



# **Embracing Risk: One IH's Perspective**

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# What is Risk\*

## **Risk (*noun*)**

**exposure to the chance of injury or loss; a hazard or dangerous chance**

**\*Source – Dictionary.com**

# Putting yourself 'at risk'

Participating voluntarily or involuntarily in an activity or event that could lead to injury, damage, or loss.

# Voluntary Risk

- Exposure to hazards we knowingly accept
- Examples of voluntary risk:
  - skydiving
  - driving a car
  - smoking cigarettes
  - living in a floodplain
  - investing in the stock market



# Involuntary Risk

- **Exposure** to hazards that occur **without our prior consent**
- Examples of **involuntary** risk:
  - tornado
  - terrorist attack
  - lightning strike
  - cosmic radiation
  - contamination in drinking water



# Relative Risk

- Percentage increase in risk associated with one activity over another
- Typically it compares the 'risk of doing something' to the 'risk of doing nothing'
- Most common type of risk quoted by the media
- By itself, relative risk is meaningless
  - A 100% increase in relative risk must have context
  - Is a change from 1 in a million to 2 in a million significant?

# “USING PAIN PILLS INCREASES RISK OF HEART ATTACK BY 24%”

- Increased risk of heart attack was observed ‘*in men over the age of 50 using ibuprofen-like medication at ‘intensive’ doses*’
- Let’s say the risk of heart attack for all individuals over a lifetime is 10 in 1000, or 1%
- A *relative* increase of 24% would be 1.24%
- In terms of real increase: ~ 12-13 heart attacks per 1000 people, or an increase of 2 - 3 per 1000
- But...the study only applies to *intensive* users of the drug
- Out of 1000 people taking intensive doses of pills, expect 2 – 3 deaths in addition to the ten that would likely happen anyway
- The relative risk for a 30-something using ‘pain pills’ in moderation may be negligible

## **Activities w/ Equivalent Relative Risk**

**(each listed activity increases risk of premature death by 1 in a million)\***

**Smoke 1.4 cigarettes (total in a lifetime)**

**Live 2 months with a smoker (cancer - secondhand smoke)**

**Travel 10 miles by bicycle (accident)**

**Travel 300 miles by car (accident)**

**Travel 1000 miles by jet airplane (accident)**

**Travel 6000 miles by jet airplane (cancer from cosmic rays)**

**Live 5 miles from nuclear plant for 50 years (nuclear accident)**

**Live 2 months in Denver (cancer - radiation)**

**Live 2 months in stone/brick building (cancer - radiation)**

**Live 5 years - boundary of a nuclear power plant (cancer - radiation)**

**Exposure to 1 chest x-ray (cancer - radiation)**

**Eat 40 tablespoons of peanut butter (cancer)**

**Eat 100 charcoal-broiled steaks (cancer)**

**Drink 30 cans of diet soda made w/ saccharine (cancer)**

**\*Bernard Cohen, University of Pittsburgh (1995)**



# Risk in Perspective

- **“Life” is a series of activities that affect our well-being**
- **We encounter risk every day**
- **All decisions are, to some degree, our attempt to manage risk**
- **Which risks do / should we...**
  - **...fret over?**
  - **...avoid?**
  - **...accept?**

# What are the consequences of...

- ...Ignoring risk completely?
- ...Being totally risk averse?



If we viewed risk through a different lens, we might find ourselves embracing it!

Acknowledging risk could be the best management strategy...

...so why don't we do it?



# WHAT ARE WE AFRAID OF?

## People tend to:

- Overestimate the danger associated with rare events
- Underestimate dangers of common events
- Worry more about dramatic but infrequent events
- Assume if a situation can be ‘controlled’ it is safer
- Have different perspectives on voluntary & involuntary risk

## Activities w/ Equivalent Relative Risk

(each listed activity increases risk of premature death by 1 in a million)\*

Smoke 1.4 cigarettes - total in a lifetime (cancer)

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Travel 10 miles by bicycle (accident)

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**The traditional IH perspective...**

**...collect a sample & compare  
the result to a standard...**

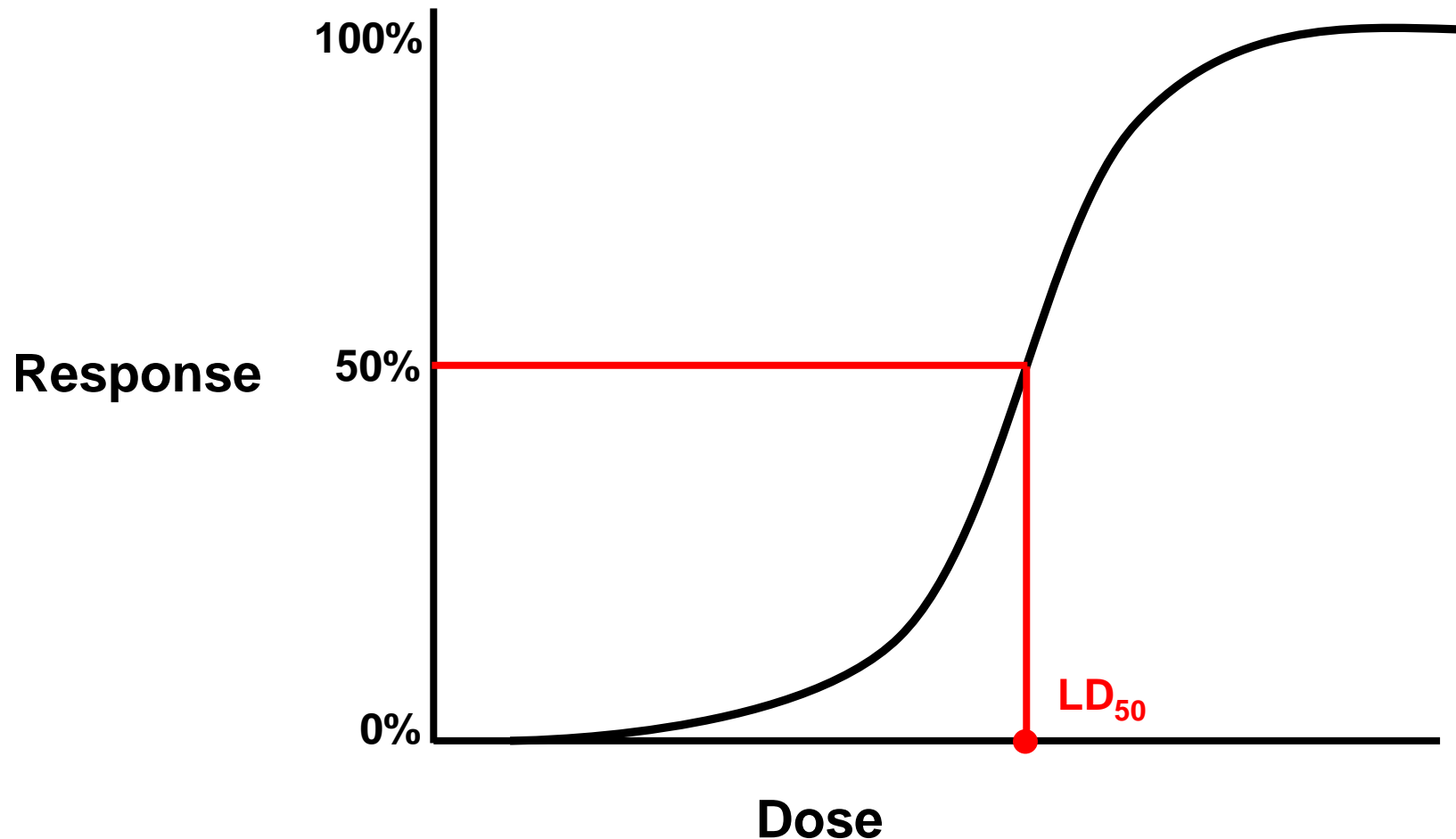
**...health risk assessment.**



**What exposure  
(and associated risk) is the IH  
trying to assess & manage?**

**The dose makes the poison...**

# Dose-Response Curve



**Cancer is the typical 'response of interest'**





**How are exposure limits  
established?**

**Occupational Exposure Limit:  
Formaldehyde**

# Formaldehyde

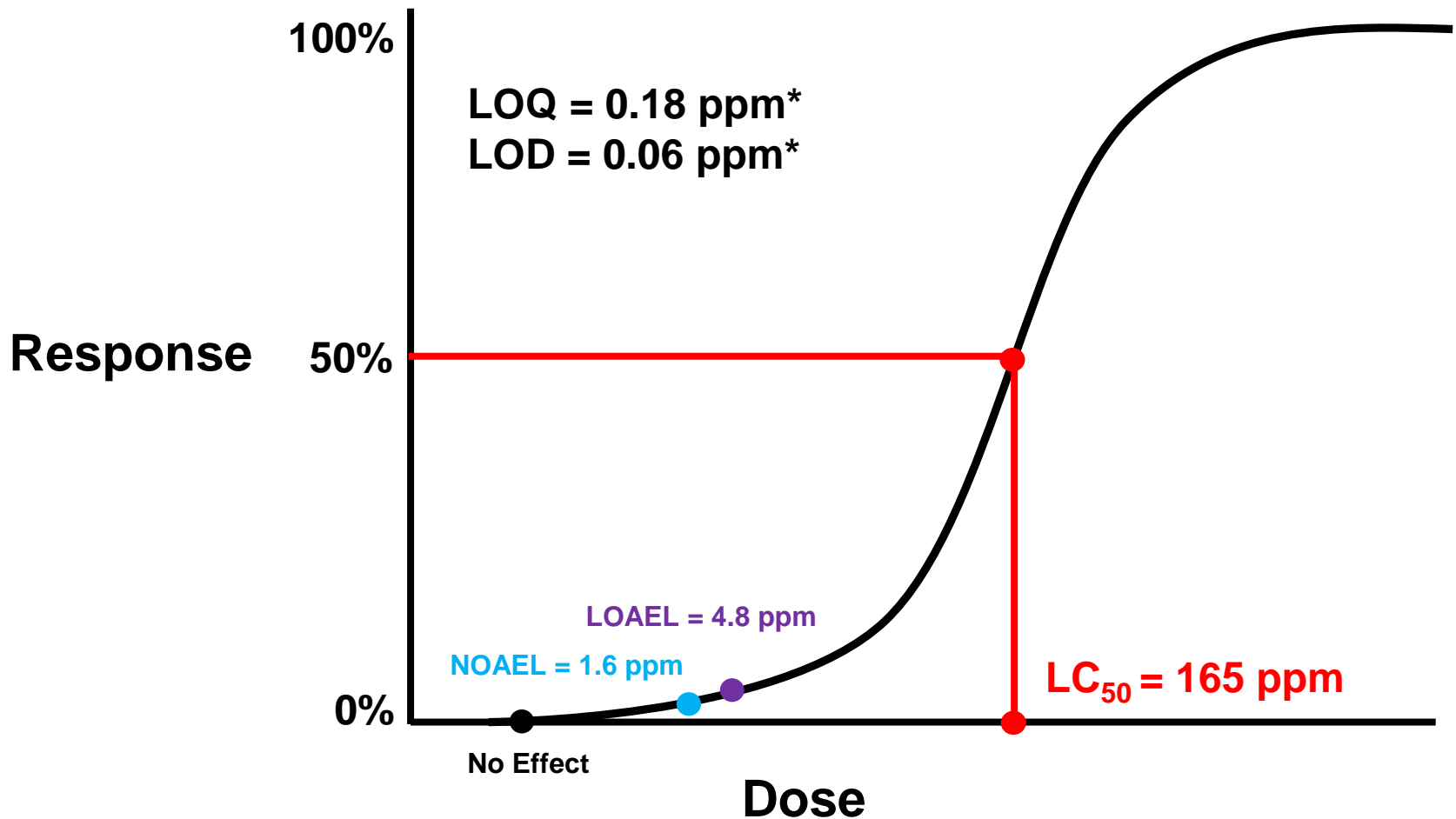
- **Classified as a Suspected Human Carcinogen – rat nasal carcinoma**
- **Rats are obligate nose breathers**
- **Current Standards:**
  - **OSHA – 0.75 ppm 8-TWA; 2 ppm STEL**
  - **ACGIH – Ceiling 0.3 ppm**

# Formaldehyde

## Points to Consider:

- **LC<sub>50</sub> – Lethal Concentration 50%**
- **LOAEL – Lowest Observable Adverse Effect Level**
- **NOAEL – No Observable Adverse Effect Level**
- **Limit of Quantification – LOQ**
- **Limit of Detection – LOD**
- **Applying exposure data collected on rats to humans?**
- **What to consider in setting an exposure limit?**

# Notional Dose-Response Curve Formaldehyde



\*NIOSH Method 2016 using minimum sampling volume

# Formaldehyde

## ■ In Summary:

- **LC<sub>50</sub> – 165 ppm**
- **LOAEL – 4.8 ppm**
- **NOAEL – 1.6 ppm**
- **LOQ – 0.18 ppm**
- **LOD – 0.06 ppm**

## ■ Current Standards:

- **OSHA – 0.75 ppm 8-TWA; 2 ppm STEL**
- **ACGIH – Ceiling 0.3 ppm**

# Considerations

- **What is a reasonable exposure limit based on the data being considered?**
- **What is an appropriate margin of safety – 10x, 100x, 1000x?**
- **What if the difference between controlling exposure at the NOAEL versus the LOQ is \$1 million in real cost?**



# Points to Consider

- **Do lawmakers rigorously consider the science on which standards are based?**
- **Do regulatory agencies consider all types of risk & associated cost w/ proposed standards?**
- **Who can be ‘most’ objective in establishing a risk-based standard?**



**Health Risk** is one consideration in performing a comprehensive risk assessment...

- Operational risk
- Financial risk
- Non-compliance risk
- Political risk



# Final Thoughts

- Understand the processes being employed to make decisions in your organization
- Recognize health risk is weighted differently in different situations
- EHS professionals may lose credibility by focusing solely on health risk
- Understand and be engaged in the EHS regulatory standard setting process
- Use ‘teachable moments’ to educate on risk