

air concentrations across the four monitoring sites (Bell, Rulison or Battlement Mesa, Parachute, and Rifle).

**4. Cumulative Risks** -The cumulative health impacts of the 90 measured ambient air toxics cannot be adequately determined due to the absence of toxicity values for 17 air toxics and the use of semi-quantitative screening methods for about 50 aliphatic and aromatic hydrocarbons.

**5. Multiple Emission Sources** - Most of the chemicals that are found to be the major risk contributors in this evaluation are also ubiquitous in the environment, and are emitted from a variety of sources including industrial and mobile sources.

## 7 Conclusions

- This evaluation indicates a trend toward decreasing potential for public health impacts from 2008 to 2012, based on the estimated cumulative cancer risk and noncancer hazards.
  - The cumulative cancer risk and noncancer hazard estimates indicate a decreasing trend (1- to 4.5-fold) depending on the monitoring site location.
  - The semi-quantitative/qualitative evaluation of acute noncancer risks suggests a trend toward decreasing potential for harmful health effects.
- Definitive conclusions cannot be drawn regarding the magnitude of cancer and noncancer risks associated with emissions from oil and gas operations because of the major uncertainties and knowledge gaps. .

## 8 Knowledge Gaps in Oil and Gas Health Risk Evaluation

The following outlines additional data collection and scientific research which are needed to improve health risk evaluation related to oil and gas exposures:

- Short-term (acute) air sample of less than 24-hour duration are needed in order to evaluate health risks posed by intermittent peak exposures.
- Larger scale source apportionment studies to determine stationary and mobile source contributions for risk driving chemicals including formaldehyde, crotonaldehyde, and benzene.