

# Oil and gas development in California: Workers, communities and public health scientists

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**An Independent Scientific  
Assessment of  
Well Stimulation in California**

**Summary Report**

**An Examination of Hydraulic Fracturing  
and Acid Stimulations  
in the Oil and Gas Industry**

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Lawrence Berkeley  
National Laboratory

<https://ccst.us/>

## Chapter Six

# Potential Impacts of Well Stimulation on Human Health in California

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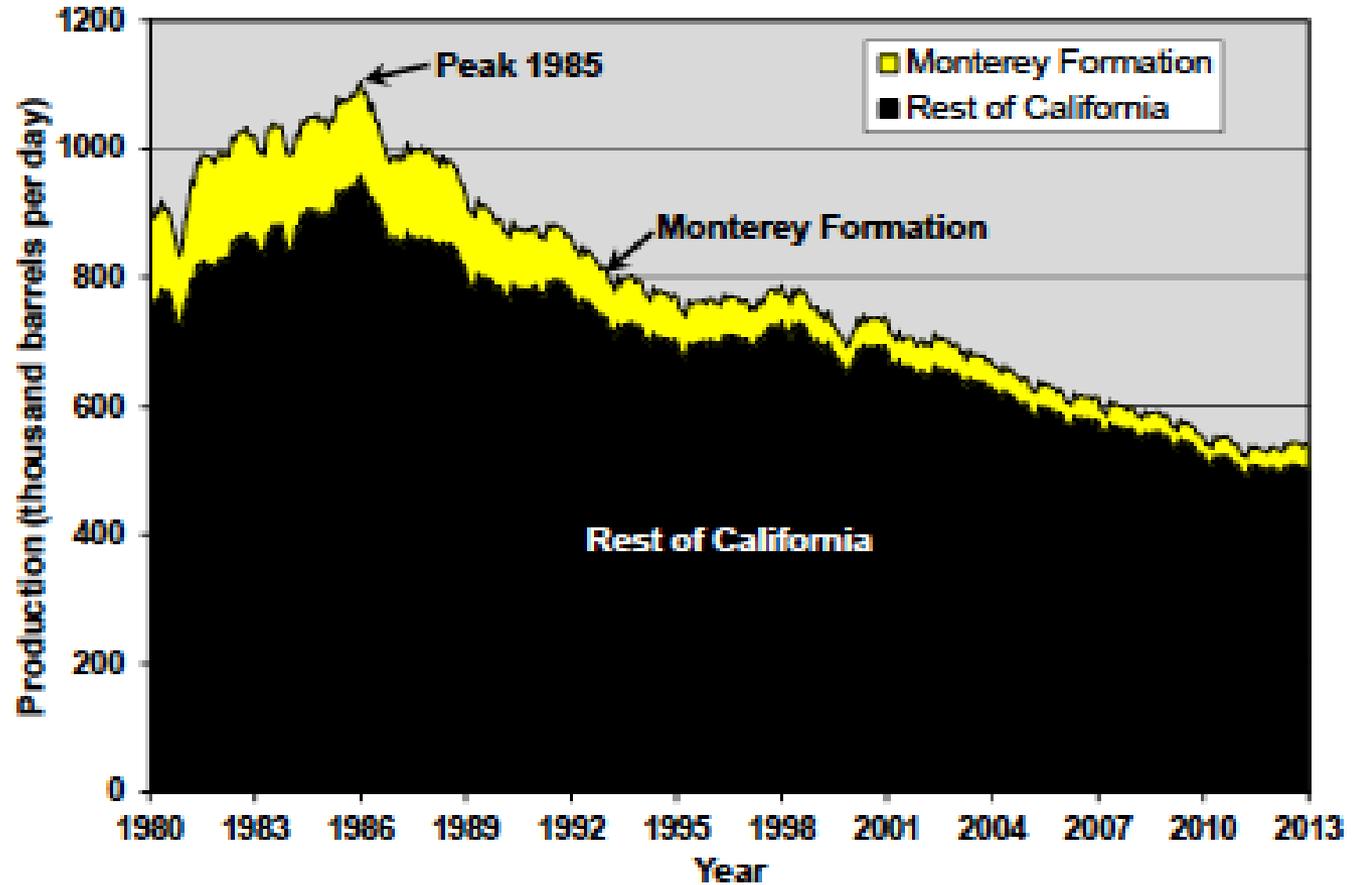
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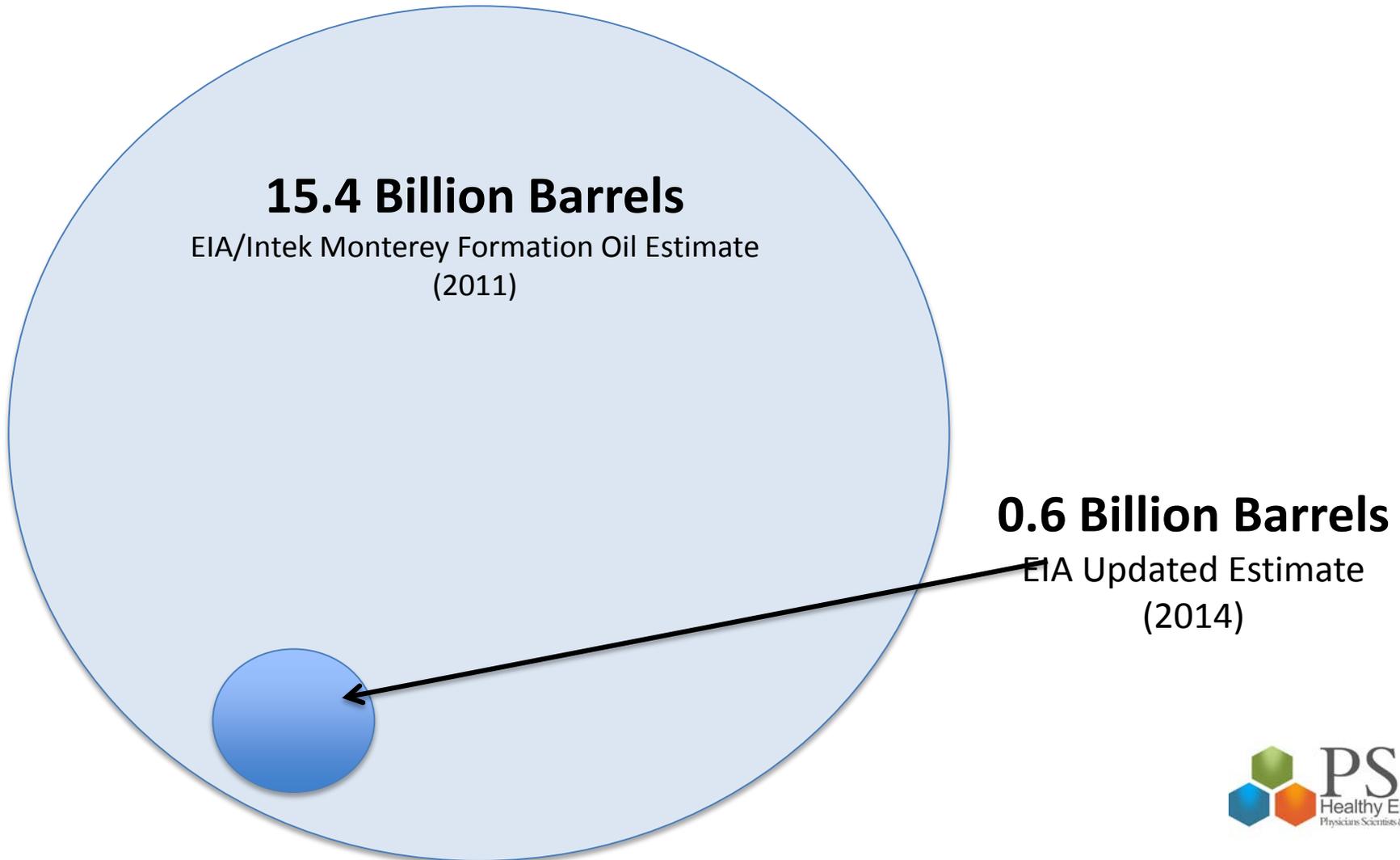
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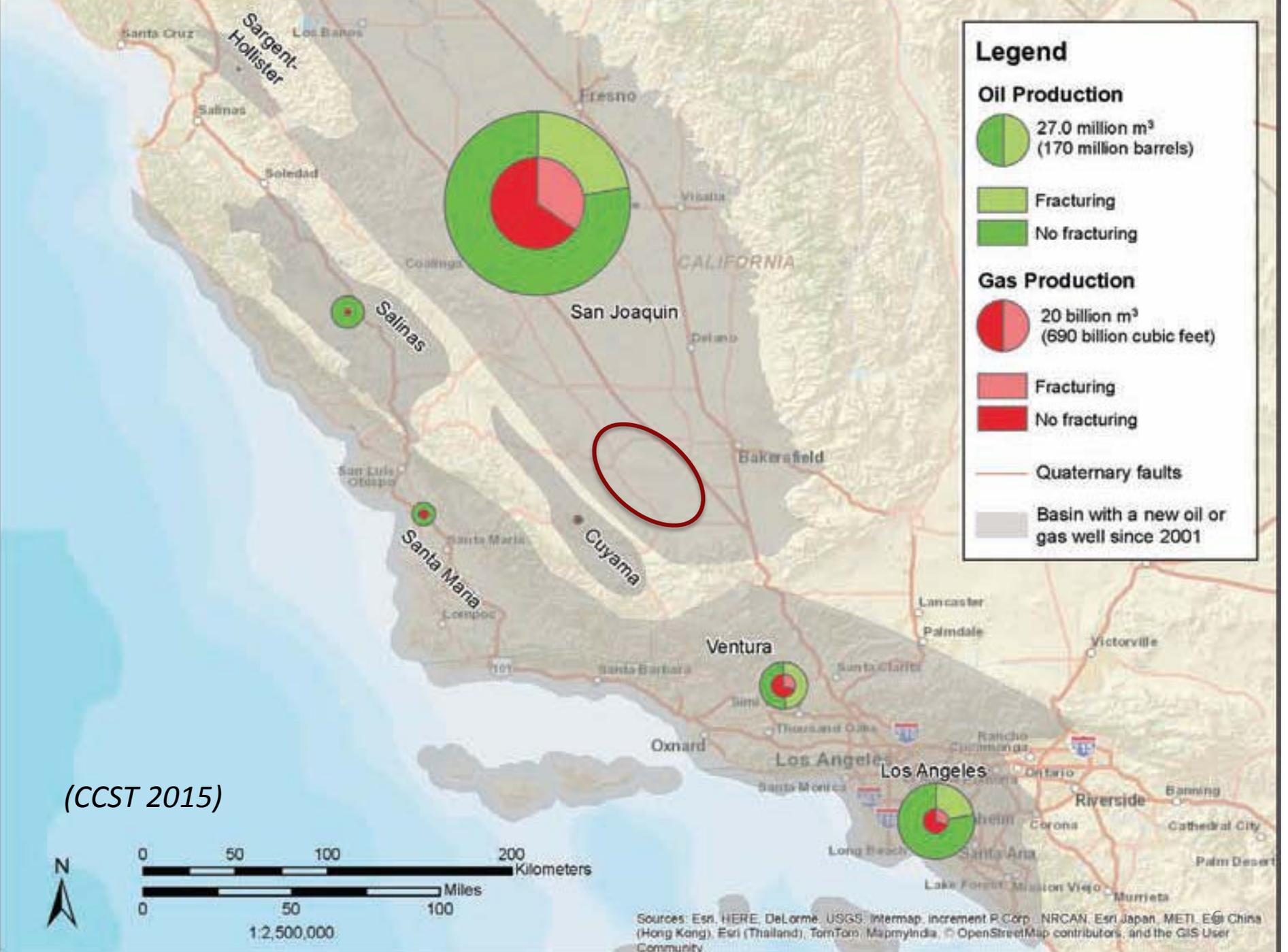
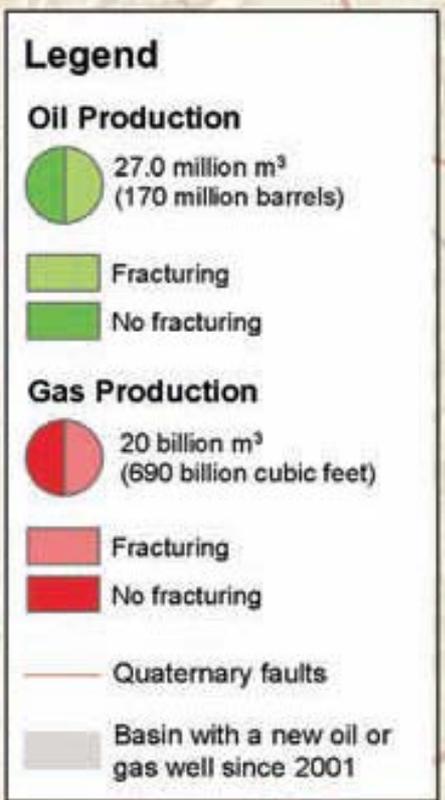
# Oil Production from the Monterey and the Rest of CA 1980 to May 2013



Hughes (2013)

# EIA Monterey Formation Recoverable Oil Estimates





(CCST 2015)



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, OpenStreetMap contributors, and the GIS User Community

# What we know about the use of well stimulation in California

- As of July 2014, there were 51,694 active oil wells in California
- 125 to 175 wells (40%-60%) on average are hydraulically fractured per month out of ~300 wells that are installed
- 18k to 26k wells have been fractured since 2001.
- ~20% of oil is developed using hydraulic fracturing in CA

# What we know about the use of well stimulation in California

- ~90% of all hydraulically fractured wells in CA are in the San Joaquin Valley.
- In 2012-2013 over 85% of hydraulic fracturing operations occurred in four fields on the west side of the San Joaquin Valley: **South Belridge, North Belridge, Elk Hills, Lost Hills.**
- ~12-15 *onshore* wells are hydraulically fractured in Los Angeles per year.

# California data gaps pertinent to environmental public health

- Epidemiology: there are no (0) studies in California
- Local air pollution and intermittent spikes in emissions from oil development infrastructure
- # of people in close proximity to oil production wells, stimulated or otherwise
- Air pollutant emissions from plugged, abandoned, and orphaned wells

# California data gaps pertinent to environmental public health

- Proportion of wellbores with structural integrity issue
- Chemical ID, acute and chronic toxicity, and mass of chemicals used in stimulation fluids, drilling muds, and wellbore cleanout
- Emission factors of BTEX and other VOC compounds
- Handling of hydrofluoric acid
- Environmental persistence of chemicals found in flowback and produced water and exposed to agriculture and the food supply



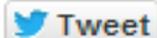
## The Team











## Selected Category: Oil and Gas

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### Reports of Worker Fatalities during Flowback Operations

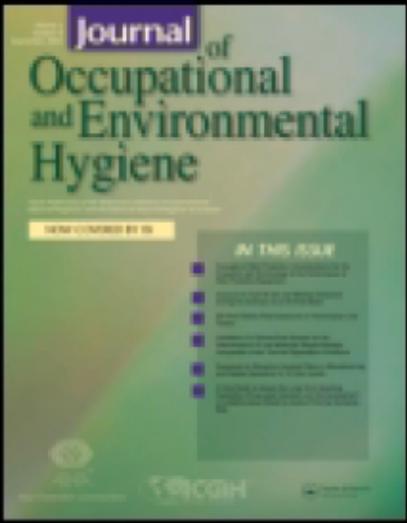
**Categories:** [Oil and Gas](#)

May 19th, 2014 9:10 am ET - **John Snawder, Ph.D, DABT; Eric Esswein, MSPH, CIH; Bradley King, MPH, CIH; Michael Breitenstein, BS; Marissa Alexander-Scott, DVM, MS, MPH; Kyla Retzer, MPH; Max Kiefer, MS, CIH and Ryan Hill, MPH.**



Figure 1. Flowback Tanks

Although worker safety hazards in the oil and gas extraction industry are well known, there is very little published data regarding occupational health hazards (e.g., types and magnitude of risks for chemical exposures) during oil and gas extraction operations. To address the lack of information, NIOSH requests assistance from oil and gas stakeholders in further characterizing risks for chemical exposures during flowback operations and, as needed, develop and implement exposure controls. This blog briefly describes flowback operations and addresses reports made known to NIOSH of recent worker fatalities related to or located at flowback



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### Evaluation of Some Potential Chemical Exposure Risks During Flowback Operations in Unconventional Oil and Gas Extraction: Preliminary Results

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**TABLE V. Airborne Area Benzene Measurements Using Direct-reading Instruments<sup>A</sup> Sites 1 and 2**

Type, Location, Time (if available) (ppm)	Concentration
Area, headspace, front hatch of flowback tank, 1300 hr	209
Area, ladder of flowback tank, 18" from front hatch, worker gauged tank from this location, 1305 hr	149
Area, headspace, hatch of 500 barrel production tank 1056 hr	172
Area, front hatch of closed flowback tank,	2.56
Area, underneath workers' break tent	1.58
Area, workers' break tent	0.46
Area, next to area air samples east of NIOSH vehicle	0.2
Area, front hatch of a closed flowback tank, 0922 hr	52
Area, front hatch of same closed flowback tank, 0927 hr	1
Area, front hatch of same closed flowback tank, 0932 hr	2.5
Area, front hatch of same closed flowback tank, 1345 hr	12.5
Area, front hatch of same closed flowback tank, 1425 hr	5.3
Area, on top of flowback tank, 0831 hr	9.5
Area, workers' break tent, 0826 hr	< 0.2

<sup>A</sup>RAE systems Ultra RAE 3000 w/ benzene separator tube, Dräger Chip Measurement System.

