ECON 260
Water Pollution-Control Policy

Learning Objectives

LO1 Describe the characteristics of water pollutants and how that affects the type of policy instrument that can be used.

LO2 Provide a brief sketch of federal water quality policy.

LO3 Assess the effectiveness of technology-based standards using an example from Canada and the U.S.

LO4 Explain the challenges in regulating nonpoint source emissions.

Characteristics of Water Pollutants

- One way to categorize waterborne pollutants is by their chemical and physical nature.
  - Organic wastes: degradable wastes such as domestic sewage and residuals from pulp mills and food-processing plants; chemicals such as pesticides, detergents, and solvents; oil.
  - Inorganic substances: chemicals such as toxic metals, salts, and acids; plant nutrients such as nitrate and phosphorous compounds.
  - Non-material pollutants: radioactivity, heat.
  - Infectious agents: bacteria, viruses.

Waterborne Emissions

- There are different types of discharges of waterborne emissions:
  - Point sources: include outfalls from industry and domestic wastewater treatment plants
  - Non-point sources: include agricultural runoff of pesticides and fertilizers and the chemicals and oils that are flushed off urban streets by periodic rains

  - Emissions may also be **continuous** or **episodic**
  - **Persistent pollutants**: do not readily degrade
  - **Degradable waterborne pollutants**: undergo a variety of biological, chemical, and physical processes that change their characteristics after emission

A Civil Action

Example Case: *A Civil Action* – a book by Jonathon Harr

- True story of health impacts of a persistent water pollutant.
- A cluster of families in Woburn, Massachusetts were ill with similar conditions.
- A number of children in the families had leukemia, 16 died.
- Probable cause: TCE, highly volatile compound found in drinking water.

This case illustrated a number of issues for public policy:

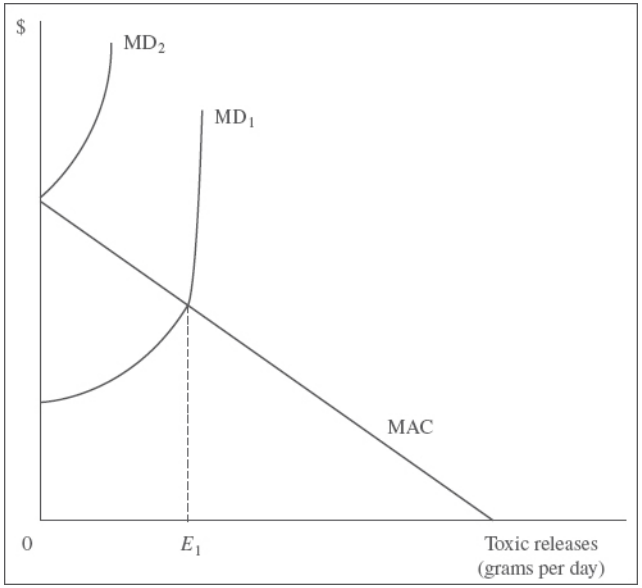
1. This is not an isolated incident, all provinces have similar examples.
2. There can be a long gap between discharge of a pollutant and its discovery in water supplies. This knowledge gap makes it difficult to regulate effectively with any policy instrument.
3. The safe level of a compound in our drinking water is often not known.
4. Linking pollutants to sources can also be problematic, which makes it difficult to prove liability and prove damages.

Waterborne Emissions and Issues for Public Policy

- The different characteristics and types of discharges of water pollutant affects the type of policy instrument that can be used.
  - Market-based policies, such as taxes, are not good policy candidates when the target level of pollution must not be exceeded.
  - A regulatory approach, either a ban on a compound or explicit limit on emissions, is warranted when the MD curve shows very adverse impacts at a particular emission level.
  - If there is uncertainty about the location of the MD curve, a ban might be the optimal policy.
  - Question: Could TEPs be assigned in some way?

Standards for the Release of Toxic Substances

- Figure 16-2 Imposition of Standards for the Release of Toxic Compounds



- Figure 16-2 illustrates two MD curves. If the regulator is certain that MD_1 reflects damages, then a standard set at E_1 is an appropriate policy. If however, it isn't known what the 'safe minimum level' of emissions is, for example, marginal damages could be MD_2, then a complete ban on the release of the compound is warranted.

Federal Water Pollution Policy

- The federal government has never played a major role in water-pollution regulation due to constitutional constraints. Its key role has been to:
  - Introduce national standards for some compounds.
  - Address international and interjurisdictional water-pollution problems.
  - Establish national guidelines for water quality.

Federal Policy

- The federal *Fisheries Act of 1868*: Canada's first legislation that laid a foundation for environmental regulations
  - Basis: clause that banned the discharge of substances deleterious to fish, beginning with 1971 amendments to the act.
  - 2012: amendments limited its application to surface water with commercial, recreation, or First Nation's use.

Fisheries Act

- The discharge into any waterways of a small number of toxic substances has been banned or limited. These include:
  - Zero discharges of dioxins and furans from pulp and paper mills
  - Emissions from chloralkali plants
    - Releases mercury as a by-product of their production of chlorine and caustic soda.
- Other regulations exist for processors of meat and poultry products, metal mining operations
- This allows the *Fisheries Act* to impose a zero emissions standard for substances deemed toxic
  - Socially efficient if MD function lies above the MAC function for all possible levels of emissions, shown with MD_2 curve in Fig. 16-2

Interjurisdictional Water Pollution Policies

- *Canada Water Act*, 1970: addresses interjurisdictional water pollution issues. The Act has two parts:
  - Part 1 provided funds to assist municipalities in the construction of sewage treatment plants and to undertake research on water-quality issues
  - Part 2 provided for Water Quality Management Authorities to set up regional water quality boards in cooperation with the provinces
    - Federal and provincial governments have shared responsibilities over water quality
    - Boards were to establish water-quality management plans involving boundary waters
    - Also had the power to implement these plans (by charging fees, monitoring discharges, imposing standards, etc.)

Interjurisdictional Water Pollution Policies

- *Canada Water Act* issues:
  - Boards appear to have been doomed by terms of the act
    - Federal gov't could only act when water quality had deteriorated to the point of "urgent national concern", and only with permission from the provinces
- Part 2 of the Act used to enact the Phosphorous Concentration Regulations
  - Successful in improving the water quality in the Great Lakes
  - High phosphorous concentrations a concern in 1960s and 1970s
    - Contributes to eutrophication, destroying fish populations
  - Phosphorous control in Canada was coordinated with the U.S. through the Interjurisdictional Joint Commission
  - Great Lakes' water quality improved greatly in a short period of time

Groundwater Protection

- Canadians obtain their drinking water from surface water and groundwater
  - Quality of groundwater threatened by non-point sources
- CCME guidelines for the protection of groundwater
  - 1968: *Guidelines for Canadian Drinking Water*
  - Not binding on any government, provinces can adopt guidelines or impose their own guidelines or standards
- Nationwide, concern has been expressed with water quality due to deterioration of water treatment infrastructure, contamination of groundwater by toxic compounds, and nonpoint-source contaminants.

Technology-based Effluent Standards

- A technology-based effluent standard (TBS) is an effluent standard set at the level of emissions that a source would produce if it were employing a particular type of abatement technology.
  - Would require enormous effort to establish effluent standards for each and every individual source
  - Initially, standards based on best practicable technology (BPT)
    - Technology that is reasonably well known and readily available without excessive costs
  - Best available technology (BAT) later used to set standards
    - Must still be economically achievable

Technology-based Effluent Standards

- For a TBS to be socially efficient, the standard must be set where MAC=MD for a given pollutant and its source
- Cost-effectiveness examines whether we are getting the maximum reduced emissions for the money spent
- TBS will be cost-effective only if all individual plants in each category have exactly the same marginal abatement costs

Ontario Experience

- Mid-1980s: Ontario *Municipal and Industrial Strategy for Abatement* (MISA)
  - Technology-based standard
  - Goal: “the virtual elimination of toxic contaminants in municipal and industrial discharges into waterways.”
  - Companies typically complying with targets and standards set 20 years ago
  - Limits on maximum allowable concentrations per day that are based on the technology available for pollution control from each type of source
  - Based on what is technically feasible, rather than marginal benefits and damages
  - Unclear in practice what role economic achievability plays in establishing the standard
  - Without some link to MAC and MD, cannot tell whether elimination of contaminants is socially efficient or technically feasible

Delaware River Example

- Cost ineffective TBS: The Delaware River
  - The lower Delaware River runs through heavily industrialized sections around Philadelphia and SW New Jersey, then opens up into the broad and shallow Delaware Bay
  - Wastewater emissions contribute to serious water-quality issues in the estuary (DO, other types of organic and inorganic wastes)
  - INSERT Table 16-4

Delaware River Example Cont.

- Cost ineffective TBS: The Delaware River
  - To meet the uniform treatment approach, achieving DO levels of 2ppm: $5 million/year
  - To meet the equal treatment program, achieving DO levels of 3-4 ppm: $20 million/year
- The **same DO targets** could be reached at a much lower cost by reducing emissions in a cost-effective way
- The costs of a program designed to meet the targets with a set of emission controls satisfying the equimarginal principle were $1.6 million for 2ppm, $7.0 million for 3-4 ppm DO
  - These costs are roughly **1/3 of the costs** of the uniform treatment plan
- Single emissions tax, zoned emissions charge possibilities for Delaware study

Non-Point Source Emissions

- Nonpoint-source (NPS) emissions account for a substantial amount of the water pollution in Canada
- Major nonpoint sources:
  - Agricultural runoff,
  - Urban street runoff, and
  - Activities related to land clearance and building construction
- NPS difficult to control:
  - Emissions are diffuse
  - Not concentrated into specific outfalls
  - Pollutants weather-related, runoff patterns more difficult to monitor

Challenges With Non-Point Source Emissions

- Emissions standards and taxes problematic, difficult to measure emissions accurately
  - Input taxes could be applied to those activities or materials that lead to the emissions as output taxes on non-point source emissions are hard to impose
- Technology Based Solutions (TBS) that specify technologies or practices that must be followed are commonly used in Canada to address NPS pollution
  - These policies specify pollution control technologies that must be put in place, however as with technology standards these policies are often inefficient
- Difficulties of control explain why NPS pollution has not been addressed as vigorously in the past as point-source emissions, despite their importance.

Chapter Overview

- Canadian environmental regulation is a complex mix of federal and provincial policies that rely primarily on command-and-control instruments in the form of guidelines and objectives.
  - There are few specific standards
  - Co-operation between and within governments and industry sought
  - Most water pollution policies are at the provincial level
- The federal government has introduced national standards for some compounds, addressed some interjurisdictional water pollution problems, and established national guidelines for water quality
- TBS most commonly used policy in Canada
  - Less pollution control for more money
  - Normally violate equimarginal principle
  - Provide fewer incentives for finding new, cheaper ways of reducing
- Chapter 17 will discuss air pollution-control policies