

SCREENING HEALTH RISK ASSESSMENT SLIDES FROM PUBLIC MEETING

The following slides are based on short bullets which were designed for verbal presentation at the public meeting.

Screening Health Risk Assessment

Eric Walther, Ph.D.

Sierra Research

Sublette County Library

Pinedale, Wyoming

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Study Specifications

- Screening: simple, but health protective
- Monitoring Network
 - ❖ February 2009 – March 2010 (14 months)
 - ❖ 12 monitoring sites, 2 with co-located samplers (14 monitoring stations)
 - ❖ Collected 24-hour air samples every 6th day.
 - ❖ TO-15 (GC-MS) & Summa canisters for 50 toxics
 - ❖ TO-11A (HPLC) & absorption cartridges (2,4-dinitrophenylhydrazine [DNPH]) for 2 toxics





Study Limitations

- Snapshot in time (2009/2010)
- Sampling every 6th day.
- No simultaneous “actual” emission inventory.
- Not every toxic air contaminant (TAC) has an EPA-recommended screening value.



Monitoring Network (Report Figure 1-2)



Air Toxics Studied

- Report Table 3-1
- 51 Toxic air contaminants (TACs), based on analytical laboratory experience and EPA Method for “Toxic Organic Compounds in Ambient Air”
- 27 Tentatively-Identified Compounds (TICs), based on barely detectable mass spectrometer response
 - ❖ Failed “match quality” or no screening value





Screening TACs and TICs

- Screening value = concentration inhaled for 70 years without causing a health effect
- Cancer screening value = concentration that carries a potential risk of 1 in-one-million.
- Chronic non-cancer screening value = 1/10 inhalation reference concentration





Screening TACs and TICs (continued)

- 26 out of 51 TACs exceeded chronic screening health values (i.e., a Y for Yes in Table 7-1)
- None of 51 TACs exceeded acute screening values
- 26 of 27 TICs did not pass screening to merit further analysis because either
 - ❖ EPA did not recommend a screening health value, or
 - ❖ Could not assure identity of chemical, or Both





Results, Excess Cancer Risk

- Potential excess cancer risk = 14-50 in one million
 - ❖ Major TAC contributors:
 - Benzene
 - 1,2-Dichloroethane
 - Vinyl chloride
 - Acetaldehyde





Context for Excess Cancer Risk

- EPA acceptable threshold for a single project = 100 in one million
- Excess cancer risk measured in a large city = 1,200 (South Coast Air Basin 2004-2005)
 - ❖ #1: Diesel particulate matter
 - ❖ #2: Benzene
- Total cancer risk (all causes) = 250,000 in one million



Results, Non-Cancer Chronic

- Potential non-cancer chronic health hazard index = 0.28 -0.53
 - ❖ Significance threshold = 1.0
 - ❖ EPA Reference concentrations (RfCs)
 - ❖ Acetaldehyde
 - ❖ Formaldehyde





Exposure Assumptions

- Resident lives at the monitoring site 70 years.
- Resident inhales measured concentrations 24 hours each of the 25,550 days in 70 years.
- Adult resident breathing rate (95th percentile) = 393 liters/kg-day





General Source Categories

- Report Table 8-2
- Natural gas (NG) stationary engines (17 of 26 TACs)
- Motor vehicle exhaust (12 of 26 TACs)
- Non-combustion (7 of 26 TACs)



General Source Categories for Contributor TACs

- Benzene: Motor vehicle and natural gas (NG) stationary engines
- 1,2-Dichloroethane: NG stationary engines
- Vinyl chloride: NG stationary engines
- Acetaldehyde: Motor vehicle and NG stationary engines
- Formaldehyde: Motor vehicle and NG stationary engines



TAC Non-Cancer Health Effect Target Organs/Systems/Endpoints

- Benzene: hematologic/hematopoietic*, nervous and immune systems; development
- Vinyl chloride: central nervous and respiratory systems; eyes
- Acetaldehyde: respiratory system
- Formaldehyde: respiratory system and eyes

* Blood, blood vessels, blood-forming organs (bone marrow, spleen, liver, lymph nodes, and thymus gland)



Health Risk Assessment

Inputs and Outputs

- Airborne concentrations (microgram per cubic meter, $\mu\text{g}/\text{m}^3$), measured or modeled
- Exposure assumptions (hrs/day, days/week, weeks/year, years)
- Dose (mg/kg-day), implied in screening HRA
- Health impacts
 - ❖ Excess cancer risk
 - ❖ Chronic non-cancer health hazard index
- Target organs or systems





Questions and Responses

- Basic terminology of risk versus hazard
 - ❖ Risk means potential maximum excess cancer risk: a probability in units of “in-a-million”
 - ❖ Hazard means chronic (or acute) non-cancer health hazard index = sum of chronic (or acute) health hazard quotients
 - ❖ Chronic health hazard quotient of a TAC = long-term (annual) average concentration / RfC (reference concentration)
 - ❖ Sum per organ/system and over all





Questions and Responses (continued)

- What about 12 out of 51 TACs (see report Tables 6-1 and 7-1) with no EPA screening values?
 - ❖ Not able to quantitatively compare with a screening threshold.
 - ❖ Not able to calculate potential excess cancer risk if a carcinogen, and
 - ❖ Not able to calculate potential chronic health hazard quotient





Questions and Responses (continued)

- “Snapshot in time”
 - ❖ Screening potential health impacts linear with TAC concentrations in ambient air.
 - ❖ Ambient concentrations depend on emission rates, source locations, and exit parameters.
- Acute (non-cancer) health impacts
 - ❖ Monitored TAC concentrations did not exceed acute screening values.





Questions and Responses (continued)

- EPA Screening Risk Analysis Methodologies
 - ❖ Used “A Preliminary Risk-Based Screening Approach for Air Toxics Monitoring Data Sets”
 - ❖ Did not use “Risk-Based Concentration Analysis” from Region 3 because:
 - Designed for Superfund Sites (hazardous waste site cleanups)
 - Screening concentrations higher, not lower, than used in health risk assessment (i.e., fewer TACs would exceed screening values)





Questions and Responses (continued)

- Synergistic interactions among 51 TACs
 - ❖ Unknown; cannot be analyzed quantitatively
 - ❖ EPA's methodology protective as follows:
 - Potential excess cancer risk from each TAC screened at the 1-in-one-million level
 - Potential chronic (non-cancer) health hazard screened at one-tenth EPA's Reference Concentration (RfC)





Questions and Responses (continued)

- What about other exposure pathways?
 - ❖ Inhalation
 - Overwhelmingly dominant, hence used for
 - Screening (simplicity)
 - ❖ Deposition rate and other details required for:
 - ❖ Dermal absorption
 - ❖ Ingestion
 - Soil, mother's milk, fish, pasture, home-grown produce, pigs/chicken/eggs



Questions and Responses (continued)

- Target organs and systems for chronic hazards
 - ❖ Neurological/nervous system: benzene
 - ❖ Respiratory system: acetaldehyde
 - ❖ Eyes: formaldehyde
 - ❖ Immune system: benzene
 - ❖ Development system: benzene
 - ❖ Hematologic/hematopoietic system (blood, blood vessels, organs forming blood): benzene
 - ❖ Cardiovascular system: methylene chloride
 - ❖ Reproductive system: 1,3-butadiene



Questions and Responses (continued)

- Target organs and systems for chronic hazards (continued)
 - ❖ Alimentary system: carbon tetrachloride
 - ❖ Kidney: chlorobenzene
 - ❖ Liver: ethylbenzene
 - ❖ Endocrine system (hormones and producing glands [pituitary, thyroid]): ethylbenzene





Questions and Responses (continued)

- Worker health risk assessment?
 - ❖ Community concerns focused on residents
 - ❖ Occupational Safety and Health Administration (federal) promulgates regulations to protect workers
 - ❖ Worker calculations adjust resident risk by different exposure period (e.g., 40/70 years, 49/52 weeks per year, 5/7 days per week, 8/24 hours per day)





Questions and Responses (continued)

- Epigenetic: heritable change in genome function without change in DNA
 - ❖ Ex: Twins with same DNA can develop differently based on their environment



Questions and Responses (continued)

- Other TACs

- ❖ Crotonaldehyde from UGWOS at 3.04 ug/m^3
 - Modified EPA Method TO-11A (carbonyls [aldehydes & ketones])
 - Has no cancer unit risk factor nor chronic inhalation reference concentration (Integrated Risk Information System [IRIS])
- ❖ Acetone
 - Has no IRIS cancer unit risk factor nor chronic inhalation reference concentration





Questions and Responses (continued)

- Other TACs
 - ❖ Garfield County and DISH, Texas
 - 101 other chemical compounds
 - 1 in TO-15 list from laboratory
 - 7 require special calibrations
 - 65 require other analytical methods
- NATA 2005 < half of NATA 2002





The End

- Thank you for your attention and interest.
- If you have further questions, please email Darla Potter at the DEQ: DPotte@wyo.gov

