Some Plume Dispersion Highlights From Joint Urban 2003 and Urban 2000

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Joint Urban 2003

Daytime - Nighttime Differences
1. Concentration Fluctuation Intensity
2. Normalized Surface Concentrations
3. Vertical Mixing
4. Susceptibility to Increased Toxic Dosement for Given Species Toxicity and Mean Concentration
5. Characteristic Data Distribution

Effect of Fluctuation Intensity on Toxic Dosement

Nighttime has lower concentration fluctuation intensity (\(\gamma = \mu\)) and higher normalized mean concentrations.

Daytime typically much more variability and larger fluctuations than nighttime. Toxic dose (\(D = H^{\gamma} \gamma^{-\mu}\)) significantly affected by larger concentration fluctuations.

Summary

Daytime

- Larger
- Smaller
- More Uniform
- Greater
- Lognormal

Nighttime

- Larger
- Smaller
- Lower
- Lesser
- Normal

Joint Urban 2003 Dispersion Pattern

1. Poor correlation between observed winds and plume dispersion in anomalous case (except in close proximity to release).
2. Suggests dispersion driven by local, small scale flows in down valley drainage wind and increases away from plume centerline.
3. Plume transport follows light down canyon and down valley drainage wind flow towards the west.
4. Intensities generally higher in day than night and increases away from plume centerline.

Urban 2000

1. Emergency responders need to understand that toxic chemicals may not travel the direction they think the wind is blowing especially if the wind measurements are made some distance from the release.
2. The only way to document and prepare for unexpected plume behavior is through the use of dense meteorological networks and/or atmospheric tracer experiments.
3. Atmospheric dispersion models need to be able to predict this type of behavior to be useful in an urban environment.

Summary

- PNNL stations surrounding downtown. All stations within 150m of release.
- With the release over and well developed easterly wind flow, large concentrations are now measured upwind of the release site.
- Plume continues to move down valley to the west and northwest.
- No significant concentrations were measured during the next half hour after the release had ended. The plume had essentially dispersed.
- Large concentrations continue upwind of the release site.
- Plume generally follows a typical drainage flow pattern despite winds blowing in different directions.
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