TEXAS TECH UNIVERSITY™

Department of Chemistry and Biochemistry

Changing A Culture: The Accident at Texas Tech, What Happened in the Next Five Years, and Why You Should Develop a Culture of Safety: Thoughts From the Department Chair at the Time

Dominick Casadonte

Texas Tech University

Department of Chemistry and Biochemistry

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Texas Tech Chemistry:

- **Faculty:** 29 (24 in 2010)
- **Graduate Students:** 105
- **Postdoctoral Research Associates:** 34
- **Technical Staff:** 9
- **Clerical Staff:** 10
- **Chemistry Undergraduate Majors:** 250
- **Biochemistry Undergraduate Majors:** 256
- **Federal R&D Expenditures (2010):**
  - Top 100
  - #83 (2015)

Texas Tech University

Department of Chemistry and Biochemistry

State of RCR Prior to January 7, 2010

- **Chemical Hygiene Plan**:
  - Website

- **Chemical Inventories**
  - Each lab responsible for inventory

- **MSD Sheets**
  Computerized MSD from Suppliers + 2003

- **Chemical Safety Committee**
  - Composed of Mostly Untenured Faculty
  - *Never Met; Used to Cover Service Load*

- **Chemical Safety Inspections**
  - *Push Back from Faculty, Staff, Graduate Students Resulted in Sporadic Inspections unless specific requests made > 2003*

- **Safety Training:**
  - *Faculty Responsible for Training after 2006*

• January 7, 2010: Explosion in Energetic Materials Lab Injures Student

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• Accident Picked Up in National Media:

- C&EN, Jan. 25, page 7
- C&EN, Feb. 1, pages 25-26
- C&EN, July 23 (Online)
- C&EN, Aug. 23, pages 34-37

• January 7, 2010: Explosion in Energetic Materials Lab Injures Student

- January 8, 2010: Call from National Chemical Safety Board
- Feb. 11: Lab Reopened
- Feb 26: DHS Visit (Northeastern)
- March 19-23: Visit by Chemical Safety Board
- April 9: Internal Investigation Results
- May 25: DHS (ALERT) Visit
- October 15: Findings from the CBS Released

TTU: Response To CSB Report

- **Adapt elements of physical risk into our chemical hygiene plan.**
- **Require Texas Tech University (TTU) to become an exemplary institution around the culture of safety.**
- **Require the University to report annually to the U.S. Chemical Safety Board about progress made toward improving the culture of laboratory safety; the parameters will need definition.**
- **Acquire an online chemical inventory system.**
- **Require the Provost and Vice President for Research to make laboratory safety an element of annual evaluations (e.g., college, department, faculty).**
- **Others to be determined.**

Texas Tech University: The Beginnings of a Change in Culture…

- Working Group Established to Review Lab Safety Policies and Training
- Institutional Laboratory Safety Committee (ILSC) Established
- Peer Review Panel Commissioned to Review Safety Culture (April 4, 5, 2011)
- Research Programs Requiring Significant Monitoring Identified

Texas Tech University: The Beginnings of a Change in Culture…

- Search for Ph.D. – Level Departmental Safety Officer (Not hired until July, 2014; not Ph.D.)
- Safety Information Required in Annual Reviews
- Safety Information Required (where relevant) in Theses and Dissertations
- New Emergency Action Plan (EAP) Instituted Campus-Wide

Texas Tech Chemistry: Towards a New Culture…

• Department Safety Committee Reorganized and Charged to Change Department Safety Culture :

- Biweekly Meetings

- Committee Contains Representation from Faculty (5), Postdocs (2), Graduate Students (5), Undergraduates (3) Staff (3), and EH&S (3)

Texas Tech Chemistry: Towards a New Culture…

- New Model Results from Reflection on Visit from Rick Danheiser on March 30, 2011

- Each Research Group has a "Safety Captain":

  - Primary Lab Contact

  - Works with Safety Committee and EH&S for Better Communication

Texas Tech Chemistry: Growing Pains

- Regulatory Authority of VPR/EH&S Increased: Rekeying of Labs for Serious Lack of Compliance (2.5 times)
- Solvent Reduction Below NFPA Limits in Each Lab Now Required
- Safety Surveys by EH&S

  - Labs can be Rekeyed or Shut Down if Seriously Non-Compliant

Texas Tech Chemistry: Growing Pains

- Incident Report Forms Developed For Both Research and Teaching Labs

- "Peer Safety Surveys", Involving Faculty, Graduate Student/ Postdoc, and Safety Officers Instituted in Summer of 2011

  - One per semester.

  - Complement EH&S safety surveys.

Texas Tech Chemistry: Growing Pains

• T.A.s Undergo Additional Safety Training. Walk Through By Faculty and Prep Chemist in Each Academic Lab. Loss of Pay and/or Assistantship if Graduate Student Lax. Three strikes rule. Time 1 = Written warning in personnel file. Time 2 = Loss of three days wages. Time 3 = Loss of Assistantship

- Only implemented once (Spring, 2011)
- Now, Safety Committee and ILSC deal with these issues

Texas Tech Chemistry: Building the Culture

• All Continuing Lab Researchers are Required to Undergo Mandatory Chemical (and other) Safety Training (September): Verification in Personnel File

- 100% Compliance, Spring 2012 +

• All New Lab Researchers are Required to Undergo Safety Training Before They Can Chose a Research Mentor: Verification in Personnel File

- 100% Compliance, Summer, 2012+

Texas Tech Chemistry: Building the Culture

- All Relevant PPE Required in Research Labs by Researchers

- No One Can Enter Labs Without PPE

- Two workers in lab at a time now (normative)

Texas Tech Chemistry: Building the Culture

• EH&S, ILSC, and Chemistry Safety Committee Revamped CHP

- Completed 2013

- Updated Annually

- All researchers tested
(Students once a year; faculty once every two years)

Texas Tech Chemistry: Building the Culture

•Each Lab Has Safety Guidelines Prominently Displayed

• Common University Chemical Inventory System In Use: (EH&S Assistant): Teaching Labs Compliant; Research Groups Compliant Across Entire Campus (Fisher – Aided); Chemistry Finished in Spring, 2015

• Common Scheme for Labeling All New Chemicals That Come Into The University (11 Types; Based On Prudent Practices)

Texas Tech Chemistry: Building the Culture

- Instrument Safety Training Required on All Instruments

- All Laboratories Have a Hazard Plan in Place

- Synthesis Labs Have Protocols and Procedure in Place, Code of Conduct, General Laboratory Rules or SOP's. Reviewed and Signed by Students in most labs.

Texas Tech Chemistry: Building the Culture

- Strengthened EH&S Lab Walk Through (Unannounced)

- University –Wide Safety Summit Every Fall for Continuing Safety Education Beyond Initial Safety Training Planned by EH&S:

- Jack Breazeale,
LSI, Sept. 9. 2011

Texas Tech Chemistry: We're Still Working On It

- Train at Least One Division Member in CPR and First Response Methodology to Aid Safety Officer (Emergency Action Plan)

- List Rooms Under Alarm System with Types of Hazards for First Responders

Texas Tech Chemistry: We're Still Working On It

- Annual Assessment of All Safety Plans (Required in CHP)

- Working to Improve Culture of Safety for All Academic Laboratories

Texas Tech Chemistry: We're Still Working On It

American Chemical Society:

Tasked by CSB to Develop
Methods for Hazard Analysis
In the Research Laboratory:

"Identifying and Evaluating Hazards in the Research Laboratory"

- Ad Hoc Hazards Identification and Evaluation Task Force of the ACS Committee on Chemical Safety (Kim Jeskie; Casadonte)

Texas Tech Chemistry: We're Still Working On It

National Academy of Science:

- November, 2010 Summit on Developing A Culture of Safety In Academic Laboratories (Casadonte)

- Spring, 2014: Safe Science: Promoting a Culture of Safety in Academic Chemical Research (2014) [Young, Casadonte]

- Presentations at CSHEMA Meetings (Young, Casadonte)

Texas Tech Chemistry: We're Still Working On It

- Working on Developing "Carrots" for Superior Laboratory Safety Activities

- CHEM 5104: Introduction to Laboratory Safety and Responsible Conduct of Research
  - Developed in Spring, 2015
  - All New Graduate Students in Chem and Biochem Required to Take It (47 have so far)

- Safety/RCR Graduate Cumulative Exam Each September

Texas Tech Chemistry: Ongoing

• TA Training: In conjunction with Department of Theater and Dance, Six-Week Course Designed to Teach Useful Teaching Behavior and Role Playing in Chemical Safety Scenarios in the Laboratory in Fall, 2012. Changed to Weekend course, Fall, 2013

• Research Was Conducted into the Effectiveness of this Approach to Improving TA and General Graduate Student Education in Chemical Safety: Results Overwhelmingly Positive (BCCE)

Texas Tech Chemistry: Energetic Materials

- Experimental Protocols for All Procedures in Place, Written by Students and Checked by Faculty and EH&S and Reviewed with Students.

- Instrumentation Protocols for All Procedures in Place, Written by Students and Checked by Faculty and EH&S and Reviewed with Students.

Texas Tech Chemistry: Energetic Materials

- All Appropriate Shielding in Place in Lab

- All Required PPE in Place in Lab and Required by All Students

Texas Tech Chemistry: Energetic Materials

- Group Code of Conduct and Operating Procedures in Place, and Provided to and Signed by Students

- Failure to Comply with Policies and Protocols Results in Immediate Dismissal from the Laboratory

Texas Tech: The Journey Continues…

As a result of our activities, in July of 2015, the National Chemical Safety Board has closed its investigation into our 2010 explosion that severely injured a Texas Tech University graduate student. They indicated in their letter stating that they were satisfied with our actions that we had gone above their expectations…

Texas Tech: The Journey Continues…

Colleagues,

As we begin this new school year, I want to emphasize that safety is a priority on our campus and remind everyone that we all must take responsibility for making sure that our colleagues and students are safe.

We received good news this summer. The U.S. Chemical Safety Board (CSB) has closed its investigation into our 2010 explosion that severely injured a Texas Tech University graduate student. I want to applaud everyone for taking on the challenge in the last couple of years of developing a strong, positive safety culture at Texas Tech University. Students, staff, faculty and administrators have worked to change our expectations about the safety needs of our work and about how we act in the context of those needs in our laboratories, studios and field sites.

Texas Tech: The Journey Continues…

At the heart of our safety culture at Texas Tech University is our Chemical Hygiene Plan (CHP). The CHP is Texas Tech University's guidance document when we work with physical or chemical hazards. The CHP guides our work in labs, studios, field sites and any other areas in which necessary hazards may be present. Please talk to your advisor or supervisor about whether you should take basic CHP training and about whether there are specialized safety plans specific to your areas of study and work.

We have a wide range of on-line and face-to-face safety training courses at TTU as well. The TTU Department of Environment Health and Safety (EH&S) has developed a safety training matrix to help you identify opportunities in the context of your position at Texas Tech University.

Texas Tech: The Journey Continues…

To further enhance our safety efforts, EH&S has developed a new resource to report safety concerns. The
Safety Concerns And Near-misses (SCAN) system is designed to let faculty, staff and students report safety concerns or unplanned events that did not result in injury or damage (i.e. close calls). This helps us as we move forward to prevent accidents by learning from each other.

Texas Tech: The Journey Continues…

A strong positive safety culture is an integral part of all our activities at Texas Tech University. We'll once again focus on this important subject during September. Follow the
Safety@TTU blog for tips and resources that can help us all keep our university safe for our students, staff, faculty and visitors

Thank you for attention to this important matter throughout the entire year. Let's have a great and safe year.

Sincerely,

M. Duane Nellis, President
Texas Tech University

Texas Tech: The Journey Continues…

Accident: March 10, 2017

Accident is Still Under Investigation; Report will be Released Soon

Texas Tech: The Journey Continues…

My Observations (My Opinion Only)

- 3:45 PM: Shell Vial Explodes in Research Lab
- Less than Five Minutes: Multiple Police, Ambulance, Fire Trucks on the Scene
- By 4:00 PM, Picture of Student Leaving the Building Is on TTU Twitter Feed

Texas Tech: The Journey Continues…

What went right:

- Student had minor injuries only
(hand lacerations; treated and released)

- Student was wearing goggle, lab coat, gloves

- Experiment carried out in the hood

- Not an energetic material synthesis; literature procedure

- Student immediately placed under the safety shower

Texas Tech: The Journey Continues…

What went right:

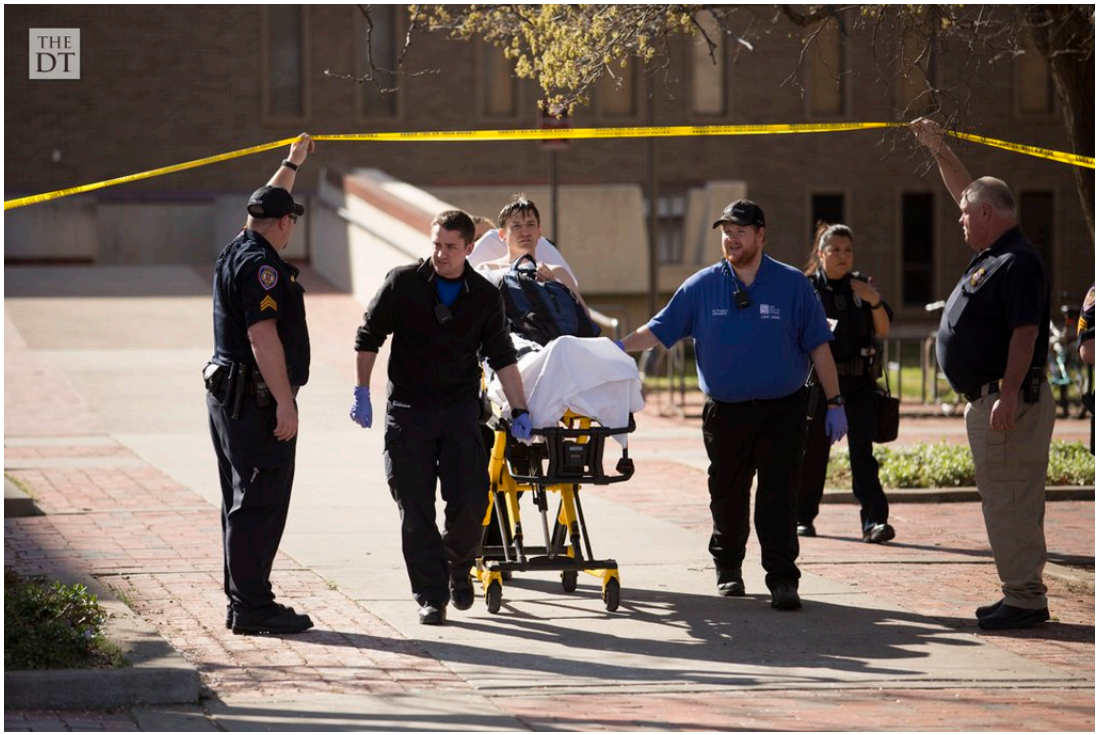
- Within 15 minutes of accident, meeting with department chair, PI, EH&S

- Meeting with Chair of ILSC within 30 minutes

- Meeting with Chair of Departmental Safety Committee, EH&S, PI; Chemistry Identified through use of student's electronic lab Notebook (available to PI, EH&S immediately)

- Report pending

Texas Tech: The Journey Continues…



Lessons Learned

1) Accidents at Public Universities are Public Events

2) Faculty: EH&S Relationship Has Changed at Texas Tech
   - Communication is the Key!!

3) A Stick is More Effective than a Carrot to Start
   - We Still Need More Carrots!

4) We Need Specific Protocols for Specific Lab Procedures In a Common Database

5) We Need Templates for Common Safety Paperwork

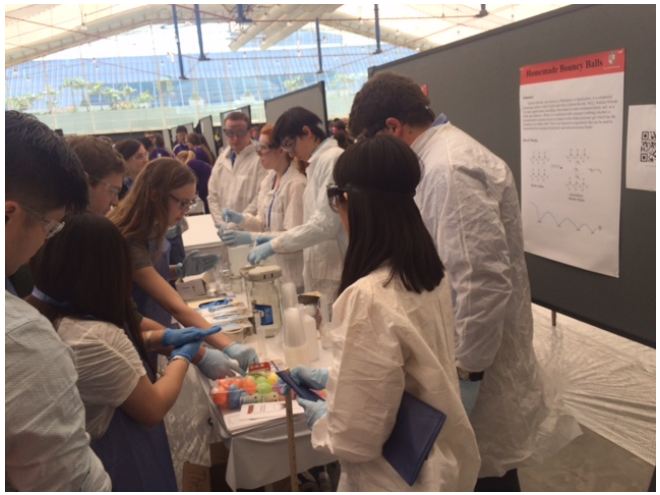
Lessons Learned

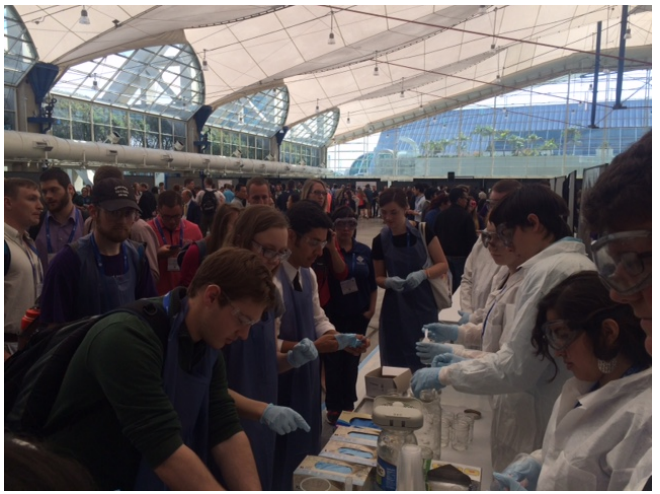
6) The University, College, Department, Faculty, Staff, Students Must All Work Together for the Culture to Change: Safety Really is EVERYONE'S Responsibility

7) It Saves Time and Resources to be Safe! Safety Costs Money, but Saves Money (and Lives)

8) The Culture IS Changing Through the Younger Generation of Scientists

Lessons Learned





Final Thoughts

Our aim at Texas Tech is to change the culture of safety from one of local apprenticeship to a globally proactive and positive response.

The TTU explosion, along with accidents at UCLA and Yale, are now **textbook** for the consequences of not following safety protocols, and suggest steps that the academic community can take to change the culture of chemical safety in general.

Safety Culture is the responsibility of ***every*** laboratory worker.

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