

This session is titled:  
**Risk regulation to support  
technological innovation**

We will have two presentations

**Richard Meads**, European Risk Forum

"Innovation and the Regulation of Risk"

**Dirk Pilat**, OECD, Directorate for Science, Technology and  
Industry

"OECD Work on Innovation and Risk Regulation"

These will be followed by some panel discussion and Q&A.

# But first...

...I'd like to begin the session with a few very brief remarks about innovation and the need for flexible and adaptive risk management and risk governance.

# Flexible Regulation and Technological Innovation:

Be sure you actually want what you ask for.

M. Granger Morgan  
Chair, IRGC S&TC and  
Prof., Engineering and Public Policy  
Carnegie Mellon University  
Pittsburgh, PA 15213  
+1-412-268-2672  
granger.morgan@andrew.cmu.edu

# Anyone who has spent...

...time talking with folks in regulated industries (which today is pretty much *all* industries) has heard vigorous complaints about the inflexibility of many regulations.

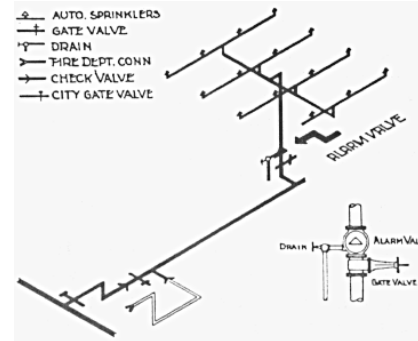
While regulations generally provide protection to health, safety and the environment, it is also true that:

- Inflexible regulations often are a serious impediment to innovation.
- Existing regulations end up costing more than they should to achieve the desired outcome.

# Two approaches:

## Design standards:

For example, detailed specifications of how many ceiling sprinkler heads must be installed and how the system must work.



## Performance standards:

For example, specification that with a stated probability all building residents must be able to evacuate a building before a fire becomes life threatening.



Performance standards allow greater innovation and flexibility but demonstrating that they have been met can be challenging

# Using a supercomputer to assess fire protection performance standards



Carnegie Mellon University

CARNEGIE INSTITUTE OF TECHNOLOGY

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

TITLE: The Role of Uncertainty in Improving Fire Protection Regulation

PRESENTED BY: Kathy A. Notarianni

ACCEPTED BY THE DEPARTMENT OF: Engineering and Public Policy

April 2000

<http://fire.nist.gov/bfrlpubs/fire00/PDF/f00125.pdf>

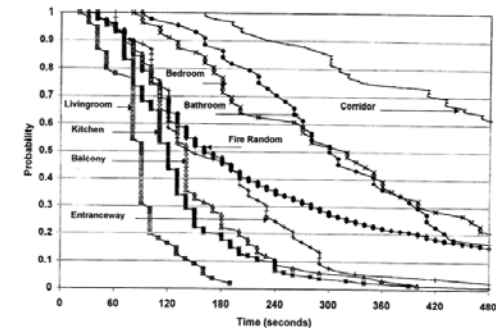
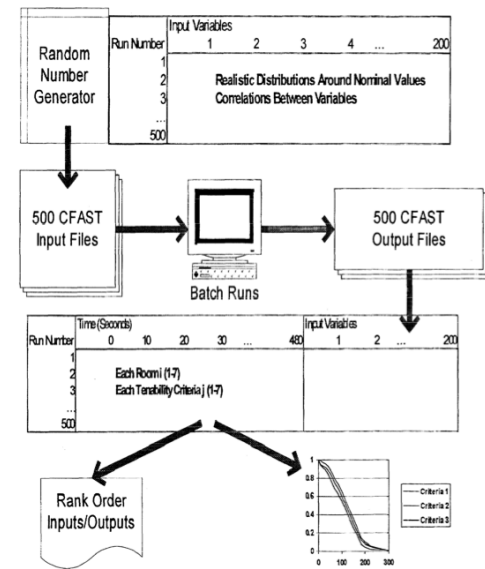


Figure 5-19. Time to Untenability (65 0C or P-FED 0.5) in the Livingroom by Room of Origin

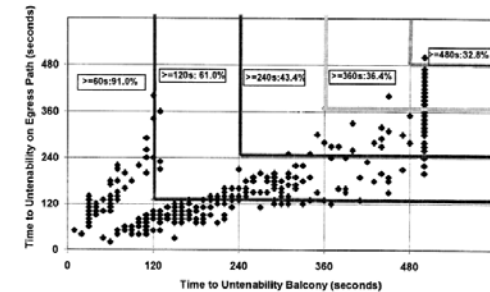


Figure 5-27. Time to Untenability (650C or 0.5 P-FED) Balcony and Egress Path, Sprinkler in Corridor and Entranceway

# The need to include learning

In many cases, when it first becomes necessary to address, a hazard we don't know enough about it to establish a definitive regulation.

In such cases, regulators (on both sides of the Atlantic) tend to exercise precaution.

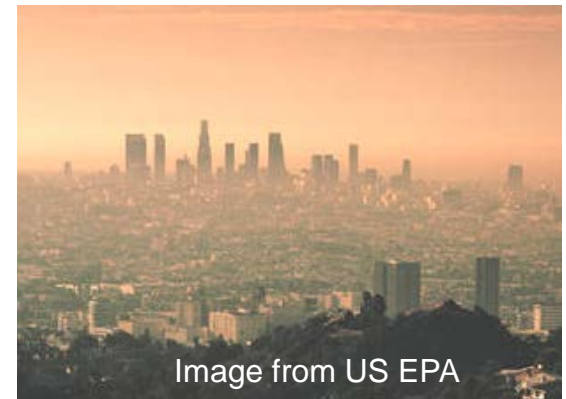
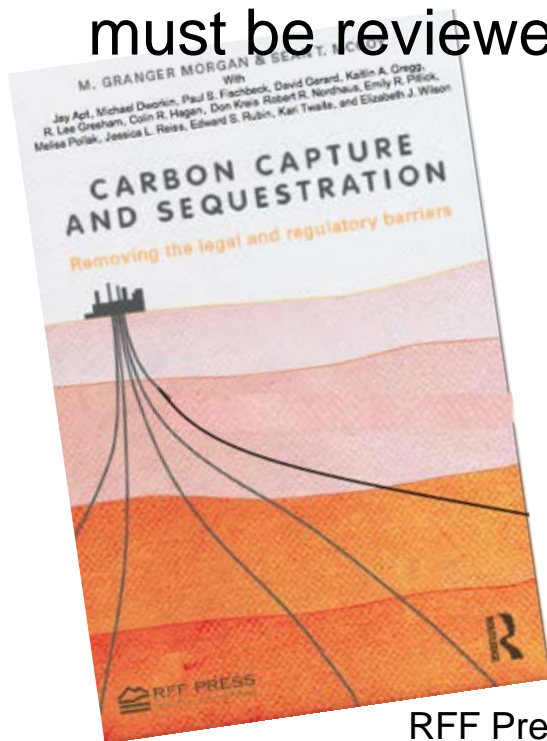
BUT...as more is learned, it is often the case that the regulation should be revisited and revised.

Regulatory agencies are often reluctant to do this, and regulated parties may also not want it done because they don't want change.

# To assure that this *does* happens...

...regulations should come with a time limit, after which they must be revisited.

EXAMPLE: Standards for criteria air pollutants under the U.S. Clean Air Act must be reviewed every five years.



A few years ago my colleagues and I undertook a major study to develop a U.S. regulatory framework for deep geological sequestration of carbon dioxide (CCS).



# We proposed a process...

...to have a standing committee of the NRC systematically gather information on CCS experience all around the world, and then have EPA revisit and revise the standard as needed every eight years.

**A BILL**

To establish a comprehensive system for the safe and effective transport and geologic sequestration of carbon dioxide.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

**SECTION 1. SHORT TITLE.**  
This Act may be cited as the "Carbon Capture and Sequestration Act".

**SEC. 2. TABLE OF CONTENTS.**  
The table of contents for this Act is as follows:

**SECTION 1. SHORT TITLE.**

**SEC. 2. TABLE OF CONTENTS.**

**SEC. 3. FINDINGS**

**SEC. 4. DEFINITIONS**

**SEC. 5. SEVERABILITY OF PROVISIONS.**

**TITLE I—CARBON DIOXIDE PIPELINES**

**SEC. 101. SITING AND CONSTRUCTION OF CO<sub>2</sub> PIPELINES.**

**SEC. 102. SAVINGS PROVISIONS**

**TITLE II—ADAPTIVE AND PERFORMANCE-BASED APPROACH**

**SEC. 201. NEED FOR AN ADAPTIVE APPROACH TO THE GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE**

**SEC. 202. CREATION OF A CCS TECHNICAL ADVISORY COMMITTEE OF THE NATIONAL RESEARCH COUNCIL.**

**SEC. 203. REQUIREMENTS FOR PERIODIC REVIEW AND REVISIONS**

**TITLE II—ADAPTIVE AND PERFORMANCE-BASED APPROACH**

**SEC. 101. NEED FOR AN ADAPTIVE AND PERFORMANCE-BASED APPROACH TO REGULATING THE GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE**

(a) THE CONGRESS FINDS AND DECLARES:

(1) IN GENERAL.—Because at present there is limited experience with large-scale geologic sequestration of carbon dioxide, regulations developed to govern GS site permitting operation, and issuance of a certificate of closure, including criteria for a transition to long-term stewardship, should emphasize the promulgation of adaptive and performance-based rules and standards to encourage flexibility and learning, and mandate a systematic process to regularly review and improve the regulation of GS.

(b) DEVELOPMENT OF PERFORMANCE-BASED RULES AND STANDARDS.—The objective of rules and standards developed by the Environmental Protection Agency for permitting and monitoring the operation of GS Projects shall be to assure that these activities are conducted in a manner that provides reasonable protection to health, safety and the environment. Similarly, the objective of the standards or criteria developed by the Federal Geologic Sequestration Board for accepting GS sites into long-term stewardship and managing those sites once they have entered long-term stewardship shall be to assure that these standards, criteria and management activities continue to provide reasonable protection to health, safety and the environment. Consistent with those objectives, both the Environmental Protection Agency and the Federal Geologic Sequestration Board shall, to the extent practicable, promulgate rules and formulate standards that are performance-based such that compliance strategies may evolve with increased knowledge, while the required level of regulatory performance remains constant.

**SEC. 102. CREATION OF A CCS TECHNICAL ADVISORY COMMITTEE OF THE NATIONAL RESEARCH COUNCIL.**

(a) FORMATION OF THE TECHNICAL ADVISORY COMMITTEE.—Within three months of the adoption of this Act, the EPA shall contract with the National Research Council

(NRC) to establish an independent expert CCS Technical Advisory Committee. Membership of this committee shall consist of at least nine experts, chosen by the NRC for their technical expertise in accordance with standard NRC procedures.

(b) INITIAL REVIEW.—Within one year of its establishment, the CCS Technical Advisory Committee of the NRC shall complete a review of the available accumulated data and experience from operational carbon dioxide sequestration projects in the U.S. and elsewhere, and publish a summary of its findings together with recommendations, based on those findings, as to:

(1) how regulations and standards for permitting and operating a carbon dioxide geologic sequestration facility should best be shaped to provide reasonable protection to health, safety and the environment;

(2) the feasibility of adaptive strategies and performance-based standards that improve the effectiveness of GS operations with no loss of protection to health, safety and the environment; and,

(3) research needed to provide the foundation for improving standards in the future.

(c) PERIODIC REVIEW.—Seven years after the NRC CCS Technical Advisory Committee's initial review, and at least every seventh year thereafter, the Administrator and the Chairperson the Federal Geologic Sequestration Board shall jointly request the Committee be reconvened to:

(1) update and evaluate the cumulative experience from all geologic sequestration facilities operating in the U.S. or elsewhere;

(2) identify research to provide the foundation for improving the formulation of standards in the future; and

(3) publish a summary of its findings and make recommendations regarding the following:

(A) modifications to performance-based elements of the regulations, such as clearer articulation of objectives, specification of performance standards, guidance on assessment methodologies to insure that performance standards are met, and requirements for overall accountability;

# When we vetted this...

...with an industry group, they expressed great alarm:

"We need certainty, don't change things on us over time."

It was not until we clarified that what we were proposing was to modify the basic regulatory framework, *not* previously issued operating licenses, (unless those involved a major risk) that they decided that the proposed adaptive approach would be OK.

**Bottom line:** Learning and adapting regulation over time is good, but it needs to be done in a way that provides some certainty to investors and operators.