiatives focused on “green” or “precautionary” consumption that direct responsibility away from the state and towards “citizen-consumers” (MacKendrick, 2010). Shostak (2004) raises concerns over trends in environmental health research and governance that are shifting the responsibility of risk reduction away from polluters and onto adversely affected individuals as expectations grow for “responsible subjects” to engage in biomonitoring, chemo prevention or lifestyle modifications. She emphasizes the intimate relationship between particular kinds of knowledge production, power relations, modes

of subject-making and approaches to environmental health risk decision-making, arguing that an individualized focus on risk has implications for how scientific research is conducted, and interpreted to justify decisions in regulatory settings (2004). Individualized risk management has been criticized as “a corollary of the inability of institutions to tackle complex contemporary hazards through existing legal, political, economic and scientific systems; and as merely a means for diverting accountability while facilitating the continuation of existing arrangements and of the hazards produced through them” (Pidgeon & Butler, 2009, pg. 680; see also MacKendrick, 2010).

A governmentality lens assists in contributing to these discussions through linking widely espoused normative principles of collaborative, multi-stakeholder engagement to specific and situated practices and techniques of power enacted by various actors in real empirical settings. For our purposes it allows an interrogation of whether the increased engagement of NGOs is resulting in a redistribution of influence, knowledge and authority in chemical assessment and management practices, and ultimately the social (re)distribution of risks and benefits. We extend these discussions by attempting to address “the dearth of analytical attention paid to how deliberative processes and institutions emerge, function, succeed and/or fail, and relate to the real politik of their contexts and conditions of enactment” (Hobson, 2009, p. 176). In other words, as Hobson goes on to explain, while much attention has been paid to the “internal conditions” of multi-stakeholder deliberations less emphasis has been given to their position within, and ability to affect, the political and economic milieu (2009).

2. Shaping the conduct of NGOs: subjectivity & the enrollment of the “good” stakeholder

In addition to enhancing citizen influence and confidence in governance processes and outcomes, incorporating the perspectives and expertise of diverse stakeholders into risk decision-

making is purported to be instrumental in identifying better methodologies, unaccounted for variables, value judgments upon which scientific standards (e.g. statistical significance) are based, upstream environmental and political causes, and standards of best practice (Jasanoff, 2002; Gibbon, 2008; Pidgeon & Butler, 2009; Harrison, 2011). In other words stakeholder engagement is thought to be an essential component of legitimating the regulation and/or de-regulation of “the governed” (Schumann, 2007). In this light multi-stakeholder forums and processes can be viewed as “technologies of power” whereby government and regulatory institutions extend their reach through enrolling “good” stakeholders in ways that enact particular forms of participation, expert advice, conduct and citizenship with the aim of creating a collective amenable to specific forms of intervention (Hobson, 2009; Konefal & Hatanaka, 2011).

This requires that stakeholders be both *able* and *willing* to engage and articulate their beliefs and policy preferences within the confines of prescribed mechanisms and timeframes imposed by government. Stakeholders who engage in constructive ways, particularly those congruent with dominant regulatory rationales, are rewarded with so-called influence over the regulatory process (Gibbon, 2008). The remainder of this section provides insight into the subjectivities and identities of NGO stakeholders involved in the CMP process, including characteristics that were self-ascribed, attributed by others, and resisted, and how this might link to particular kinds of knowledge production and boundaries around expertise.

Industry and environmental groups became particularly engaged in chemicals management reform during the time that the Canadian Environmental Protection Act (CEPA) was being developed and implemented in 1988. This engagement grew throughout the 1990s as the Act underwent review and revision resulting in a modified version being adopted in 1999

(CEPA, 1999). CEPA, 1999 would later become the legislative foundation underpinning Canada's Chemicals Management Plan (CMP). The nature of NGO engagement has, and continues to undergo, continuous negotiation and evolution since Canada began the task of systematically addressing existing substances in use prior to environmental legislation being in place. The early stages of this process involved a governmental review and "categorization" exercise of the 23,000 chemicals listed on its Domestic Substances List, many of which were known or suspected carcinogens, neurotoxins, developmental toxins and endocrine disruptors (Tilman, 2010). This was done to establish risk assessment and management priorities. Health Canada was responsible for identifying substances that had i) the greatest potential for exposure to the general population in Canada, ii) substances that were persistent, iii) bio-accumulative and/or iv) inherently toxic to humans. Environment Canada utilized the same criteria to categorize substances with respect to potential risks to non-human organisms (Government of Canada, 2007a; Environmental Defence, 2011). A technical advisory group comprised of industry representatives and independent experts was established by the Government to assist in this process. Notably, NGOs were reportedly not initially invited to be a part of this advisory group and it was not until after they submitted a formal letter to request their participation that they were allowed to sit in on the process:

"There was a perception that the NGO role was limited to certain aspects of that process. We tend to disagree with that. We think that even if it's a technical issue, the ability, the opportunity should be there, and should be given to allow for public interest groups to participate so that there's a level of transparency and accountability. And to allow us to find the appropriate person to provide that technical expertise and respond around the issues that we see. Otherwise questions come up at the end in terms of the adequacy of the approach" ("Tonya"/environmental NGO)

As will be discussed, NGO groups were granted access and the government has adopted various strategies to enhance their engagement. However, issues remain around contested definitions and subjectivities of expertise, and by extension the capacity and accessibility

attributed to NGOs and other members of civil society to engage in deliberations around the more technical elements of the CMP process.

The categorization exercise resulted in the identification of approximately 4300 chemical substances in need of further attention such as screening assessment, additional research and surveillance, and potential management measures to control their use or release. All of this is currently being addressed under the Chemicals Management Plan. The review of the 200 highest priority substances was recently completed in sequential fashion under the “Industry Challenge” program (details of which are explored in section 3) (Environment Canada, 2010). The Government established processes through which both stakeholders and independent experts could offer input into the implementation of these programs and exchange dialogue on concerns surrounding assessment and management processes (Government of Canada, 2010). This included a Stakeholder Advisory Council (comprised of Aboriginal bodies, Consumer Groups, Environment & Health NGOs, Industry Associations), and an independent expert panel called The Challenge Advisory Panel (see Edge & Eyles, forthcomingA). In addition to these forums stakeholders can petition the Government for face-to-face bilateral discussions.

NGOs, particularly a few key organizations extremely active in the CMP, have “enrolled” in various stakeholder roles and expectations including serving as representatives of the public interest, undertaking public outreach initiatives around risk communication, in addition to acts of scientific, policy and legislative knowledge translation (“Kassandra”/environmental NGO; “Beverly”/health NGO; “Anita”/health NGO; “Tonya”/environmental NGO). NGOs have increasingly become involved in establishing a scientifically-based list of priority health effects and exposure concerns to focus on within policy reforms directing customized advocacy work

towards both the public and policy makers (“Beverly/health NGO; “Kassandra”/environmental NGO):

“My role has been to do that sort of research and writing...all that foundational stuff, pouring over the evidence, summarizing it, and then being involved in developing the broader partnerships, the summary materials, factsheets, brochures...lots and lots of outreach stuff, working with service providers...and there’s a big challenge of making this information accessible to the general public because it’s very complex, but we’ve made a lot of headway. I think the fact there’s been additional policy reform, especially in product safety, nowhere near enough, but there has been movement in that direction is because of that public awareness (“Kassandra”/environmental NGO)”

Various NGO representatives stressed that it has become expected for them to generate the public or ethical pressure necessary for challenging the status quo use of chemicals in commerce and triggering regulatory change that is more health protective. Some expressed reluctance around this ascribed role or frustration that this burden is seemingly disproportionately placed on their shoulders in comparison to government:

“When we meet with them (government), we often find that they too share our concerns but loathe to do anything about it when there’s no public support. And this is what I’m finding all along, it’s almost like they’re scared to death of regulating. And I keep saying to them, you’re the regulators...do the right thing. Don’t expect us to go out and beat the bush and get the public all upset, and pushing, pushing, pushing. But that seems to be the way it works” (health NGO/BM)

An interview with a senior government official indicated that there may be *some* agreement with these assertions. For example, they were discussing how global or economic trade issues often dictate the feasibility of proposed risk management initiatives. When subsequently asked whether it is the job of government or NGOs to exert additional pressure their response was:

“I think everybody has a role to play. But I appreciate NGOs being at the table because they’re an active force against industry and they can sometimes put points out there that I’m not in a position to do” (“Kimberly”/government regulator)

While government representatives expressed their commitment to maintain a position of neutrality between opposing stakeholder interests (“Gordon”/government regulator; “Kimberly”/government regulator; “Corrine”/government risk assessor), this can be viewed by NGOs as perpetuating the status quo that is ultimately favourable to industry interests.

Many of the NGOs have made it a priority to enhance their capacity to identify and interrogate data gaps and quality within the Government's risk assessments. Some of the larger NGOs not only seek to build technical capacity within their own organizations, but also leverage capacity and coordinate engagement at broader networked levels to enhance stakeholder and civil society influence more generally. For example, the government desires timely, efficient and evidence-based input into the CMP or criticism that is grounded in science (Tilman, 2010). Yet the technical literacy and pace of activity that this demands of civil society seeking to enroll in this process can be extremely challenging. In an attempt to address this barrier to engagement, a three year contract called the "CMP Capacity Building Project" was developed in 2007 between Health Canada, and the Canadian Environmental Network (CEN) (which facilitates the networking of environmental NGOs and consultations with the federal government), in partnership with Environmental Defence (a national NGO). The objective was to "enhance civil society capacity to participate in the CMP process and better respond to Government's work through increased accessibility, evidence-based platform submissions and opportunities for stakeholder collaboration" (Tilman, 2010). Environmental Defence was contracted to provide the scientific expertise required to analyze and summarize Governmental risk assessment and management reports. They then provided recommendations on key issues that other NGOs could focus on when commenting to the Government on how their policy conclusions should be modified for improvement. A publicly accessible website and list-serve was managed by the CEN and circulated amongst a range of environmental and health NGOs and individuals seeking information on the CMP (Tilman, 2010).

Despite efforts to enhance technical capacity in some instances NGOs and their staff working as senior scientists and knowledge translators continue to be dismissed when they lack scientific credentials which can perpetuate their marginalization within technical deliberations (see Edge & Eyles, forthcoming):

“I’ve never been able to afford to go back to get either a Masters or a Phd, but as far as I’m concerned I’ve got several of them in terms of the work that I’ve done...I’ve been doing 40, 50, 60 hour work weeks for twenty years, the prospects of going back and getting the credentials that would confirm that I can do what I already do... I’m not going there. But it is an issue. I do get dismissed by snobby academics because I don’t have the credentials they have, but I know what I’m capable of, and I don’t care anymore. But it bothered me for a long time”
(“Kassandra”/environmental NGO)

Some independent scientists and industry stakeholders believe that the advocacy work that NGOs are engaged in can undermine their scientific credibility (“Trevor”/industry scientist/government advisor; “Joseph”/industry representative; “Garreth”/industry representative; “Wade”/academic scientist):

“They’re trying to take extremist positions to get the public worked up over things and may not be as concerned about the science, they’re just making noise and concerned with getting revenue, contributions for their causes and that sort of thing” (“Joseph”/industry representative)

On the other hand, NGO representatives also talked about how they have built up a great deal of credibility due to the time and effort put into doing the foundational research and getting scientific facts straight which is resulting in them being taken more seriously by industry and government:

“Of course there are always the people that just want to dismiss it. But that has changed dramatically over the last 25 years. The credibility we’ve built up is so important, I’ve said this so many times about NGOs, particularly my own, but all we have is our name. So we don’t mess with it. You have to get your facts straight, and you admit when you’re wrong or you don’t know something. That’s where credibility comes from, because once you screw up, you’ve lost it. It’s so hard to get it back” (“Kassandra”/environmental NGO).

The fact that science can be an unreliable ally for NGOs seeking to shape environmental governance has been widely documented (e.g. Brown, 1992; Corburn, 2002; Eden et al, 2006; Harrison, 2011). Consequently, many of the more resourced NGOs involved in this particular

case and others engaged in broader environmental governance reform nationally and internationally, are increasingly responding to these credibility challenges by employing more people with recognized scientific training (Tamiotti & Finger, 2001; Eden et al, 2006). NGO representatives articulated this as being key to addressing one of their primary stakeholder responsibilities which is to enhance the technical capacity of the public to understand what is most important to address within policy reform so that their health and the environment becomes better protected:

“I’m looking at, understanding and summarizing associations between early environmental exposures and chronic disease, so...epigenetics...lifecourse epidemiology...So for each...cardiovascular disease, diabetes, alzheimers disease, parkinsons disease, respiratory disease, and endocrine weaving all the way through all of them, you know what’s the evidence in terms of early exposures and associations with those chronic diseases...So which health effects ...which exposures are of greatest concern from the evidence, so again, lead, flame retardants, the legacy stuff, the organochlorine pesticides, the PCBs, BPA, phthalates. You know, it’s a long list...but it is a focused list” (“Kassandra”/environmental NGO)

“I would say that is what Environmental Defence did...I think for those with the ability to hire staff, yeah...Pollution Probe, Canadian Environmental Law Association, EcoJustice, David Suzuki Foundation, Canadian Partnership for Children’s Health & the Environment” (“Tonya”/environmental NGO)

NGOs have also demonstrated concerted effort to re-cast what was previously by and large defined as an environmental debate, as one centered around health concerns. In other words, a reshaping of their subjectivity, influence and expertise through efforts to strengthen their credibility through a broadening of epistemic communities (Eyles et al, 2009) and advocacy coalitions (Jenkins & Sabatier, 1994) engaged with issues of environmental protection and product safety This has been achieved through targeting and aligning with powerful health interest groups, organizations and service providers that assist in enhancing the public and political profile of chemical management:

“I have chosen in the last ten years to predominantly work with those health groups, rather than other environmental groups. I got very frustrated over however many years of preaching to the choir. You go to these meetings and you’re with a bunch of environmental groups that don’t represent a lot of people. And some of them are flakes, certainly not all of them. When it’s the health groups and environmental groups talking together, and the lawyers and the child care groups it’s not only reaching a different audience, but people are taking notice of what

we're saying because of the credibility and the interesting mix there. I want to be more effective... So like the Canadian Pediatric Society, The Ontario College of Family Physicians, Ontario Public Health Association, Toronto Public Health Association, its an AMAZING list. And then all the groups in the Ontario Chronic Disease Prevention Alliance, so the Cancer Society, the Lung Association. People pay attention where there's that kind of group talking. So it's a good strategy" (Kassandra)/environmental NGO)

The strategic enrollment of health interest groups into environmental NGO networks has placed additional pressure upon the government to apply the precautionary principle more liberally to protect human health:

"Exercising precaution is a function of the risk. I would take a highly precautionary approach when it comes to dealing with babies versus polar bears. I hate to say that but at the end of the day the risk is much, much greater... So in my mind, you don't play too much, you exercise precaution much more given the human consequences than you would say with you know a substance showing persistence in benziic organisms" (Gordon)/government regulator)

Coordinated outreach and engagement with health groups has also pressured the government to produce and commission more human bio-monitoring and exposure data which is significant given risk assessments are determined based on *existing* weight of evidence. In other words, the episteme of knowledge production and the evidence-base upon which decisions are made is being reconfigured in part by network expansion and broader NGO pressure, albeit in ways that signal a deeper enrollment in scientifically reductionist approaches to managing adverse effects from chemical production, use and exposure.

"We were influential I think in getting the biomonitoring program off the ground and some of the smaller projects. If you look at the CMP website there is a list of research things that are going on that the feds are funding... individual biomonitoring, some of the cohort, or longitudinal studies. A lot of those are happening because of us pushing. They might have happened anyways, but we helped. You push from the outside, they push from the inside, it sort of helps it along. That's why you have good relationships with people on the inside" (Kassandra)/environmental NGO)

Government representatives indeed spoke of various instances where specific technical NGO input resulted in them re-thinking some of their decisions and processes, and how this kind of input is more useful to them than general normative comments outlining a fundamental opposition to their decision rationales ("Corrine"/government risk assessor; "Kimberly"/government regulator). Nevertheless, tight boundaries placed around that which is

constituted as technical expertise and a lack of transparency around scientific details and value judgements wielded within assessment methodologies (e.g. with respect to data quality, estimating margins of safety and exposure, etc.) continue to impede democratic and stakeholder scrutiny of norms and assumptions built into the assessment process (see Edge & Eyles, forthcomingA).

“This is the kind of information that we would like to see... So going back to the principles of what’s engrained in CEPA. If you’re promoting pollution prevention, if you’re applying the precautionary approach, and if your intent really is to prevent rather than have to only typically be reactive, are you doing that with the approach you’re taking?...And even within consultations the discussions never really focus on the technical stuff... The Government really doesn’t want to revisit those issues” (“Tonya/environmental NGO)

In some cases, the Government’s tight control over access to information is limiting the ability of NGOs and civil society to obtain and understand the technical *details* perhaps most necessary for invoking real regulatory change. This also serves to help ensure that risk continues to be ascertained predominantly through conventional reductionist and expert-driven means that attempt to make risk management tractable despite the presence of significant scientific uncertainties that force normative judgement calls to be made. Moreover, as discussed in *Nature* one of the world’s most prestigious science journals, since Prime Minister Stephen Harper’s Conservative Party won power in 2006 there has been a gradual tightening of media protocols for federal scientists and several documented instances of scientists being “muzzled” or prevented from discussing or explaining the details of publicly funded research (Editorial, 2012). Given that the “good” stakeholder is expected to engage through formal submissions grounded in scientific evidence, such transparency limitations perpetuate the marginalization of NGO input and expertise.

A lack of technical capacity (e.g. expertise in toxicology, biochemistry, epidemiology, etc.) and resource constraints further exacerbates these challenges (“Beverley”/health NGO;

“Tonya”/environmental NGO; “Kassandra”/environmental NGO; “Anita”/health NGO). Many groups argue that the financial resources available to support the participation of civil society are very limited relative to the time needed to understand and invest in the CMP which can make it difficult for some to justify participation to their organizations. For example the budget of the Capacity Building Project was a mere \$17,000 which mostly covered honorariums for those making submissions regarding Batch assessment decisions (CEN, 2011). Consequently, many NGOs lack the resources to pay staff to engage in research, consultations and commentary. The fact that so many chemicals were reviewed under such tightly imposed timelines makes the task of reviewing the technical documents, laws, policies and regulations framing the risk assessment/management process even more onerous particularly when risk management proposals and reversals of previous decisions began to come forward. The process was too fast for NGOs to be enrolled in engagement processes in what they would characterize as meaningful ways (Tilman, 2010; “Tonya”/environmental NGO; “Beverley”/healthNGO).

Others have also pointed to similar techniques (e.g. accreditation, selective participation, subsidization, data accessibility, etc.) used to control the subjectivity and influence of governance stakeholders (Tamiotti & Finger, 2001; Masuda et al, 2008). We argue that this assists in perpetuating particular kinds of chemical risk assessment and management tools, rationales and approaches that in many ways are supported by, while mutually reinforcing, broader neo-liberal political-economic ideals and interests. Such strategies and rationales may not always be entirely deliberate on the part of all government actors, and instead be more of a reflection of customary, taken-for-granted, hegemonic practice and/or efforts to maintain a process that is manageable.

3. Constituting the practices and rationales of risk governance: techniques, tools, and approaches within a neo-liberal agenda

This section highlights the “Industry Challenge”, a key component of the CMP dedicated to reviewing the 200 highest priority substances. We pay particular attention to the assessment techniques and management approaches that have become most prominently drawn upon. We also discuss NGO perspectives in regards to the Industry Challenge’s strengths and weaknesses and their recommendations on how chemical governance policy could be improved. We conclude the paper by attempting to draw connections between i) stakeholder subjectivities and capacities, ii) the rationales or tools/techniques most commonly taken up thus far in the CMP, and iii) how these prevailing “governmentalities” are connected to broader neo-liberal political and socio-economic ideals.

Risk Assessment

Many of the “Challenge” substances had little to no published data available on key health endpoints when previously reviewed under the Categorization exercise for the Domestic Substances List which resulted in their classification as high-priority. The Industry Challenge was an attempt to address this problem through the Government issuing voluntary questionnaires and mandatory surveys to chemical manufacturers, importers and industrial users to provide any information they possessed on chemical properties, uses, imports, releases, and toxicology and exposure data that would inform their screening risk assessments (Government of Canada, 2010). Industry could request that any information submitted be held in confidence and not released to the public or NGO stakeholders to protect proprietary interests (Tilman et al, 2010). In addition to the significant dependency on industry data, the Government also utilized peer reviewed scientific literature and reviews from other jurisdictions to inform their assessments. In an

attempt to fill remaining data gaps the Government used several predictive methods including computer models (to estimate parameters), chemical analogues, and exposure estimation tools to determine industrial releases and environmental concentrations (Government of Canada, 2010). Nationally and internationally through the OECD, a significant amount of resources are being invested into developing these new tools for risk assessment that are intended to fill data gaps in ways that enhance throughput or the pace of review for a high volume of chemicals.

Under CEPA 1999 the Government is mandated to apply a “weight-of-evidence” approach and the precautionary principle with the burden of proof intended to rest on industry’s shoulders for Challenge substances as they are to be classified as CEPA-toxic unless convincing evidence suggesting otherwise is provided (CEPA, 1999; Scott, 2009; Edge & Eyles, forthcoming). A substance is “toxic” under CEPA if it is entering or may enter the environment in a quantity that i) may have an immediate or long-term harmful effect on the environment or its biological diversity; ii) may constitute a danger to the environment on which life depends; or iii) may constitute a danger in Canada to human life or health (CEPA, 1999). In other words, assessment determinations of toxicity are *exposure* driven, not based on *inherent* hazard. Upon completion the Government makes the results of their screening assessments publicly available in draft form providing a 60-day time period for commentary. After receiving input and if deemed necessary the Government incorporates additional revisions into their final screening assessment reports (Environment Canada, 2010).

Throughout the duration of the Challenge program via consultation processes and submitted commentaries NGOs consistently voiced several concerns about assessment techniques and processes. Many of these related to how uncertainties and data gaps were being dealt with. Existing data gaps acknowledged by government include being able to accurately

determine persistence, bioaccumulation and inherent hazard/toxicity (PBiT); sources, routes, and concentrations of exposures; cumulative effects from multiple substances, and the relevance of results from animal studies with respect to human toxicity (Tilman & Madray, 2009; Lewis, 2011). As mentioned earlier, NGOs are concerned about a lack of transparency or detailed explanations provided on how precaution is employed when estimating margins of safety and exposure in the face of these uncertainties (discussed in Edge & Eyles, forthcomingA). Even when uncertainties are noted within risk assessment documents proposed conclusions do not necessarily err on the side of precaution in ways that privilege public health protection over economic restrictions (Tilman et al, 2010; “Tonya”/environmental NGO). For example, a number of assessments concluded that confidence in toxicity data is moderate or low and further studies are required to reduce uncertainty. Nevertheless, despite the burden of proof being legislated onto industry for Challenge substances the majority of assessments concluded that the chemicals evaluated do not meet the criteria for CEPA-toxic (Tilman et al , 2010; Lewis, 2011). Many have argued that the mandatory surveys requiring industry to submit information in their possession and voluntary questionnaires are not effectively addressing existing data gaps, especially with respect to toxicity, which makes it difficult to draw well-supported conclusions around CEPA-toxicity (e.g. Tilman et al, 2010; “Tonya”/environmental NGO; “Beverly”/health NGO).

Under Section 71 of CEPA 1999 the Government has legal authority to demand the generation of any toxicological tests that may improve an assessment (CEPA, 1999). However, up to this point they have not invoked those authorities (“Gordon”/government regulator; “Corrine”/government risk assessor; “Beverley”/health NGO). Through formal commentaries, bi-lateral discussions and notices of objection NGOs have criticized the Government for failing

to adequately utilize measures under Section 71 to improve information on endocrine disruption, carcinogenicity, neuro, reproductive, developmental and geno-toxicity or PBiT to enable sound risk management measures protective of human health and the environment. They also argue there has been no clear explanation on the part of the Government as to why they have thus far failed to do so despite repeated requests for explanation (“Beverley”/health NGO; “Tonya”/environmental NGO; Tilman et al, 2010). Many believe that the European Union’s REACH program is a more health protective model that should be followed in Canada as it asserts a “no data no market” mantra whereby industry must submit minimum data requirements including information on toxicity to maintain market access (European Chemicals Agency, 2012). During interviews government representatives offered various explanations as to why they had not used their powers under CEPA to their fullest extent. One risk assessor stated that for most of the Challenge substances they believed they had enough data to make defensible decisions without having to place further burdens on industry (“Corrine”/government risk assessor). A government manager discussed the socio-economic trade-offs between a full audit versus a more “efficient” streamlined approach:

“Candidly REACH took a very much polluter pay approach, in other words the full burden is going to rest with industry when it comes to providing information. But, with very few exceptions, industry is also doing their own assessments, control measures and self-policing... In Canada, that would NEVER be accepted by the public...Also who bears the burden of generating data when a substance has been in commerce and it’s not protected by patent?...In Canada we’re doing what I would characterize as a middle of the road approach, and that is we still maintain the full burden on industry when it comes to new substances...When it comes to existing substances, if it’s high risk, industry is to give me the data they have, and if they don’t give me anything better than I have right now I am going to declare it toxic, its reverse onus. On some of the lower risk substances we have basically said we will continue to honour the past, what I call social contract with industry, where government bears the burden of proof on existing substances. We’ve balanced it a bit (“Gordon”/government regulator).

This government representative went on to explain that adopting a full auditing approach raises questions over the law of diminishing returns stressing that the European Chemical Agency (ECHA) has nearly 500 people undertaking spot audits on just 5% of the substances which would likely compare in costs to the entire budget designated to researching, monitoring, and

assessing ecological risks for all chemicals under the CMP (“Gordon”/government regulator). Hence the effectiveness of stricter data generation expectations under REACH remains to be seen as the program is further implemented. However, a recent evaluation conducted by the ECHA suggests that the vast majority of information dossiers submitted by industry prior to the December 2010 deadline under REACH remain inadequate based on their audit of roughly 5% of the 25,000 submitted. Some NGOs claim this shows REACH’s current system of compliance monitoring is not working as dossiers only have to pass a computerized completeness checklist to ensure continued market access which does not account for data adequacy/quality (Chemistry World, 2012).

Addressing data gaps and uncertainties is a monumental, resource-intensive challenge. Hence the balance between the efficient and effective use of resources is constantly being weighed. Government representatives did indicate that Canada is considering becoming more aggressive with industry to generate data within the second phase of the CMP dedicated to evaluating “medium-priority” substances as industry has now had more time to adapt to these expectations, and so the program more closely aligns with REACH and public feedback (“Gordon”/government regulator; “Corrine”/government risk assessor). However, NGOs remain concerned that the precedent for fast but not necessarily thorough screening assessments may have already been set and that more investment is being put into generating high throughput predictive models as opposed to toxicological data for individual substances (Tilman & Madray, 2009; “Beverley”/health NGO). This concern is further substantiated by government comments confirming where risk assessment research dollars are predominantly being invested:

“Recognizing that we can’t conduct in-depth substance-specific research on all 3000 chemicals we need to assess over the next decade the research is focused more on developing high throughput assays and models and risk assessment approaches generally, rather than additional data generation for each of those chemicals”
(“Corrine”/government risk assessor)

Another related issue raised by NGOs is the fact that risk determinations and definitions of “CEPA-toxic” are exposure-driven. That is, a substance can be found “non-toxic” because of low-likelihood of exposure even if it presents a high hazard of toxicity to human health (Tilman & Madray, 2009). NGOs argue that when a chemical demonstrates inherent hazard attempts should be made to phase it out. The limitations of a weak exposure data-base due to uncertainties around concentrations in the air, water, soil and consumer products are underscored (“Beverley”/health NGO), along with scepticism over the adequacy of safety margins applied within individual studies and broader assessments (“Tonya”/environmental NGO). Yet the Government maintains that they have to operate based on risks of exposure to maintain economic competitiveness (“Kimberley”/government regulator) and given global trade commitments under the World Trade Organization. Without scientifically justifying a regulation or other management strategy they would be considered as applying a non-tariff trade barrier whereby industry could take the Government to the WTO court and likely win (“Gordon”/government regulator).

Finally NGOs are particularly concerned about inadequate consideration being given to vulnerable/sensitive populations within risk assessments. The Government’s approach is to estimate potential and likely exposures for the *general* population (Government of Canada, 2010), which NGOs argue does not adequately protect pregnant women, fetuses, infants, young children, women, Aboriginals, people with chemical sensitivities, and workers with occupational exposures (despite the fact that these populations are known to be particularly vulnerable and sensitive to adverse exposures) (Tilman & Madray, 2009; Tilman et al, 2010; Lewis, 2011; “Beverley”/health NGO; “Kassandra”/environmental NGO; “Anita”/health NGO; “Dorothy”/academic government advisor; “Tonya”/environmental NGO).

Many of the assessment techniques and tools align with neo-liberal goals of ensuring that resources are used “efficiently” and that commitments to complete the review of a large volume of chemical substances within a very tight timeline are met. Toxicity determinations largely driven by exposure estimations as opposed to hazard data enable the continued use of chemicals with emphasis placed on *managing* exposures as opposed to working towards phase-out and/or the adoption of safer alternatives (a rationale in line with minimal regulation). Further it can be argued that failing to invoke powers under CEPA to enforce the generation of toxicity data is in many cases contributing to an “absence of evidence” being regarded as “proof of an absence of harm” (“Beverley”/health NGO). This is reflected by the fact that the existing weight-of-evidence for many substances is determined not to be sufficient to support a conclusion of CEPA-toxic, despite the burden of proof being legislated onto industry under CEPA 1999. Of the 193 high-priority substances assessed under the “Industry Challenge” only 23% were concluded to be CEPA-toxic (Environmental Defence, 2011). Many NGOs are concerned given all 193 were originally categorized as high-priority on the Domestic Substances List due to their potentially persistent, bioaccumulative, or inherently toxic nature (PBiT). In this light, precaution could be viewed as erring on the side of protecting economic interests over public and environmental health. Additionally, exposure assessments based on the “general” population may not adequately address the real impacts of current processes and patterns of chemical production and use if those most vulnerable under those very conditions are not adequately accounted for. Consequently concerns remain over the CMP’s ability to adequately protect public health and the environment (e.g. Tilman et al, 2010; Lewis, 2011).

Risk Management

A determination of CEPA-toxic obliges the Government to develop risk management instruments which can include regulatory measures such as prevention, control, reduction and/or elimination of use, as well as non-regulatory measures such as future use notifications, further information gathering, monitoring, etc. (Environment Canada, 2010). There has been a significant trend towards issuing Significant New Activity Notifications (SNAC) provisions as a risk management tool for a number of chemicals under the CMP that meet the criteria of being PBiT, *but* are low volume substances not currently in commerce in Canada or industrial activity is below the reporting threshold of 100kg (Lewis, 2011). SNAC provisions under CEPA 1999 require that persons planning to manufacture, import or use a particular substance submit additional information on its proposed new use so that it can be re-assessed to determine whether it might be released in amounts or conditions that would result in the chemical becoming CEPA-toxic thereby requiring management (Environment Canada, 2010b). SNAC provisions have been applied to roughly 30% of substances, with no risk management actions proposed whatsoever for just under half of the remaining priority substances also found not to meet the criteria for toxicity (Tilman et al, 2010; Environmental Defence, 2011). NGO evaluations report that the number of substances found CEPA toxic decreased dramatically from the first batches assessed onward, while the number of SNAC provisions increased, which may in part be a reflection of increased data gaps and uncertainties as the batches rolled out. Additionally frequent use was made of non-regulatory risk management measures for many of the substances that *were* found to be toxic including “future use notifications” or addition to the “Cosmetic Hotlist” (an administrative list aimed at manufacturers that currently lacks comprehensive regulatory power). Future use notifications are applied when exposures to a substance are expected to be low. NGOs are critical of this approach as little to no information has been released for public review on how the

government intends to implement such an approach in terms of scope, process or provisions (Tilman et al, 2010; “Beverley”/health NGO). They are also concerned about the 100kg reporting threshold for substances that have SNAc provisions suggesting that this results in inadequate consideration of aggregate effects from multiple users. In addition, some of these substances have been used in consumer and personal care products in the past or may be present in imported products (Tilman et al, 2010; Lewis, 2011) and government and Canadian industry representatives admit that obtaining accurate exposure data for these particular products is especially challenging:

“A lot of the data does belong to the companies that have developed the substance...which is not resident in Canada...the multi-national headquarters are in many cases in Europe, the States or Japan. So getting a hold of that kind of data for the government here is a difficult selling job to parent companies and their suppliers to provide the full test reports, you know its proprietary information, in the sense that the company has a lot invested in developing it...I guess the leverage government has is to declare something toxic and then all of a sudden the company wakes up” (“Joseph”/industry representative)

“Industry here doesn’t know what’s in imported...so we are working with them to get better information on that. I think we had hoped we’d be able to get industry to be more proactive in doing actions so that we would have to do less work, but because we haven’t found too many chemicals that pose problems to take action on, it’s not been enough of a stimulus to get industry to do more than they are currently doing. Also, Canada is an importing country so we only have so much clout” (“Kimberley”/government regulator)

NGOs believe that given the inadequate availability or accessibility of exposure data necessary for justifying a conclusion of toxicity, that rather than applying SNAc provisions to PBiT substances no longer in commerce the government should consider prohibiting or restricting their use, release, import or export as preventative measures (Tilman et al, 2010). This can pose a catch 22 for government given a declaration of CEPA-toxicity itself is instrumental in triggering risk management responses.

When discussing the merits of the SNAc approach some government and industry stakeholders pointed to its importance in maximizing the effectiveness and efficiency of the overall system aimed at governing risks from existing chemical substances. It was argued that

there is no use on spending limited resources on an assessment for a substance no longer in widespread use which considerably reduces the burden of assessing thousands of chemicals in a short timeframe (“Garreth”/industry representative). A senior governmental official discussed how the government has gone from getting approximately 10 substances assessed per year to over 300, a 30-fold increase in productivity stressing that the level of investment from tax payers is fair for the productivity that is put out and the results generated (“Gordon”/government regulator). They went on to state that the Canadian Government:

“took a hell of a great approach for the CMP given the current economic plight of most nations. We ensure that the Canadian industry and economy is still competitive relative to other nations... So we didn’t shift the full burden and cost to industry. And my sense is that as the economy starts to rebound, we’ll start to take a more aggressive polluter pay approach”(“Gordon”/government regulatory)

The Government is “comfortable if SNAC substances remain in low volume and dispersed throughout Canada” (“Gordon”/government regulator) particularly if this translates into savings on expenses associated with detailed assessments and the development and implementation of risk management strategies. While the Government is committed to undertaking market-based surveys to ensure allowable thresholds are not surpassed one could question whether resources for monitoring and surveillance will continue to be readily available if the annual budget for the CMP declines or when the temporary program comes to an end entirely. Similar concerns exist over the ability of the government to uphold its commitment to keep abreast of new data for priority substances as it emerges. The lack of clarity provided on how the government will proceed if new studies come out that were not available at the time of the screening process that shift the weight-of-evidence was also flagged:

“When there are new published data from academic studies, or from chemical programs under other jurisdictions like REACH, it is unclear whether this new information would result in a reopening and review of decisions made under the CMP... We don’t know if they even have a policy of reviewing that, or whether they’re going to wait for NGOs to have to say ‘excuse’ me... because we’re not going to have the time or effort to do that. They should have someone really involved in that... a couple of people at the national level, at least, to keep that afloat”
(“Beverley”/health NGO)

Delaying regulatory measures until more compelling evidence becomes available is seen as favourable to industry, as delays equate to continued and unfettered market access. Nevertheless, government and industry representatives argue that even in the absence of regulatory measures and/or CEPA-toxic designations, industry is compelled to innovate and develop safer alternatives due to market mechanisms and increased public and retail pressure that arise when a substance is even *suspected* as being of potential concern:

“I always like to thank the Grocery Distributing Association. They sat down with their suppliers and basically said Canada has a challenge program, these 200 substances, we don’t care if they’re good or bad, we don’t want to see them on our shelves within two years, are we clear. If you want to maintain market share, you have to clean up your act. For the most part, if you’ve been following the CMP challenges, a lot of them are popping out as not CEPA toxic, because they’re not in commerce anymore, they’re not being used. So in effect, what happens is the retailers or the value chains push the manufacturers into getting their act together, cleaning up their design if you will of their particular substances and products. And I like to say those guys did more just with that threat than I could ever do with a regulation...When we catch our breath I’d like to look at what the savings were to the government by those guys being proactive and good corporate stewards. And that to me is the success of the CMP” (“Gordon”/government regulator)

Following this rationale some government representatives argue that more emphasis should be placed on strategically educating retailers and the public about what is contained within consumer products and what they should be potentially concerned about, as market demand for greener alternatives results in more effective and immediate changes than what government would achieve through costly regulations that take a long time to implement and enforce. While NGOs tend to seek binding regulatory action, many also employ strategies to foster green consumerism in an attempt to pressure retailers and manufacturers to “clean up their act”. Notable examples in the Canadian context include campaigns spearheaded by Environmental Defence aimed at generating public awareness about hazardous consumer goods, personal care products and cosmetics and safer available alternatives (Environmental Defence, 2012).

Indeed, similar to commonly used tools of assessment, prevalent management approaches also generally align with neo-liberal ideals and practices. Extensive use of non-regulatory measures, voluntary initiatives, SNAc provisions, the delaying of regulatory action in the face of uncertainties, dependency on retail pressure and consumer choice all reinforce broader objectives of “efficient” governance from a distance, minimal intervention, and reliance on cost-benefit analyses and market mechanisms.

4. Conclusions

Using a governmentality lens, this paper attempts to interrogate whether the increased engagement of NGOs in chemical governance is resulting in tangible changes to the forms of expertise and evidence underpinning decision rationales, and the techniques of assessment and management most commonly drawn upon to govern chemical use and the social distribution of risks and benefits. Secondly, it attempts to examine how NGO engagement in deliberations over the constitution of chemical governance rules and practices are situated within broader political-economic contexts. We explored how evolving and contested modes of subject-making around NGO expertise and technical capacity in part explain why particular forms of knowledge production and interpretations of “evidence” are adopted while others are downplayed. Prevailing “risk rationales” reinforce, and are supported by, engrained neo-liberal ideals and objectives (e.g. efficiency, governing at a distance, unfettered trade and investment, consumer choice, individualization of risk and market mechanisms, etc.) (Shostak, 2004; Pidgeon & Butler, 2009; MacKendrick, 2010) that circulate through power and production relations between modern administrative states, mega-science and industry (Levy & Newell, 2002; Backstrand & Lovbrand, 2006; Gibbon, 2008).

Neo-liberal “governmentalities” gain saliency through a combination of i) cognisant political and strategic efforts to support and conform to broader socioeconomic agendas, ii) attempts to maintain “manageability” and “tractability”, and iii) inadvertent reinforcements due to taken-for-granted, hegemonic practices becoming engrained and obscured from critical gaze. The degree of fit of neo-liberal “risk rationalities” with existing socio-political conditions plays an important role in their uptake (Pidgeon & Butler, 2009). Efforts by NGOs to exert change to the status quo management of chemicals (e.g. through advocating for stronger regulations, reductions in production, shifted burden of proof, new knowledge practices, greater transparency of technical details, etc.) are therefore embedded within pre-existing relations of power (Levy & Newell, 2002). As others have shown in relation to climate change policy, the scope for change is restricted by liberal political rationalities that favour market based solutions and actions justified by cost-benefit analysis over strictly moral imperatives (Pidgeon & Butler, 2009).

A governmentality lens focused on subject-making, knowledge production and techniques and tools of analysis assists in revealing the difficulties and challenges which may arise for NGOs seeking to institute new practices. For example, various techniques of “enrolment” were identified that aim to control the subjectivity and influence of NGO stakeholders (e.g. accreditation, selective participation, limited subsidization, selective transparency or data accessibility, and staging or strategic control of timelines and other criteria for engagement etc.). Similar techniques have been identified by others who caution that seemingly deliberative practices may provide legitimating cover for business-as-usual (e.g. Tamiotti & Finger, 2001; Masuda et al, 2008; Konefal & Hatanaka, 2011). Given that NGO expertise and influence remains marginalized particular kinds of chemical risk assessment and management tools, rationales and approaches gain ascendancy that in many ways are supported

by, while mutually reinforcing, broader neo-liberal political-economic ideals and interests. Specific examples include practices and research investments that focus on efficient high-throughput assessments, toxicity determinations based on exposure as opposed to inherent hazard, a failure to invoke powers under CEPA to force industry to fill evidence gaps by generating toxicity data, a failure to place the burden of proof onto industry in practice, extensive use of SNAc provisions and other non-regulatory voluntary measures, and reliance on retail pressure and consumer choice.

This paper extends governmentality scholarship and analyses of the “conduct of conduct”. Existing research predominantly focuses on governmental/citizenry relations, and how state regulations and policies impact and shape the conduct and beliefs of the general population (Rutherford, 2007). However, with the increased adoption of multi-stakeholder and neo-liberal processes the boundary between those who govern and those who are to be governed becomes further blurred resulting in multiple sites of governing (Rutherford, 2007; Schumann, 2007). Hence our analysis extends beyond a confined focus on the governed citizenry residing outside of government circles by placing emphasis on governance stakeholder actors themselves as subjects of “enrolment” tactics intended to enact particular forms of participation, fields of action, and conduct that are most likely to align with specific forms of intervention.

This story is not all doom and gloom. Indeed NGOs have cited numerous factors and constraints that need to be addressed if multi-stakeholder, deliberative, precautionary ideals and principles as increasingly espoused in national and international environmental policy are to be genuinely upheld. Despite identified limitations of the CMP, most NGOs still believe it is an important program endeavoring to accomplish the extremely difficult task of timely and systematic assessments for a very large number of substances already entrenched in commerce,

and that, in some cases, it has resulted in precedent-setting risk management measures (Environmental Defence, 2011). Others concede that while a great deal of frustration exists over current factors constraining their engagement and influence, they have gained access to a wealth of information that enhances their understanding of the government's approach on these issues that is extremely valuable for their future strategizing ("Tonya"/environmental NGO). Still others remain focused on, and committed to, positive changes over the long term:

"There's something about the 'gods grind exceedingly slow'. But this is it with environmental issues people say to me don't you get fed up at the lack of success? And I say you know we don't know what our successes are. It's like Chinese water torture, that slowly but surely you're influencing people that you probably don't even know you're influencing. And so hopefully it will all come about" (health NGO/BM)

There is recognition on the part of NGO stakeholders, expert advisors and government representatives that many revelations or "lessons learned" have indeed been gleaned by regulators and risk assessors employed within the *bureaucratic* arm of government as they "learn by doing" gaining beneficial insights from stakeholder input ("Corrine"/government risk assessor; "Gordon"/government regulator; "Steven"/academic government advisor). There is also recognition by many of the governmental employees directly involved in assessment and management processes that they could benefit from further opportunities for deliberation on how to appropriately apply, interpret and operationalize precaution and weight-of-evidence, as many related challenges are unanticipated prior to implementation attempts. The primary concern or question that remains is whether the *political* arm of Government will continue to ensure that the resources and political will remains in place to support ongoing iterative deliberations necessary for accommodating a dynamic evidence-base and refining and enhancing the rigour of governance principles, tools and techniques through adaptive management practices. The fact that the Capacity Building Project, Stakeholder Advisory Committee, and expert Challenge Advisory Panel have been recently discontinued with their funding terminated under the second

phase of the Chemicals Management Plan despite widespread calls to the contrary is very disconcerting. This is indeed reflective of more pervasive trends of efforts to “liberalize” (or gut) environmental policy and legislation displayed by Prime Minister Harper’s Conservative Party.

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CHAPTER 5

Discussion & Conclusions

Introduction

The assessment and management of environmental health risks from chemicals (particularly “existing” substances in commerce prior to comprehensive environmental legislation) can be viewed as an emerging and contested domain of governance whereby multiple stakeholders seek to shape its constituent actors, rule systems and knowledge inputs. This thesis therefore explores how governance and decision-making rationales, knowledge inputs, influence, and authority become established in practice through the socio-spatial disputes and negotiations of stakeholders engaged in chemical management in Canada.

Accordingly, the specific objectives were to:

- i) Examine how political and scientific assumptions, values, beliefs, goals, and claims are socially constructed by different governance stakeholders with respect to:
 - a) conceptualizing environmental health ‘risks’ from chemicals as a policy problem
 - b) determining which evidence and expertise is “legitimate” for informing decision-making, and
 - c) determining which techniques and approaches to use for facilitating policy objectives and interventions
- ii) Examine the role and significance of “space” in constituting chemical governance processes and practices
- iii) Consider implications for the sustainability and equity of chemical governance processes and outcomes

This final chapter summarizes the key findings from the preceding chapters, and identifies the primary substantive, theoretical, methodological and applied policy contributions of the research. The chapter concludes with a reflection on remaining knowledge gaps and implications for future research.

Summary of Key Findings

Chapter 2 draws upon a case-study of Bisphenol A (BPA), one of the more controversial, high profile substances reviewed under Canada's Chemicals Management Plan to develop a deeper understanding of the ways in which different stakeholders divergently interpret evidence on chemical risks and exploit scientific uncertainties. It examines various tactics employed by stakeholders to legitimize and advocate particular scientific and political claims and policy prescriptions that are favourable to their interests. This chapter paid particular attention to "weight-of-evidence" and "precaution", two mandated yet ambiguously defined principles that have become increasingly customary within national and international agreements, including the Canadian Environmental Protection Act and the Chemicals Management Plan. It discussed how each approach is defined and distinguished within stakeholder arguments and decision-making. Finally, Chapter 2 discussed various factors within the Canadian context that influenced the trajectory of claims-making disputes, including how "weight-of-evidence" and "precaution" were reconciled in this particular case allowing Canada to become the first national government to declare BPA toxic, an internationally contentious, albeit increasingly precedent setting policy response.

Chapter 2 demonstrates that in order to comprehend how weight-of-evidence and precaution are defined and valued in particular policy contexts it is necessary to understand how scientific knowledge is created and used by those seeking to make or influence decisions. This

includes identifying which factors are included or excluded as “relevant” and the particular objectives and interests being served. The paper emphasizes tensions from both within and beyond scientific circles with respect to that which is distinguished as a “weight-of-evidence” versus “precautionary” approach and how the two differ characteristically. The two approaches are often believed to be discrete and mutually exclusive, the former typically characterized as objective and technical, and the latter normative (Kriebel et al, 2000). However, the case-study demonstrates that these distinctions are not so simple, suggesting the approaches may be better characterized as a continuum of normative-factual matters open to dispute and negotiation. The findings also support the need for better integrating precautionary ideals into the *production* stage of science (see Adams, 2002), and weight-of-evidence reviews, which requires enhancing the transparency and democratic scrutiny of expert-driven assessments given that the boundaries between that which is normative vs. objective, technical vs. political, scientific vs. precautionary, are not always distinct or agreed upon.

Chapter 2 unveiled various tactics and claims-making strategies used by different stakeholders to shape the ways in which an evidence-base is interpreted when formulating decisions on where, how and by whom chemical risks should be governed. Nevertheless, to gain a better understanding of which issues, perspectives, knowledge inputs and “frames” gain ascendancy and why, further attention needed to be given to the actual construction of legitimacy and authority. Therefore Chapter 3 examined how stakeholders construct and spatially bound political and epistemic legitimacy and authority through contested definitions and rationales of accessibility, inclusion and exclusion. Chapter 3 paid significant attention to the second primary objective of this dissertation as it interrogated the usefulness of a spatial analytical framework in

deconstructing how elements of governance emerge, transform, become institutionalized and/or marginalized.

Through integrating distinct literatures on “politics of scale”, “scale-frames” and “boundary-work” an analytical framework was developed to examine and interpret stakeholder narratives, discourses and actions. The resulting insights and findings confirmed that a spatially oriented analytical framework is indeed a useful tool for understanding how governance actors make sense of and shape policy problems and potential interventions. For example, three key avenues through which contested spatial boundaries fundamentally contribute to the constitution of a system of chemical governance were identified. They included: i) boundaries demarcated around the perceived policy problem and its constituent variables, ii) boundaries drawn around legitimate expertise or evidence required to address the problem, and iii) the spatial extent of prescribed interventions. Collectively these shape the operationalization of overarching policy and legislative principles (e.g. precaution), the execution of risk assessment and management decisions, and associated outcomes. For example, those with higher risk tolerances, economic interests, or a desire to maintain tractability tend to draw tight, conservative boundaries around the settings and mechanisms in which risk is ascertained. This is for the purposes of limiting scientific complexity and uncertainty, thereby making it easier to estimate appropriate margins of safety and exposure, identify targeted management strategies, and consequently justify the continued, albeit controlled use of a chemical. In contrast, those who question the status quo assessment and management of environmental health risks, and/or advocate the primacy of public health protection cast far wider scale-frames around a policy problem. These findings are in line with previous works which also indicate wider scale-frames are characteristic of

participatory policy development, while expert driven approaches tend to be more reductionist (Mansfield & Haas, 2003; Bijlsma et al, 2011).

The use of wider scale-frames strategically enhances complexity and uncertainties. Consequently the boundaries which distinguish existing dominant epistemic authority and its associated customary rationales, practices and methods become blurred and open to challenge making it easier for marginalized actors to justify their own entry into decision-making forums. It is through these very strategies and arguments that environment and health NGOs and other members of civil society have challenged preeminent reliance on expert-driven decision-making and scientific determinism (Brown, 1992; Coburn, 2002; Carolan, 2004; Eden et al, 2006) fuelling national and international trends of increased investment in multi-stakeholder engagement and deliberation practices (Doern & Reed, 2000; Government of Canada, 2010; UNEP & WHO, 2006). Nevertheless, as Chapter 3 concludes stakeholders seeking to shape policy must (re)define and gain access to both jurisdictional *and* epistemic spaces in which knowledge, evidence and rationales are created and institutionalized. With respect to the latter, representatives from environment and health NGOs and industry all expressed a desire for greater transparency around the technical details and fine-grained norms and assumptions built into study methodologies, risk assessments, and weight-of-evidence reviews particularly in regards to determining confidence levels in data accuracy and quality, and estimated margins of safety and exposure. It is *these* spaces of knowledge production that dictate the ways in which regulatory statutes and practices of environmental health risk governance become operationalized, benefiting some while marginalizing others (e.g. fetuses, workers, women, Aboriginals, low-income individuals, those with multiple chemical sensitivities, etc).

Chapter 2 and 3 both demonstrate that while stakeholders engaged in the Chemicals Management Plan generally endorse a scientific weight-of-evidence approach to assessing risk and determining management priorities, they also desire more transparency and opportunity to scrutinize technical details, assumptions and interpretations. This is particularly imperative to understanding and influencing how the statutory principle of precaution is exercised within a science-based approach. Chapter 3 concludes by suggesting that the degree to which the adoption of multi-stakeholder processes will actually result in tangible changes in chemical management practice and influence remains limited if the epistemic spaces in which expertise and evidence are produced continue to lack transparency. Such conditions will most likely result in the perpetuation and reinforcement of the status quo.

Given this assertion and the concerns of others (e.g. Chilvers & Burgess, 2008; Reed & Bruyneel, 2010) Chapter 4 was dedicated to examining the degree to which the increased engagement of NGOs in Canada's Chemicals Management Plan is resulting in different forms of expertise and evidence underpinning decision rationales, techniques of assessment and management predominantly drawn upon, and ultimately tangible challenges to the existing status quo of unfettered market access. A governmentality lens was adopted as it assists in illuminating the often opaque, taken for granted methods and tools of governance practice that are both shaped by and reinforce particular subjectivities of authority and expertise (Dean, 1999; Rutherford, 2007; Ekers & Loftus, 2008). It is concerned with how conduct and beliefs are shaped through the enactment and perpetuation of dominant rationales that enhance the legitimacy of particular principles, policy agendas or programs (Kothari, 2001; Zinn, 2006). Chapter 4 therefore additionally sought to examine how NGO engagement and influence within

governance deliberations is situated within and constrained by broader neo-liberal political-economic ideals, objectives and practices.

Chapter 4 discussed techniques of enrollment aimed at encouraging “good” stakeholder conduct for NGOs seeking to engage in the CMP process which has the overarching goal of stakeholder consensus, or at the very least endorsement of governmental decisions. For example, all stakeholders are expected to provide input through formal submissions grounded in scientific evidence. However, in some cases the Government’s tight control over access to information is limiting the ability of NGOs and civil society to obtain and understand the scientific details perhaps most necessary for invoking real regulatory change or for challenging existing governmental rationales. Various techniques were identified as serving to control the subjectivity and influence of NGO stakeholders (e.g. accreditation, selective participation, subsidization, selective transparency or data accessibility, and strategic control of timelines and criteria for engagement etc.). Similar techniques have been identified by others (e.g. Tamiotti & Finger, 2001; Masuda et al, 2008).

Bringing contested modes of subject-making around NGO expertise and technical capacity to the fore assists in explaining why particular forms of knowledge production and interpretations of evidence are adopted while others are downplayed. This in turn perpetuates particular kinds of chemical risk assessment and management tools, rationales and approaches that in many ways are supported by, while mutually reinforcing, broader neo-liberal political-economic ideals and interests. Examples include practices and research investments that focus on efficient high-throughput assessments, toxicity determinations based on exposure as opposed to inherent hazard, a failure to invoke powers under CEPA to force industry to fill evidence gaps by generating toxicity data, a failure to place the burden of proof onto industry in practice, extensive

use of non-regulatory measures and voluntary initiatives, and reliance on retail pressure and consumer choice. All of these tactics reinforce broader neo-liberal agendas which include the ideals of “efficient” governance from a distance, minimal intervention, unfettered trade and investment, consumer choice, and reliance on cost-benefit analyses and market mechanisms to justify and generate policy change (Rose, 1999; Rose, 2000; Shostak, 2004; Masuda et al, 2008; Pidgeon & Butler, 2009; MacKendrick, 2010). Efforts by NGOs to exert change to the status quo management of chemicals (e.g. through advocating for stronger regulations, reductions in production, shifted burden of proof, full transparency of technical details, etc.) are embedded within preexisting relations of power and production circulating between modern administrative states, mega-science and industry (Levy & Newell, 2002; Backstrand & Lovbrand, 2006; Gibbon, 2008).

Despite identified limitations of the CMP, most NGOs still believe it is an important program endeavoring to accomplish the extremely difficult task of timely and systematic assessments for a very large number of substances already entrenched in commerce, and that, in some cases, it has resulted in precedent-setting risk management measures (Environmental Defence, 2011).

Many regulators and risk assessors employed within the *bureaucratic* arm of government articulate the value of stakeholder input stating it has been instrumental in highlighting what needs to be improved within chemical governance practice, and that there is room for enhancing opportunities for deliberation on how to best apply and operationalize precaution and weight-of-evidence. (“Corrine/government risk assessor; “Gordon”/government regulator; “Steven”/academic government advisor). The primary concern is whether the *political* arm of Government will continue to ensure that the resources and political will remains in place to

support ongoing iterative deliberations necessary for accommodating a dynamic evidence-base and refining and enhancing the rigour of governance principles, tools and techniques through adaptive management practices. The increasingly evident adoption of aggressive policies aimed at “liberalizing” and significantly weakening environmental programming, policy and legislation by Harper’s Conservative Government further substantiates this concern.

Knowledge Contributions

Substantive

Substantively this research contributes to wider examinations and debates unfolding across many literatures (e.g. sociologies of science & technology, environmental studies, resource management, risk studies, political geography, etc.) concerned with understanding the constitution and effects of ‘new’ alternative spaces and practices of multi-stakeholder governance emerging in response to contested and uncertain environmental health risks related to scientific and technological advancement and practices of modern living. It explores how interests, evidence, rationales, practice and authority are negotiated and institutionalized benefiting some while marginalizing others, and the role of “space” in these processes. The results are also informative to governance stakeholders engaged in “on-the-ground” experimentations with collaborative, deliberative and integrative approaches to governance and knowledge production aimed at enhancing capacity to address complex problems.

This dissertation assists in evaluating whether the beliefs and conduct of diverse stakeholders, and commonly used techniques and practices of governance actually align with more broadly espoused participatory and precautionary norms and principles. This involved identifying which factors are included or excluded as “relevant” to chemical management debates by various stakeholders, and the particular objectives and interests being served by

associated boundaries of inclusion and exclusion. This is essential as the alleged promotion and adoption of participatory and deliberative processes will not result in meaningful changes to decision-making methods and outcomes if the power dynamics, framing effects, and discourses operating within them are not carefully considered (Chilvers & Burgess, 2008). Similarly, the refinement of sophisticated risk assessment methodologies will not result in ‘risk’ reductions if they fail to capture the values, concerns, and interests of everyday people (Corburn, 2002).

Locating and deconstructing the discourses that make up both dominant and alternative scientific and political rationales may provide governance actors with the information needed to reflect upon their own unidentified assumptions. Such reflection could provide grounds for epistemological convergence and transformation, and ultimately the creation of alternative ways of conceptualizing, addressing, and governing environmental health controversies, or more specifically risks from chemical substances. At the very least, this research provides insight into how inequalities are reinforced or resisted through epistemic communities and practices.

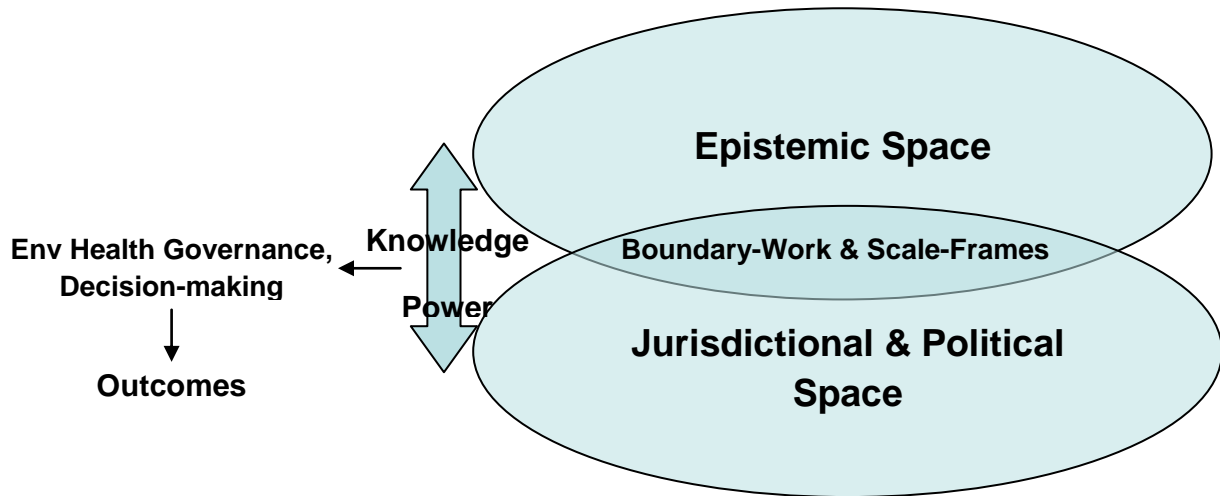
Theoretical

The analytical framework developed in Chapter 3 is a result of a novel integration of theories and concepts from divergent literatures that have adopted distinct constructionist approaches to exploring various facets of governance, knowledge production, policy and decision-making, power dynamics and stakeholder interactions. Different intellectual traditions are responses to the same problems (Delanty, 2002). Drawing linkages, points of similarity and departure between theories results in new ideas about how the world works and innovative methods for studying social phenomena (Litva & Eyles, 1995). Through interrogating the limitations and strengths of existing theories and extending their boundaries this thesis contributes to transdisciplinary theoretical development. For example, there is a significant

divide between scale-related research emphasizing the significance of jurisdictional power, and other works analyzing the importance of the spatiality of information flows (Kok & Veldkamp, 2011). Scale-frame analyses reveal contested stakeholder perceptions over how a policy problem is constituted, related disputes over the spatial extent of proposed interventions, and how stakeholders draw these boundaries in ways that situate themselves at the center of power (Kurtz, 2003; Termeet & Kessener, 2007; van Lishout et al, 2011; Dewulf et al, 2011). However, less attention has been given to the socio-spatial nature, production and negotiation of “legitimate” knowledge and expertise fundamentally driving those very processes. Hence the utility of merging scale-frame analyses with boundary-work analyses, as the latter describes the processes through which actors establish territorial limitations around epistemic authority (Gieryn, 1983; Kleinman & Kinchy, 2003; Eden et al, 2006).

By merging scale-frame theory and politics of scale literatures (largely situated in human/political geography, and environmental studies), with boundary-work analyses (founded in science and technology studies) this thesis contributes a theoretical framework (see Fig. 1) that assists in understanding how key statutory principles, research and assessment methodologies, rationales and values underlying systems of environmental health governance operate in practice determining the inclusion and exclusion of stakeholder actors and ultimately the social distribution of risks. In order for governance stakeholders to gain the influence and legitimacy to truly shape environmental health policy, they must (re)define the jurisdictional *and* epistemic spaces in which knowledge, evidence and rationales are created and institutionalized.

Figure 1: Conceptual framework: “contested spaces & boundaries of legitimacy & authority”



A second theoretical contribution stemming from this research relates to governmentality scholarship. Governmentality research predominantly focuses on governmental/citizenry relations, and how state regulations and policies impact and shape the conduct and beliefs of the general population (Rutherford, 2007). However, with increasing trends towards the adoption of multi-stakeholder and neo-liberal governance processes the boundary between those who govern and those who are to be governed becomes further blurred resulting in multiple sites of governing (Rutherford, 2007; Schumann, 2007). Accordingly this thesis extends analyses on the “conduct of conduct” beyond a confined focus on the governed citizenry residing outside of government circles. This is achieved by examining how governance stakeholder actors themselves become “enrolled” in (and/or resist and negotiate) various tactics that enact particular forms of participation, expert advice, conduct and citizenship for the purposes of facilitating a collective amenable to specific forms of intervention (Masuda et al, 2008; Hobson, 2009; Konefal & Hatanaka, 2011).

Methodological

The analytical framework “contested spaces & boundaries of legitimacy & authority” developed in Chapter 3 (see Fig. 1) also provides a methodological contribution as it can serve as a useful heuristic device or model for future research analyzing other contentious contemporary governance and policy problems. It will be particularly useful for examining issues and governance actors situated within inter-jurisdictional, multi-sectoral, multi-disciplinary, transboundary contexts as it assists in deconstructing how political and epistemic authority and power are interactively constructed, negotiated, (de)legitimized and socio-spatially bounded. Potential examples include water governance, energy policy, food security, sustainable development, health policy, the regulation of new technologies, etc. The thesis also contributes to the method of discourse analysis as it demonstrates the importance of thinking about how “space” is treated and utilized (consciously and sub-consciously) within discourse. Thus spatial concepts like “scale-frames” and “boundary-work” should be incorporated into critical discourse analytic frameworks. For example Gee (2005) identifies a suite of “building tasks of language” which include the construction of significance, activities, identities, relationships, values, and connections. The construction of spatial frames and by extension boundaries of inclusion and exclusion are also fundamental features of language and discourse that should be drawn out to better understand how different worldviews are constructed, disseminated and negotiated.

Policy Contributions

This research is of practical policy significance given the management of chemical substances, particularly “existing substances” is currently a high-profile issue at all levels of jurisdiction in Canada. The same is true abroad most notably in Europe, the US, and Australia in addition to international agreements and harmonization efforts under the OECD. This research

illuminates some of the underlying techniques, principles and processes that are often taken for granted and/or become obscured from critical gaze by political and rhetorical conflicts despite the fact that “the devil is in the details”. In other words, the enactment of what often appear to be inconsequential and inaccessible technical details has in fact been shown to be extremely fundamental in enabling and constraining the political and epistemic agency required for shaping policy processes and outcomes. With respect to chemical assessment and management policy greater transparency is needed on how precaution, weight-evidence, “adequate” margins of safety and exposure, “appropriate” null hypotheses and evidentiary thresholds, etc. are being defined and operationalized if one of the primary goals of emerging domains of chemical governance is indeed decisions created and endorsed through authentic multi-stakeholder deliberations.

Secondly in Canada risk assessment is distinctly separated from risk management with the tasks of assessing risk and interpreting weight-of-evidence generally confined to “experts”, while more democratic or political discussions around, for example, the appropriate use of precaution are generally not enabled until later stages of risk management decision-making. The findings from this research suggest an increased recognition of the inherently normative elements of assessment science, particularly when navigating uncertainties. Therefore within both research and governance practice there is need for improving the ways in which uncertainties are characterized and communicated to scientists, stakeholders and the lay community. The value judgments and assumptions employed to account for such uncertainties need to become more visible and democratically accessible. This requires additional resources necessary for supporting the development of technical and scientific capacity amongst stakeholders wishing to engage such as better financial compensation for the time and energy put into engaging and

providing input. Additionally, more resources are needed that make it easier to understand the CMP process, including where to find important scientific and legislative information, and how to make formal submissions. This could be in the form of a handbook, or ongoing courses and teleconferences.

Future Research Directions

This dissertation has made a number of significant contributions to the literature as previously discussed. Nevertheless, there are a number of knowledge gaps and areas that remain fruitful for future inquiry. Firstly, on a practical level there remains need for better understanding the factors and mechanisms that work to “trigger” a precautionary response, and for deeper comparative analyses on how precaution is being defined and interpreted. This thesis paid particular attention to factors facilitating an (albeit limited) precautionary response to the particular chemical substance BPA. Yet broader decision trends in the CMP suggest that the degree of precaution and regulatory response exercised for BPA appears to be an anomaly. While this may in part be a reflection of potential risks uncertainties remain as to why precaution has not been exercised consistently within Canada, even once a precedent has been set, and whether the same “triggering” factors apply for other chemicals of concern in both Canada and abroad.

Secondly, a more in-depth comparative analysis between Canada’s CMP and Europe’s REACH program of governance processes and outcomes would be informative as REACH was at very early stages of implementation when this research was undertaken. This would further assist in identifying what mix of factors enable, legitimize or constrain a precautionary stance, and related implications for its operationalization particularly with respect to weight-of-evidence conclusions. A comparative analysis would also help determine the degree to which nation-

states conform to international precedence and practice, and/or assert autonomous conclusions and measures. Interrogations along this line would further advance understandings of the constraints and windows of opportunity for change that exist within a globalized, neo-liberal, political economy. Finally, from a practical stand-point a follow-up study approximately five to ten years post hoc from the completion of the Challenge Program under the CMP would be useful for assessing the degree to which the government has been able to support and carry out adaptive management. This includes assessing their will and capacity to keep abreast of the changing evidence-base and accordingly make adjustments to toxicity determinations (or lack thereof), and resulting management prescriptions. In other words, will the governance of environmental health risks from existing substances in Canada continue to undergo iterative deliberation, or will the completion of the CMP signal a “case closed” mentality despite the many remaining uncertainties and loose ends?

From a theoretical perspective a key finding throughout the dissertation was the importance of stakeholders being viewed and included as *legitimate* actors within collaborative decision making settings. However, this research did not explicitly focus on how stakeholders actually define (or redefine) legitimacy itself within collaborative governance settings. Multi-stakeholder, collaborative approaches can be viewed as responses to legitimacy deficits. State-centered approaches to managing domestic, transboundary and international environmental resources face serious limitations in dealing with complexities, enforcing regulatory compliance, managing conflicts, overcoming jurisdictional fragmentation, and possessing information and resources necessary for supporting decision-making. As this research has discussed, collaborative, multi-stakeholder processes are touted as being instrumental in addressing some of these shortcomings. Yet uncertainty remains over the extent to which new governance actors have

the requisite capacities and autonomy to carry out emergent roles, responsibilities and objectives. Additionally concerns exist over the extent to which collaborative processes undermine the legitimacy of broader political normative systems within which they are embedded (Hirst, 2000; Connelly et al, 2006; Edwards, 2007). For example, moving away from government control potentially undermines fundamental democratic principles such as the representation of public interest through formal elections (Connelly et al, 2006). Related concerns include how to afford power to unelected actors (McCloskey, 2010), and how to ensure civil society is effectively and equitably represented (Reed, 2010; Borrás and Ejrnæs, 2011). Hence, the political legitimacy of both traditional state-directed institutions, *and* new collaborative regimes, are in question, creating a “legitimacy gap” in theory and practice (Krell-Laluhova & Schneider, 2004; Noholm & Haveri, 2009).

Therefore there is need for examining how legitimacy is (re)defined and enacted by different stakeholders involved in collaborative environmental governance. A unique extension of this inquiry would be to explore these concerns within the context of a transboundary policy issue of concern involving multiple nations, and sub-national actors to examine how “scale” influences the capacity of various stakeholders to “achieve” legitimacy ideals. This dissertation gave some attention to how scale is used as a means of determining which actors, interests, and resources are included or excluded from spaces and processes of decision-making. Yet it remains unclear how scale-dependent factors in turn shape the privileging of certain knowledge types, and the definition and practice of legitimacy itself.

Finally, there remains room for further employing a governmentality lens within the context of emerging environmental health epistemic communities and domains of governance. There continues to be increased calls in theory and practice for governance structures that

integrate human health concerns, knowledge, and policy; with environmental resource and management initiatives, expertise and capacities (e.g. Parkes et al, 2010; Confalonieril & Schuster-Wallace, 2011). This includes efforts to better understand the interrelationships between data on environmental quality and contaminants (e.g. pathogens, chemical toxins), with epidemiological information on disease occurrence and mortality (e.g. carcinogenic, reproductive, neurobehavioural effects). Integrated data management systems that link the monitoring of environmental hazards with human disease surveillance are being collaboratively developed in Canada, Australia, the U.S, and internationally (see Confalonieril & Schuster-Wallace, 2011.) Globally a wide range of institutions believe such integration is essential for generating informed and comprehensive environmental health policy interventions (Parkes et al, 2010). Nevertheless, while recent developments of innovative data integration tools are promising, there remains need for interrogating associated governance challenges, particularly existing power and legitimacy dynamics involved in the production, interpretation and application of knowledge and evidence used to inform environmental health policy and decision-making (Parkes et al, 2010). My future research will endeavour to continue to examine the processes and mechanisms through which actors, knowledge and data are included and excluded within epistemic communities and systems of collaborative environmental health governance.

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APPENDIX A

Interview Schedule/Guide

Interview Schedule/Guide

Introductory Section

- Can we start with you providing me with some background information about yourself with respect to how you became involved in chemical management and/or the assessment of environmental and human health risks? What is the nature of this involvement?
 - POTENTIAL PROMPTS:
 - What is your occupational background or area of expertise?
 - Why are you involved with this issue?
 - How did you become involved?
 - Which organizational affiliations do you have that are relevant to this field of concern?

How Claims are Made? How is the Issue Perceived?

- The next few questions are a little more specific in that they specifically centre around the substance Bisphenol A. I am interested in gaining a better understanding of how you personally would characterize or perceive this substance with respect to implications for human, social and/or environmental well-being?
- What do you think are the primary impacts or issues of concern?
- Do you feel there are any risks associated with the use of Bisphenol A?
 - POTENTIAL PROMPTS:
 - What is the level/significance of this risk?
 - What types of risk are you concerned about or are plausible?
 - Who or what is at risk?
 - Are there particular populations that you feel are particularly vulnerable?
 - Cumulative risks? Low dose controversy
 - I was wondering if you would characterize the response as precautionary? Or have any perspective as to why the precautionary approach was employed in this particular case, but not for other substances?
 - Is there clarity with respect to how the precautionary principle is defined or wielded within the CMP or government risk assessment and environmental policy more broadly?
- What knowledge or information have you used to support or form your position?
 - POTENTIAL PROMPTS:
 - Is all your information based on scientific sources? Which sources? Which scientists?
 - What other sources of information do you feel are important or relevant?
- How do you evaluate the credibility of knowledge claims put forth by different individuals, groups, or interests?
 - POTENTIAL PROMPTS:

- Do you have more confidence and trust in certain sources or types of information and evidence than others? Why?
- Are there any disciplines or sources of information that you may not regard as highly?
- Is science the most important source of information or anecdotal cases/stories?
- Are all sources of information equal?

- Who do you feel has the legitimacy to contribute information used to guide or inform policy and decision-making?

- Who are the experts when it comes to assessing or communicating the risk of Bisphenol A? Is there consensus amongst these experts?

- How should uncertainties or disagreements be dealt with?

- How should different types of knowledge be used? What is their role with respect to informing policy?

Claims-making Tactics and Resources

- Now that I have a better idea on your position regarding the safety and use of Bisphenol A, I would like to ask you some questions that will help me understand how you and your organization go about communicating or advocating your position to others...
- What mechanisms or avenues do you use to communicate or disseminate your position or evidence related to BPA? Who is your target audience?
- How do you use or frame evidence on the effects or safety of BPA to communicate your position?
- Is the way in which information is communicated or framed important? Why?
- Do you think your message is convincing? To whom? Who remains unconvinced?
- What is your end goal?
- Do you think your message is viewed as being equal to those of others?
- What resources do you draw upon to enhance the influence of your position and views?
- Do you have the necessary resources to meet your objectives? How do you think the capacity and influence of your organization might be enhanced?
- What are your organizations' greatest strengths and weaknesses?

The Sociology and Geography of Governance & Influence

Okay, the information that you have given me up until this point has focused primarily on the activities of your own organization. Now I would like to gain a better understanding of how your organization interacts with other stakeholders and interests.

- Who are some of the major stakeholders (e.g. NGOs, government, industry, science, etc) involved in chemical management, risk assessment, and environmental health protection?
 - POTENTIAL PROMPTS:
 - Are these players the same with respect to chemical management generally, and BPA policy more specifically?
- Do you regularly work and interact with these stakeholders?
- Can you describe the nature of some of your collaborative relationships?
 - POTENTIAL PROMPTS:
 - What is the objective of the collaborative group?
 - How do you communicate and how often are you in contact with one another?
 - Do your partnership relationships have clearly defined goals, objectives and codes of conduct for decision-making?
 - Are there other organizations or interests that need to become further involved, or whose interests are not being addressed?
 - Are there other organizations that should be included in your network that would be beneficial to your mandate?
 - Have you tried unsuccessfully to engage with some of these organizations? What were the challenges?
- Are all of the organizations that you interact with on the same page with respect to values, objectives and policy priorities?
 - POTENTIAL PROMPTS:
 - How do you resolve differences?
 - Are there particular procedures or settings that facilitate conflict resolution?
 - If so, who does or should act as the facilitator (or knowledge broker)?
- Does the location of where these organizations are based influence your interactions?
 - POTENTIAL PROMPTS:
 - Who are you trying to influence and why?
 - Is there a particular jurisdiction or policy arena within which your efforts are concentrated? Is this constant? Under what circumstances might there be changes?
 - Is scale a meaningful term?
- What do you think will happen in the near future with respect to BPA policy or chemical management more broadly? What about the distant future?