Environmental Health Risk Assessment

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Disclaimers

- The views expressed are personal and not reflective of current or past organisations I have worked for.
- Experience-

  Soil Contamination pre-school sites

  Fukushima nuclear emergency

  Asbestos contaminated land sites

What is EHRA?

Environmental Risk assessment is the process of estimating the potential impact of-

- chemical, physical, microbiological or psychosocial hazards;
- on a specified human population or ecological system;
- under a specific set of conditions and for a certain time frame.
- Priority is given for potential human health impacts

What is the scope of EHRA?

Can cover health impacts of:

- chemical pollutants and contaminants in air, water, soil and food
- pathogenic microbiological contaminants in food and water
- radiation sources
- electromagnetic fields (EMFs)
- climate and climate change

What does EHRA enable?

- The estimation of risks at a point in time (including baseline risks) and changes in risk over time
- Establishes whether action is necessary
- The identification and comparison of different factors that affect the nature and magnitude of the risk
- The issues to be prioritised according to their levels of risk
- The use of health guidance values (GVs – Aus) or Acceptance Criteria (ACs - NZ) to be estimated for environmental hazards that will adequately protect public health
- The setting risk-based standards for regulatory exposure limits as well as clean-up standards
- The comparison of the potential health impacts of various environmental health interventions (thus enabling cost-effectiveness estimates)
- The use of risk-based policy making and consistent, transparent appraisal and recording of public health risks
- The challenging and addressing of questionable theories, methods and data by providing clearly documented and open processes.

What are some of the underlying EHRA principles?

- Precautionary principle
- Inherently conservative to protect public health
- Assume constant rather than episodic exposures over a lifetime (75 years)
- Vulnerable and susceptible rather than Healthy worker populations
- Screening desk top assessments vs Tier risk assessments
- Use of upper percentile “worst case” scenarios
- Probabilistic vs point estimates of risk eg Monte Carlo

Susceptible populations -Children

Different physiology – higher RR

Higher metabolic rates

Greater duration of life

Behavioural differences – soil ingestion

Dietary differences and breast milk accumulation

Placental transfer

Exposure factors eg surface area to body weight

SA - new born 3 m2 adult 75 m2

SA to BW - new born 0.067 m2/kg

- adult 0.025m2/kg

When are EHRAs needed?

- When there are plausible concerns about the human health from products, processes, scenarios and activities
- To inform on the selection of safest option to manage risk

Examples

- Contaminated land sites
- Impact of air pollution
- Drinking water contaminants
- Changes in land use
- Future climate change impacts

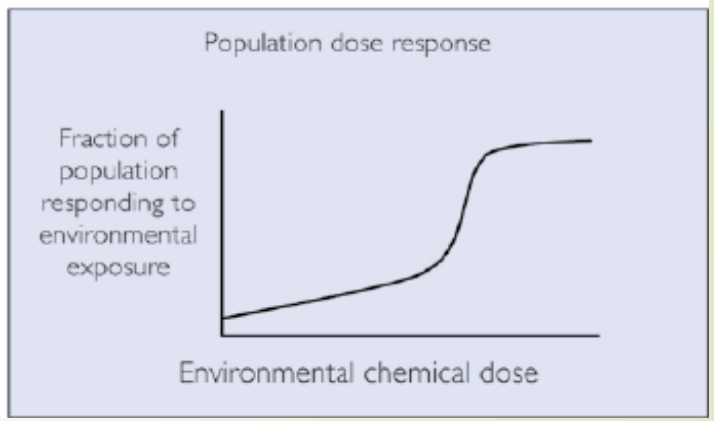
What are the 5 stages of EHRA?
1. Risk Identification

- What is your role – and the limits of this?
- How did the issue arise? How urgent is it?
- What has already been done?
- What are the real issues to be addressed?
- Are the true drivers for the issue being assessed?
- Who are the key people and organisations?
- Who is at risk?
- What are the current risk perceptions?
- What are the relevant legislation and legal risks?
- What are the political agendas?
- The technical stuff…
- Are there any intervention strategies to manage the risks?

What are the 5 stages of EHRA?
2. Hazard Assessment

- The population, global community, communication, risk perception and political hazards
- The severity and reversibility of the health effects of concern
- Latency of the health effects – acute vs long term
- Critical windows of exposure – reproductive and developmental effects

What are the 5 stages of EHRA?
3. Dose Response

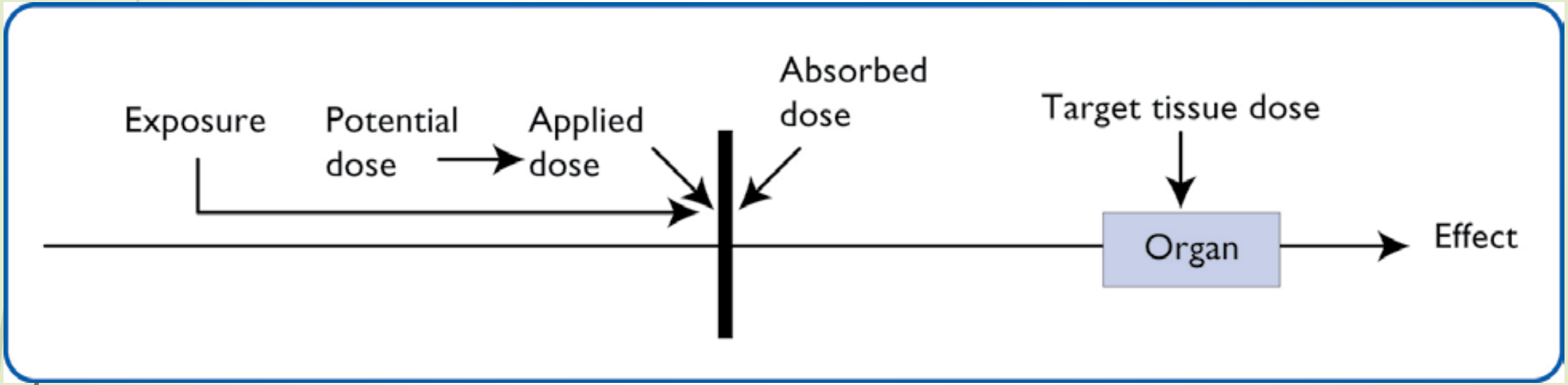


- Is appropriate dose–response data available?
- Has the data been appropriately scaled in translation from animal to human?
- Has the potency of the agent been determined for both acute and chronic dosing?
- Does a threshold or non-threshold model best describe the data?

What are the 5 stages of EHRA?
4. Exposure

- What is the duration, timing, frequency and consistency of exposure?
- Are exposures continuous, intermittent or episodic, or do they show clear patterns?
- Are there are relevant past, current or future exposure patterns to consider?
- Have all exposure routes (ingestion, inhalation, dermal) have been considered?
- Are exposures intergenerational or cumulative, or should they be aggregated?

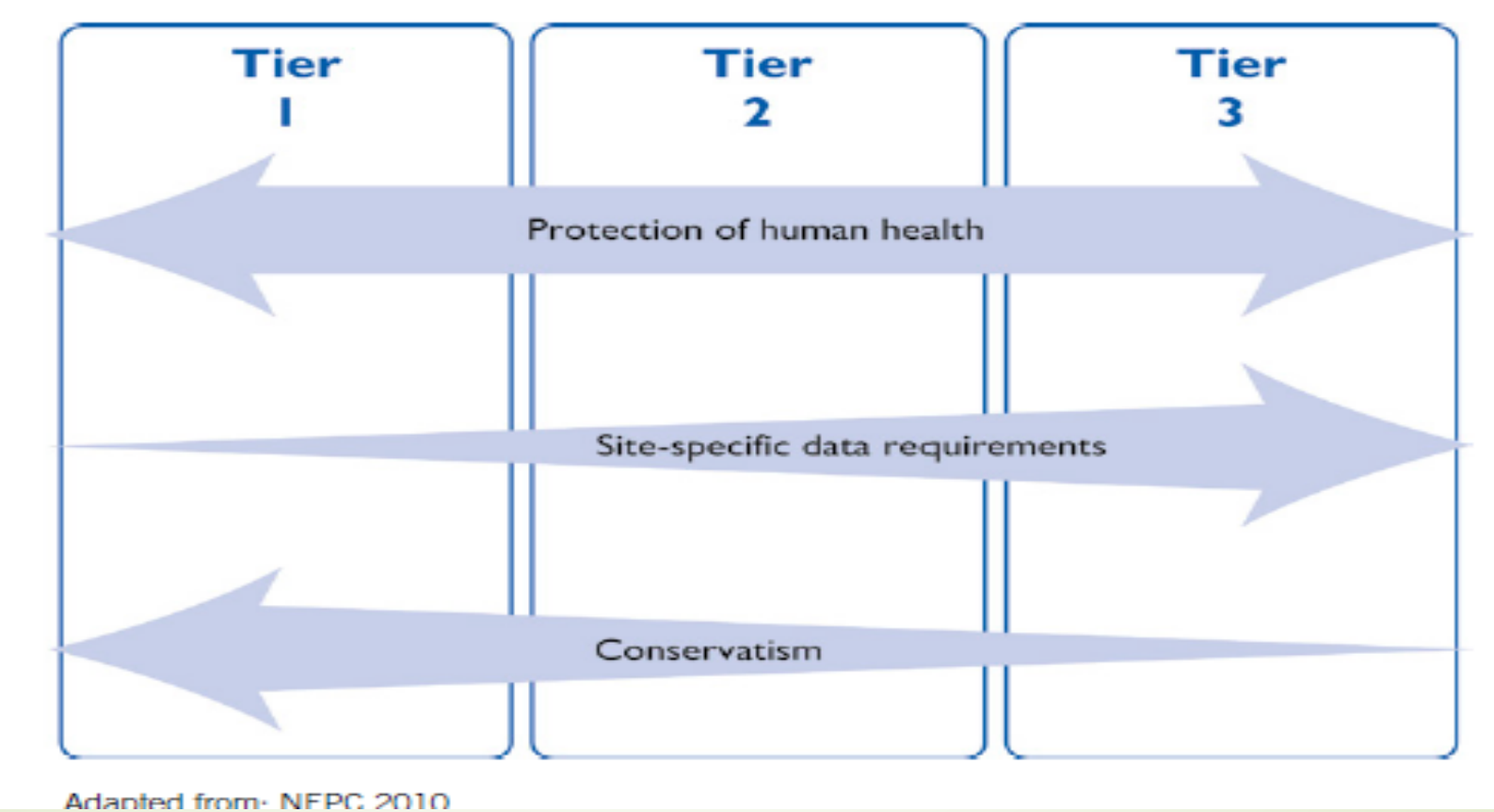
Exposure assessment



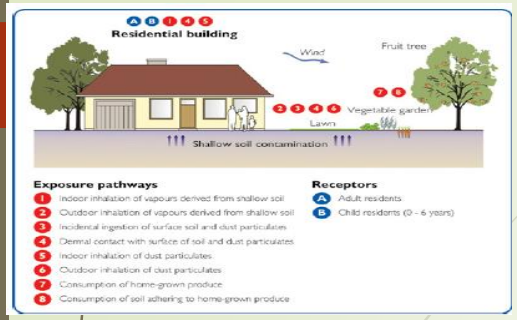
What are the 5 stages of EHRA?
5. Risk characterisation

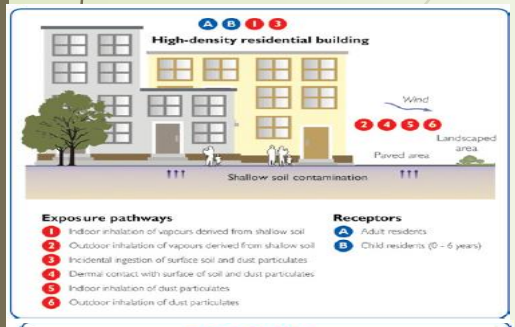
- Has genetic variability in the exposed population (or in the source toxicological data) been adequately accounted for?
- Are there individual host characteristics (e.g. age, gender, body weight, pre-existing poor health, immune status, nutritional status, previous exposures or reproductive status) that need to be considered?
- Are there population characteristics (e.g. herd immunity and social behaviours for communicable diseases, social mobility for exposure to air and soil contaminants, recreational patterns for exposure to contaminated recreational waters) that need to be considered?
- Has the risk estimate been expressed quantitatively or qualitatively?
- if quantitative, is it a finite risk estimate based on extrapolation of the dose–response relationship, or is it an acceptable daily intake (ADI) or tolerable daily intake (TDI), based on application of safety/uncertainty/ modifying factors to a no observed adverse effect level (NOAEL), lowest observed adverse effect level (LOAEL) or benchmark dose (BMD)?

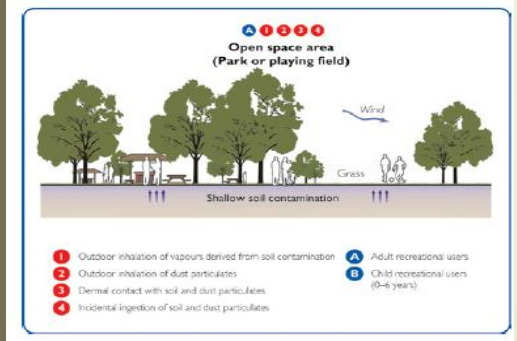
What are Tiered approaches?



Adapted from: NEPC 2010







How is a conceptual site model developed?

THE URGENT ASSESSMENT, REMEDIATION AND MANAGEMENT OF SIX CONTAMINATED CHILDCARE CENTRES, AUCKLAND, NEW ZEALAND

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- The process of how people

  maybe exposed to hazards from relevant environmental sources at a specific site or scenario.
- Describes the sources of contamination, exposure pathways, and potentially exposed human populations
- Contaminants – concentration, distribution, and media (air, sediment, water)
- Physical environmental characteristics eg soil type, ground water, climate
- Characteristics of the exposed population – working on site, adjacent residents, future residents, ecosystems

What are some of the criticisms and problems with EHRA?

- Default data/ values/ assumptions are inaccurate
- Interaction between agents/ mixtures of agents not understood
- Use of default values not representative of site specific values
- Incomplete understanding of nature of population – exposure characterisation or susceptibility
- Uncertainties of risk assessment not well described eg specific point estimates
- Focus of cancer risks and not other outcomes eg reproductive risks/ cognitive impairment in children

What are some of the criticisms and problems with EHRA?

- Perceptions of being tailored for specific outcomes eg “green washing”
- Takes too long to achieve timely outcomes.
- To conservative or not safe enough
- That a derived risk assessment number can be taken as a ‘bright line’ between possible harm and safety

How about risk communication?

Sandman formula of Risk perception = Hazard and OUTRAGE

Outrage factors

- Imposed/involuntary risks
- Inequitable distribution of risks
- Artificial (industrial) risks
- Occurrence of events and accidents
- Mixed messaging
- Uncertainties about nature and magnitude of risks
- Experts - Lack of trust and credibility, perceived & real conflicts of interest, perceived lack of transparency, poor communication, lack of engagement with affected communities
- Conspiracy theories

So what is good risk communication and community engagement?

Starts immediately

Identifies ALL the stakeholders

Two way interactive process between all stakeholders

Identifies stakeholders' risk perceptions

Genuine engagement of the affected community and its concerns

Honesty and realism

Mutual trust and respect

Consistent messages to all stakeholders

Understandable by all stakeholders

Focus on the issues and the community - not how good a job you or your organisation is doing

Good result is an outcome with a high level of agreement between the affected parties

What are three things to remember?

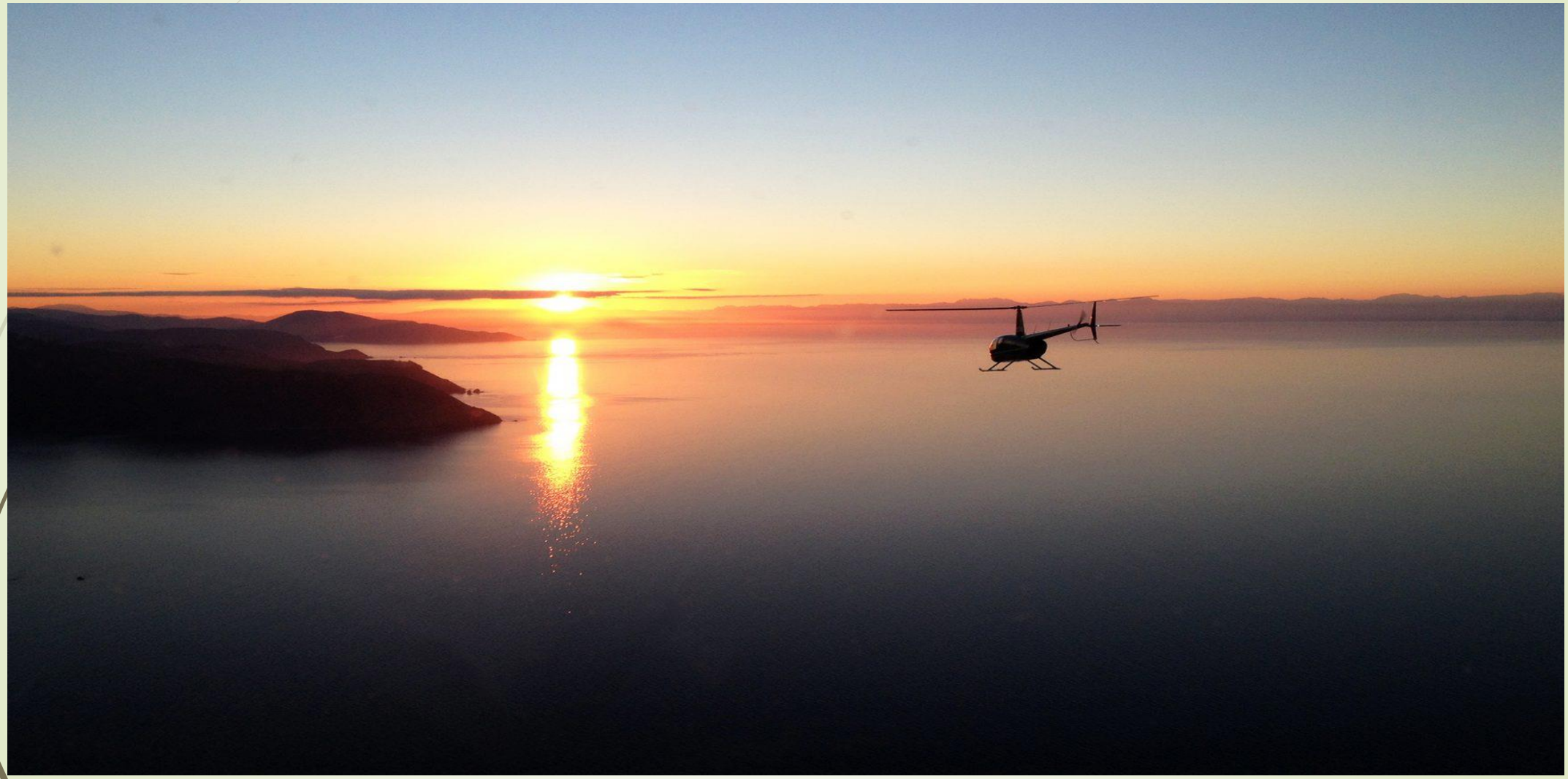
- Engage stakeholders from the start
- Risk communication from the start
- Engage the Community in the solutions

The rest is technical……

Media coverage

- **"Toxic scare at preschools"** - NZ Herald, 1 April 2006
- **"Minimal health risk from toxic ground, council tells parents"** - NZ Herald, 5 April 2006
- **"Baby breaks out in blisters at contaminated site"** - NZ Herald, 6 April 2006
- **"Soil cleared in blistered baby case"**- NZ Herald, 7 April 2006
- **"Remediation to begin next week at childcare facilities"** - NZ Herald, 7 April 2006
- **"Council secrecy over preschool soil-testing led only to over-reaction"** - NZ Herald, 7 April 2006
- **"Kindy arsenic thirteen times over limit"** NZ Herald, 21 April 2006

Questions?



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- Health and environment: communicating the risks – WHO, Regional Office for Europe 2013