Nuclear Decisions

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Understanding the Societal Challenges Facing Nuclear Power

Committee on the Laying the Foundation for New and Advanced Nuclear Reactors in the United States

September 1, 2021

Overview

Background
Sources of despair
Reasons for hope
Strategic challenges

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NUREG/CR-1614
ORNL/Sub-7656/1

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Approaches to Acceptable Risk: A Critical Guide

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This Work Performed for
U.S. Nuclear Regulatory Commission
under
NRC Interagency Agreement 40-550-75

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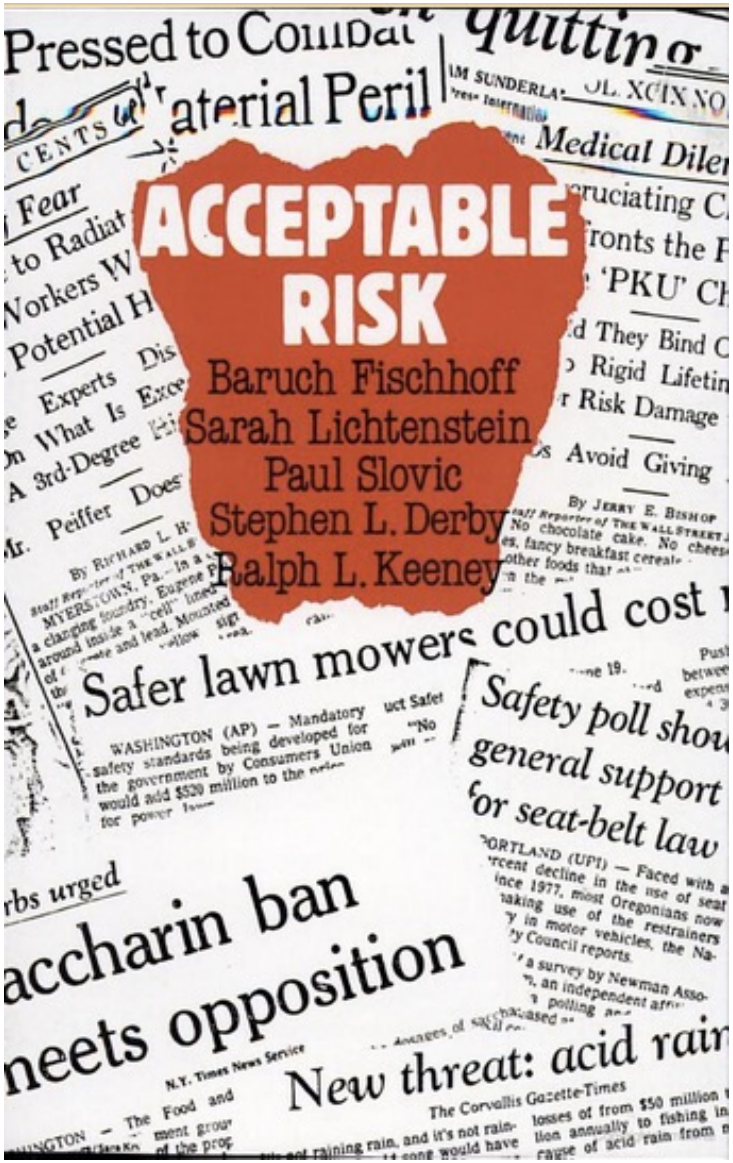
FOR THE UNITED STATES
DEPARTMENT OF ENERGY



Fischhoff, B., Lichtenstein, S., Slovic, P., Derby, S. L. & Keeney, R. L. (1981). *Acceptable risk*. New York: Cambridge University Press. In Chinese, Peking University Press, 2009.

Goals

Fair judgment of industry, relative to alternatives.

Fewer, but better conflicts.

Premise

Any industry depends on a commons of public goodwill that grows or shrinks, each time that the industry comes to the public's attention.

Premise

That goodwill affects:

- regulation
- politics
- capital markets
- executive efficiency
- employee recruitment and retention
- …

Premise

The public may not discriminate among segments of the industry. As a result, poor performance in any segment can threaten the others. If poor performers cannot be distanced, then they must be helped. Conversely, good performers benefit all.

“Nuclear Power” Might Include

mining
transportation
construction
power generation
waste disposal
proliferation
medicine
careers
innovation
energy security
climate change
…

As a Result

Communication must address the decisions that stakeholders face.

Those may include issues that the industry does not naturally consider – and may be powerless to affect.

The communication process may matter as much as its content.

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One Source of Despair

Everyone has faulty intuitions about how well they understand other people, and vice versa

http://www.thebulletin.org/nuclear-energy-industrys-communication-problem

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One Source of Despair

Everyone has faulty intuitions about how well they understand other people, and vice versa – including scientists, engineers, political leaders, etc. As a result, they may communicate poorly and then blame their audience.

A Second Source of Despair

Scientists, like everyone else, have emotions

http://www.thebulletin.org/emotions-nuclear-experts

Four Emotions

Anger
Dread
Panic
Stress

Four Emotions

Anger → confidence, blaming
Dread → feelings of risk, lack of control
Panic → social mobilization, private paralysis
Stress → regression, narrowing

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Scientific Communication Design

Step 1. Identify the facts most relevant to the choices that people face.
Step 2. Find out what they know already.
Step 3. Design communications to fill the critical gaps.
Evaluate.
Repeat as necessary.

Some Applications

plague
perchloroethylene
LNG
climate change
detergent
breast cancer
nuclear explosions
herpes (stigma)
xenotransplantation
smart meters
phishing
…

domestic radon
methylene chloride
EMF
sexual assault
low birth weight
breast implants
nuclear energy in space
Plan B (morning after pill)
neonates
vaccines (anthrax, MMR)
tornadoes
…

Behavior Follows Simple Principles

Some Principles of Judgment

People are good at tracking what they see, but not at detecting sample bias.

People have difficulty projecting non-linear trends.

People have limited ability to evaluate the extent of their own knowledge.

People have difficulty imagining themselves in other visceral states.

Transient emotions can affect perceptions, perhaps enough to tip close decisions.

Some Principles of Choice

People are insensitive to opportunity costs.

People consider the return on their investment in making decisions.

People dislike uncertainty.

People confuse ignorance and stupidity.

People are prisoners to sunk costs, hating to recognize losses.

People may not know what they want, especially with novel questions.

Behavior Follows Simple Principles

However,

the set of principles is large,
the contextual triggers are subtle, and
the interactions are complex

As a result, communication requires a scientifically informed design process.

IOP Publishing Environ. Res. Commun. 1 (2019) 071002 https://doi.org/10.1088/2515-7620/ab2ec0

Environmental Research Communications

LETTER

How stable are preferences among emerging electricity generation technologies

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OPEN ACCESS

RECEIVED
27 February 2019

REVISED
3 June 2019

ACCEPTED FOR PUBLICATION
2 July 2019

PUBLISHED
11 July 2019

Keywords: public preferences, attraction effect, energy policy, nuclear power, carbon capture and sequestration

Supplementary material for this article is available online

Abstract

Coal-fired power plants with carbon capture and sequestration (CCS), natural-gas-fired power plants with CCS, and Small Modular Reactors (SMR) are potentially important emerging energy technologies that could help mitigate climate change and contribute to a low-carbon future. Public opinion and preferences towards these technologies will affect their adoption when they are technologically ready to be implemented. This study examines the nature and stability of public preferences among these options. We find that participants have internally consistent preferences, when tested in several ways. Overall, they prefer SMRs to natural gas with CCS to coal with CCS. On a group level, these preferences depend on the choice alternatives, but not on how fully the technologies are described nor how far away a hypothetical power plant would be sited. On the individual level, preferences are related to participants' perceptions of the technology and their political ideology. Our findings suggest that presenting the three technologies together will produce the most balanced, informed judgment, with the least influence of political ideology.

Alternatives for Replacing an Aging Fossil Fuel Plant, 30 Miles Away

Table 1. Experimental group assignment.

Group	Technologies compared
Group 1	NG-CCS, SMR.
Group 2	Coal-CCS, SMR.
Group 3	NG-CCS, Coal-CCS.
Group 4	NG-CCS, Coal-CCS, SMR.

NG-CCS = Natural-gas-fired power plant with carbon capture and sequestration.
Coal-CCS = coal-fired power plant with carbon capture and sequestration.
SMR = Small Modular Reactor.

How Much People Like SMRs Depends on What Else They Are Offered

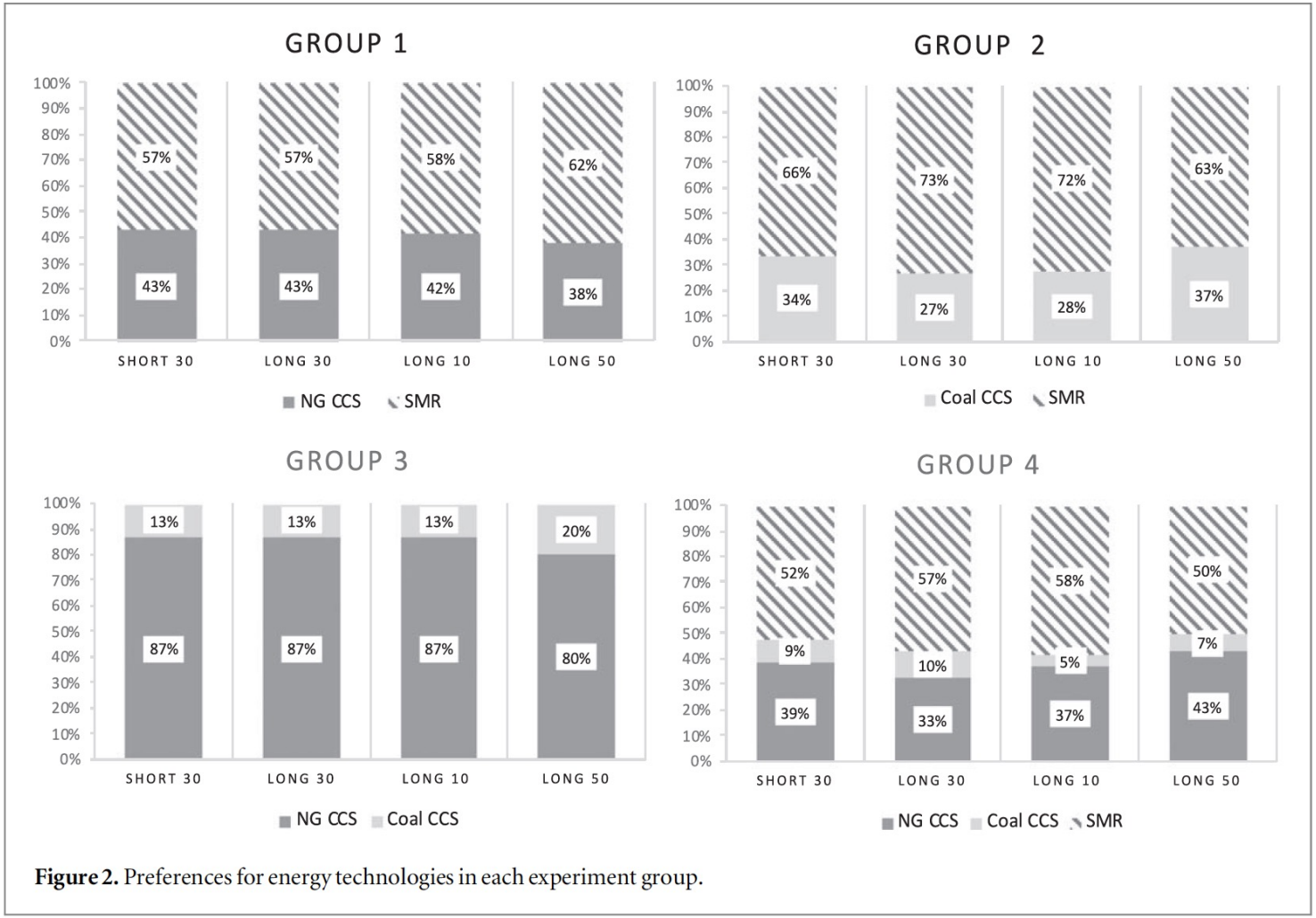

Figure 2. Preferences for energy technologies in each experiment group.

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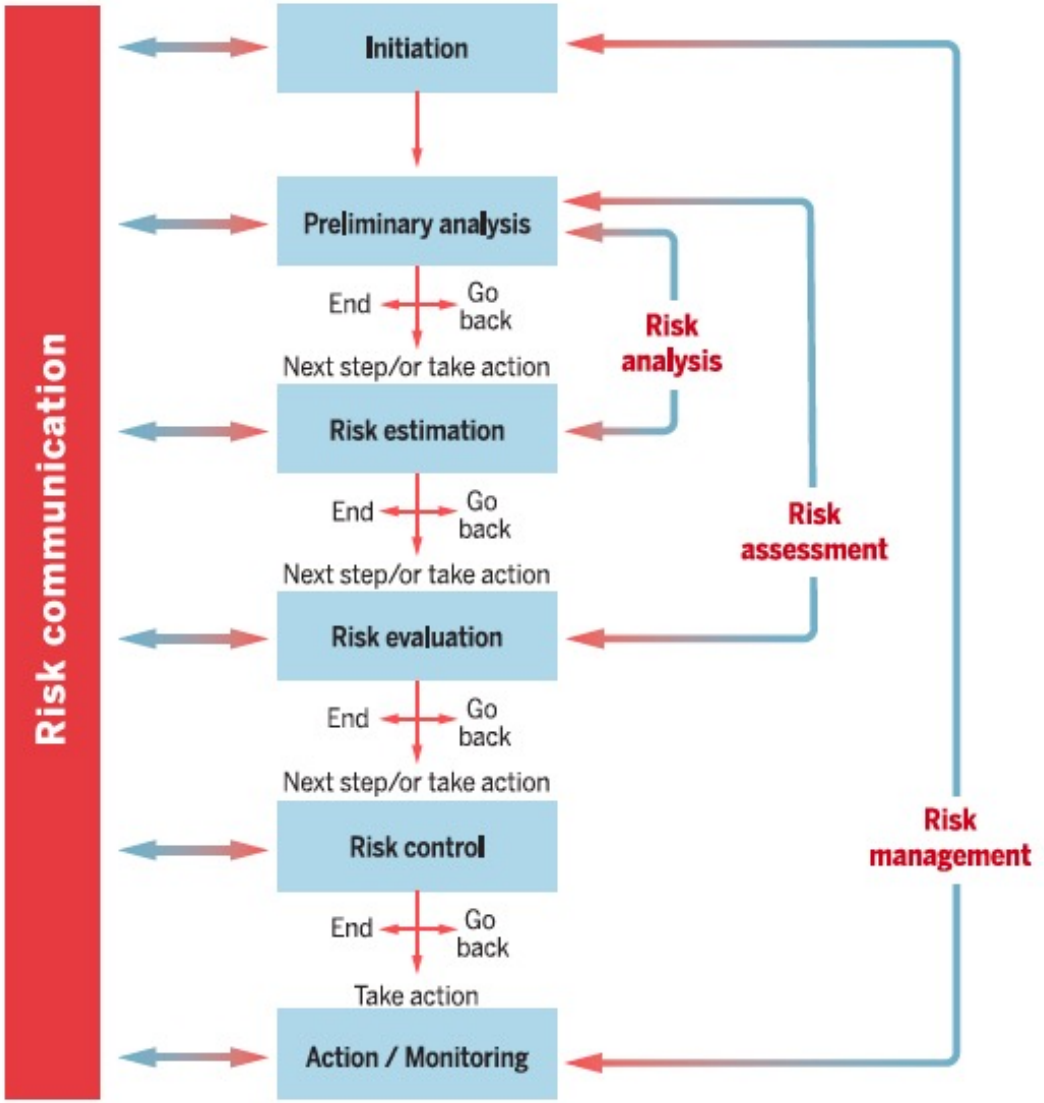
Strategic Communication Requires

Staffing
Process
Leadership

Staffing

Domain specialists
Risk and decision analysts
Behavioral scientists
Communication professionals

Process



Fischhoff, B. (2015). The realities of risk-cost-benefit analysis. *Science*, *350*(6260), 527. http://dx.doi.org/10.1126/science.aaa6516

Performance Metrics

A communication is adequate, if…

it contains the facts material to effective decision making

users can access those facts

users understand and trust them

Leadership

Senior management must:

- see communication as strategic, not an afterthought.
- assume stewardship over the life cycle of its technology.
- press for industry-wide discipline.
- separate public affairs and public health communications.
- value trust as an intangible asset with tangible benefits

http://www.thebulletin.org/nuclear-energy-industrys-communication-problem

Three Papers

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Fischhoff, B., & Davis, A.L. (2014). Communicating scientific uncertainty. *PNAS, 111*, 13664-13671. www.pnas.org/cgi/doi/10.1073/pnas.1317504111

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Science of Science Communication

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http://www.pnas.org/content/111/Supplement_4

PNAS, 116(16), 7670-7675. www.pnas.org/cgi/doi/10.1073/pnas.1805863115

RESEARCH

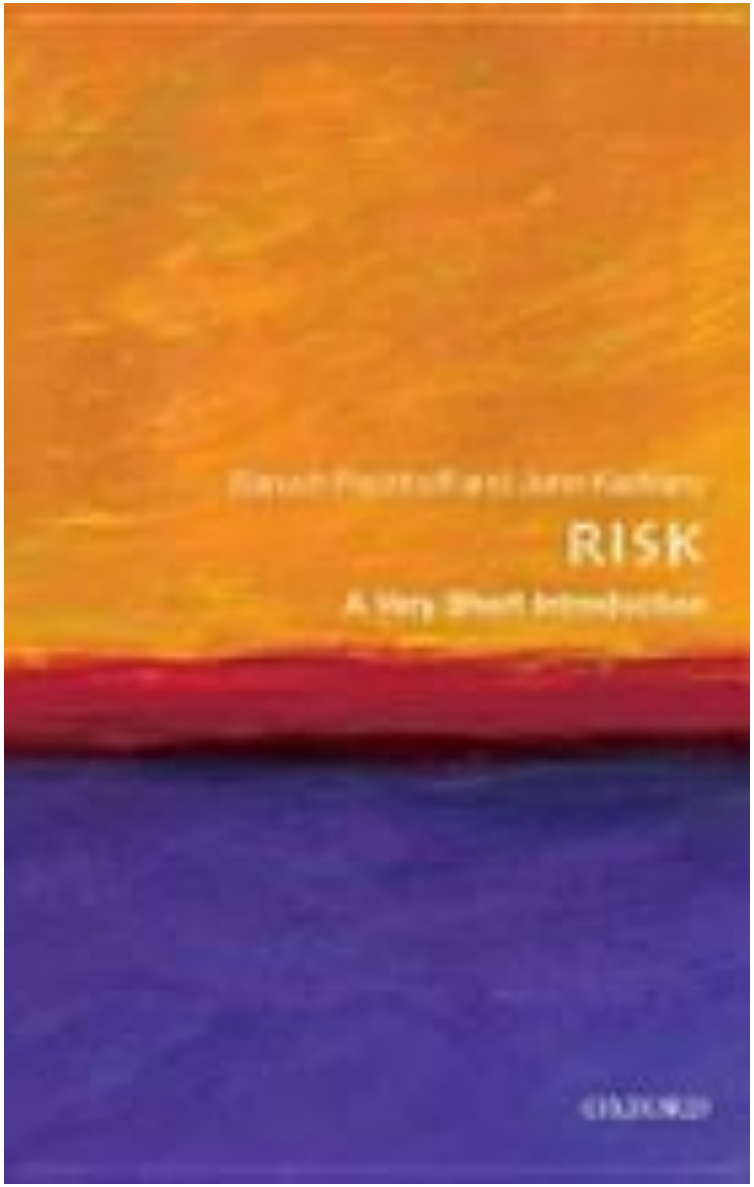
REVIEW

RISK ASSESSMENT

The realities of risk-cost-benefit analysis

Baruch Fischhoff

http://dx.doi.org/10.1126/science.aaa6516



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