OEHHA’s New Hot Spots Exposure and Assessment Guidelines

October 24, 2012

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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:
  - Risk = Dose$_{\text{prenatal}}$ * 10 * 0.33/70 * Potency PLUS
  - Risk = Dose$_{0-2}$ * 10 * 2/70 * Potency PLUS
  - Risk = Dose$_{2-16}$ * 3 * 14/70 * Potency PLUS
  - Risk = Dose$_{16-30}$ * 1 * 14/70 * 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\textsubscript{inhalation} = concentration \times breathing rate

  - Old method: used 80\textsuperscript{th} percentile breathing rate\textsuperscript{†}
  - New method: Use high-end breathing rates for each age range

\textsuperscript{†}Interim guidance in 2008 changed from 95\textsuperscript{th} to 80\textsuperscript{th} percentile

<table>
<thead>
<tr>
<th>Age Range</th>
<th>3\textsuperscript{rd} Trimester</th>
<th>0 &lt; 2 yrs</th>
<th>2 &lt; 16 yrs</th>
<th>16 &lt; 30 yrs</th>
<th>30 &lt; 70 yrs</th>
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<td>L/kg/day</td>
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<td>Current</td>
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<td>Ages 0-70</td>
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<td>302</td>
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</tbody>
</table>
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

Monitor Site
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 = \( \text{Dose}_{\text{prenatal}} \times 10 \times 0.33/70 \times \text{Potency} \) PLUS
    - Risk = \( \text{Dose}_{0-2} \times 10 \times 0.33/70 \times \text{Potency} \)
  - > 6 months duration: exposure = project duration (up to 30 years)
    - Risk = \( \text{Dose}_{\text{prenatal}} \times 10 \times 0.33/70 \times \text{Potency} \) PLUS
    - Risk = \( \text{Dose}_{0-2} \times 10 \times 2/70 \times \text{Potency} \) PLUS
    - Risk = \( \text{Dose}_{2-16} \times 3 \times 14/70 \times \text{Potency} \) PLUS
    - Risk = \( \text{Dose}_{16-30} \times 1 \times 14/70 \times \text{Potency} \)
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_{0-2} * 10 * 2/70 * Potency PLUS
    - Risk = Dose_{2-16} * 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 $1 \times 10^{-6}$, $1 \times 10^{-5}$, $1 \times 10^{-4}$ 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