

## Assessing Toxicity of Volatile Organic Compounds (VOCs)



### What are VOCs?

Volatile Organic Compounds (VOCs) are compounds that are emitted as vapors from certain solids or liquids into the surrounding air.

### Why is this research needed?

VOCs, which include both natural and human created sources, are present in the air we breathe both inside and outside and have the potential to impact human health.

### Potential Sources of VOCs



### What are the research challenges?

-  Traditional scientific methods, which test the effects of VOCs on animals, take a long time to complete, making it difficult to provide timely results. They also use high concentrations of VOCs that may not adequately represent the levels to which we are exposed. Cell-based (*in vitro*) tools are an attractive alternative for evaluating these potential human health effects.
-  Most cell-based systems require that a chemical be soluble (have the ability to dissolve) in another medium (e.g. a liquid) that is not harmful to the cells.
-  About 10% of the first ten chemicals being evaluated under the Toxic Substance Control Act are either volatile or insoluble, making conventional *in vitro* methods challenging.

### How are the challenges being addressed?

EPA scientists developed a new device and methods to test the potential toxicity of VOCs, called a cell culture exposure system (CCES). This device not only allows previously untested chemicals to be evaluated, but also improves the efficiency for which these chemicals can be evaluated. The CCES is an important development, and in the future, will continue to be used to screen the toxicity of volatile chemicals in EPA's chemical inventories.

### Case Studies and Examples

- **Regulating temperature and relative humidity in air-liquid interface *in vitro* systems eliminates cytotoxicity resulting from control air exposures:** Using a commercial system, EPA scientists tested whether temperature and relative humidity (RH) influence cell death. Findings suggest regulating temperature and RH is essential for conducting adequate VOC exposure tests. These findings show the system needed to be extensively modified in order for cells to survive, resulting in development of a better exposure system, known as the CCES. **DOI:** 10.1039/c7tx00109f
- **A new cell culture exposure system for studying the toxicity of volatile chemicals at the air-liquid interface:** EPA scientists developed the CCES, which when compared to the commercial system, exposes cells to volatile chemicals more effectively. The versatility and effectiveness of the CCES makes this a promising new tool for future *in vitro* toxicology studies to aide in EPA's goal to help refine, reduce, and replace animal models used to study potential health effects of airborne contaminants. **DOI:** 10.1080/08958378.2018.1483983