



U.S. National Science Foundation  
Directorate for Technology, Innovation  
and Partnerships

### Project Title

An Optoelectronic Nose for Toxic Gas  
Detection by First Responders

### Awardee

Iridescent Sensors Inc.

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### Award Contract Type

R&D

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### PROJECT ABSTRACT

Every year, over 22,000 chemical spills and related incidents occur on U.S. rails and highways, resulting in more than \$6.8 billion in economic loss and more than 3,600 serious injuries or deaths. Unfortunately, for police and firefighters (the first responders to such incidents), the capability for rapid, mobile and inexpensive detection of toxic gases is extremely limited.

To address this urgent problem, the team — Iridescent Sensors Inc., University of Illinois Urbana-Champaign and Texas A&M University — is developing a new class of chemical sensors: The Optoelectronic Nose, a digital multidimensional extension of litmus paper. This handheld analyzer uses colorimetric sensor arrays to protect first responders against exposure to chemical spills. A disposable array of chemically-responsive dyes is digitally imaged; the array's color changes are a unique molecular fingerprint that allow rapid and accurate determination of toxic gases and their concentrations from well-above hazardous levels to well-below permissible exposures.

The team's goal is to demonstrate commercial value through field-testing of The Optoelectronic Nose for rapid detection of toxic gases, leading to a marketable device. First, the team will optimize sensor array manufacturing, refining a unique 60-ink inkjet printer and automating production. Second, the handheld analyzer's performance and usability will be engineered to improve size, interface and durability. Third, the team will expand the toxic gas identification library, collecting comprehensive data on a wide range of toxic industrial chemicals at various concentrations. Fourth, extensive field testing and validation will be conducted with partners from the hazardous materials community to provide crucial real-world feedback for final refinements, including drone and robotic carriers. The Optoelectronic Nose will have substantial impact on society by improving the safety of nearly two million U.S. first responders.