

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

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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



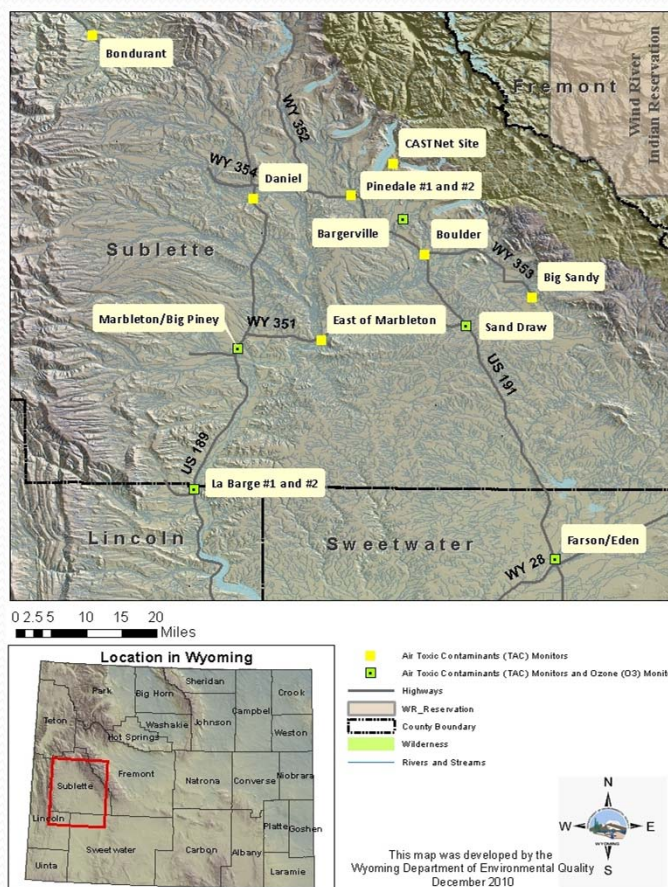


Study Limitations

- 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 $\mu\text{g}/\text{m}^3$
 - 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

