Application of Risk Assessment Principles to the Assessment of Impacts on Fish Health from Oil Sands Development: How Safe is Safe Enough?

Presented by

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Why Use Risk Assessment Within an EIA?

- Quantitative; provides a transparent and rigorous basis for impact predictions
- Incorporates public concerns
- Can be used when there are no environmental quality criteria
- Useful for guiding recommendations about mitigation and monitoring

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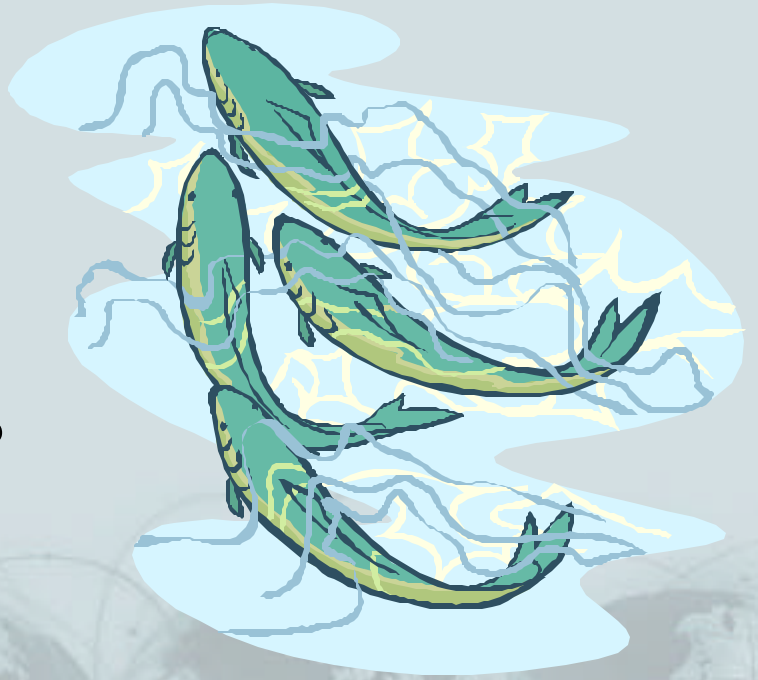
What is Risk Assessment?

- A step-by-step method for answering the following questions:

1. How safe is it?
2. How sure are we?
3. Is it acceptable?



How Safe is It?

- What are the possible environmental effects?
- How likely are these effects?
- How severe would the effects be?

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Steps to Answering the Question
How Safe Is It?

- Understand the problem (i.e. who, what, where, when, how)
- Analyze exposure and effects
- Quantify the risk and put it into perspective

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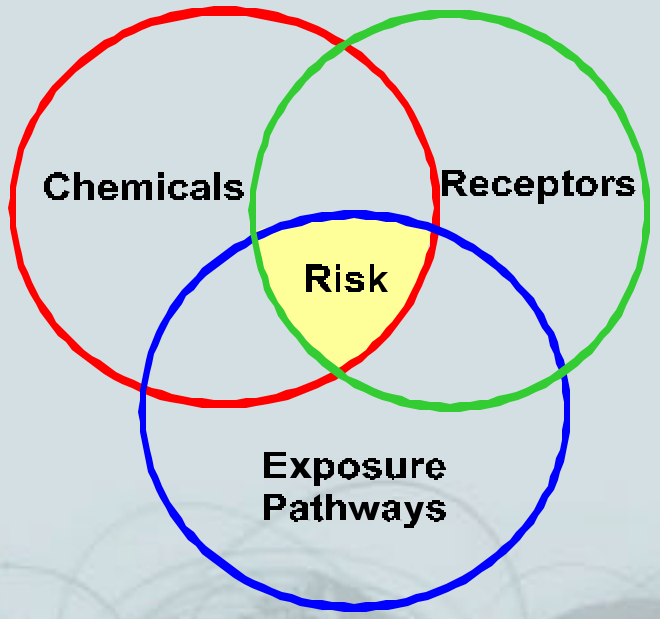
How Safe Is It?
Understanding the Problem

- How will the stressors interact with the receptors?
- There has to be a ‘pathway’ for the stressor to interact with the receptor



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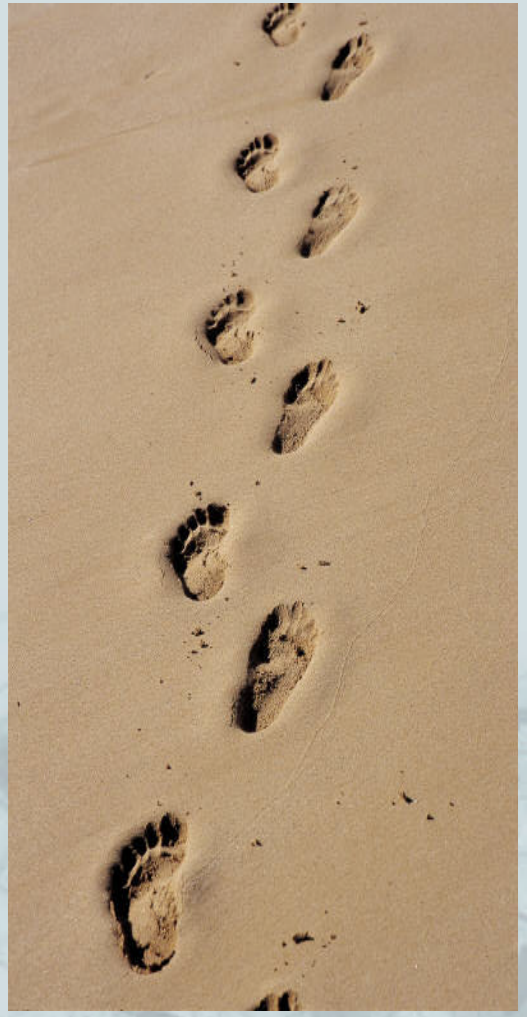
How Safe Is It?
Understanding the Problem

- **THERE CAN BE NO RISK IF THERE IS NO PATHWAY BETWEEN STRESSORS AND RECEPTORS**



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Receptors and Stressors in Oil Sands EIAs

- Receptors: fish and benthic invertebrates
- Stressors: metals, major ions, PAHs, naphthenic acids
- Pathways of Exposure: direct contact with water and sediment; food chain

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How Safe Is It?
Analyze Exposure and Effects

- ***Where and how*** fish and benthic invertebrates could be exposed to oil sands stressors
- Accomplished by using water and sediment quality modelling

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How Safe Is It?
Quantify Risk and Put It Into Perspective

Is there a chance that the predicted exposure could cause effects?

- Compare estimated exposure to lowest threshold for effects
- Examine evidence from field studies
- Assemble a Weight Of Evidence

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How Safe Is It?
Lines of Evidence

Exposure via Water

- Comparison with water quality objectives
- Acute and chronic toxic units
- Comparison with chronic effect values
- Fish Health Index

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How Safe Is It?

Exposure via Sediment

- Comparison with sediment quality objectives

Exposure via Food Chain

- Comparison with fish tissue residue effect thresholds

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How Safe Is It?
Quantify Risk and Put It Into Perspective

For each line of evidence, evaluate:

- Magnitude (How much effect?)
- Frequency and Duration (How often and for how long would effects occur?)
- Spatial distribution (Would the effects occur over a wide area?)

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How Safe Is It?
Quantify Risk and Put It Into Perspective

Weight of Evidence will indicate whether:

- Stressors are causing or could cause observed ecological effects
- Adverse effects will significantly affect populations or communities
- These effects exceed natural population fluctuations

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How Safe Is It?
Quantify Risk and Put It Into Perspective

- The overall goal is to protect populations
- Therefore, effects on a few individuals may not be significant, depending upon the receptor

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Weight of Evidence for Predicted Concentrations

Lines of Evidence	Operating	Closure	Post Closure
Concentration versus CEV	○	◉	◎
TU versus regulatory thresholds	○	○	◉
FHI versus FHI<1	○	○	○
Sediment versus sediment quality guidelines	○	◉	◎
Tissue versus published effects thresholds	○	○	○

○ (negligible), ◉ (moderate), ◎ (high)

How Sure Are We?

- Conservative assumptions are used to account for what we don't know
  - e.g. fish spend all of their time in a small area with the highest stressor level
  - e.g. laboratory toxicity data generated using "fresh" process-affected water
  - e.g. use the "no effect level" or geometric mean between no effect and lowest effect levels
- Goal: Be sure that risks have not been underestimated

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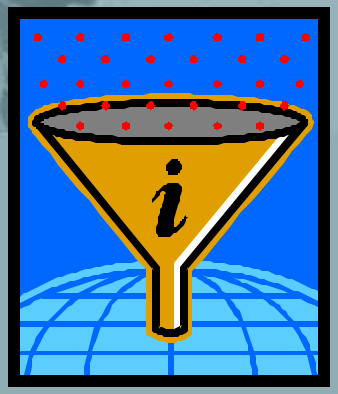

How Sure Are We?

- Scientific uncertainty can be dealt with by:
  - identifying the things that affect the risk level the most and making sure we have enough data for those items
  - applying conservative assumptions
- Social/political uncertainty can be dealt with by:
  - including broad cross-section of people in discussions

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How Sure Are We?

- Can a decision be made even if we are uncertain?

  Yes, if:

  - we are sure we are not underestimating risk (i.e. the consequences of being wrong are acceptable)
  - we know what to monitor for to check our decision
  - we know what “signals” to watch for in the monitoring data and we have a plan for responding to those signals

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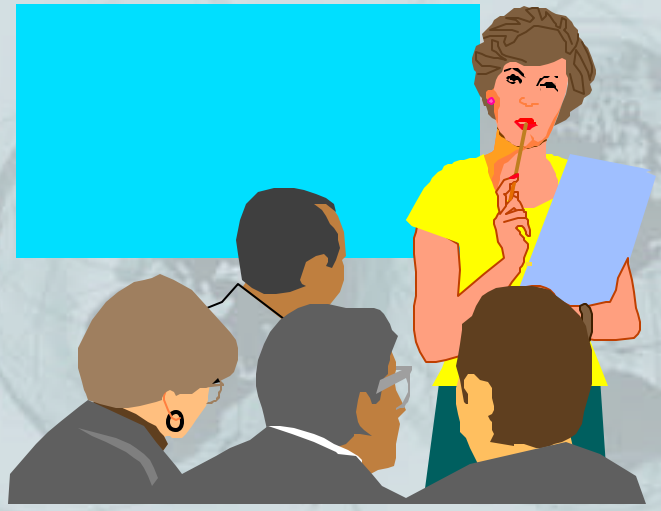
Is That Acceptable?

- Most of the time, scientists present their interpretation of acceptable risk and the public reacts
- Include public input “up front”
- The EIA included input from the community (e.g. receptor selection)



Is That Acceptable?
The Scientific Point of View

- The evidence must be evaluated against some benchmark for “acceptable risk” to populations or communities of fish or benthic invertebrates
- “Acceptable risk” is usually defined as very low likelihood of affecting the persistence of a population (e.g. birth rate, death rate, growth are not affected enough to endanger the population)

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Is That Acceptable?
The Public's Point of View

More Acceptable

- voluntary
- fair
- control or scrutiny by public is possible
- morally correct
- visible benefits
- familiar; know how to manage the risks

Less Acceptable

- involuntary
- unfair
- no control or scrutiny
- ethically objectionable
- no visible benefits
- unfamiliar; don't know how to manage risks

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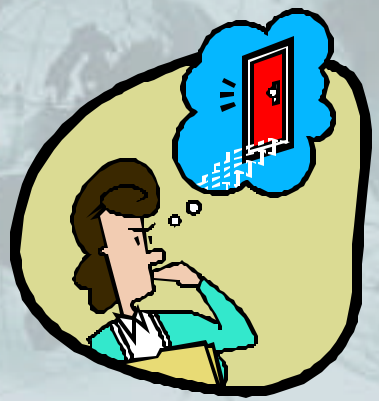
Where Does Risk Assessment Get Us?

- A better understanding of “how safe it is”
- An answer to the question “how sure are we?”
- An opportunity to achieve consensus on acceptable risk
- **A basis for quantifying impacts and issuing permits**



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