OEHHA's New Hot Spots Exposure and Assessment Guidelines

October 24, 2012

Steve Hill

Sierra Research

Introduction

- Background
- Changes in Cancer Risk Methodology
  - Age-Specific Factors
  - Short-term Breathing Rates
  - Duration of Exposure
  - Activity Patterns
  - Spatial Averaging
- Bottom Line

Background

Background: What is this document for?

- Technical basis for subsequent guidance to preparers of Hot Spots Health Risk Assessments (HRAs).
- Guidance is also used in toxics new source review programs throughout California
- Risk assessments are often include in California Environmental Quality Act (CEQA) documents

Background: What does this document contain?

- For point estimate (single value) cancer risk assessments
  - Mandatory methodology for all HRAs prepared for Hot Spots program
  - Default values for some variables.
  - Recommendations for some variables
- For stochastic analysis for cancer risk (optional for Hot Spots risk assessment)
  - Mandatory methodology for stochastic analysis prepared for Hot Spots program
  - Default ranges for variables.

Background: What is the Hot Spots Program?

- AB2588, the "Air Toxics 'Hot Spots' Information and Assessment Act of 1987"
- Requires facilities to report emissions of Toxic Air Contaminants
- Requires "High Priority" facilities to prepare Health Risk Assessments
  - Cancer
  - Chronic non-cancer
  - Acute non-cancer
- Requires notification to neighbors in case of significant risks
- Risk Reduction

Background: What is a Risk Assessment?

- Risk Assessment Components
  - Exposure Assessment
    - Emissions
    - Dispersion Modeling
    - Receptor Characterization
  - Hazard Assessment
    - Dose
    - Toxicity
  - Reporting/Notification

Background: Why is the Guidance being revised?

- Last updated in 2000†
- Office of Environmental Health Hazard Assessment (OEHHA) is required by state law to consider infants and children
  - OEHHA has developed factors to address early-in-life exposures
- Incorporate the latest scientific data on exposures, fate, and transport
  - Large body of literature published since last version

†OEHHA revised breathing rate guidance in 2008.

Background: What is being revised?

- Inhalation Pathway
  - Age-specific values for breathing rate, susceptibility
  - New short-term breathing rates for periodic exposures
    - Take level of activity into account
  - Duration of Exposure
    - Residential
    - Worker
  - Activity Patterns
  - Spatial Averaging
- Dermal Exposure
  - Several values combined into a single value

Background: What is being revised?

- Exposure duration for short term projects
- Noncancer Assessment Unaffected
  - Acute and chronic noncancer health impacts based on Reference Exposure Levels (RELs)

Cancer Risk

Cancer Risk: Tiered Risk Assessment Approach

- Tier 1: Point Estimate using default values for variates (high-end values for 2 dominant pathways; average for others)
- Tier 2: Point Estimate using justified site specific values
- Tier 3: Stochastic approach using OEHHA default distributions
- Tier 4: Stochastic approach using justified site specific distributions

Cancer Risk: Sidebar on SB-352

- SB-352 requires risk assessment ("reverse" risk assessment) for proposed school site within 500 feet of a busy roadway.
  - Other existing state law requires identification and assessment of air pollution sources within ¼ mile
- SB-352 specified use of the Hot Spots risk assessment procedures, but current guidance only specifies 24-hour breathing rates
- 1-hour breathing rates at various levels of activity have been added for use in SB-352 risk assessments.

Cancer Risk: Pathways

- Inhalation
- Non-inhalation (due to deposition)
  - Dermal
  - Soil Ingestion
  - Mother's Milk
  - Home Grown Produce
  - Home Raised Meat
  - Angler Caught Fish
  - Cow's Milk
  - Drinking Water (Not reservoirs)

Cancer Risk: Pathways

- Initial screen to identify dominant pathways for inclusion in Risk Assessment
- Inhalation
- Other Pathways
  - Soil Ingestion
  - Mother's Milk
  - Dermal
  - Other

Cancer Risk: Exposure variates for different age ranges

- Old methodology for residential risk:
  - Risk = Dose* Potency
- New methodology for residential risk:
  - $\text{Risk} = \text{Dose}_{\text{prenatal}} * 10 * 0.33/70 * \text{Potency}$ PLUS
    $\text{Risk} = \text{Dose}_{0\text{-}2} * 10 * 2/70 * \text{Potency}$ PLUS
    $\text{Risk} = \text{Dose}_{2\text{-}16} * 3 * 14/70 * \text{Potency}$ PLUS
    $\text{Risk} = \text{Dose}_{16\text{-}30} * 1 * 14/70 * \text{Potency}$

  Exposure (i.e., Daily Dose) is greater early in life because of behavioral and physiological differences. Susceptibility is greater as well.

Cancer Risk: Exposure variates for different age ranges

- $Dose_{inhalation}$ = concentration * breathing rate
  - Old method: used 80th percentile breathing rate†
  - New method: Use high-end breathing rates for each age range

†Interim guidance in 2008 changed from 95th to 80th percentile

	3rd Tri-mester	0 < 2 yrs	2 < 16 yrs	16 < 30 yrs	30 < 70 yrs
	L/kg/day				
Mean	225	658	452	210	198
95th	361	1090	745	335	295
Current			Ages 0-70	302	

Cancer Risk: Breathing Rates

- Chronic periodic exposure
  - For exposure only during 8-12 hours/day
    - Off-site workers
    - Schools
    - Residential exposure to single-shift emissions
  - Previous method: Dose adjusted to account for overlap between emissions and receptor
  - New method: Also account for 8-hour breathing rates at various activity levels

Cancer Risk: Exposure Duration

- Residential exposure
  - Old methodology:
    - 70-year exposure duration (lifetime risk)
  - New methodology:
    - 30-year exposure duration (residential risk)
      - Represents 95th percentile for actual residence at a single location
    - Lifetime risk still calculated for use in burden calculations

Cancer Risk: Exposure Duration

- Worker Exposure
  - Old methodology:
    - 40-year employment tenure
  - New methodology:
    - 25-year employment tenure
      - Represents 95th percentile
    - 8-hour breathing rate
      - Guidance not clear on when to use this

Cancer Risk: Activity Patterns

- Old methodology:
  - No Adjustment
- New methodology:
  - Ages 0<2 0.86 †
  - Ages 2<16 0.72 †
  - Ages 16<70 0.73

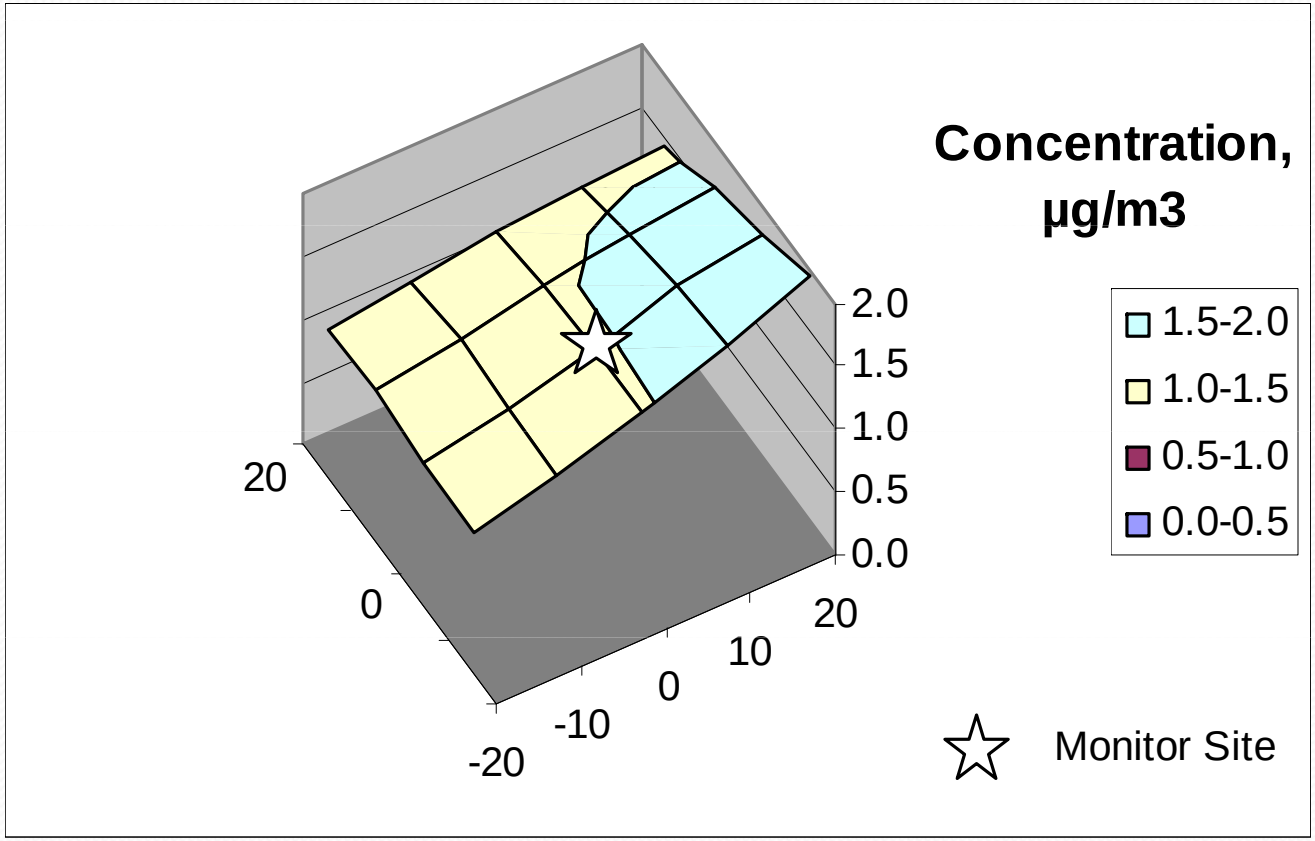
†Facilities with a school within the 1 X10-6 residential risk cancer risk isopleth should use 1 as the fraction of time at the residence for ages 3rd trimester to less than age 16.

Cancer Risk: Spatial Averaging

- Old methodology:
  - No Adjustment
- New methodology:
  - Use average of modeled concentrations within a 20 m x 20 m grid

May be useful for very short stacks with very close receptors (e.g., gasoline dispensing facilities or diesel backup generators)

Cancer Risk: Spatial Averaging



Cancer Risk: Short-term projects

- Old methodology:
  - Varied by jurisdiction
- New Methodology
  - Residential exposure durations start with exposure in the 3rd trimester and use age sensitivity factors.

Cancer Risk: Short-term projects

- New methodology:
  - < 2 months duration: no cancer risk
  - 2-6 months duration: assume 6 months exposure
    - Risk = $Dose_{prenatal}$ * 10 * 0.33/70 * Potency PLUS
      Risk = $Dose_{0\text{-}2}$ * 10 * 0.33/70 * Potency
  - > 6 months duration: exposure = project duration (up to 30 years)
    - Risk = $Dose_{prenatal}$ * 10 * 0.33/70 * Potency PLUS
      Risk = $Dose_{0\text{-}2}$ * 10 * 2/70 * Potency PLUS
      Risk = $Dose_{2\text{-}16}$ * 3 * 14/70 * Potency PLUS
      Risk = $Dose_{16\text{-}30}$ * 1 * 14/70 * Potency

Cancer Risk: Short-term projects

- Example: 30 month project
  - Old methodology
    - Some jurisdictions: any project over a threshold period (e.g., one year) treated as permanent. Use lifetime risk to evaluate cancer impact
    - Some jurisdictions: Short-term projects evaluated using a specified (e.g., 9 years) duration.
  - New methodology
    - Risk = $Dose_{prenatal}$ * 10 * 0.33/70 * Potency PLUS
      Risk = $Dose_{0\text{-}2}$ * 10 * 2/70 * Potency PLUS
      Risk = $Dose_{2\text{-}16}$ * 3 * 0.33/70 * Potency

What is the bottom line?

The Bottom Line: Residential Risk

- Individual risk is calculated using 30-year exposures.
- Changes in early-in-life potency factors, exposure duration, and activity patterns increase individual risk (over previous method) by about 7% if a school is present in the impact area,† decrease by 13% if not.
- Changes in breathing rates, however, combined with the above, result in an increase in individual risk by a factor of 2.7 if a school is present,† or 2.2 if not.

†The impact area is the area within the 10^{-6} isopleth, using the 30-year exposure methodology and no activity adjustment.

The Bottom Line: Population Risk

- No change from previous guidance
  - OEHHA recommends reporting the number of individuals residing within a 1×10^{-6}, 1×10^{-5}, 1×10^{-4} residential risk isopleth.
  - Cancer burden calculated using 70-year exposure (not 30-year exposure)

The Bottom Line: Worker Risk

- Changes in exposure duration reduce worker risk by 37%.

The Bottom Line: Short-term Projects

- < 2 months: no cancer risk
- 2-6 months: assume 6 months exposure
- > 6 months: exposure = project duration (up to 30 years)

Residential exposure durations start with exposure in the 3rd trimester and use age sensitivity factors.

Next Steps

- OEHHA will incorporate the Technical Support Document methodologies into its Risk Assessment Guidelines
- California Air Resources Board will incorporate the Guidelines into Hot Spots Analysis Reporting Program (HARP)

Summary

- Residential risks using the new methodology will be much higher (much, much higher for short-term projects in some jurisdictions)
  - Age-specific breathing rates increase the risk
  - Age-specific sensitivity factors increase the risk
  - Duration of residential exposure reduces the risk
  - Activity pattern factor may reduce the risk
- Worker risks will go down
- Noncancer impacts not affected