

**U.S. Chemical Safety and Hazard Investigation Board**



# **Back from the Future: What nanotechnology can teach us about chemical safety today**

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Board Member & Interim Executive**

**2018 ACS National Meeting & Exposition  
August 21, 2018**



U.S. Chemical Safety and  
Hazard Investigation Board



# Texas Tech University Explosion (2010)







# West Fertilizer Company Fire and Explosion (2013)



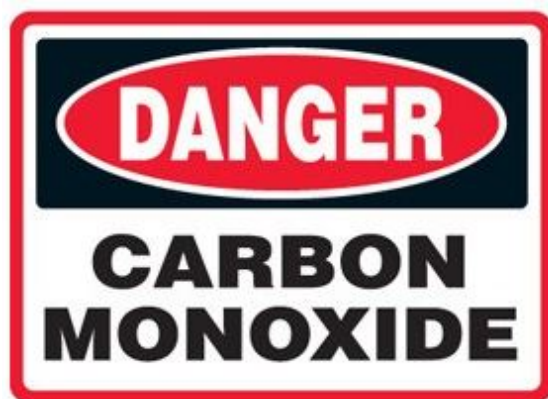
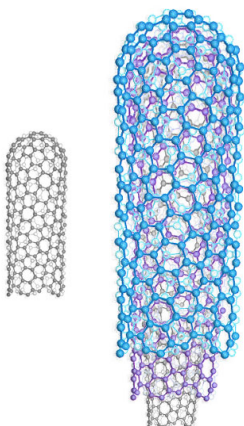
## Incident Description

- Detonation of ammonium nitrate stored in fertilizer retail facility
- 15 fatalities; >260 injured
- Destruction of two schools, nursing home, and apartment building
- ~150 homes destroyed or damaged
- ~\$230 million in damages





# Academic Carbon Nanotube Scaleup Pilot Facility c. 2000



Oh, and sometimes I cough  
up black stuff.



Hey, should I be worried that my  
lab coat is covered in black dust?





 ***Learning from the past***

***Anticipating the future*** 



# Texas City Explosion (1947)



Second ship blown ashore



Dock with debris



Destroyed Monsanto plant





# Historical Ammonium Nitrate Explosions

- **32 incidents dating back to 1916**
- **Most explosions resulted from a massive fire**
- **Occurred within 20 min. to 1 hour from the initial report of the fire**
- **Slight variations in storage conditions can impact AN detonability during fires**

July 30, 2009

El Dorado Chemical Company,  
Bryan, TX



The Eagle/Stuart Villanueva



## Contributing Causes of West Incident



Storage of other combustible materials near fertilizer



Facility and storage bins constructed of combustible materials





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# (Nano)Particulates and Public Health



<http://commons.wikimedia.org/wiki/File:AirPollutionSource.jpg>



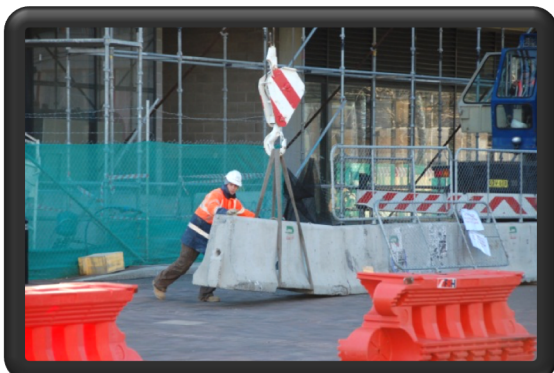
[http://commons.wikimedia.org/w/index.php?title=File:EVENING\\_RUSH\\_HOUR\\_TRAFFIC\\_ON\\_PARKWAY\\_EAST\\_AT\\_PITTSBURGH\\_PENNSYLVANIA\\_-\\_NARA\\_-\\_557230.tif&page=1](http://commons.wikimedia.org/w/index.php?title=File:EVENING_RUSH_HOUR_TRAFFIC_ON_PARKWAY_EAST_AT_PITTSBURGH_PENNSYLVANIA_-_NARA_-_557230.tif&page=1)



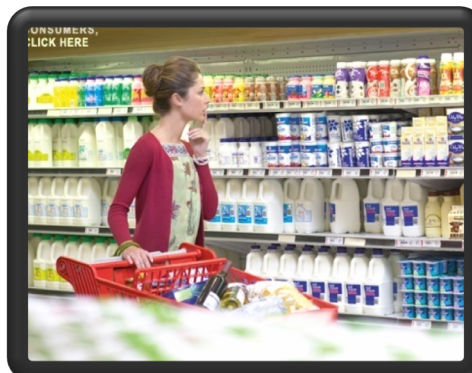


# Potential Targets of Risk

Workers



Consumers



Environment

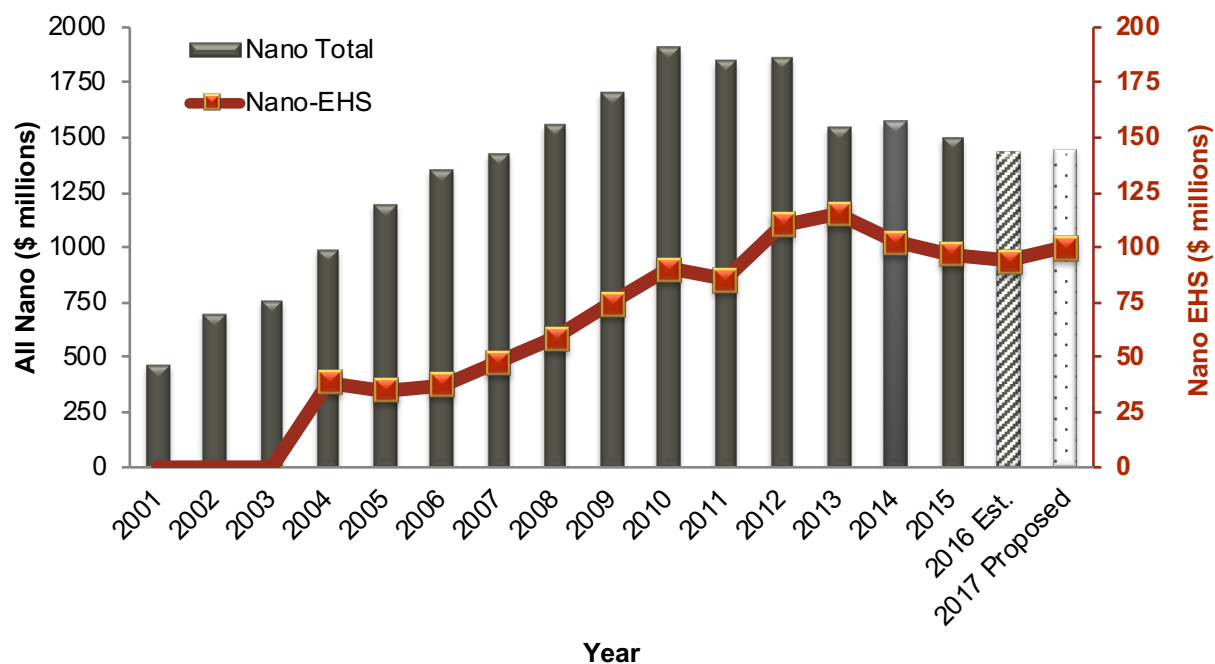


What is known about the environmental, health, and safety (EHS) impacts of engineered nanomaterials?



# U.S. Federal Investment in Nano Research

**U.S. Federal Nano Budget History**



Environmental, Health, and Safety (EHS) research has made up  
~3-7% of the U.S. federal nanotechnology budget





## Key Points

- Much of the early nanoEHS research has focused on simple systems of limited relevance to human health (e.g., cytotoxicity)
- Some nanoparticles can translocate throughout the body after exposure via inhalation, contact with skin or ingestion
- Some nanoparticles can induce unwanted health effects in animals or cell cultures

*It makes sense to control exposure to those nanomaterials for which preliminary hazard data show unwanted health effects or hazards are unknown*



## Findings from TTU Incident



### Findings for TTU

- No tracking of prior incidents
- Physical hazards of chemicals (scale-up)
- Safety management, incl. training

### Broader Findings for Research Community

- Guidance on hazard evaluation in academic labs
- OSHA lab standard
- Influence of granting agencies





# Incidents in Schools and Informal Educational Settings

Between 2001-July 2017

- 261 incidents in lab, classroom, or demonstration setting
- 130 in higher ed > 185 injuries and 5 fatalities
- 66 in elementary and secondary schools > 170 injured

CSB Safety Bulletin



Washington Post October 30, 2015



TEXAS

12 Preschool Kids Burned When Teacher's 'Rainbow Experiment' Goes Wrong

Melissa Chan  
May 17, 2017





## Back to School Safety: The Importance of Laboratory Safety in the Classroom

A Joint Safety Statement by  
Board Member and Interim Executive Kristen Kulinowski  
of the U.S. Chemical Safety Board  
and  
2018 President Peter K. Dorhout  
of the American Chemical Society

As we begin another school year, the U.S. Chemical Safety Board (CSB) and the American Chemical Society (ACS) remind educators and students of the importance of performing laboratory experiments and classroom demonstrations safely to prevent injuries. Chemical safety is a shared core value of the CSB and ACS, and both organizations have worked separately, as well as collaboratively, to raise awareness of the importance of laboratory safety in the classroom.

In 2015, the ACS published guidelines, *Identifying and Evaluating Hazards in Research Laboratories: Guidelines Developed by the Hazards Identification and Evaluation Task Force of the American Chemical Society's Committee on Chemical Safety*,<sup>1</sup> following the January 7, 2010, incident at Texas Tech University where a graduate student was severely injured after the chemical he was working with unexpectedly detonated. The ACS guidelines emphasize the importance of reporting and discussing "incidents, near misses, and close calls." The guidelines also stress the importance of striving for continuous improvement by identifying lessons learned during the course of work as well as using them to inform future hazard evaluations. The CSB attended the first ACS Safety Summit in February 2018, where participants discussed such topics as laboratory chemical safety information, laboratory safety education needs, and the importance of risk assessment in chemical safety practice and policies.



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