Designing Safety Regulations for High-Hazard Industries

A report of the

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Presented by

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Penn Law
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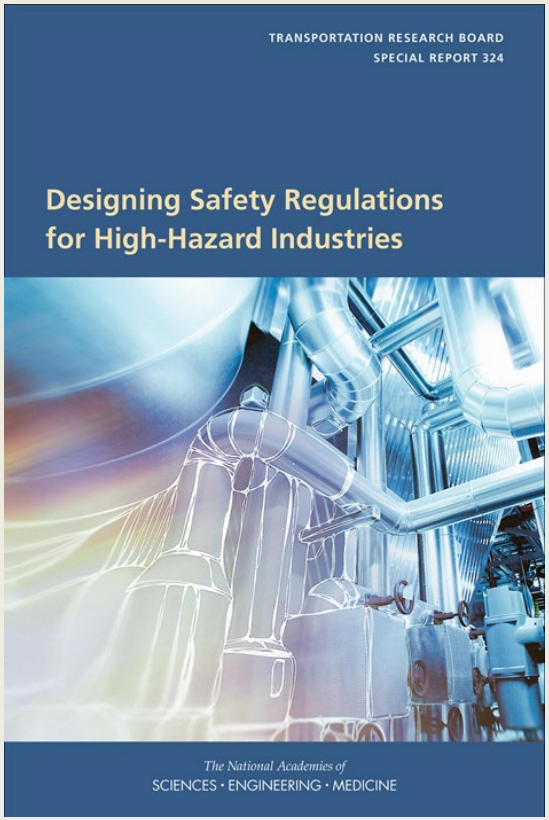
PENN PROGRAM ON REGULATION

The Regulatory Review

Committee for a Study of Performance-Based Safety Regulation



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Study Context and Purpose

- High-hazard industries which have risk of low-frequency, high-consequence events
- Difficult for regulators to discern quantitatively if their regulations are reducing risk of these rare events
- Regulators of high-hazard industries need to be able to justify their choices of regulatory designs
- This study explains key considerations for regulators when making these choices

WHY DOES THE TYPE OF REGULATORY DESIGN MATTER?

Different designs….

…can affect degree of **flexibility** afforded to regulated firms

…can require different types of **capacities** of regulated firms, small and large

…can call for different **capabilities** from the regulator to monitor and enforce

Hence, different designs can yield different benefits and costs....

Study Approach

- Review of regulatory studies literature
- Briefings to elicit a range of views
  - **Regulators**: pipeline, offshore, rail, aviation, chemical, nuclear, occupational safety
  - **Industry**: pipeline, offshore, chemical—large and small
  - **Jurisdictions**: federal, state, Canada, UK, Norway, Netherlands, Denmark
  - **Others:** OMB, Experts on rulemaking, labor union officials, local community official

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- “Performance-based” traditionally refers to regulations that specify outcomes and give flexibility on means of compliance
- But alternative uses equate “performance-based” with *management-based* regulations
- Paucity of systematic empirical evidence of advantages and advantages of regulatory designs

“Richards (2000) summarizes dozens of classification schemes in the literature”

TABLE A2: SUMMARY OF INSTRUMENT CATEGORIES FROM SAMPLE OF ENVIRONMENTAL POLICY LITERATURE

Stahr (1971)
1. Product Standards
2. Production Process Standards
3. Taxes on Emissions
4. Subsidies for Pollution Control
5. Government Expenditure on Abatement Projects

Majone (1976)
1. Regulation, Direct Public Action, and Subsidies
2. Effluent Charges
3. Contract and Redefinition of Property Rights
4. Organization

Baumol and Oates (1979)
1. Moral Suasion
2. Direct Controls
   a. Regulation of levels of emissions
   b. Specification of processes or equipment
3. Market Processes
   a. Tax on environmental damage
      i. Rates based on damage
      ii. Rates designed to achieve preset environmental quality standard
   b. Subsidies
      i. Payments per unit of pollution reduction
      ii. Subsidies to defray equipment costs
   c. Marketable pollution licences
      i. Sale of licenses to highest bidder
      ii. Equal distribution of licenses
   d. Refundable deposits against environmental damage
   e. Allocation of property rights
4. Government Investment Facilities
   a. Regenerative facilities
   b. Dissemination of information
   c. Research
   d. Education

Bohm and Russell (1985)
1. Prices and Taxes
2. Tradeable Rights
3. Deposit-Refund Systems and Performance Bonds
4. Liability
5. Regulation
   a. Forcing private negotiation
   b. Performance standards
   c. Regulating decision variables correlated to emissions
   d. Design standards
   e. Bans on products or processes
6. Government Investment in Protection and Restoration
7. Moral Suasion

Bressers and Klok (1988)
1. Creating Alternatives (Technological Development)
2. Alternatives Reduction (Physical Intervention)
3. Changing Pros and Cons of Alternatives
4. Changing Valuation of Outcomes
5. Information Provision

Department of Energy (1989)
1. Regulation
   a. Regulation by controls
      i. Bans
      ii. Emissions controls
      iii. Input controls
      iv. Consumption controls
      v. Price controls
      vi. Rate of return regulation
   b. Standards
      i. Technology standards
      ii. Licensing and certification
2. Fiscal Incentives
   a. Emission fees
   b. Tradeable emission rights
   c. Deposit-refund systems
   d. Taxes
      i. Excise taxes
      ii. Taxes on firms
      iii. Personal income tax
      iv. Property taxes
      v. Tariffs
   e. Subsidies
   f. Direct government expenditure
      i. R&D support
      ii. Direct government purchases
3. Information
   a. Advertising and labeling
   b. Education
   c. Moral suasion
   d. Signaling
4. Research, Development, and Demonstration
   a. Public invention support programs
   b. Commercialization education
   c. Provision of specialized information
   d. Demonstrations

Hahn (1989)
1. Standards
   a. Ambient standards controlling environmental quality
   b. Emissions standards
      i. Technology-based standards
      ii. Performance standards
2. Subsidies
3. Taxes and Emissions Fees
4. Tradeable Permits

Environmental Protection Agency (1990)
1. Conventional Regulations
   a. Standards
   b. Use restrictions
   c. Product design
2. Market Incentives
   a. Pollution charges
   b. Permit systems
3. Scientific/Technical Measures (R&D)
4. Provision of Information
5. Enforcement
6. Cooperation with Other Government Agencies and Nations

Project 88C Round II (1991)*
1. Command-and-Control
   a. Technology-based standards
   b. Uniform performance standards
2. Market-Based Instruments
   a. Pollution charges
   b. Tradeable permits
   c. Deposit-refund systems
   d. Market barrier reductions
   e. Government-subsidy elimination

* Also similar: Project 88 (1988), Stavins (1992), Hahn and Stavins (1991, 1992), Stavins (1998)

Office of Technology Assessment (1995)
1. Direct Limitations
   a. Single-source tools
      i. Harm-based standards
      ii. Design standards
      iii. Technology specifications
      iv. Product bans and limits
   b. Multisource tools
      i. Integrated permitting
      ii. Tradeable emissions
      iii. Challenge regulations
2. Indirect Limitations
   a. Pollution charges
   b. Liability
   c. Information reporting
   d. Subsidies
   e. Technical assistance

Department of Energy (1996)
1. Information and Education
2. Voluntary Programs
3. Research, Development and Demonstration
4. Regulation
5. Market-Based Incentives

Callan and Thomas (1996)
1. Command-and-Control
   a. Technology-based standards
   b. Performance-based standards
2. Market-Based
   a. Pollution Charge
      i. Effluent charge
      ii. Product charge
      iii. User charge
      iv. Service charge
   b. Subsidy
   c. Deposit/Refund
   d. Pollution permit market
      i. Credit system
      ii. Allowance system

Intergovernmental Panel on Climate Change (1996)
1. Market-Based Programs
   a. Taxes
   b. Full-cost pricing
   c. Subsidies
   d. Phaseout of subsidies
   e. Tradeable emissions quotas
2. Voluntary Agreements
   a. Energy use and emissions standards
   b. Government procurement
   c. Promotional programs
3. Regulatory Measures
   a. Mandatory building or equipment standards
   b. Product and practices bans
   c. Nontradeable emissions quotas
4. Research, Development and Demonstration

Fisher et al. (1996)
1. Conventional Regulation
2. Market-Based Instruments
   a. Taxes and subsidies
   b. Tradeable permits
3. Other Complementary Policies
   a. Education and provision of information
   b. Family planning
   c. Modification of trade policy and subsidies

Blackman and Harrington (1998)
1. Economic Incentives
   a. Direct (emissions fees, marketable permits)
   b. Indirect (environmental taxes)
2. Command-and-Control
   a. Direct (emissions standards)
   b. Indirect (technology standards)
3. Government Investment
   a. Direct (road paving, waste disposal plants)
   b. Indirect (R&D in clean technology)
4. Informal Regulation

Table A2 (Continued): Summary of Instrument Categories from Sample of Environmental Policy Literature

Source: Richards (2000)

Key observation: Vital need for a clearer conceptual framework for examining regulatory designs!

Two Dimensions of Regulatory Design

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- **Means versus Ends**
  - Means: “command that the regulated entity take or avoid an action”
  - Ends: “mandate the achievement or avoidance of certain ends”

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- **Means versus Ends**
  - Means: "command that the regulated entity take or avoid an action"
  - Ends: "mandate the achievement or avoidance of certain ends"
- **Micro versus Macro**
  - Micro: "targeted to a specific contributor or causal pathway to the ultimate problem"
  - Macro: "focus is widened to the ultimate problem itself"

A Regulatory Design Framework

	Means	Ends
Micro	**Micro-means** **“Prescriptive”**	**Micro-ends** **“Performance-based”**
Macro	**Macro-means** **“Management-based”**	**Macro-ends** **“General duty/liability”**

Source: Adapted from Coglianese (2010)

	Means	Ends
Micro	Micro-means "Prescriptive"	Micro-ends "Performance-based"
Macro	Macro-means "Management-based"	Macro-ends "General duty/liability"

Micro-Means

"Prescriptive"

Mandated actions aimed at points on a causal pathway to the ultimate problem

Examples:

- "Install a hazard warning sign having a certain color scheme"
- "Install a particular type of valve"
- "Inspect the condition of equipment at a defined time interval"
- "Construct a pipeline by using a specified grade of steel"

	Means	Ends
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Micro-Ends

"Performance-based"

Mandated outputs at points on a causal pathway leading to the ultimate problem

Examples:

- "Ensure that an electrical component of a product passes a test for shock resistance"
- "Limit sulfur dioxide emissions to certain levels"
- "Demonstrate the capability to evacuate all occupants from a building in a designated time"

	Means	Ends
Micro	Micro-means "Prescriptive"	Micro-ends "Performance-based"
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Macro-Means

"Management-Based"

Mandated actions aimed to induce managers to focus on the ultimate problem

Examples:

- "Engage in threat and risk analysis"
- "Establish and execute a safety management program"
- "Reevaluate and revise safety management plan at regular intervals"

	Means	Ends
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Macro-Ends

"General duty/liability"

Mandated outcomes that avoid the ultimate problem

Examples:

- "Keep workplace free from recognized hazards"
- "Design and maintain a facility to prevent releases of hazardous substances"
- "Conduct certain observations or measurements"
- "Avoid a transportation accident"

Using Framework to Study Regulation of High-Hazard Industries in Four Case Studies

- U.S. and Canadian pipeline sectors
- U.S. and North Sea offshore sectors

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Using Framework to Study Regulation of High-Hazard Industries in Four Case Studies

- U.S. and Canadian pipeline sectors
- U.S. and North Sea offshore sectors
- Examined challenges faced by regulators and firms implementing, enforcing, and complying with the regulations
- Considered:
  - number, size, and diversity of regulated firms and complexity of their operations
  - budgetary resources and staffing levels and competencies of regulatory agencies
  - types of regulations that make up the regimes

Observations from Case Studies

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- The specific structures of these regulations vary to account for different characteristics of regulators and industry (e.g., large vs. small firms, regulator capabilities)
- North Sea regulators collaborate with industry more than North American regulators. (Is this essential for macro-means regulations? Not clear whether it is….)

Pros and Cons:
Micro-Means ("Prescriptive") Regulations

PROS

- "may be easier to follow by regulated firms"
- "may be easier to enforce, for ... same reason"

CONS

- "may result in less effective or less cost-effective methods of addressing risk ... because one size does not always fit all"
- "may not afford regulated entities room to change"

Pros and Cons:
Micro-Ends ("Performance-based") Regulations

PROS

- "may allow more flexibility by different firms"
- "may allow greater opportunities for firms to innovate"

CONS

- "may be difficult for the regulator to monitor"
- "may foster a 'teaching to the test' effect or encourage gaming"

Pros and Cons:
Macro-Means ("Management-based") Regulations

PROS

- "may allow for flexibility and opportunities for innovation"
- "may be used when outcomes are difficult to measure"
- "may help infuse a sense of responsibility, accountability, or safety culture"

CONS

- "both the firm and the regulator may need to develop new skills to implement ... the regulation effectively"
- "regulator may have difficulty in monitoring and ... in maintaining motivation for continuous improvement"
- may present challenges for smaller firms

Pros and Cons:
Macro-Ends ("General Duty/Liability") Regulations

PROS

- "may provide flexibility and opportunities for innovation"
- "may reinforce other types of regulatory designs as a backstop"

CONS

- "may not adequately prevent harms since regulatory consequences are only imposed after an event"
- "may not provide adequate direction to firms that lack knowledge of what to do or lack the incentives to find out"

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Key Constraints and Conditions

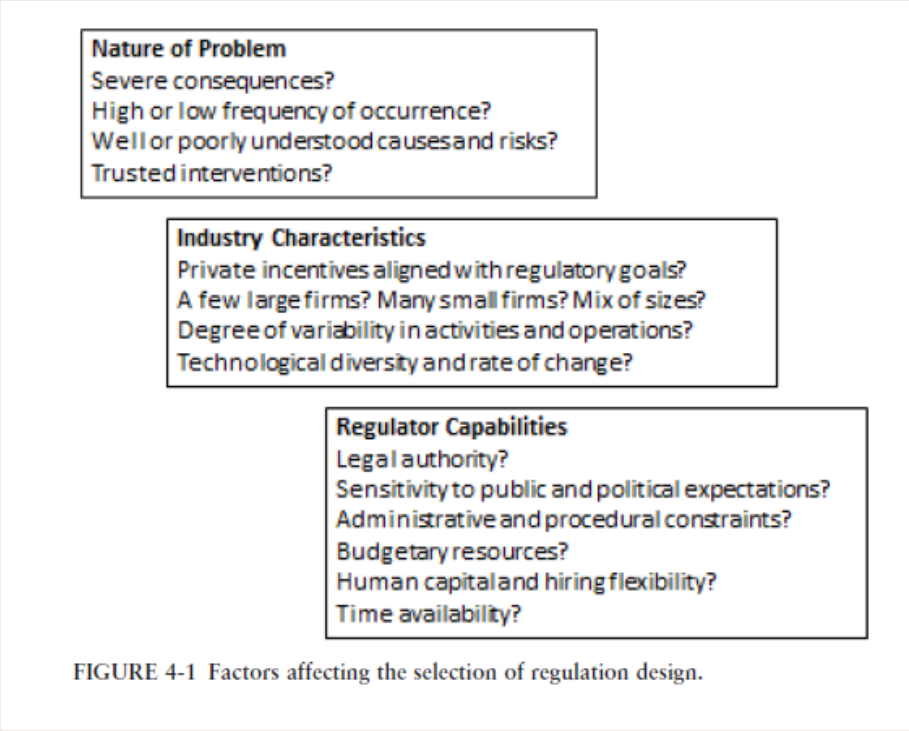

FIGURE 4-1 Factors affecting the selection of regulation design.

- **The Problem** (and its causal pathway)
- **The Industry** (and its incentives and charac-teristics)
- **The Regulator** (and its capabilities)

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2. *"The regulator's task is to determine how well different designs or combinations of designs will work **under the constraints and conditions** encountered in practice"*
3. *"A regulation's advantages and disadvantages will **depend on how it is structured**"*

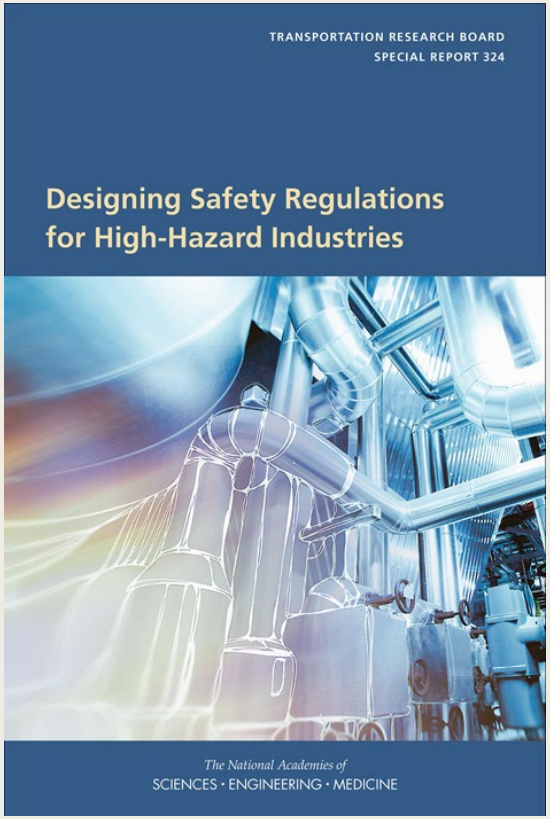
Not All Rules are the Same (even within the same design type)

Example: Ways that the Structure of Micro-Ends ("Performance-based") Regulations Can Vary

- Specificity (*loose vs. tight*)
- Proximity between legal command and regulatory goal (*close vs. distant*)
- How performance is determined (*measured vs. predicted*)
- Basis for the standard (*ideal vs. feasible*)
- Unit of analysis (*individual vs. aggregate*)
- Burden of Proof (*regulator vs. regulated*)

The Upshot

Are Micro-Ends ("Performance-Based") Regulations Always More Flexible?



"If in a particular context a required end can only be achieved in one way at the present time, an ends-based regulation will be no different from a means-based regulation in terms of the flexibility offered."

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- They can also augment micro-level regulations.

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- These regulations can serve a valuable purpose by addressing risks that cannot be controlled by highly targeted micro-level regulatory interventions, including risks from interaction of factors.
- They can also augment micro-level regulations.
- But regulators must take into account their ability to enforce, motivate, and support compliance

Think Also About Ways to Structure Macro-Means ("Management-based") Regulations

1. Require just planning, or planning & implementation?
2. What level of specificity or precision in planning criteria?
3. Role of regulator in planning: e.g., pre-approval ("safety case")?
4. Transparency: e.g., record-keeping?
5. Extent to which they overlay or are supplemented with other types of regulation?

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Performance = Regulation (Design, Structure) x
Context (Problem, Industry, Regulator)

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- The challenge for the regulator will be to choose a design and structure it in a way that is suited to the nature of the problem and the characteristics of the regulated industry, as well as the regulator's capacity to promote and enforce compliance.
- Regulators should consider whether the best approach to achieving their regulatory goals may be to combine various regulatory approaches.

Selected Additional Publications on Regulatory Design

Cary Coglianese, "The Limits of Performance-Based Regulation," *University of Michigan Journal of Law Reform* 50:525-563 (2017)

Cary Coglianese, *Listening, Learning & Leading: A Framework of Regulatory Excellence* (2015)

Cary Coglianese & Lori Bennear, "Flexible Approaches to Environmental Regulation," in Michael Kraft and Sheldon Kamieniecki, eds., *The Oxford Handbook of U.S. Environmental Policy* (2012)

Cary Coglianese, "Management-Based Regulation: Implications for Public Policy," in Gregory Bounds and Nikolai Malyshev, eds., *Risk and Regulatory Policy: Improving the Governance of Risk* (OECD Publishing, 2010)

Cary Coglianese, Adam Finkel, & David Zaring, *Import Safety: Regulatory Governance in the Global Economy* (University of Pennsylvania Press, 2009)

Cary Coglianese & Jennifer Nash, eds., *Leveraging the Private Sector: Management-Based Strategies for Improving Environmental Performance* (Johns Hopkins University Press/Resources for the Future Press, 2006)

Cary Coglianese, Jennifer Nash, & Todd Olmstead, "Performance-Based Regulation: Prospects and Limitations in Health, Safety, and Environmental Regulation," *Administrative Law Review* 55: 705-729 (2003)

Cary Coglianese & David Lazer, "Management-Based Regulation: Prescribing Private Management to Achieve Public Goals," *Law & Society Review* 37: 691-730 (2003)

Kenneth Richards, "Framing Environmental Policy Instrument Choice," *Duke Environmental Law and Policy Forum*, 10: 221-285 (2000)

Questions and Discussion

For further information

Download the full report at
https://www.nap.edu/download/24907

See also
Cary Coglianese and Thomas R. Menzies, Designing Safety Regulations for High-Hazard Industries, *The Regulatory Review* (Oct. 4, 2017), https://www.theregreview.org/2017/10/04/coglianese-menzies-safety-regulations-hazard-industries/

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