

COMPLIANCE MODELS FOR ENFORCEMENT OF ENVIRONMENTAL LAWS AND REGULATIONS

Liping Fang

Department of Mechanical and Industrial Engineering, Ryerson University, Toronto, Ontario, Canada

Keith W. Hipel

Department of Systems Design Engineering, University of Waterloo, Ontario, Canada

D. Marc Kilgour

Department of Mathematics, Wilfrid Laurier University, Waterloo, Ontario, Canada

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Summary

A variety of approaches to enforcement of environmental laws and regulations are surveyed, including the regulatory regime, economic measures, and citizens' enforcement. In the regulatory approach, formal standards are set by governments (through regulatory agencies) and operators who fail to comply with the standards are sanctioned. The regulatory agencies are responsible for enforcement activities, usually including monitoring and inspection. Current inspection/enforcement processes for environmental laws and regulations in North America are described and cost-effectiveness questions raised by the regulatory approach are discussed. Verification/enforcement theory, which is the application of game-theoretic methods to multiple-objective, multiple participant decision making problems involving the enforcement of social norms through inspections, is illustrated by a simple enforcement game. Instead of mandating the desired behavior as in the regulatory approach, the objective of economic measures is to affect operators' decision behavior by changing estimates of costs and benefits of various alternatives, thereby motivating them to choose options that tend to produce more desirable environmental conditions. Pollution charges, subsidies to alter operator behavior, deposit-refund systems, and emission

trading are some examples of economic measures. Alternatives to entrusting enforcement to governments and their agencies include self-monitoring by operators and giving citizens the right to initiate enforcement actions by regulatory agencies or courts. Many jurisdictions require operators (especially industries) to implement self-monitoring and self-reporting systems for discharges. Citizen alert, or whistle blowing, has considerable appeal because concerned citizens can be involved in environmental enforcement.

1. Introduction

Enforcement problems arise in virtually all areas of human endeavor—wherever there are rules, laws, or standards to regulate the behavior of independent decision makers. Environmental laws and regulations set up by governments are an important example. For instance, Canada's *Environmental Protection Act* declares that “the protection of the environment is essential to the well-being of Canada.”

The objective of environmental laws and regulations is to regulate environmental risks within an appropriate overall risk management framework. Yet the mere existence of laws is rarely sufficient to ensure their success, and much environmental damage has been caused by illegal use, storage, and disposal of dangerous or waste materials. Obviously, compliance is a problem, and environmental laws and regulations typically include some kind of enforcement provisions intended to ensure that the desired level of environmental protection is achieved. In 1990, *Canada's Green Plan* put it simply: “Legislation and regulation are only as good as their enforcement.”

Traditionally, environmental laws and regulations are enforced using a regulatory approach in which operators are required to comply with formal standards, either general or site-specific, established by regulatory agencies structured by governments. The regulatory approach is also called “command and control.” Compliance is enforced through monitoring, inspection, and other enforcement activities. Alternatives to the regulatory approach are available, and often include greater reliance on economic measures and citizens' enforcement.

The major objective of this article is to survey various approaches to enforcement of environmental laws and regulations. Section 2 contains a review of the inspection/enforcement process in Canada and the United States, along with a simple game-theoretic analysis of enforcement applicable to environmental laws and regulations. Economic measures are discussed in Section 3, and citizen's enforcement in Section 4. Section 5 concludes with a summary.

2. The Regulatory Approach

2.1. The Inspection/Enforcement Process for Environmental Laws and Regulations in Canada and the United States

In the regulatory approach to enforcement of environmental laws and regulations, governments (through regulatory agencies) set formal standards that operators of facilities must meet. Enforcement activities, usually including monitoring and

inspection, are also the responsibility of the regulatory agencies. To illustrate, the main components of current inspection/enforcement processes for environmental laws and regulations in Canada and the United States are described below. As will be explained, these procedures have the same basic structures and raise the same central questions. Regulatory monitoring refers to the assessment of operator behavior by means of procedures that do not require the consent of any operator. It is generally classified into three types:

- initial compliance monitoring,
- continuing compliance monitoring, and
- ambient quality monitoring.

Typically, monitoring is carried on at a distance, and does not require access to an operator's facilities. Monitoring can also be done by the operator (self-monitoring), or by third parties (citizen monitoring).

Inspection refers to procedures carried out on-site by an inspector with appropriate legal status. Under the *Environmental Protection Act* of Canada, for example, inspection is executed by an inspector to assess compliance either under a regular inspection program or subsequent to complaints. Any violations discovered by the inspector may occasion a response determined by the nature of the offence and the compliance history of the violator. A warning, a direction, or a ticket may be issued without delay. If the inspector decides that an investigation is required, the case is referred to an investigation specialist except that in "exigent circumstances" the inspector can investigate immediately. Any items or material that an inspector or investigation specialist reasonably believes were used to commit an offence under the Act, were related to the commission of an offence, or will provide evidence of an offence, can be seized and retained. If there is sufficient evidence to proceed, officials will take action as prescribed in the Act: actions include warnings, directions, tickets, ministerial orders, injunctions, prosecution with penalties and court orders upon conviction, and civil suits by the Crown (government) to recover costs.

The *Environmental Protection Act* of the province of Ontario permits "a provincial officer . . . without warrant or court order, at any reasonable time and with any reasonable assistance, make inspections." Inspections are to be based on probable grounds ("reasonable beliefs"), which the *Act* makes some effort to specify. In such circumstances, an inspector who is refused entrance to a site can apply for a court order. During an inspection, the officer can take samples or copies of any information that may be relevant to the inspection.

Under the *Environmental Protection Act*, a director, appointed by Ontario's minister for the Environment, has the power to issue a control order to the operator of a facility believed to be contravening an environmental law. In some cases, a fine can be levied directly against the operator and a criminal charge may be laid. A control order can contain a variety of specific provisions including limiting or stopping the discharge of a contaminant. By law, the operator must comply with the control order. The control order can be appealed to the Environmental Appeal Board or to the appropriate divisional court, but it nevertheless remains in effect during any appeal. Finally, both

the operator and the director may appeal any decision of the Environmental Appeal Board to the courts. The inspection and enforcement provisions of Ontario's *Water Resources Act*, which regulates water quality, are similar to those of the *Environmental Protection Act*.

In the United States of America, a range of statutes deals with different aspects of the environment. The Environmental Protection Agency (EPA) is responsible for the implementation of many of these statutes. To illustrate the inspection/enforcement process in the USA, consider the *Clean Water Act*. Under its provisions, an inspector has the right to enter the premises of an operator and collect pertinent information. Based upon evidence such as laboratory analyses of collected samples and statistical test results, the inspector can issue a compliance (control) order and/or bring court action against the operator. But "any person against whom a civil penalty is assessed under [the *Clean Water Act*] may obtain review of such assessment" in an appropriate court. The *Clean Air Act Amendments of 1990* have similar inspection/enforcement provisions to the *Clean Water Act*. Both laws authorize the EPA to take emergency action to protect the "public health or welfare, or the environment."

As these summaries indicate, the inspection and enforcement provisions of environmental laws in Canada and the United States have many common characteristics. First, an inspector with probable grounds to suspect a violation has the power to inspect the premises of an operator at any reasonable time and to collect relevant information. Second, based on evidence at hand, the inspecting agency can issue a control order. Third, the operator can appeal the control order to an environmental appeal board and/or a court.

These features of the regulatory approach to environmental enforcement raise many important questions. Given that an operator can achieve a private gain by violating, how much inspection is needed to keep compliance at an acceptably high level? Assuming that inspection resources are limited, can higher fines and court costs be used to substitute for an inspection? How should inspectors decide where and when to inspect? How do imperfections in the testing system affect the inspection/enforcement process? Would environmental protection be improved if authorities could issue irrevocable control orders, avoiding the court system altogether—in other words, to what degree is the cost-effectiveness of the inspection/enforcement process compromised by the courts, with their high costs and occasionally incorrect decisions?

Major problems with the regulatory approach in the past can be characterized as follows:

- over-reliance on self-monitoring by operators,
- infrequent auditing of self-reporting by operators,
- lack of rigorous enforcement effort, especially against ongoing violations that might be detected during inspections,
- inadequate definitions of violations, leading to ad hoc decisions,
- reluctance to use self-monitoring records as the basis for notices of violation, even when the records show significant violations, and
- penalties that are too small ("insignificant") in comparison to operator revenues.

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Biographical Sketches

Liping Fang received a B.Eng. degree in electrical engineering from Tianjin University, China, and M.A.Sc. and Ph.D. degrees in systems design engineering from the University of Waterloo, Canada. Dr. Fang is Professor and Chair of Mechanical and Industrial Engineering at Ryerson University, Toronto, Canada. He is also an adjunct professor in the Department of Systems Design Engineering, University of Waterloo. Dr. Fang has actively carried out research in the areas of industrial engineering, engineering management, systems engineering, and decision making, particularly in interactive decision making, multiple criteria decision making, and decision support systems, for which he received the 2008 Ryerson-Sarwan Sahota Distinguished Scholar Award from Ryerson University and Ryerson's Faculty of Engineering, Architecture and Science Research Excellence Award in 2006. He co-authored a book on interactive decision making and is the co-editor of a book on environmental management. He is an associate editor for the *IEEE Transactions on Systems, Man and Cybernetics*, a registered professional engineer in the province of Ontario, Canada, a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and of the Institute of Industrial Engineers (IIE), and a member of the Institute for Operations Research and the Management Sciences (INFORMS).

Keith W. Hipel is University Professor of systems design engineering at the University of Waterloo, Waterloo, Ontario, Canada, where he is the Director of the Conflict Analysis Group. Dr. Hipel thoroughly enjoys teaching and is a recipient of the distinguished teacher award and the Award of Excellence in Graduate Supervision from the University of Waterloo. His major research interests are the development and application of conflict resolution, multiple objective decision making, and time series analysis techniques from a systems design engineering perspective. The main application areas of these decision technologies are water resources management, hydrology, environmental engineering, and sustainable development. Dr. Hipel is an author or co-author of four books, eleven edited books, and close to 200 papers. He is a fellow of the Royal Society of Canada (FRSC), Canadian Academy of Engineering (FCAE), Institute of Electrical and Electronics Engineers (FIEEE), International Council on Systems Engineering (FINCOSE), Engineering Institute of Canada (FEIC), and American Water Resources Association (FAWRA). Dr. Hipel is also a recipient of the Norbert Wiener Award from the IEEE Systems, Man and Cybernetics (SMC) Society, Outstanding Contribution Award from the IEEE SMC Society, title of Docteur Honoris Causa from École Centrale de Lille, W.R. Boggess Award from AWRA, and University of Waterloo Award for Excellence in Research, as well as holder of the Canada Council Killam Research Fellowship, Monbusho Kyoto University Visiting Professor Position, Stanley Vineberg Memorial Visiting Professorship, Centre National de la Recherche Scientifique (CNRS) Research Fellowship, and the Japan Society for Promotion of Science (JSPS) Fellowship. Moreover, he is a Professional Engineer (PEng) and has carried out consulting activities with engineering firms, government agencies, and utilities in many countries. Finally, he is Vice President of the Canadian Academy of Sciences (2007-2009) and an associate editor of eight international journals including the *IEEE Transactions on Systems, Man and Cybernetics*, as well as *Group Decision and Negotiation*.

D. Marc Kilgour is professor of mathematics at Wilfrid Laurier University in Waterloo, Ontario, Canada, research director of the Laurier Centre for Military Strategic and Disarmament Studies, and adjunct professor of systems design engineering at the University of Waterloo. With degrees in engineering physics, applied mathematics, and mathematics from the University of Toronto, he has held academic and administrative positions at Wilfrid Laurier University since 1973, with leaves at the University of

Waterloo, Graduate Institute for International Studies (Geneva, Switzerland), and Kyoto University (Japan), Université de Caen, France, Universität Wien, Austria, and elsewhere. International awards have supported other research and teaching visits to the USA, UK, France, Australia, Japan, and elsewhere. Dr. Kilgour's primary research interests lie in decision analysis, at the intersection of mathematics, engineering, and social science. He has applied game theory and related formal techniques to problems in international security and arms control, environmental management, negotiation and arbitration, voting, fair division, and coalition formation, and has pioneered the development of systems for decision support in strategic conflict. Dr. Kilgour has produced four books and more than 150 refereed articles across a spectrum of academic disciplines, including mathematics, operations research, management science, political science, international security, systems engineering, environmental management, economics, social choice, biology, and philosophy. His most recent book is *Perfect Deterrence* (Cambridge University Press, 2000), co-authored with Frank C. Zagare. Dr. Kilgour is a member of the Editorial Board of *Theory and Decision*, *Group Decision and Negotiation*, and *Control and Cybernetics*. He is the Corresponding Editor of the *Handbook of Group Decision and Negotiation*, scheduled for publication in 2010. The interdisciplinary nature of his research interests accounts for the international recognition he has received.