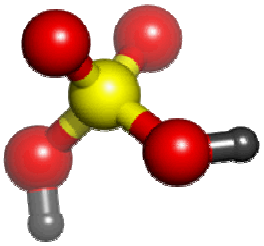

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Active Learning Approaches to Global Chemical Safety and Security (CSS) Training and Sustainability

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U.S. DEPARTMENT OF ENERGY

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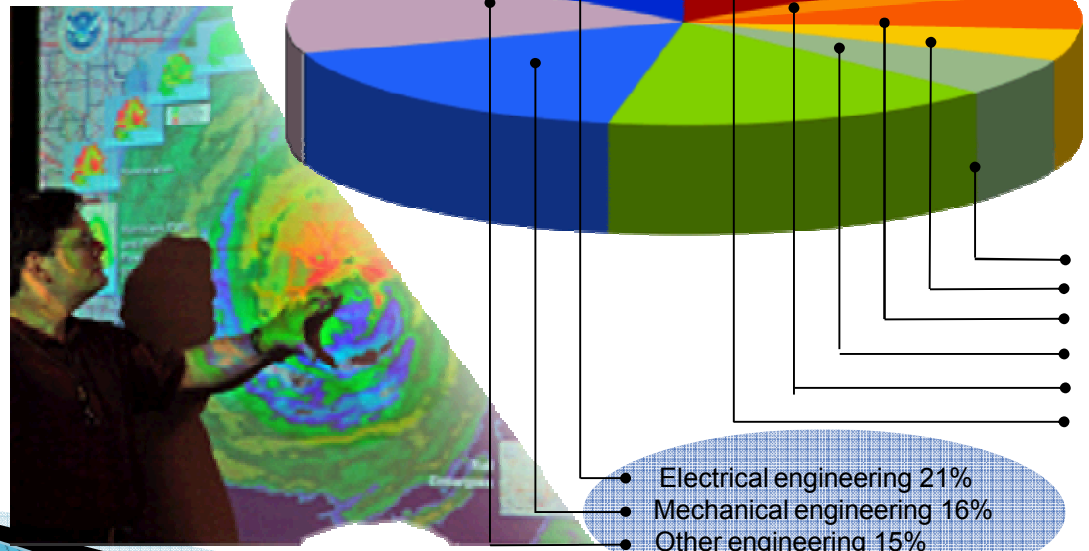
Sandia Labs: Capabilities

- *WE ARE SCIENTISTS & ENGINEERS*
  - Establish relationships in Global science community
  - Experience in labs
  - Experience with research & development
  - Fundamental and applied sciences
  - Analytical skills



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ICTR/CSP Program Goals

ICTR and CSP seek to improve global chemical security and safety by raising awareness and improving security and safety best practices.

CSP
CHEMICAL SECURITY
ENGAGEMENT PROGRAM

Program Goals:

- Raise awareness about chemical threats and dual-use nature of chemicals.
- Provide technical assistance to improve chemical security and safety best practices.
- Foster national and regional dialogue focused on improving chemical security and safety.
- Promote international scientific cooperation among chemical professionals.
- Establish cadres of safety and security programs and officers.

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CSP-ICTR: Where we work

Map of Participant Countries

https://www.csp-state.net/

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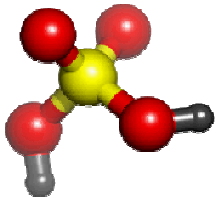
CSP CHEMICAL SECURITY ENGAGEMENT PROGRAM



Overview

Background

- Definitions
- Historical Chemical Safety and Security (CSS) Training
- Active Learning developments

Our Approach

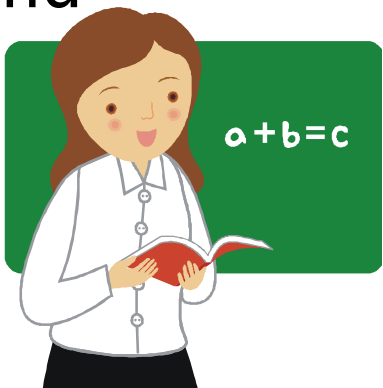
- Active learning approaches to CSS
- Active learning for Global CSS programs
- Examples

Global Challenges

- Challenges
- Lessons Learned
- What's next?

Definition Overview

- Active vs. Passive Learning
  - Amount of engagement of students
- Advantages to active learning approaches
  - Promotes an atmosphere acceptable for questions and student input
  - Promotes student interest in knowledge of subject
  - Improved material retention, problem solving and critical thinking skills,
  - Connection to real life
- Subject mastery and learning retention are facilitated by active learning techniques such as inquiry based learning, problem solving and scenario specific instruction



Historical Chemical Safety and Security (CSS) Training

- Historically CSS training is passive learning technique
  - Lecture, pamphlets, videos, PowerPoint slides
- Comprehension is assessed by quiz or test at completion
  - Short-term memory vs. long-term memory
- Follow-up? Continuation of learning?
  - Annual refresher course
  - Laboratory inspection

Active Learning developments

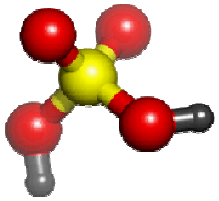
- Breaking up long lecture into shorter segments with activities
- Involve students through participation
  - Discussions and feedback
    - Reciprocal questioning
    - Background knowledge survey
    - Student summaries
  - Demonstrations
- Group projects and activities
  - Roundtable
  - Problem-based learning
  - Brainstorming
- Scenarios and Case Studies

Our Approach…..

- Changing our “lecture” based curriculum to a more interactive discussion and “peer learning” environment
  - Why? How?

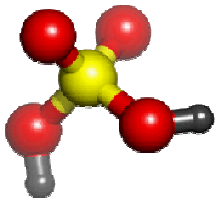
Our Program

- Chemical Safety and Security Training for Academic and Industry
  - Scientists, management, professionals, and leadership
- Broad range of workshops:
  - Awareness Workshop
    - CSS basics for any audience
  - CSS Officer Training
    - Train-the-trainer approach
  - Advanced Topics
    - In-depth topic areas for greater knowledge and understanding



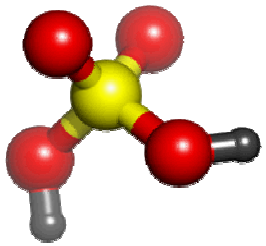
Goals and Learning Outcomes

- Each workshop must have a set goal and desired learning outcome
  - Awareness Workshop–
    - Goal: Provide participants with an awareness of the broad range of CSS and how it impacts their life/world
      1) Promote the desire for a safety culture and the desire for change and improvement
      2) Empower the participant with knowledge to promote a safety culture to their peers
    - Learning Outcome:
      - ❖ Know, Understand (or explain), Apply (or use/perform)
      - ❖ After this lesson, trainees should…"
        1) Know and Understand fundamentals of CSS
        2) Use their understanding of CSS to promote a safety culture
        3) Apply the knowledge learn to look at their own lab conditions and how they compare



Goals and Learning Outcomes

- Each module/topic in the workshop also has a set goal and desired learning outcome
  - CSS Officer Training module: Personal Protective Equipment (PPE)–
    - Goal: Provide an overview of the basic types of PPE and the considerations when selecting the proper PPE
    - Learning Outcomes:
      1) Know how to and be able to select the proper PPE
      2) Know how to properly don/doff PPE
      3) Be able to instruct others on proper PPE



Our Active Learning Approaches to CSS

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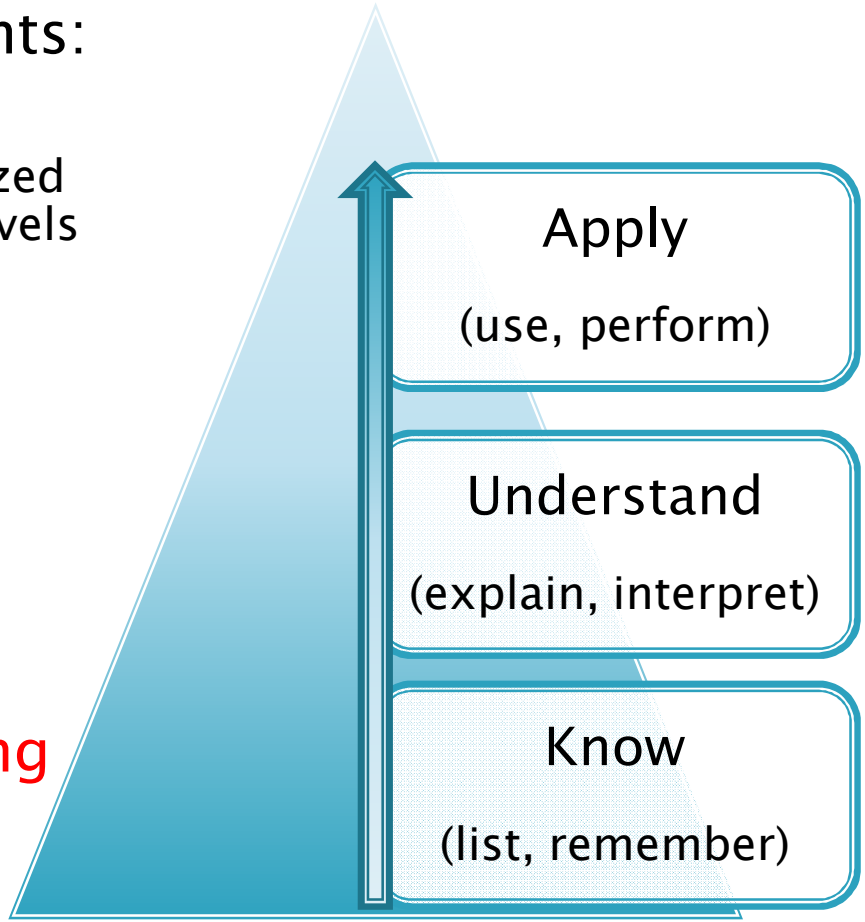
Workshop Interactivity: Learning Outcomes

- Learning outcome statements: "participants should…"
  - Learning outcomes are organized according to the foundation levels of "Bloom's Taxonomy"[1]

- Modules begin with you setting your own learning goals

We want you to take responsibility for your learning outcomes ⇨ an interactive workshop



[1] Bloom et al. (1956) *Taxonomy of educational objectives: the classification of educational goals; Handbook I: Cognitive Domain*. Longmans, Green: New York.

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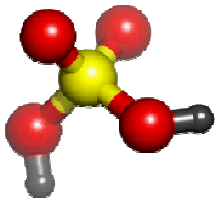
Workshop Interactivity: Training Methods

- People can learn from:
  - Presentations
  - Discussing thoughts and experiences
  - Active participation

The desire to use the most effective training methods ⇨ an interactive workshop

[1] Kolb, David (1984) *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.



Module Learning Outcomes

- Having seen the overview of this module, come up with your own learning outcomes

Learning	Metric	Future Action
At end of this module, what would I like to have learned?	How will I know when I have learned it?	How will I use this new learning after the workshop?

- Write your learning outcomes in your worksheet in the space provided

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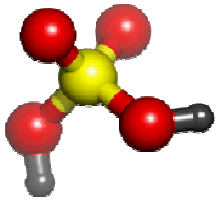
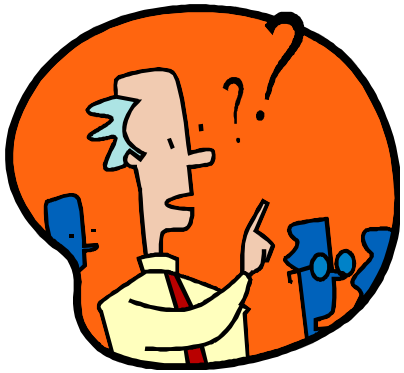


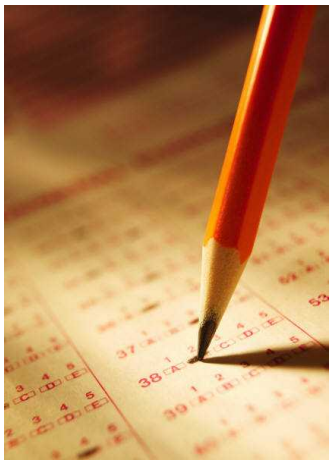
Module Outcomes: After this module, you should…

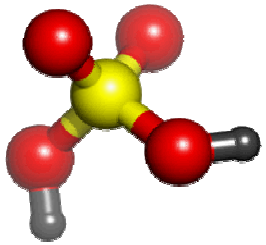
- Understand the categories of laboratory Safety and Security hazards
- Know the hierarchy of Chemical Safety and Security controls
- Be able to identify Safety and Security hazards in a laboratory layout and begin thinking about security vulnerabilities

Learning Assessment

- Evaluations – Pre and Post
- Feedback forms
- Student participation
  - Discussions, questions



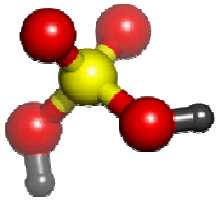




Example Participant Activities

Ice Breakers

- Participant Introductions
- Chemist Bingo
- Policy Statement Cards
- Hazards and Controls Matching
  - Use knowledge and peers to match topics



Student participation

- Question and Answer
- Group and Class Discussion topics
- Group Activities/Projects
- Scenarios and Case Studies

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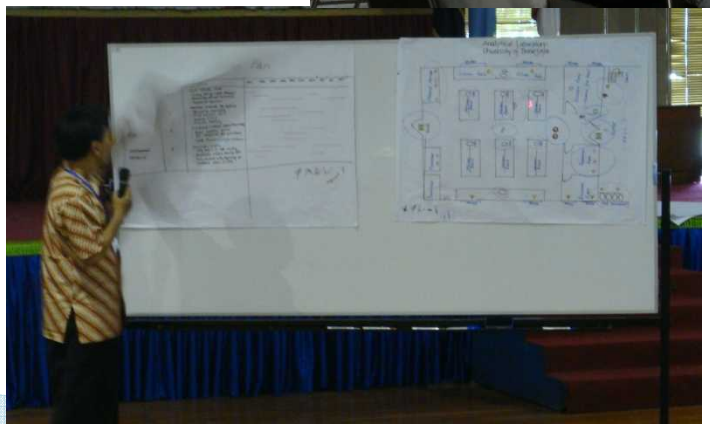
Group Activities

- Standard Operating Procedure (SOP)
- Laboratory Assessment Exercise
- Hazards and Glove Selection

Example: Laboratory Assessment Exercise

- Using lecture material of hazards, controls, PPE, emergency equipment
- Evaluate laboratory (Good and Bad)
- Group presentation of assessment and action plan



Demonstrations

- Simulated laboratory accidents
- Guided laboratory inspection
- Fire demonstration

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Global CSS Training Challenges

- Culture
  - Not every culture (or person) is comfortable with:
    - Speaking
    - Criticism
    - Questioning the instructor
- Language
  - Proper translation
  - Meaning vs. Interpretation

Lessons Learned for Challenges

- Games and Jokes
  - Requires good translation and acceptable audience
- Means for implementation of change
  - Authority based on age, position, and/or education
  - Requires new approach to empower participants with knowledge to influence leadership
    - Advanced training
    - Co-lead training
    - Laboratory Assessments

Facilitate the Spread of Active-Learning Teaching Techniques

- Train-the-trainer approach fundamentally gives participants all the tools and information they need to create their own training
- Requires more instruction and guidance
- A lot of resource material
  - Can be overwhelming

- Advanced training module “Lesson Planning”

Summary/Conclusion

- Active-learning techniques have been incorporated into our current training
- Cultural and Language challenges still occur
- Background on culture is imperative for proper delivery
- Flexibility is key to success
- Continually improve and update

Acknowledgments

- Sandia National Laboratories
- ICTR Team

- Department of State, Chemical Threat Reduction Program (CSP)

Thank you for your attention!