



# Risk Assessment of Chemicals in Laboratories:

## How & why?

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Health Sciences Center - Kuwait University

# Example

|              | Very bad Consequences | Bad Consequences |
|--------------|-----------------------|------------------|
| Small Chance | !                     | 4                |
| High Chance  | 1                     | !                |

# What is Risk Assessment?

- “Risk assessment ... is a way of examining risks ... so that they may be better avoided, reduced, or otherwise managed.”
- “The results of risk assessments will necessarily be in the form of probabilities for various events, usually injurious ...”
- “The concept of probability is hard to grasp.”

**RICHARD WILSON'S  
THOUGHTS**

# Example



We are going to ask you questions about chemicals that may or may not cause cancer.

We will be asking you to use a scale that goes from zero to 100%.

On this scale, a chemical that definitely causes cancer in humans would be rated 100%. A chemical that definitely does not cause cancer would be rated zero.

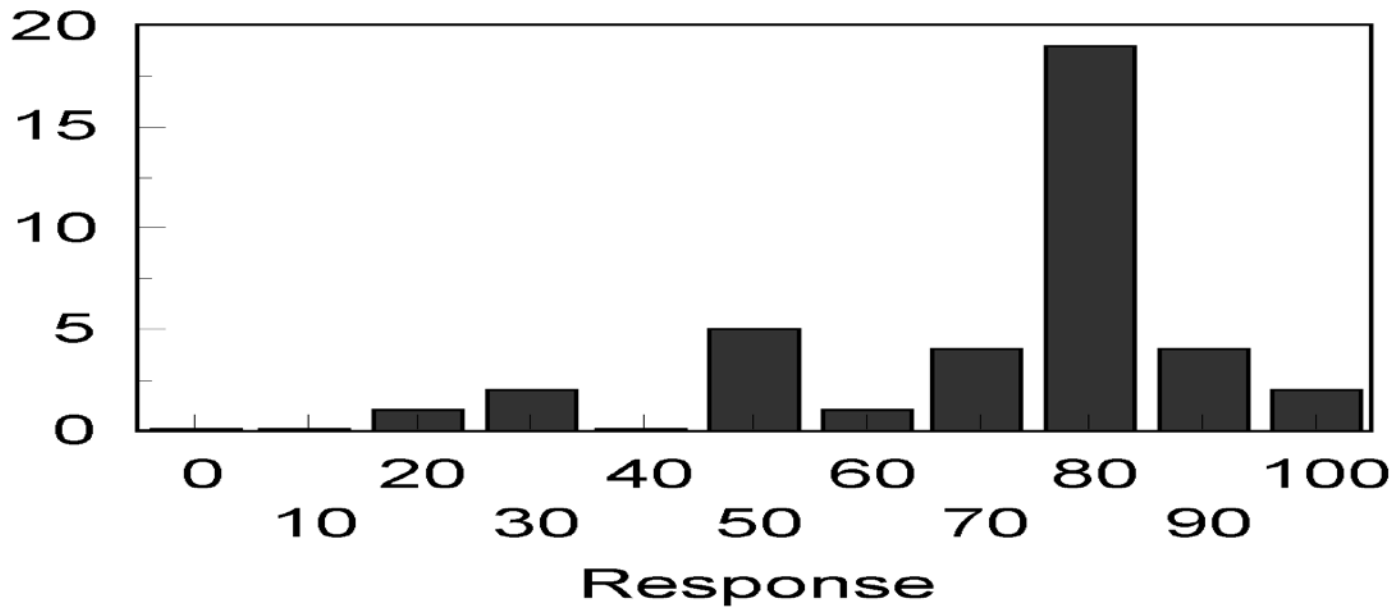
Suppose that you hear that scientists have classified a particular chemical as a *probable* human carcinogen.

How would you rate this chemical?

# Cont.

## Meaning of Probable

Frequency of Response



-- when possible was asked first

-- Spedden and Ryan, Risk Analysis, 19

# Probability vs. Likelihood



# Assessment vs. Management

- "Risk assessment is the use of the factual base to define the health effects of exposure of individuals or populations hazardous materials and situations."
- "Risk management is the process of weighing policy alternatives and selecting the most appropriate regulatory action ... integrating the results of risk assessment with social, economic, and political concerns to reach a decision."

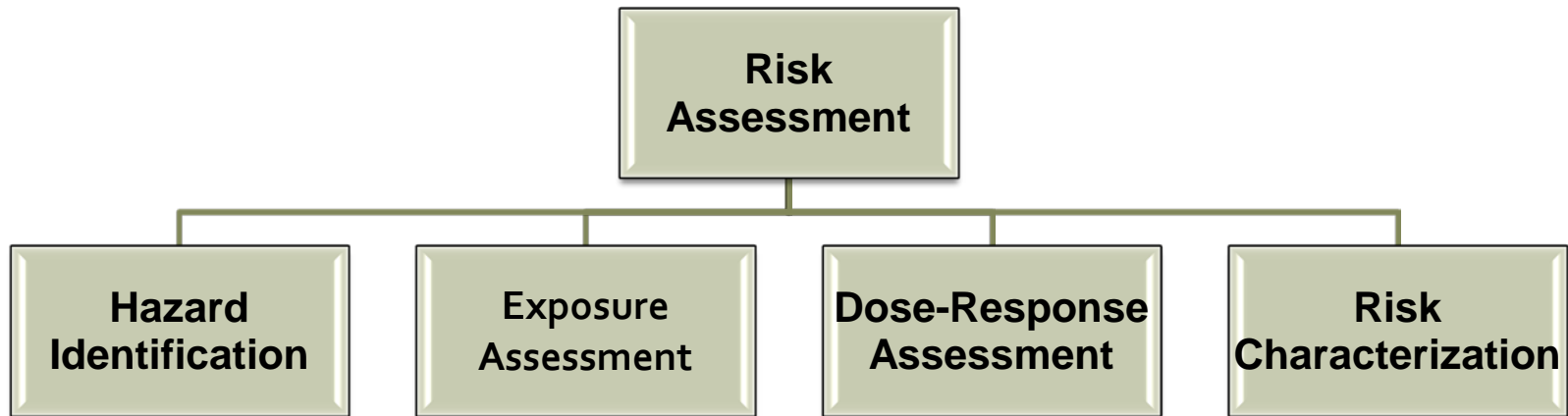
# Why Risk Assessment?



- Regulation
- Help the decision makers
- Improve the efficiency of spending and work
- Law suits and taxation



# Elements of risk Assessment



# Hazard Identification

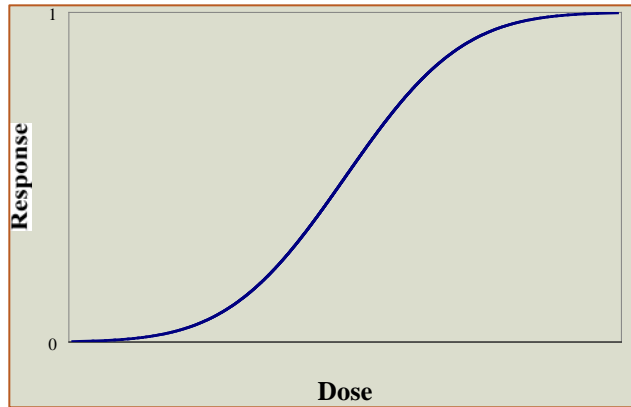
- Theoretical question yes-no
- Is there exposure?
- Is there Toxic chemical?
- How critical is it?
- Simply what if nothing has been done, are there bad outcomes?

# Exposure Assessment

- "... the process of *measuring* or *estimating* the intensity, frequency, and duration of human exposure to an agent present in the environment, or estimating the exposures that might occur from the release of new chemicals."
  - **Concentration** is a measure of the amount of pollutant in the carrier medium -- air, water, food.
  - **Exposure** is the event during which a person comes into contact with a pollutant.
  - **Dose** occurs only if the pollutant crosses the "envelope" made up of the skin and surface membranes of the lung and gi tract.

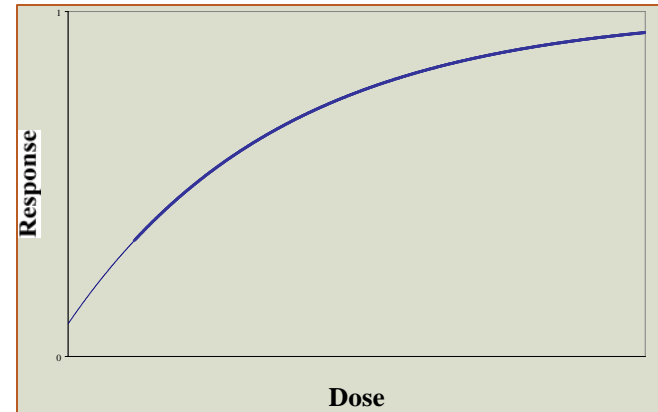
Source: NAS, "Red Book," 1983 & Ott, ES&T, 1985.

# Dose – Response Assessment



## Carcinogen

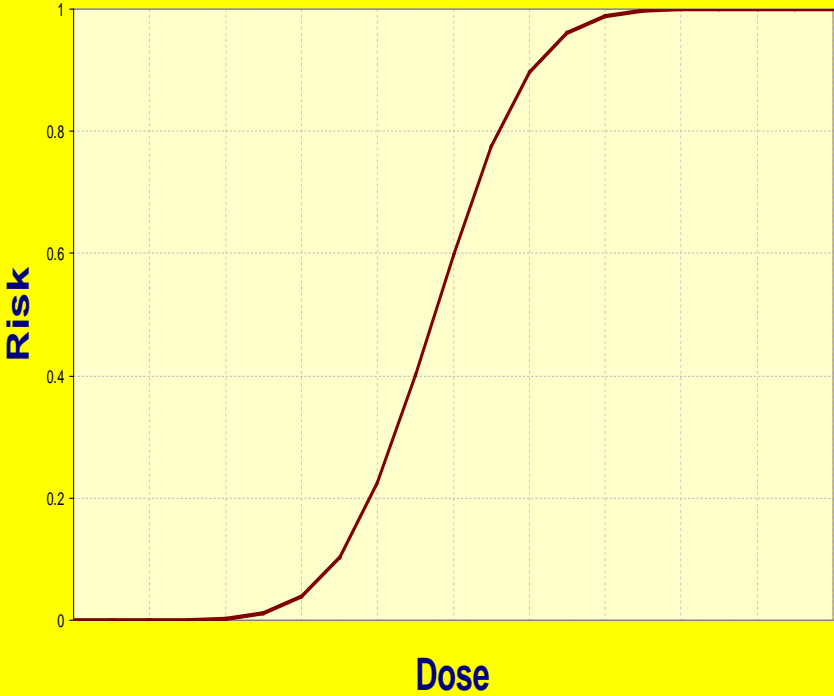
- No threshold
- Potency factor



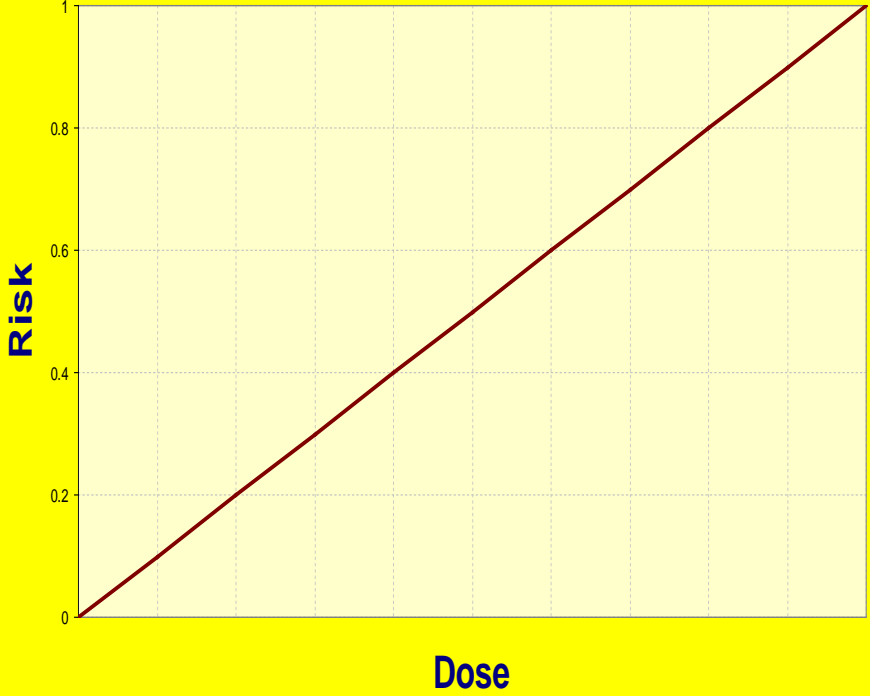
## Non-Carcinogen

- Threshold
- RfD

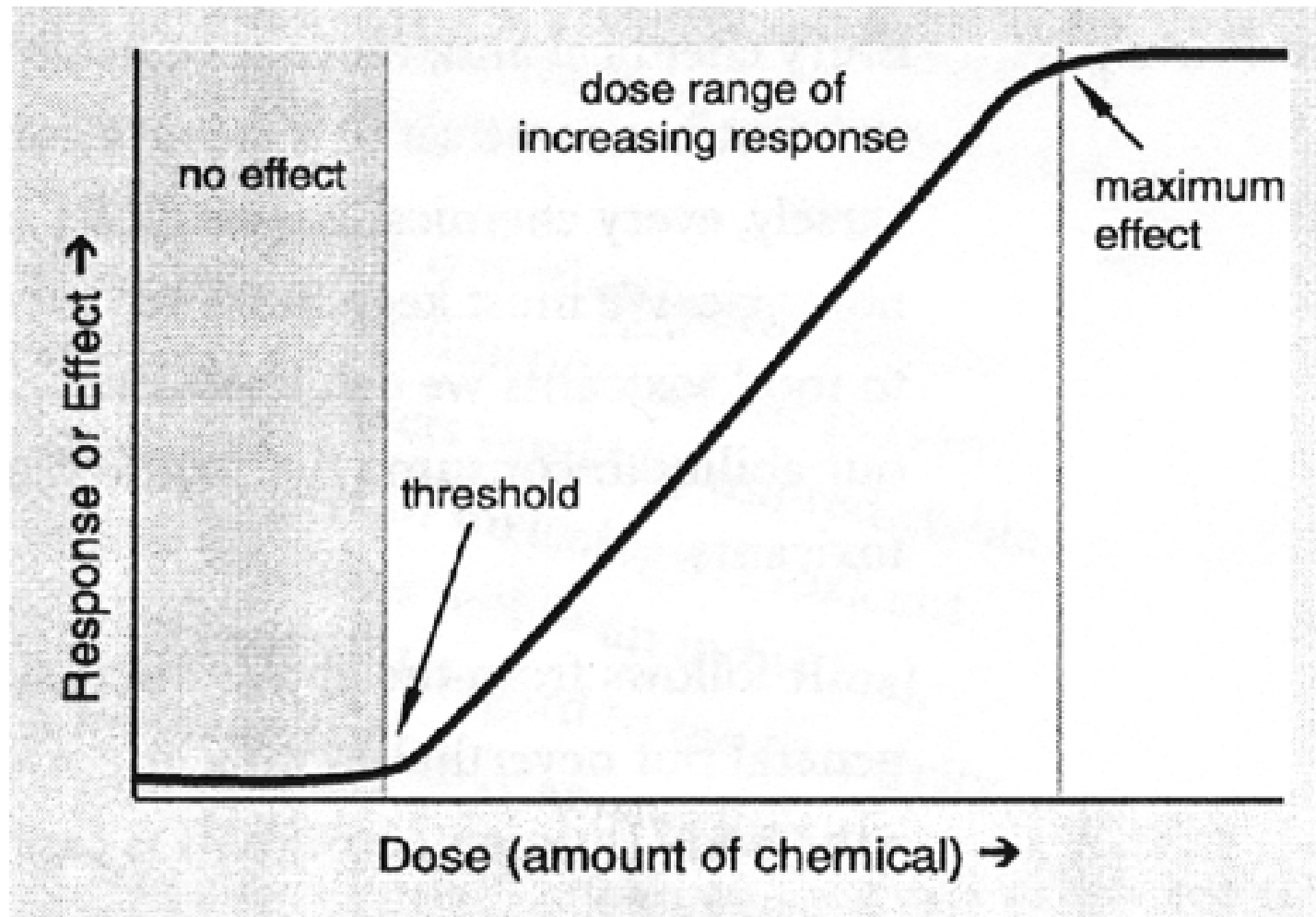
**Non-Cancer Dose-Response**



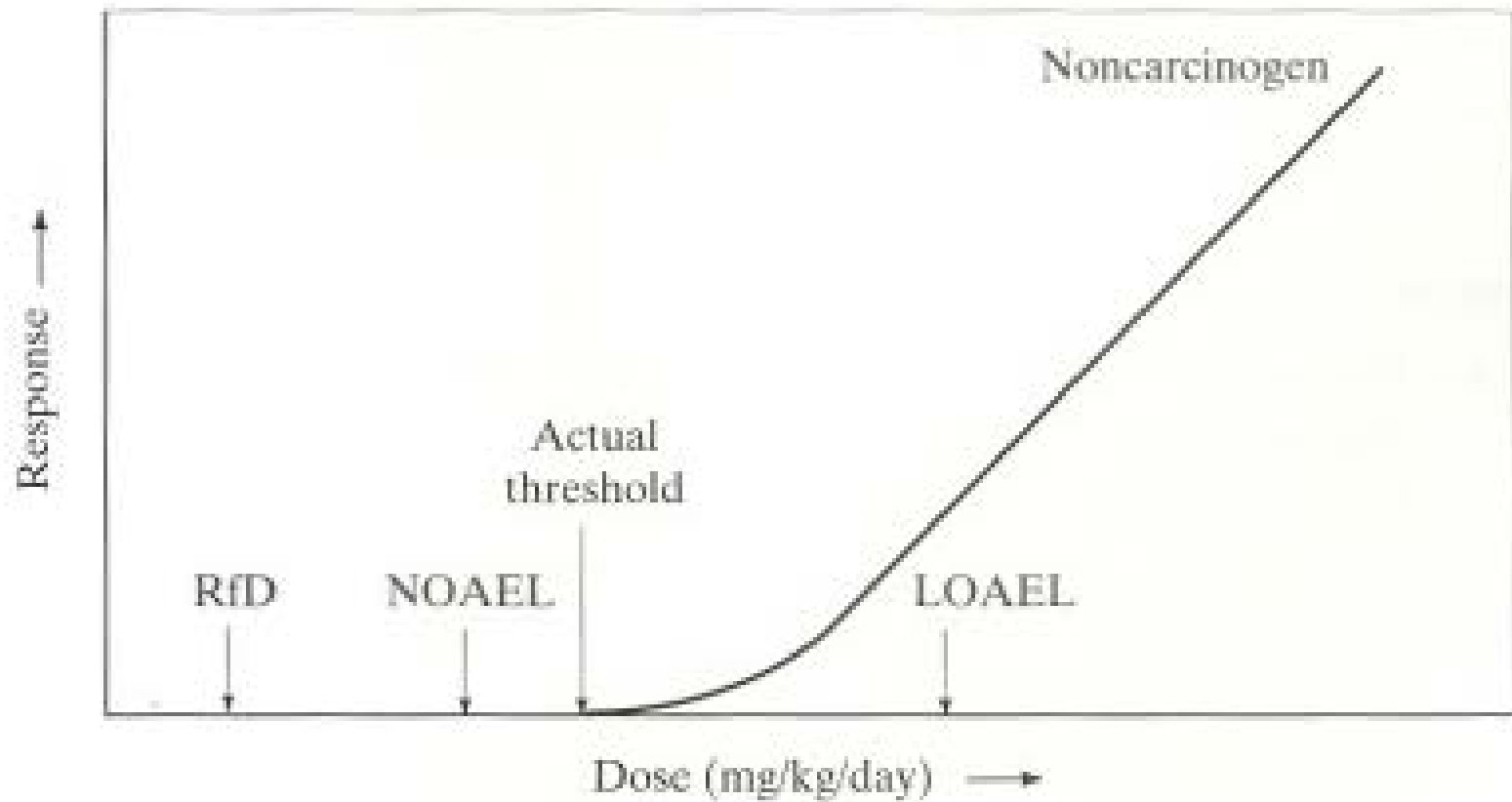
**Cancer Dose-Response**



# Cont.



# Cont.



# Carcinogens

- **Carcinogenic to Humans**
  - Indicates convincing epidemiological evidence of causal link between human exposure and cancer.
- **Likely to Be Carcinogenic to Humans**
  - Indicates weight of evidence is adequate, but not convincing.
- **Suggestive Evidence of Carcinogenic Potential**
  - Indicates weight of evidence is suggestive, but are not judged sufficient for a stronger conclusion.
- **Inadequate Information to Assess Carcinogenic Potential**
- **Not Likely to Be Carcinogenic to Humans**
  - Indicates evidence is robust and suggests that there is no basis for human concern.

Source: Guidelines for Carcinogen Risk Assessment, EPA/630/P-03/001F, 25 March 2005 – [www.epa.gov/ncea](http://www.epa.gov/ncea)



# Cont.

- two harmful chemicals A & B:

Additive  
(A+B)

Effect A + effect B = Effect

Synergistic  
(A+B)

Effect A + Effect B < Effect

Antagonistic  
(A+B)

Effect A + Effect B > Effect

# Why safety in Lab?

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- Human Life
- Human Health
- Financial Loss
- Market Reputation

# Human Life and Health

- Non-accidental pathways:
  - ▣ Inhalation (smoke, vapor, ..etc.)
  - ▣ Dermal (acid, ..etc.)
  - ▣ Ingestion (liquids, ...etc.)
  
- Accidental:
  - ▣ Fire
  - ▣ Explosion
  - ▣ Falling Objects

# Methods of Assigning Probability

- Classical method (observation and updating)
- Relative Frequency (similarity to other situation)
- Subjective probability (intuition)

# What to do?

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- Investigate the sources of risk?
- Estimate the risk?
- Estimate the consequences?
- List the alternatives?
- Make a decision

# Technically

- Carcinogen or not?
- Specify the route of exposures ?
- How much is the risk?
- Who is exposed?
- MSDS (flash point, Conc, pH, ... etc)
- Get organized (List ,Labels, tags, ...etc)
- Detectors, showers, gloves, monitors
- One person in charge of single lab than single issue for all labs
- Follow-up for quantities & dates
- Hazardous waste management

# Questions



Thank you