sudbury soils study

Human Health Risk Assessment (HHRA)

For the City of Greater Sudbury

Understanding the Results

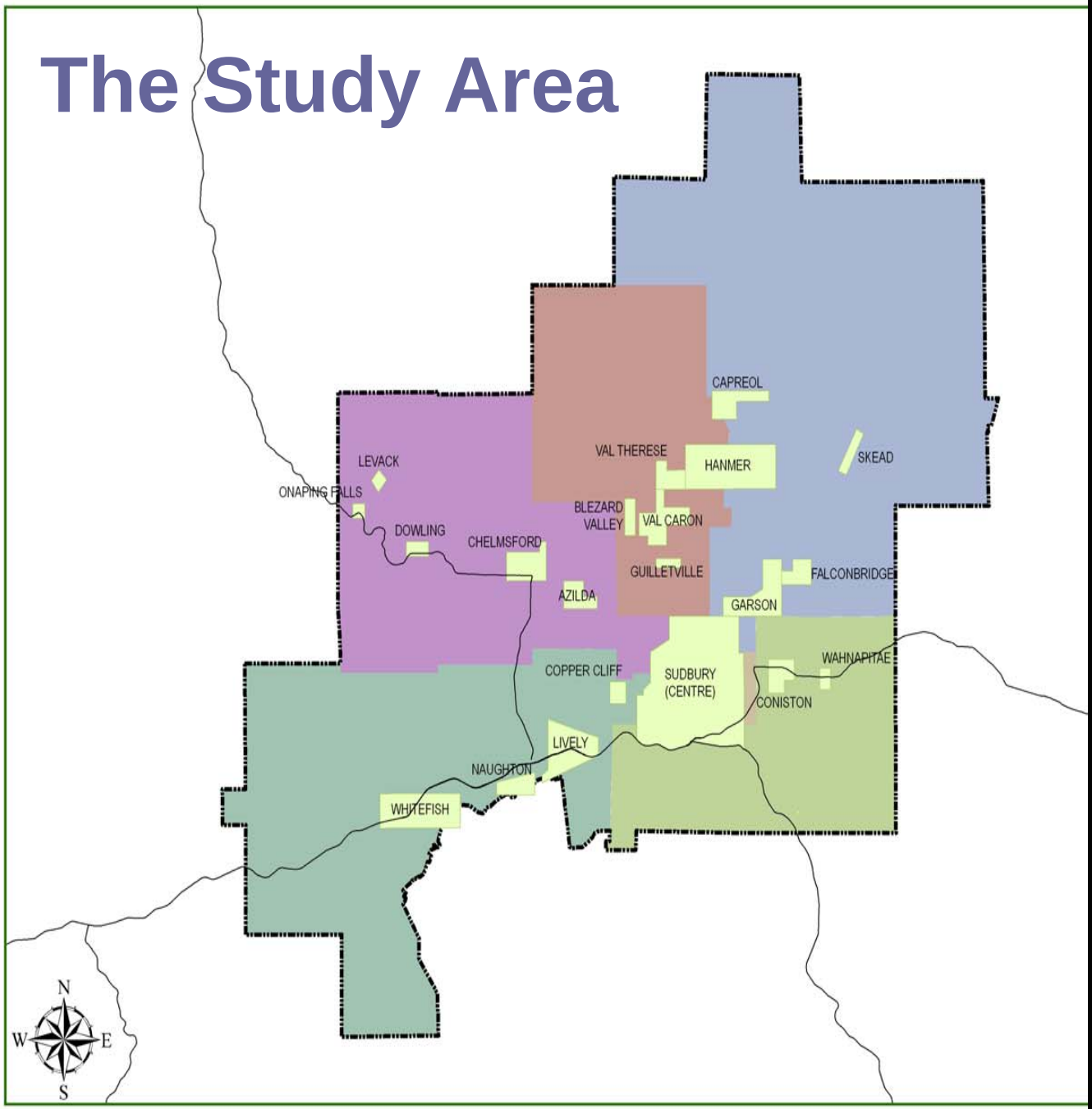
Presented by:

Dr. Christopher Wren – SARA Group

Public Advisory Committee (PAC) Meeting

September 20, 2005

The Study Area



Communities of Interest

- Copper Cliff
- Coniston
- Falconbridge
- Hanmer
- Sudbury Centre

Presentation Overview

- What is an HHRA
  - What did we look for?
  - Where did we conduct the study?
  - Risk considerations?
- What an HHRA is not
  - What won't it tell us?
- What will the final report tell us?
  - What will the results mean?
  - How will they be measured?
  - What are the next steps?

HHRA – What is it?

- An established scientific approach to evaluate the existing potential for adverse health effects from lifetime exposure to conditions in the environment
  - **Soil, water, air, food**

- A conservative decision tool to determine if future actions can or should be taken to minimize potential health risks that may be identified.

HHRA – What it isn't

- A community health study
- An evaluation of health conditions in the study area
- An evaluation of historic risks
- An occupational exposure study
- A prediction for individual health effects
- A recommendation for cleanup

Focus of the study

Chemicals of Concern (CoCs)

- Arsenic (As)
- Cobalt (Co)
- Copper (Cu)
- Lead (Pb)
- Nickel (Ni)
- Selenium (Se)

CoCs identified in preliminary soil sampling conducted by the Ontario Ministry of the Environment (MOE) and Laurentian University in 2001.

Receptor Groups

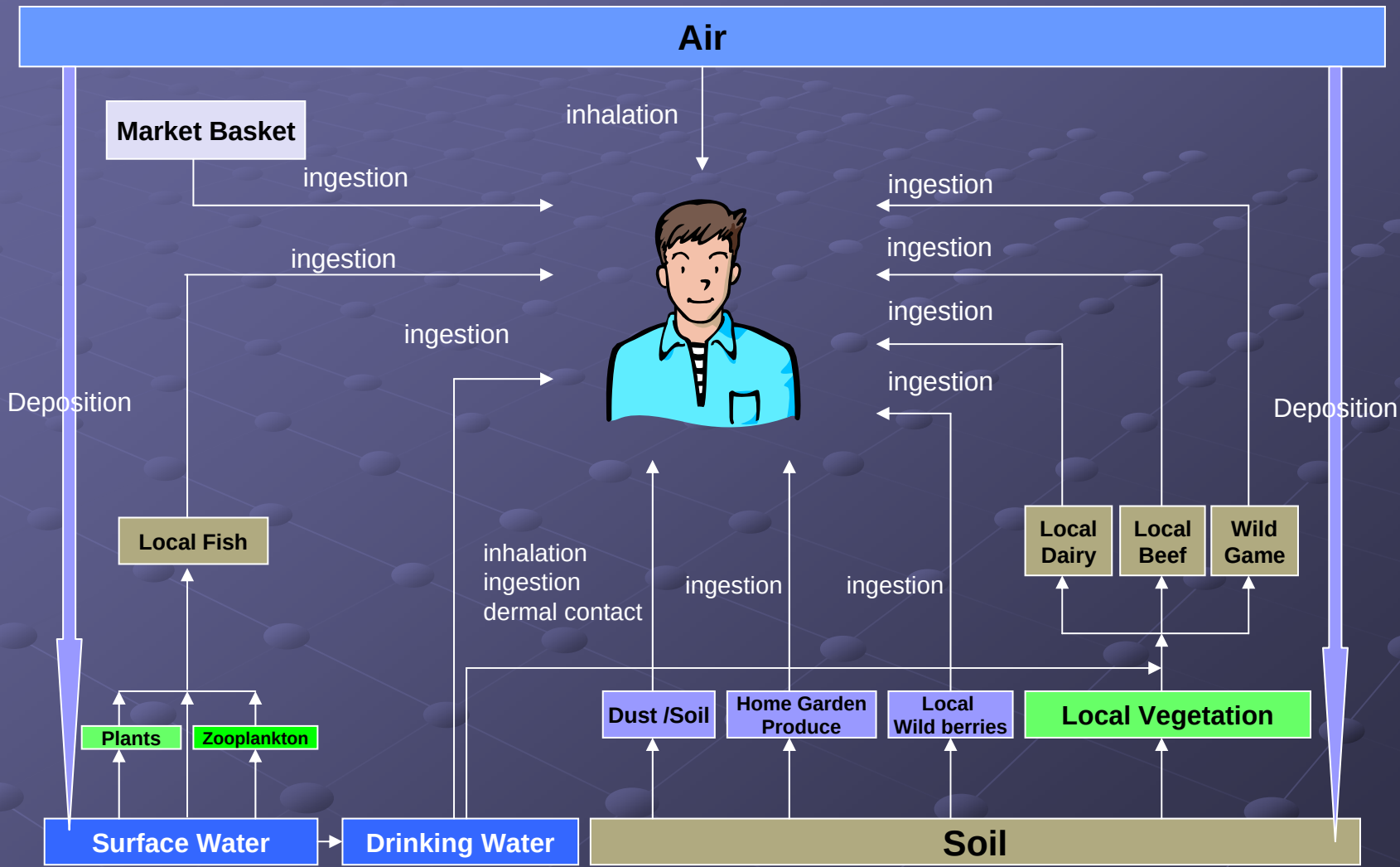
Risks assessed for different life stages and potential for exposure:

- Infant (0 to 6 months)
- Preschool child (7 months to 4 years)
- Child (5 years to 11 years)
- Adolescent (12 to 19 years)
- Adult (20 years and over)

Special interest groups, such as First Nations, hunters, anglers and gardeners will also be considered.

Female toddler considered most sensitive group, for study purposes

HHRA Model: Routes of Exposure



Possible Routes of Exposure

- Inhalation
  - Breathing affected air, vapours, or dust
- Ingestion
  - Soil, dust, drinking water
  - Local garden produce
  - Other food sources
  - Accidental ingestion of water and sediments
- Dermal absorption
  - Skin contact
  - Soil, dust and water

- About 13 primary exposure pathways

Receptor Characteristics

- Body weight (kg)
- Amount of air inhaled (m^3/day)
- Amount of soil ingested (g/day)
- Amount of dust ingested (g/day)
- Amount of drinking water ingested (L/day)
- Amount of milk and dairy consumed (g/kg/day)
- Amount of meat and eggs consumed (g/kg/day)
- Amount of fish and shellfish consumed (g/kg/day)
- Amount of root vegetables consumed (g/kg/day)

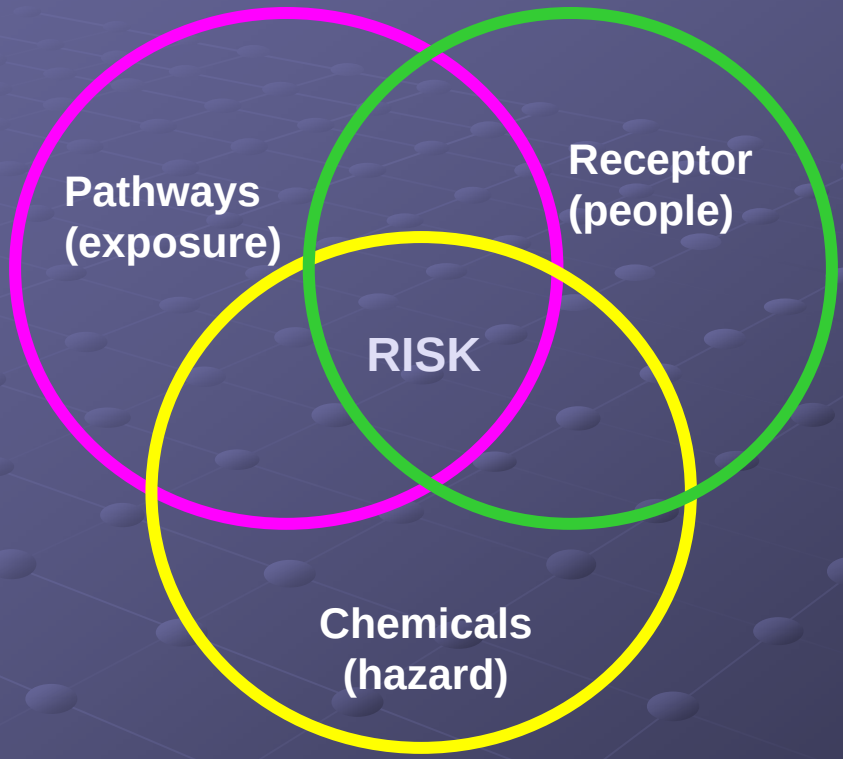
Receptor Characteristics

- Amount of other vegetables consumed (g/kg/day)
- Amount of fruits and juices consumed (g/kg/day)
- Amount of cereal and grains consumed (g/kg/day)
- Amount of sugar and sweets consumed (g/kg/day)
- Amount of fats and oils consumed (g/kg/day)
- Amount of nuts and seeds consumed (g/kg/day)
- Exposure frequency summer (days/year)
- Exposure frequency winter (days/year)
- Time spent outdoors (min/day)

Sudbury-specific Data

- 2001 soil survey
- Air monitoring program
- Drinking water survey
- Indoor dust survey (with co-located soil)
- Vegetable garden survey (with co-located soil)
- Livestock survey
- Fish tissue survey
- Food consumption survey
- Bioaccessibility
- Speciation analysis

Identifying the Risks



- For risk to be present, there must be exposure to the hazard
- RISK = Hazard x Exposure (for each receptor)

Risk Language – What does it mean?

- HQ Hazard Quotient
- CTE Central Tendency Estimate
- RME Reasonable Maximum Estimate
- PRG Preliminary Remediation Goal
- EPC Exposure Point Concentration

Cumulative Effects

- We are exposed to substances in the environment every day
  - Background levels
    - (most metals and some chemicals are naturally occurring)
  - Use of household chemicals, gardening products, food processing, smoke, dust, industry… and others
- Exposure to environmental conditions can accumulate through one or more pathways:
  - Air, Water, Food, Soil, Dust

Risk Combinations

- HHRA accounts for numerous potential risk scenarios:
  - (Communities of Interest) 5
  - X (COCs) X 6
  - X (Receptor Groups) X 10 (5 male, 5 female)
  - = 150

Plus, we account for:

- Different age/sex combinations
- Special consumers (hunters, anglers)
- 2 drinking water sources
- High sensitivity groups
- Typical Ontario resident values
- Exposure using “average” and “maximum” scenarios

TOTAL

= about 4,000 calculations!!

Risk Identification, Community 1:

Where do potential risks exist?

Receptor Group	Chemical A	Chemical B	Chemical C
Infant (0 to 6 months)	No	No	Yes
Preschool child (7 months to 4 years)	Yes	No	No
Child (5 years to 11 years)	No	No	No
Adolescent (12 to 19 years)	No	No	No
Adult (20 years and over)	No	Yes	No

No = no risk identified Yes = potential risk

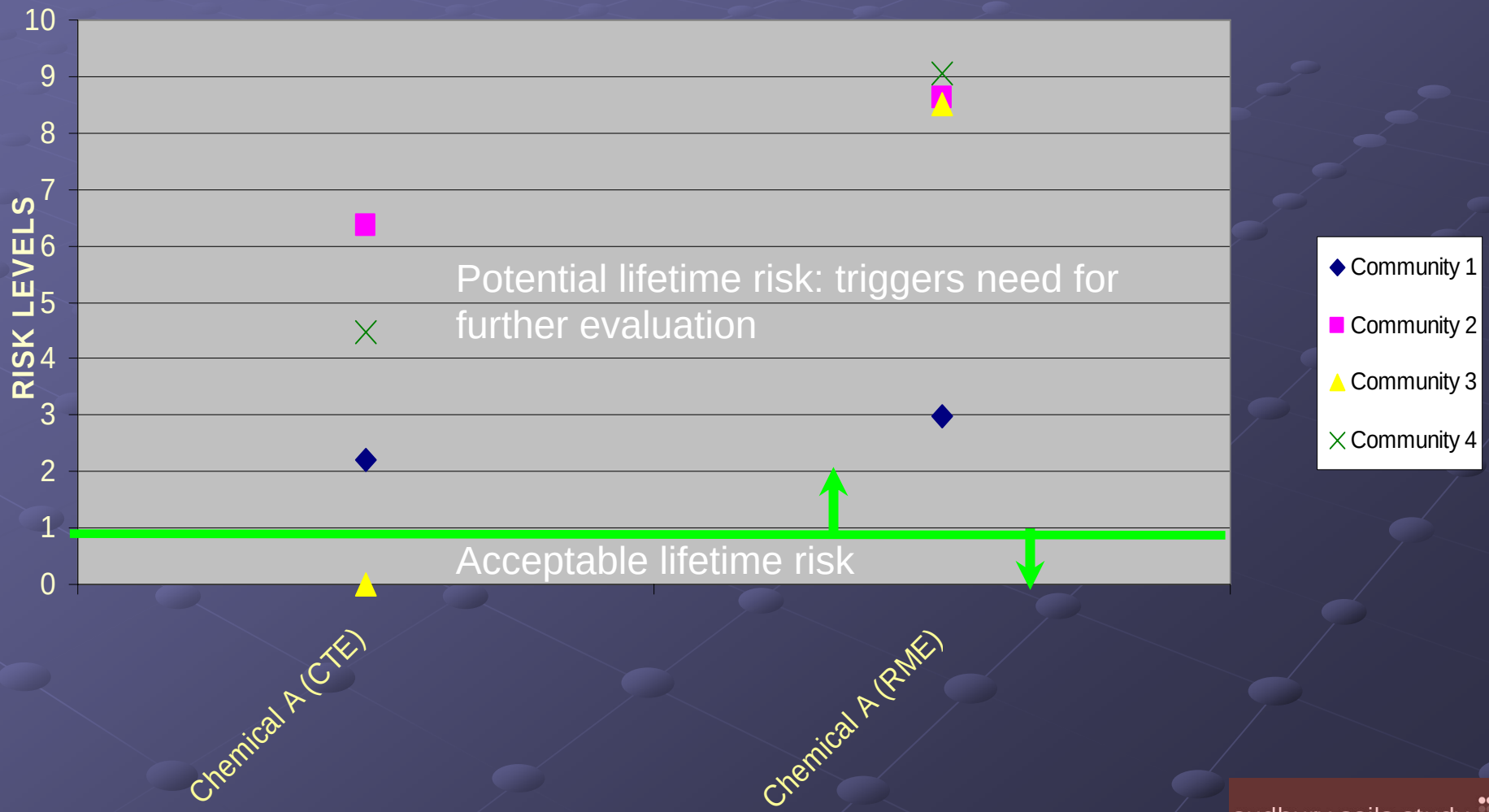
Potential for Risk from Exposure
(Female Toddler)

COMMUNITY	POTENTIAL RISK
Community 1	No
Community 2	Yes
Community 3	No
Community 4	No
Community 5	No

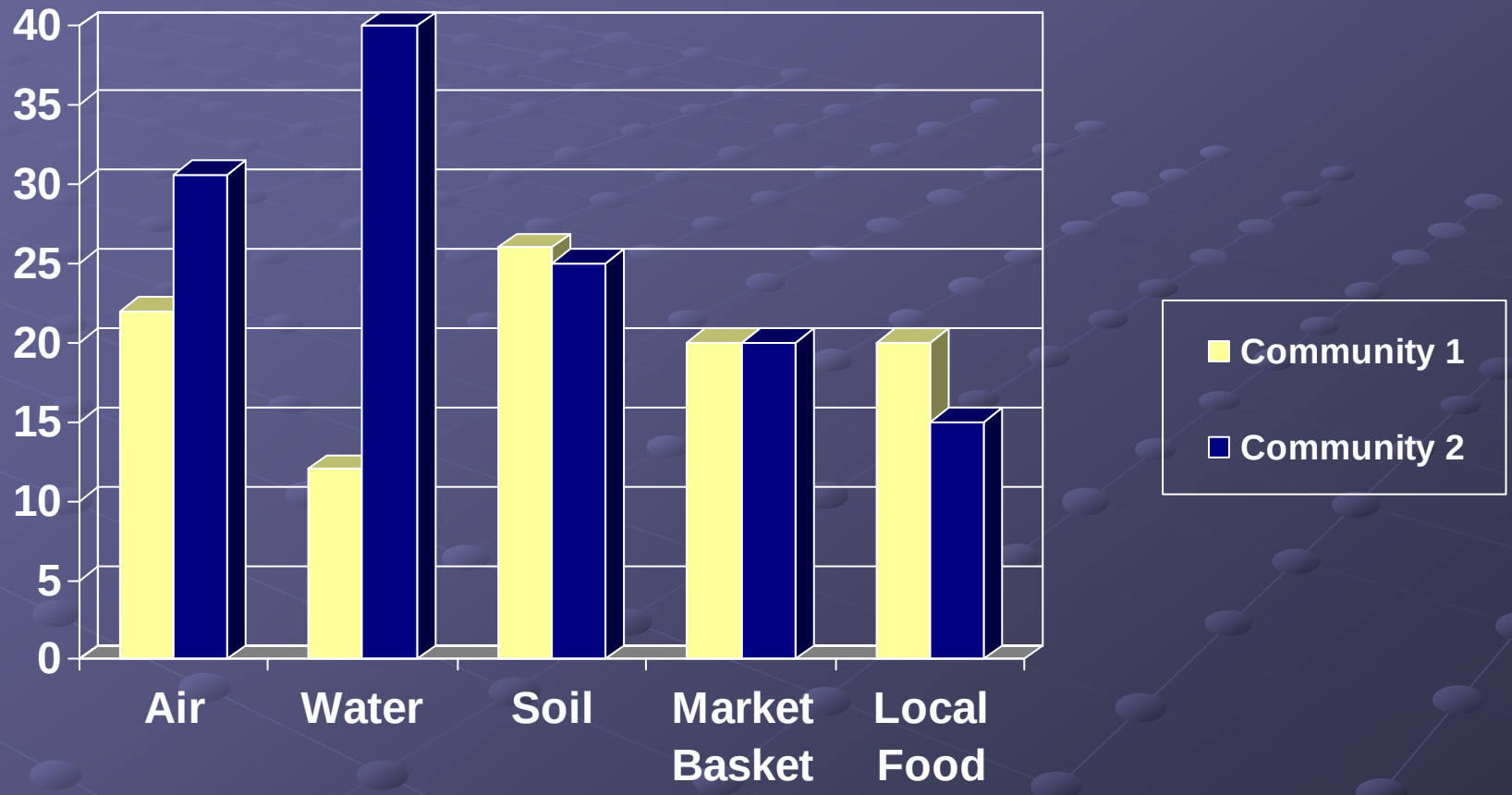
Conclusion:

Based on sampling results and risk analysis, potential risks may exist to Female Toddlers in Community 2, from total exposure to Chemical A. Risks are acceptable for all other receptors and communities.

LIFETIME RISK ESTIMATES
(CTE = central tendency estimate/ RME = resonable maximum exposure)



Percent Contribution to “Risk”



Different communities are exposed to risk in different ways. This is influenced by variables such as geography, proximity to source, community activities, etc.

Potential Soil Intervention Values (mg/kg)

For Chemical A in Community 1

Protecting Population	Value (mg/kg)
Point Estimate	6,000
90th percentile	8,000
50th percentile	14,000

Where are we now?

Projected dates are based on current information and may be subject to change

Where are we going?

TERA peer review process	Completion of Risk Assessments	Risk Management Decisions	Remedial Action *(Long-term and Short-term, if required)*
Risk Assessment		Risk Management	
2006		2007	2008

Projected dates are based on current information and may be subject to change

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Next Steps

- Any identified potential health risks will be communicated to the public and regulatory authorities:
  - MOE
  - Sudbury & District Health Unit
  - City of Greater Sudbury
  - PAC and Communities of Interest
- Draft report will undergo third-party technical evaluation by an independent international review panel (TERA) prior to final release.
- Technical committee will discus where the process goes from here, and any potential management decisions.