RISK ASSESSMENT
&
PUBLIC HEALTH

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Risk Assessment in Public Health

- Will “it” affect my health?
- Will “it” affect the Public’s health?
- Should we do something about it?
  - Government action
  - Personal action

Risk Assessment

- Uses available science to estimate the likelihood and magnitude of adverse effects in people and the environment (NRC, 1993, 1994)

- Framework for organizing, evaluating, and characterizing scientific information on the nature and magnitude of hazards from exposure (G. Omenn, 1995)

- Risk assessment is a set of decision rules widely used in the United States for identifying and quantifying the risks of chemicals and other events for adverse effects on human health.

- Risk assessment is an integral part of the regulatory decision-making that occurs at the interface between science (knowledge) and policy (values).

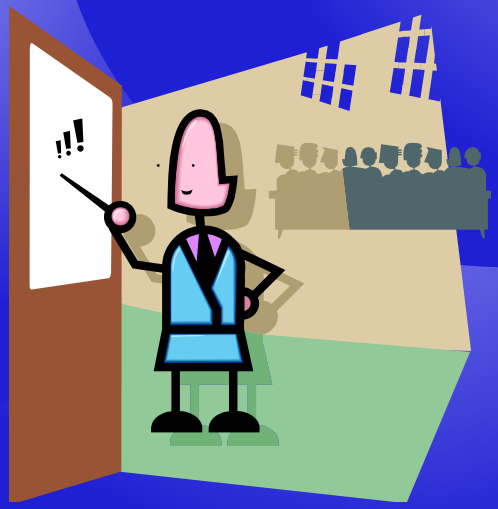
Risk Assessment-Components

- **Hazard Identification:**
  - Does the agent cause adverse effects?
- **Dose-Response Assessment:**
  - What is the relationship between dose and response in test species? In humans?
- **Exposure Assessment:**
  - What are the exposures (frequency, duration, location, to whom?
- **Risk Characterization:**
  - What is the estimated incidence of the adverse effect in a given population?

Age of Enlightenment

All substances are poison; there is none which is not a poison. The right dose differentiates a poison from a remedy.

Paracelusus (1493-1541)



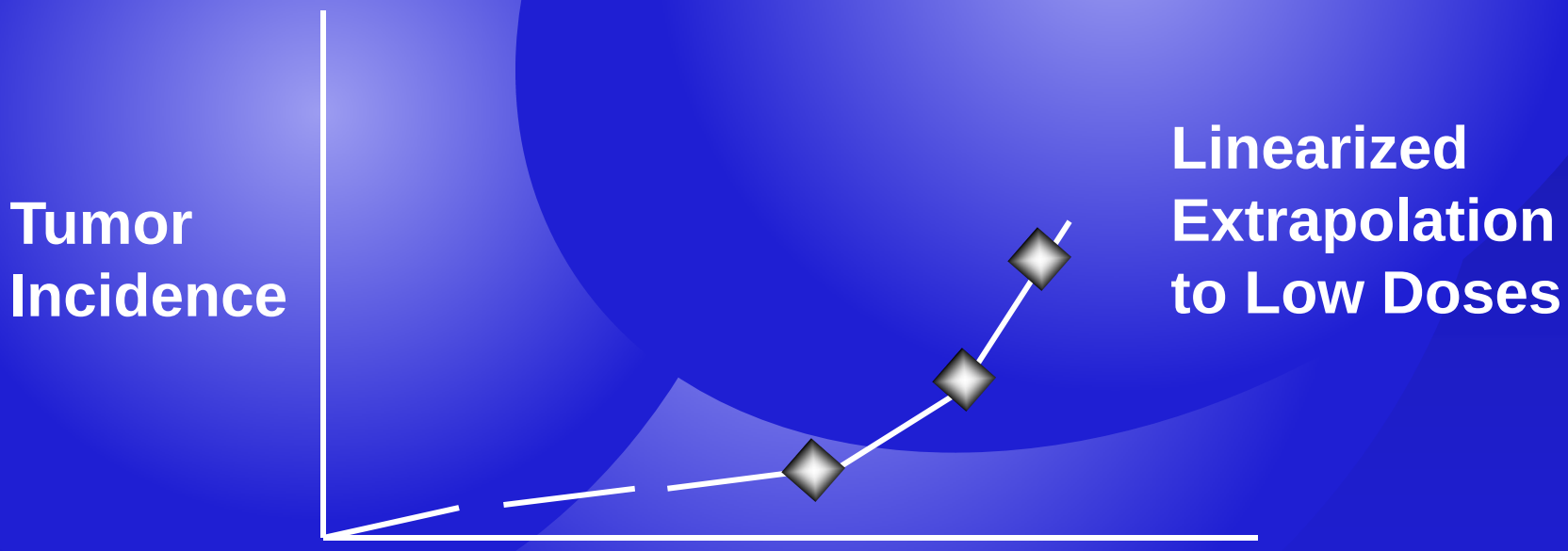
Dose-Response Assessment

- Tool to determine potential for a substance to cause harm and how much causes what kind of harm.

- <u>No single measure of toxicity</u>:
  - Acute Effects
  - Chronic Effects
    - Cancer
    - Non-Cancer
  - Animal-Toxicology Studies
  - Human-Epidemiology Studies & Accidents

Toxicity Assessment for Carcinogenic Effects

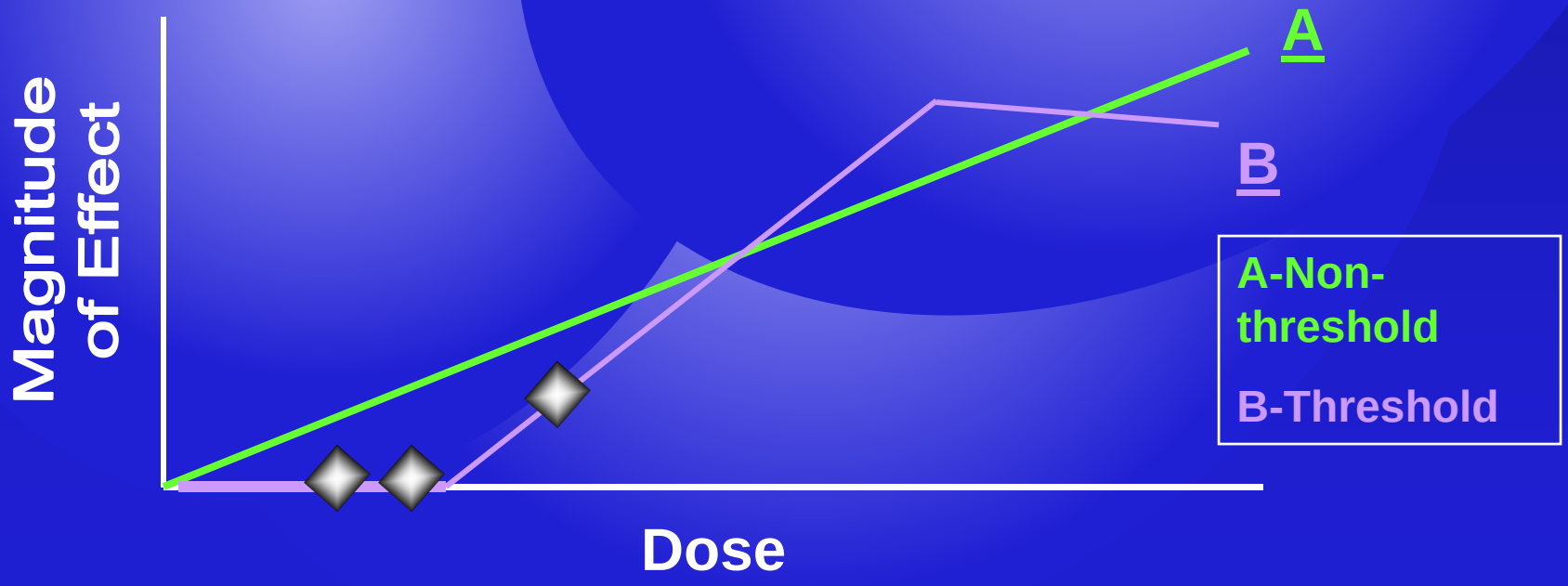
- Assume non-threshold, low dose linearity
- Extrapolate slope to low doses



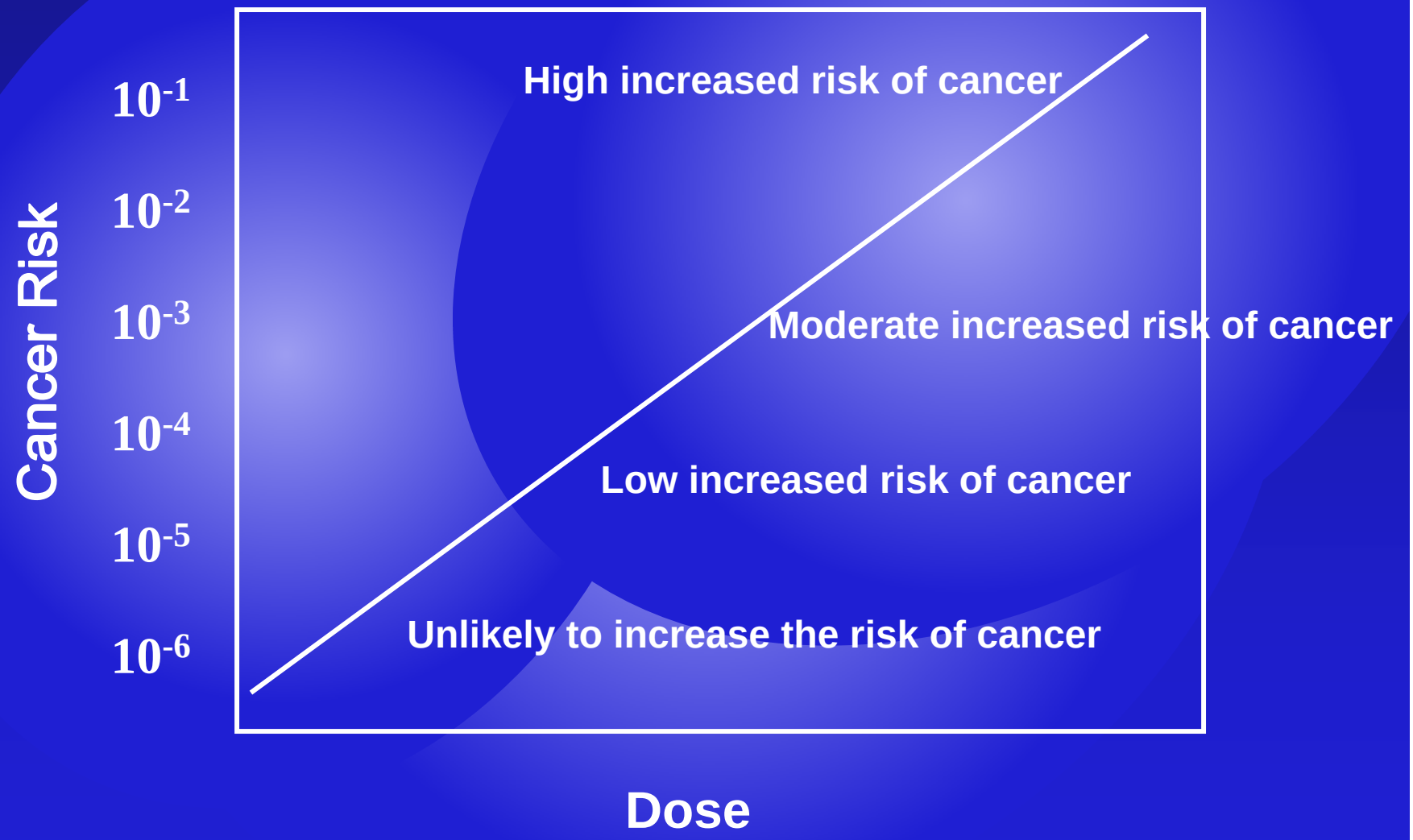
Toxicity Assessment cont...

Threshold vs. Non-threshold Toxicity

- Threshold: dose level below which no adverse effects occur. RfD based upon observed thresholds
- Non-Threshold effects: risk for adverse effects even at very low exposures; irreversible effect



Low Dose Extrapolation



Using Uncertainty Factors (UF) In Developing Standards

- UF = 10 to account for variation in human sensitivity
- UF = 10 to extrapolate a NOAEL from an animal study to humans
- UF = 10 to extrapolate a LOAEL, in either a human or an animal study, to a NOAEL
- 10x10x10 = 1000, commonly used

* NOAEL = no observed adverse effect level

* LOAEL = Lowest observed adverse effect level

Limitations of the Science

- High doses needed to see effect in small number of animals
  - relevance in question
- Inter-species differences
- Mechanism of effect not understood
- Subtle effects hard to measure in animals
  - Lead, Mercury

Components of a Pathway

- Contamination
- Environmental Media
- Point of Exposure
- Route of Exposure
- Receptor Population

What You Need To Know To Estimate Exposure Dose

C = Concentration in media (AVE, MAX, 95% UCL?)

IR = Intake rate of media

BW = Body weight

EF = Exposure factor

- Exposure frequency
- Exposure duration

Exposure Assumptions

- Inhalation Rate = 20m^3/day
- Soil ingestion (Child) = 200 mg/day
- Fish ingestion = 6.5 g/day
- Exposure duration = 30 years
- Exposure frequency = 250 day/year
- Body weight = 70 kg/10kg
- Available dose = 100%
- Background exposure = 80%

Risk Characterization

- Risk = Dose x Toxic potency
- Risk > acceptable cancer risk (10^{-6}, 10^{-5}…)
- Risk ranking
- Uncertainty discussion
- Management options

Use of Risk Information in Decision-Making

1. The results of risk assessment are but one consideration in most environmental decision-making.

2. Risk management is the catch-all phrase that encompasses all of those activities necessary to reach decisions about whether an assessed risk requires reduction and the degree of reduction necessary.

Bright Lines

- Public expect BL's
- BL's don't represent reality
- RA moving away from BL's
- RM often has to set BL Even in light of uncertainty

Risk Management Factors

- Politics, Cost, Feasibility (Lab I.D. & Cleanup Technology)
- Public health Impact
  - Severity of effect
  - Number affected
- Public Perception - Outrage
- Uncertainty of the Risk Assessment
- Government resources & precedent

Purpose of Risk Management

1. It's our job! What good is a beautiful risk assessment without action.
2. Understand and consider uncertainties of Risk Assessment.
3. Incorporate non-technical issues in decision making process. We don't live in an ivory tower.
4. Set Priorities-We can't fix all environmental problems.
5. Protect public health.

Risk Management Options

1. Laws
2. Regulation/Standards
3. Guidelines
4. Orders
5. Education
6. Mediation
7. Market Incentives
8. Funding Incentives (grant programs)

Overview of Regulatory Agencies

DEP – Primary Risk Manager

- **Delegation from EPA – Air, Water, Waste**
- **Standards, Permits, Orders, Penalties**
- **Site Related Work (Superfund, state list)**
- **Air toxics & criteria pollutants**
- **Groundwater protection standards**
- **Rely on EOHA for Risk Assessment**

Overview of Regulatory Agencies cont...

DPH – Primary risk assessment agency, not risk management.

- **Environmental Health Division**
  - **Lead, Asbestos, Radon**
- **EOHA – no enforceable mandates**
  - **Rely on LHD power**
  - **Reportable diseases CO, H_g**

Roles and Responsibilities For Local Health Departments

- Establish context under which LHD's become involved
- Know who to call and when
- Understand the broad power of LHD's
- Know how to collaborate with other agencies
- Differentiate between Environmental Health issues vs. and Environmental Protection issues

Sec. 19-13-B2 Abatement of Nuisance

(a) Any local director of health, upon information of the existence of a nuisance or any pollution occurring within his jurisdiction, or when any such nuisance or pollution comes to his attention, shall, within a reasonable time, investigate and, upon finding such nuisance or pollution exists, shall issue his order in writing for the abatement of the same.

Sec. 19-13-B22
Manufacturing and Other Wastes

No materials or waste products from any mill, factory, slaughterhouse, rendering or fertilizing works, junk establishment, common carrier or other industry or utility shall be stored or deposited so as to cause the surrounding atmosphere, land or water to be contaminated or polluted in such a manner as to injure the public health or create offensive conditions.

Case Study – Former Agricultural Land

- Farm land not covered by DEEP RSR's
- LHDs & DPH often asked –
  - high pesticide levels
  - planned housing developments
  - existing developments
- DPH & DEEP – Guidance to fill this gap.
  - Sample Soil 0-3 inches
  - Compare to RSRs
  - Isolate Contaminated Soil, Paved Areas…
  - Mix with Clean Soil
  - Remove Hot Spots
- DPH will develop alternative criteria (soccer field,

Case Study – East Lyme Orchard

- Dieldrin 75 – 450 ppb. RSR=38ppb.
- Proposed sub-division
- Proposed mixing soil, then planned on moving it
- LHD involved in sub-division approval