

# **The Challenges of Using Models in a Regulatory Environment**

Wendy Wagner, University of Texas School  
of Law

**Table 1: Some Uses of Computational Models in Environmental Regulation**

- 1) CLEAN AIR ACT
  - a. The most established use of models in environmental law occurs in EPA's effort to satisfy its Clean Air Act mandate to ensure that all areas of the United States do not exceed National Ambient Air Quality Standards (NAAQS) for several major air pollutants.
    - i. EPA uses risk assessment models to determine the "safe" level of air pollution for sensitive subgroups in the population;
    - ii. EPA also deploys sophisticated fate and transport models to predict levels of these pollutants after emissions reductions have been made from various mobile and stationary sources;
    - iii. States also have incentives to develop and run very precise models that will both predict and explain how the state will attain ambient standards presently and the future.
  - b. Although moving at a slow pace, the residual risk program of the Clean Air Act (for air toxics) involves the use of risk assessment models to help determine the safe level of air toxins in ambient air and fate and transport models to link sources to exceedances in local areas.
- 2) CLEAN WATER ACT: States and the EPA increasingly rely on models to identify and regulate point and nonpoint contributors to degraded waters through the Total Maximum Daily Load (TMDL) program. Fate and transport models play a particularly important role since they help regulators trace the contributions of individual point and nonpoint dischargers into surface waters and help regulators predict how water quality would improve with reductions of pollutants from these individual sources.
- 3) HAZARDOUS WASTE CONTAMINATION: Risk assessments are often used to determine cleanup levels for hazardous waste sites and defunct hazardous waste facilities. Fate and transport models also help predict long-term maintenance needs for cleanup of these sites.
- 4) DRINKING WATER STANDARDS: Risk assessments are used to determine the goal for drinking water quality under the Safe Drinking Water Act (the Maximum Contaminant Level Goal (MCLG)).
- 5) LICENSING PESTICIDES AND CHEMICALS: EPA uses quantitative risk assessment models to evaluate the safety of pesticides and some toxic chemicals.
- 6) ENFORCEMENT: Models are used by the EPA in the enforcement context – for example, to determine penalty amounts.
- 7) COASTAL ZONE MANAGEMENT ACT: Models may be used to assess water quality in coastal zones and along the Great Lakes.
- 8) ENDANGERED SPECIES AND MARINE MAMMAL PROTECTION ACTS: These wildlife protection statutes rely on models to determine when species should be listed, and when their populations have recovered sufficiently to be removed, in identifying critical habitats, and allowing incidental takes.
- 9) LAND MANAGEMENT AGENCIES: Land management agencies, like the Forest Service, use models extensively to determine the best uses of public lands.
- 10) REGULATORY ANALYSIS: Cost-benefit models are used by EPA to assess the economic impact of those rules that impose significant costs on the economy. Agency compliance with the National Environmental Policy Act (NEPA) also leads EPA to rely on models to consider alternative scenarios to proposed agency actions with significant environmental impacts.
- 11) LESS FORMAL USE OF MODELS BY FEDERAL ACTORS: Models can also be used by agencies or Congress more informally in assessing problems, setting priorities, or evaluating the efficiency of rules. In these cases, the models do not create binding or direct obligations for members of the public or regulated parties, but instead provide information for "deliberating" about whether there is a problem in need of redress, like climate change and acid rain, or whether a proposed solution is the best among alternatives.
- 12) STATE MODELS: States can use and develop models for their own programs or to fulfill their responsibilities under federal statutes, particularly the Clean Air Act NAAQS and the Clean Water Act TMDL programs.

# The Real Role of Models

- Exploring connections between cause and consequence
- Bringing together diverse information
- Bringing together different disciplines

**“all models are wrong,  
but some are useful”**

George E. P. Box & Norman R. Draper,  
Empirical Model-Building and Response  
Surfaces 424 (1987).



# The Courts' Review of Models

- "To make precise estimates, precise data are required."

*Gulf South Insulation v. CPSC*, 701 F.2d 1137, 1146 (5th Cir. 1983).

- "While the EPA 'may 'err' on the side of overprotection," it "may not engage in sheer guesswork."

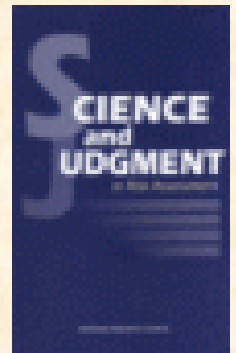
*Leather Industries v. EPA*, 40 F.3d 392, 403-05 (D.C. Cir. 1994).

- "[I]f the methodology [used in preparing a model] is challenged, [the agency must] 'provide a *complete analytic defense*.'"

*Small Refiner Task Force* at 229.

EPA's use of point estimates “suppresses information about sources of error that result from choices of model, data sets, and techniques for estimating values of parameters from data.”

COMMITTEE ON RISK ASSESSMENT OF HAZARDOUS AIR POLLUTANTS,  
NATIONAL RESEARCH COUNCIL, SCIENCE AND JUDGMENT IN RISK  
ASSESSMENT 184 (1994).



# Vulnerability #1: The Never-ending Search for the Answer

“[T]he climate models upon which NACC relies struck out.

Strike one: they can't simulate the current climate.

Strike two: they falsely predict greater and more rapid warming in the atmosphere than at the surface—the opposite is happening.

Strike three: they predict amplified warming at the poles, which are cooling instead.”



COMPETITIVE ENTERPRISE INSTITUTE

20 February 2003

Director of the Office of Science and Technology Policy  
Executive Office of the President  
Eisenhower Executive Office Building  
1650 Pennsylvania Avenue, NW  
Washington, DC 20502.

Re: **Initial Request for Correction of Information:**  
**Petition to Cease Dissemination of the National Assessment on Climate Change,**  
**Pursuant to the Federal Data Quality Act**

#### Introduction

This document follows and incorporates by reference: 1) the information presented the United States District Court for the District of Columbia in *Competitive Enterprise Institute (CEI), Inhofe, et al. v. Bush* (DC DC CV 00-02383), the complaint of which is presently withdrawn without prejudice expressly on the basis of OSTP assurances that the National Assessment does not represent a product of the federal government; 2) correspondence sent by CEI to Assistant Secretary of Commerce Dr. James R. Mahoney and Under Secretary of Commerce Vice Admiral Conrad C. Lautenbacher, Jr (18 October 2002) requesting that the US Global Change Research Change Project's (USGCRP) National Assessment Synthesis Team undergo housecleaning to remove members responsible for the unlawfully produced, incomplete and FDQA-noncompliant National Assessment on Climate Change; and 3) CEI's Comments on NOAA/USCCSP's "Strategic Plan for the Climate Science Program" (17 January 2003)(the latter two are attached).

Because "[t]he Office of Science and Technology Policy (OSTP) and the Office of Management and Budget (OMB) provide oversight [of USGCRP] on behalf of the Executive Office of the President" (<http://www.usgcrp.gov/usgcrp/GCRPINFO.html>), OSTP retains responsibility for

# Vulnerability #2: Discredit models with unfavorable results

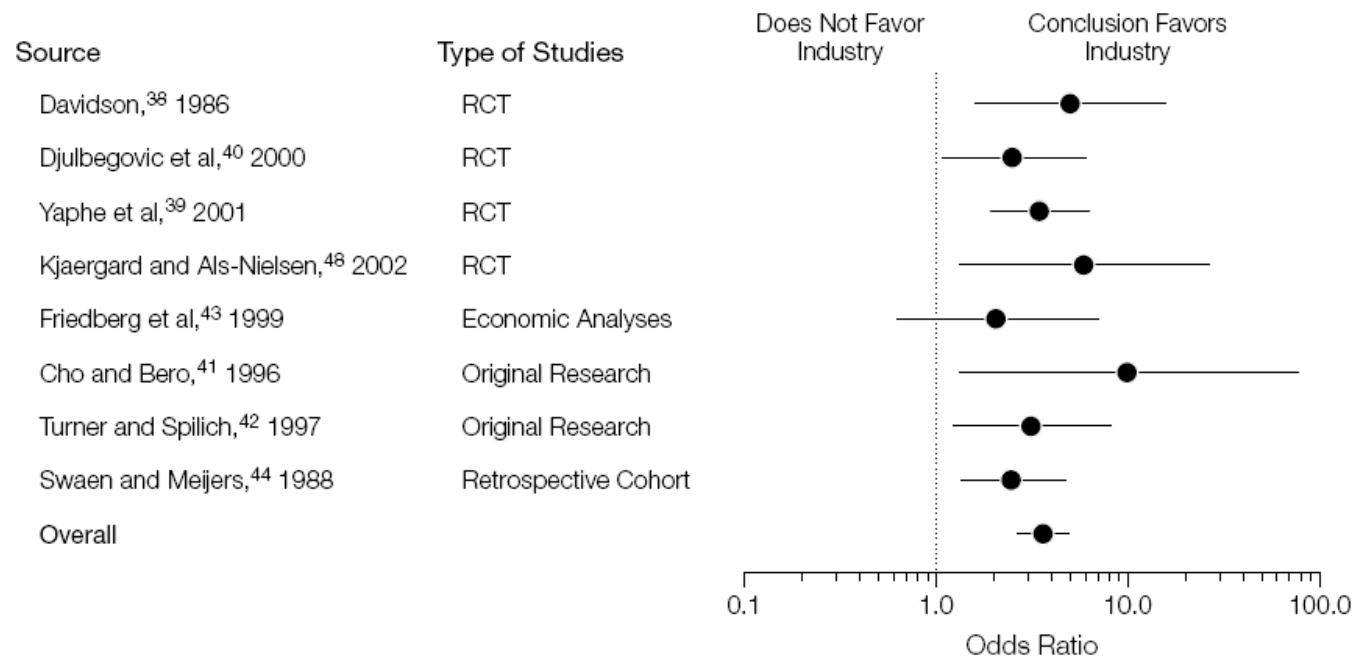
“Words like uncertainty, systematic biases, and important deficiencies [used by modelers in describing their climate change models] are music to the ears of cross-examiners.”

Daniel A. Farber, *Modeling Climate Change and its Impacts: Law, Policy, and Science*,  
86 TEX. L. REV. 1675 (2008)



# Vulnerability #3: Work backwards from preferred result to favored model

**Figure.** Relation Between Industry Sponsorship and Study Outcome in Original Research Studies



RCT indicates randomized controlled trial. Error bars indicate 95% confidence intervals.

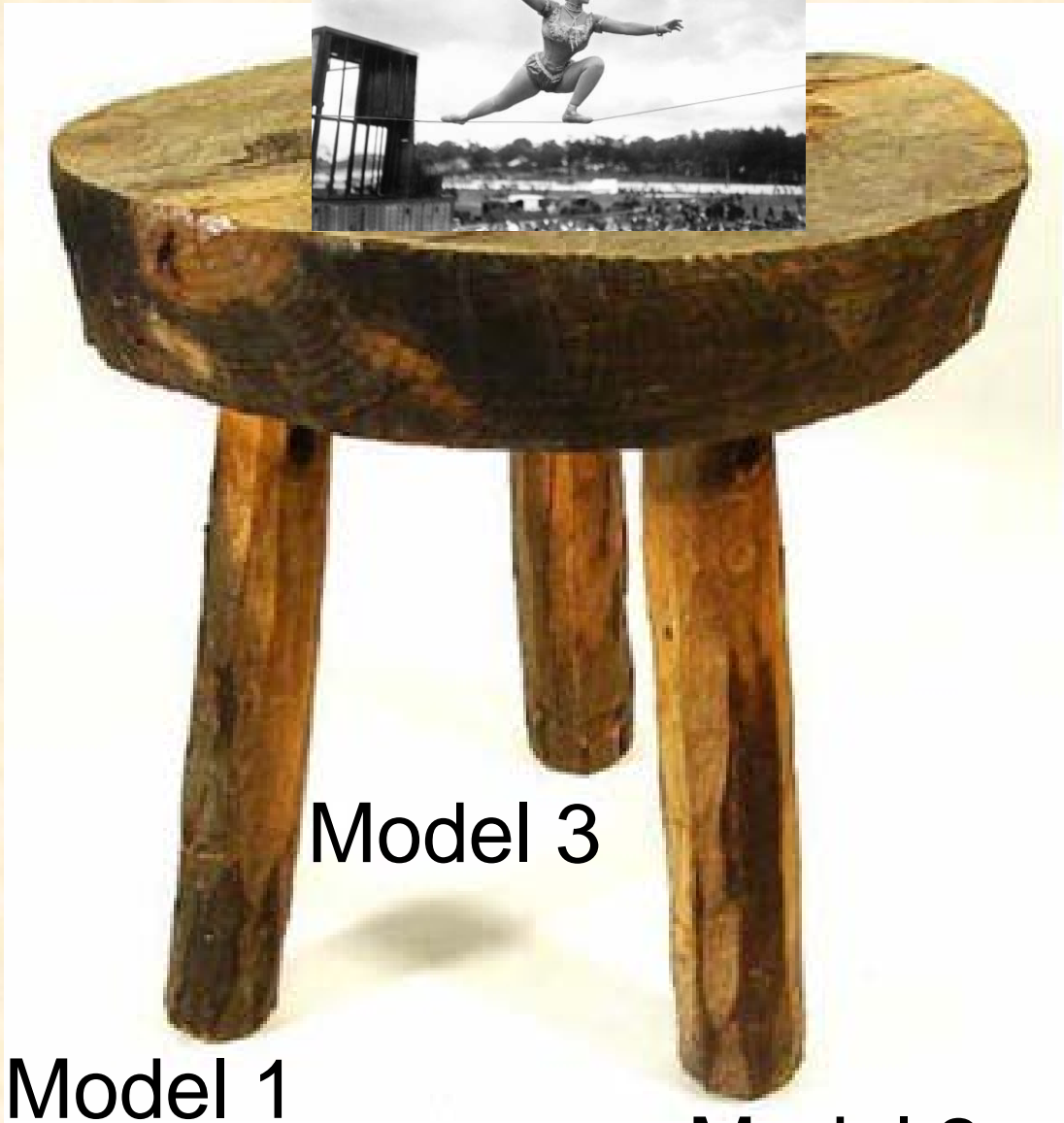
# Regardless of Mischief, Lose the Value of Models

1. Lost Opportunity for Collaborative Problem-solving
2. Single Answer rather than Questions and Insights (for policy)
3. Obsessive focus on Static Output rather than model Dynamic Process

**Table 2. The Proper Way to Understand Models vs. Models Misunderstood as “Answer Machines”**

	<b>Models properly understood</b>	<b>Models misunderstood as “Answer Machines”</b>
<b>Purpose of Model</b>	To assist in problem solving; to spark deliberation	To prove that a regulation is supported by “sound science”
<b>Basis of Model</b>	Analysis; judgment based on experience; assumptions	Scientific analysis, without any policy or related judgments
<b>Scientific uncertainty</b>	Inherent feature that needs to be explained	Undesirable feature that needs to be reduced: uncertainty can undercut the perceived reliability of a model
<b>Model output</b>	Dynamic, iterative process	Static, one-time answer
<b>Primary Administrative Purpose</b>	To aid in the process of establishing reasons for regulating	Accurately proving a relationship between source and effect
<b>Relationship to Public Participation</b>	Facilitate deliberation among disparate parties	No relationship: public participation is inappropriate for this “scientific” exercise
<b>Approaches to Public Administration<sup>122</sup></b>	Deliberative-Constitutive	Rational-Instrumental
<b>Accountability</b>	Through showing that there has been an effective problem-solving process	Through showing accuracy and adherence to the legislative mandate
<b>Means of Assessing the Quality of the Model</b>	Through assessing how it has contributed to problem-solving	Through assessing the model’s accuracy

by Liz Fisher, Oxford



Model 3

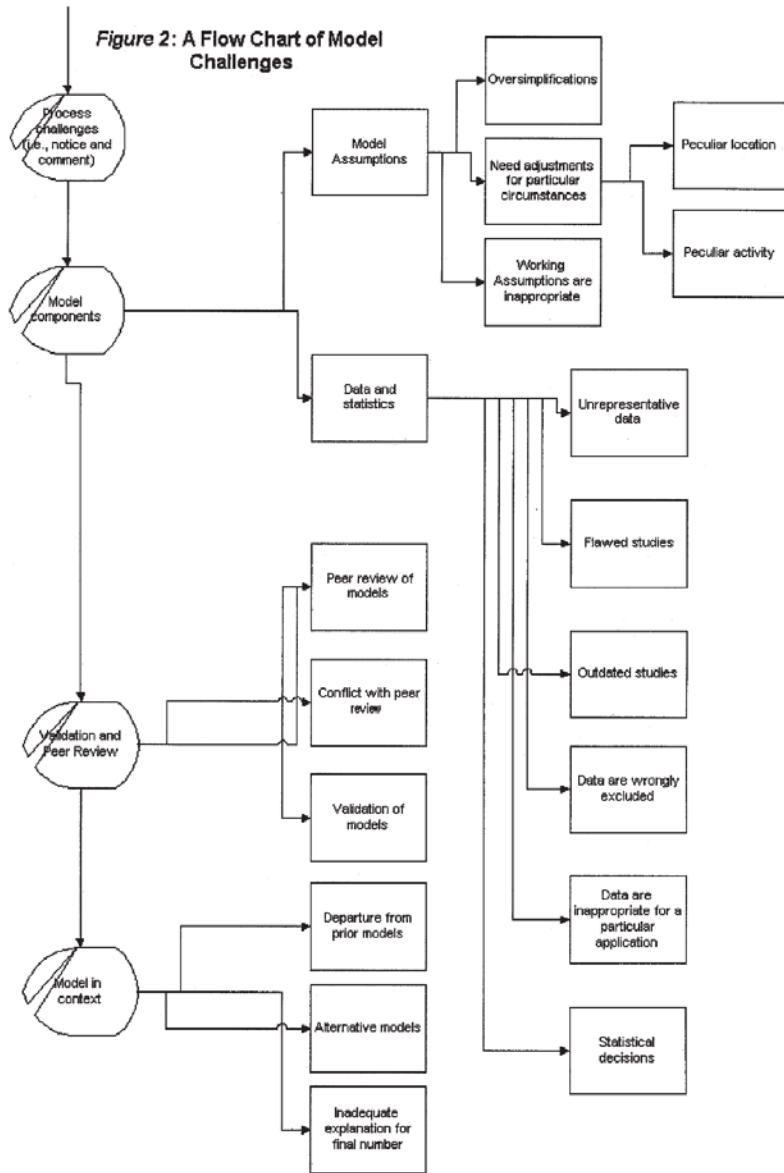
Model 1

Model 2

# Possible Advantages of Multiple Models

- Shatters the image of models as answer-machines
- Diffuses attacks against single assumptions and data sources
- Identifies most important uncertainties for policymakers
- Advances scientific exploration of complex systems

# Multiple models may even be easier to defend legally than single models

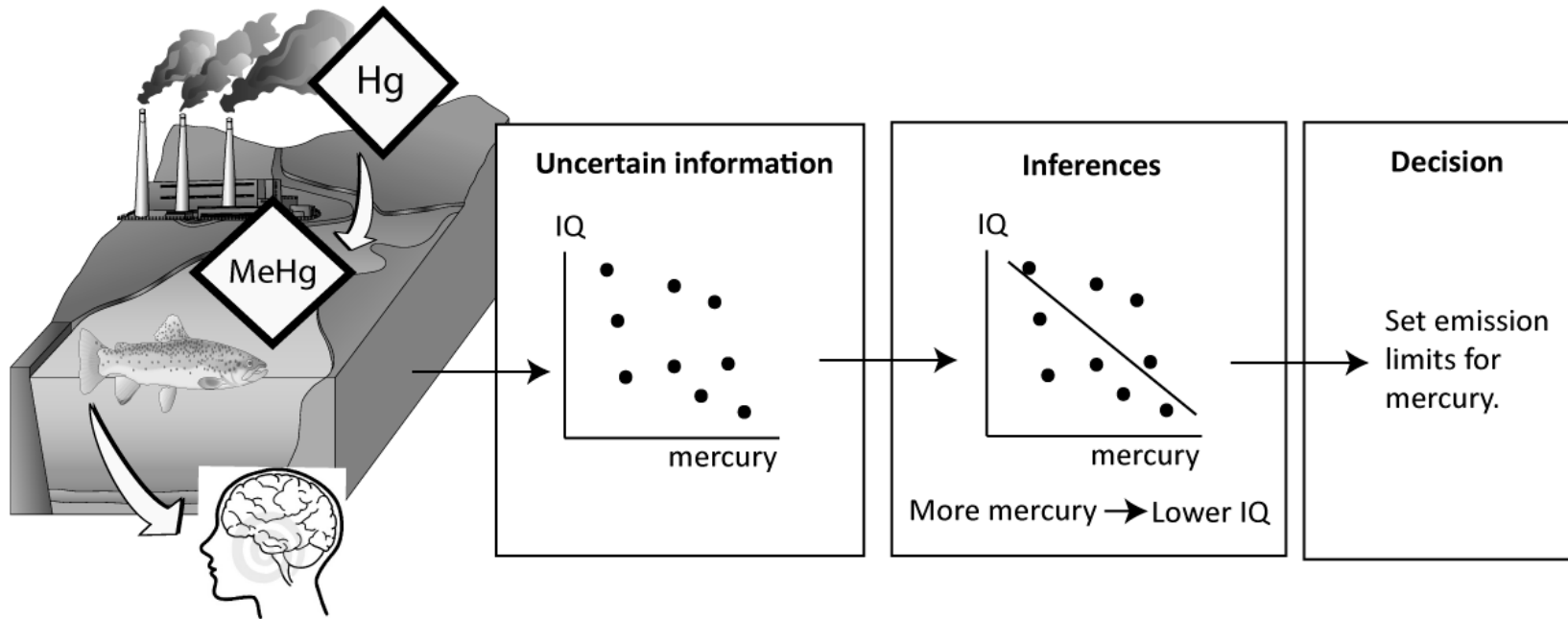


- Facilitates all-important explanation of:
  - Key assumptions
  - Data sources
  - Fit between model and problem
- Highlights the importance of policy choices and the limits of “sound science” in uncertain terrain

# Methods for Multiple Models

1. Advanced design rules for creating and using multiple models
2. Squeaky Clean Model Development
  - Provenance
  - Peer review
  - Adaptive Evaluation
3. Accessible explanations of all important judgments and policymakers take final responsibility for decision

# Various judgment-laden steps in model creation



Pasky Pascual, EPA