



**APPLICABILITY OF
RADIATION-RESPONSE
MODELS TO LOW DOSE
PROTECTION STANDARDS**

AMERICAN NUCLEAR SOCIETY & HEALTH PHYSICS SOCIETY
JOINT TOPICAL - SEPTEMBER 30 - October 3, 2018
TRI-CITIES, WASHINGTON

*Mitigating the Harm Done by
Excessively Conservative Low Dose Radiation
Protection Standards*

An Ethical Imperative





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*Current Radiation Protection Standards Were Developed
Mid-Twentieth Century. Much Scientific Information
is Available Now That Was Not Available When the
Standards Were Developed. It Must be Evaluated Now.*

Updating the Basis for Low Dose Protection Regulations





The Best of Intentions Can Have Disastrous Consequences

How Did an Ethical Concern Result From Conservative Safety Objectives?

- *The Evolution of Radiation Protection Standards*
- *Late 20th Century Data - Not Available When Standards Were Set*
- *How Did New Data Help Demonstrate an Ethical Concern?*
- *How Do We Address the Ethical Concern?*



How Did Low Level Radiation Protection Get Here?

Where do we Need to Go?

- *Early Radiation Protection*
 - *Most Health Effects Data From Early Scientific Investigators*
 - *Protect Medical Practitioners and Patients*
 - *Radium Use*
 - *Early Protection Organizations (ICRP, AARS, US Advisory Committee on X-Ray and Radium Protection)*
 - *Standards Based on Prevention of Deterministic Effects*

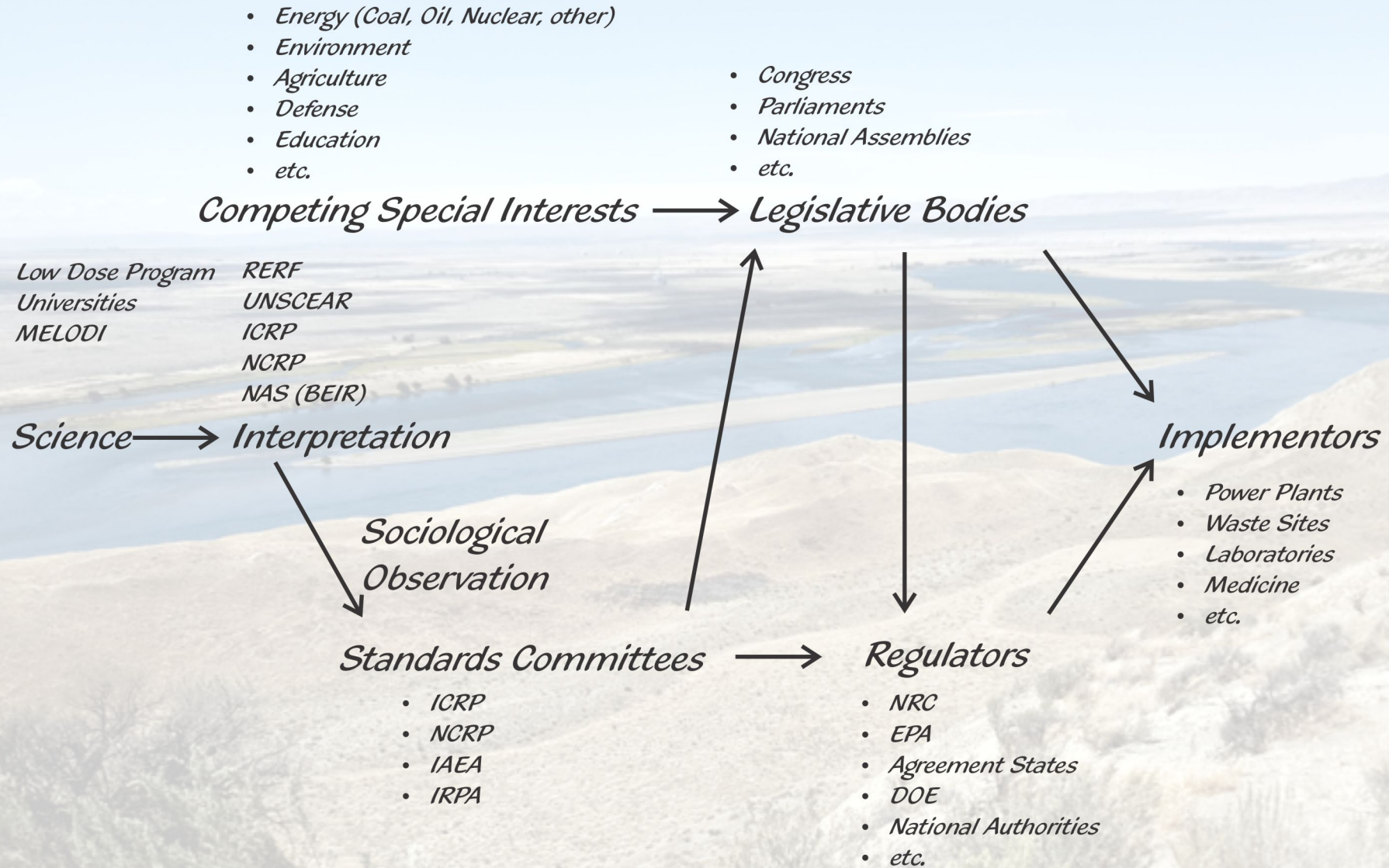
- *Early Modern Radiation Protection*
 - *Manhattan Project Needed to Protect Workers - Largely a Programmatic Concern*
 - *Manhattan Project Was The Sole Authority*
 - *Herb Parker Led Radiation Protection Standards Development*
 - *Remarkably Successful in Spite of Los Alamos Fatalities*
 - *Public Exposure Was a Consideration*

- *Radiation Protection Evolution*
 - *Civilian Control*
 - *Atomic Energy Commission*
 - *Proliferation of Agencies and Departments with Regulatory Roles*

- *Latter Half 20th Century Radiation Protection*
 - *Confusing Web of Entities with Responsibilities and Authorities*
 - *Precautionary Principle*



How is Regulatory "Policy" Established? Current Status





New Scientific Data and Observation of Current Events Raise an Ethical Concern

- *Early Modern Radiation Protection*
 - *Limited Data With Respect To Health Effects at Various Exposure Levels*
 - *Most Information From Early Researcher and Medical Practitioner Exposures*
 - *Very Clear That High Level Exposure is Harmful, Even Fatal*
 - *Health Effects of Low Level Exposure Were Not Clear*
- *Radiation Protection Evolution*
 - *Extremely Conservative Approach*
 - *In Case of Doubt, Reduce Allowable Exposure*
 - *Mantra: As Low As Reasonably Achievable*
- *Current Status*
 - *Being Overly Conservative is Considered to Be Not Harmful*
 - *Precautionary Principle*
- *Current Understanding: Overly Conservative Can Be Harmful*
 - *New Data Show Robust Protective Biological Response to Low Level Radiation*
 - *Overreaction Driven by Irrational Fear Supported by Conservative Limits*
 - *Established Regulatory Limits for the Public are Well Below Background*
 - *Unnecessary Evacuations; Refusal of Medical Treatment Kills People*
 - *Conservatism Wastes Huge Amounts of Money, Terrible Resource Allocation*



What is the Ethical Concern?

- Irrational fear of radiation
- Resistance to Mixing Science and Politics
- Regulations Driven by Narrow Precautionary Principle Perspective

- Energy (Coal, Oil, Nuclear, other)
- Environment
- Agriculture
- Defense
- Education
- etc.

- Congress
- Parliaments
- National Assemblies
- etc.

Competing Special Interests → Legislative Bodies

Low Dose Program
Universities
MELODI

RERF
UNSCEAR
ICRP
NCRP
NAS (BEIR)

Precautionary
Principle

Science →

Interpretation →

Ethics

Sociological
Observation

Implementors

- Power Plants
- Waste Sites
- Laboratories
- Medicine
- etc.

Standards Committees →

- ICRP
- NCRP
- IAEA
- IRPA

Regulators

- NRC
- EPA
- Agreement States
- DOE
- National Authorities
- etc.



How Can we Change Regulatory Requirements? Special Interest The Key to Low Dose Rad Topical Conference Success

- *Radiation Risk Scientists Want to be "Pure", Avoid Politics*
 - *Scientific Input Has Been Limited to Standards Institutions*
 - *Disagreements About Details Exist*
 - *Significant Agreement: Exposures Below Background are Not Harmful Enough for Concern*
- *Scientific Forums*
 - *Generally Restricted to Specific Areas of Science*
 - *Lots of Technical Jargon, Difficult to Explain Outside of the Discipline*
 - *Little Public Trust*
- *Powerful Special Interest Groups Dominate Public Policy*
- *Ethical Imperative:*

*Scientists Who Study Radiation Risk Have a Responsibility
For Assuring That Society Uses Their Results Ethically*

*You Are Ethically Responsible if a Bridge That You Designed Collapses
You Are Equally Responsible if You Know People are Dying to
Avoid a one mSv Exposure and You Don't Speak Up*



How Must Regulatory "Policy" be Changed to Address Ethics?

- Irrational fear of radiation
- Resistance to Mixing Science and Politics
- Regulations Driven by Narrow Precautionary Principle Perspective
- **Scientists Must Insist on Ethical Use of Their Science**
- Energy (Coal, Oil, Nuclear, other)
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