In this issue of the Environmental Health and Safety (EHS) Listserv, January 23, 2012:

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1. The Common Denominator?

What do the following have in common: cornstarch, certain textile materials, metal dust such as aluminum or magnesium, wood dust, coal or other carbon dust, plastic dust and additives, biosolids or other organic dusts such as paper? Workplaces where these or other dusts are created or handled are at risk of fire/explosion due to the hazards of "Combustible Dust".

Any combustible material and some materials normally considered noncombustible can burn rapidly when in a finely divided form. If these types of dust are suspended in air in the right concentration, they can become explosive. The force from such an explosion can cause employee deaths, injuries, and destruction of entire buildings. Such incidents have killed scores of employees and injured hundreds over the past few decades.

A combustible dust explosion hazard may exist in a variety of product production/handling operations, including but not limited to: food (e.g., candy, sugar, spice, starch, flour, feed), grain, tobacco, plastics, wood, paper, pulp, rubber, furniture, textiles, pesticides, pharmaceuticals, dyes. In a university setting, combustible dusts may be found in printing operations, woodworking shops, food processing, and certain textile processes.

The National Fire Protection Association (NFPA) defines the size of Combustible Dust as "any finely divided solid material that is **420 microns or smaller** in diameter (material passing through a No. 40 Standard Sieve)…" Let's see how that compares to everyday items:

- Talcum powder, fine salt, red blood cells, cocoa: 5-10 microns
- Sawdust, ginger spice: 20-600 microns
- Pollen, milled flour, course salt: 44-74 microns
- Table salt: 105-149 microns
- Course sand: 297-1000 microns

Combustible dust particles settle on surfaces and in crevices. When disturbed, these particles can become potentially explosive dust clouds. Per NFPA guidelines, maximum allowable dust layer thickness is no more than 1/32" over 5% of the area, including overhead beams, ledges, ceiling panels, room air filters, etc. This is a bit less than the width of the wire in a small paper clip! (NOTE: There is a separate Grain

Handling Standard, 29 CFR 1910.272. The maximum dust layer thickness guideline for grain handling areas is 1/8")

For an explosion to occur dust the following conditions are required:

- The dust must be combustible.
- The dust must be dispersed in air or another oxidant.
- The concentration/quantity of dust in air must be greater than the lower flammable limit.
- There must be an ignition source, e.g., spark, flame, hot surface, friction heat.

Evaluate your work area to assess the potential for dust explosions:

- Are there **materials** that can be combustible when finely divided?
- Are there **processes** which use, consume, or produce combustible dusts?
- Are there **open or hidden areas** where combustible dusts may accumulate?
- Are there **means by which dust may be dispersed** in the air?
- Are there **potential ignition sources**? Potential ignition sources may not be obvious. For example, even operating a light switch can produce a spark.

When the dust suspended within a room, container, or piece of equipment ignites and explodes, a **primary dust explosion** occurs. When dust accumulated on floors or other surface is lifted into the air and ignited by a primary explosion, a **secondary dust explosion** occurs. Depending on dust in the area, a small primary explosion can cause very powerful secondary dust explosions. A secondary dust explosion can also occur following a non-dust explosion, e.g. natural gas.

If any of your work processes/products or materials present a combustible dust hazard, make sure a program for hazardous dust inspection, housekeeping and control is in place. Several components should be considered:

- **Dust Control Measures.**
    - Ensure dust-collection systems (ducts and dust collectors) are installed and designed/positioned so there is minimal dust escape from the process equipment and from the ventilation system itself. Ensure systems and filters are activated/working properly during operations.
    - Clean the entire work area regularly, taking care that dust clouds are not generated in the cleaning process. The housekeeping program should include regular, established cleaning frequencies for floors and horizontal surfaces, such as ducts, pipes, hoods, ledges, and beams, to minimize dust accumulations within the work area.
    - Design working surfaces to minimize dust accumulation and facilitate cleaning.
    - Conduct regular inspections for dust accumulation. Include obvious, readily visible areas and other areas perhaps not readily visible, e.g., ceiling panels/filters of standard room ventilation.
- **Ignition Control Measures.**
    - If using electrically-powered cleaning devices such as vacuum cleaners they must be approved for dust collection. Such devices will have a

National Electrical Code Class II designation, which means they are designed for use in areas made hazardous due to presence of combustible dust.
    - Post areas where smoking is prohibited with “No Smoking” signs.
    - Ensure duct systems, dust collectors, and dust-producing machinery are bonded and grounded to minimize accumulation of static electrical charge.
    - Select and use powered industrial trucks that are approved for combustible dust locations.
- **Prevention Measures.**
    - MSDSs should be available for the chemicals/materials which could become combustible dust under normal operations. Employees must review the MSDS.
    - Train employees on the explosion hazards of combustible dusts.
- **Protection Measures.**
    - Have and practice an emergency action plan for the area. Maintain emergency exit routes.
    - Building design considerations include the following:
        - Do not locate dust collectors inside of buildings. (Some exceptions)
        - Distribute explosion relief venting for rooms, buildings, or other enclosures (dust collectors) over the exterior wall of buildings and enclosures.
        - Direct explosion venting toward a safe location away from employees.
        - Have isolation devices in place to prevent deflagration propagation (spreading) between pieces of equipment connected by ductwork.
    - Have a spark detection and explosion/deflagration suppression system within the dust collector system.

To recap, if your work involves “Combustible Dust” you should:

- Recognize dust hazards
- Control dust
- Prevent fires
- Maintain “Housekeeping”

If you have further questions on this topic or wonder if operations may have a combustible dust hazard, contact EHS by phone (402-472-4925) or email (ehs@unl.edu).

Resources:

- Chemical Safety Board- “Combustible Dust: An Insidious Hazard http://www.youtube.com/watch?v=3d37Ca3E4fA
- OSHA Combustible Dust Safety & Health Topic http://www.osha.gov/dsg/combustibledust/index.html
- OSHA Combustible Dust Safety & Health Bulletin http://www.osha.gov/dts/shib/shib073105.html

- OSHA Hazard Communication-Combustible Dust http://www.osha.gov/Publications/3371combustible-dust.html
- OSHA 29 CFR 1910.272 Grain Handling Facilities http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9874
- EHS Safe Operating Procedure (SOP): Hot Work Permit Operations http://ehs.unl.edu/sop/s-hotwork.pdf

2. Shoveling Safely

Winter will soon be in full swing and spring is around the corner, so here are a few considerations for safe use of a shovel during snow removal or for spring yard work—moving dirt, gravel, and so on. If you have a medical condition or do not exercise regularly, check with your physician before engaging in strenuous activities.

To avoid over-exertion and related illnesses/injuries:

- Be sure to warm up your muscles first by stretching, walking or marching in place.
- Tackle the job in small increments rather than working to the point of exhaustion.
- Lift correctly. Use your legs and bend your knees. Do not bend from the waist. Tighten stomach muscles as you lift.
- Use a shovel that is comfortable for your height and strength. Space your hands on the grip to maximize leverage.
- Do not twist your back to throw the material over your shoulder or to the side. Scoop small amounts into the shovel and walk to where you want to dump it.
- Take short, slow steps and pay attention to the area around you to avoid walking on uneven or slippery surfaces that can cause slips, trips, and falls.

Resources:

- UNL Cooperative Extension in Lancaster County http://lancaster.unl.edu/home/Articles/2001/SnowShovel.htm
- American Academy of Orthopaedic Surgeons http://orthoinfo.aaos.org/topic.cfm?topic=A00060
- EHS SOP General Material Handling/Safe Lifting http://ehs.unl.edu/sop/s-gen_safe_lifting.pdf

3. It Happened Here

Overexertion in lifting/carrying/holding/pushing/pulling is one common type of injury event at UNL. During the past year, 22% of the OSHA Recordable injury incidents have been due to overexertion. “OSHA Recordable” means that the injury resulted in medical treatment beyond First Aid, days away from work, the necessity for days of restricted work/job transfer, loss of consciousness, or death (no deaths reported).

Statistics associated with 30 ‘overexertion” incidents that occurred between January 1 and December 31, 2011 are highlighted below.

- The predominant Causal Factors (13 incidents) were classified within the "**Personal**" category. Injury evaluation noted:
    - Five instances due to **fatigue/stress**;
    - Four instances due to **deviation from safety protocol**. This means that a safety protocol was in place, but the worker chose to not follow the established procedure; and
    - Four instances of **physical mis-match** to the task, for example, material to be lifted was too heavy for one person to safely lift.
- The remaining injury incidents were equally divided between three Causal Factors:
    - **Material/Equipment.** The predominant finding was a defect or design flaw in the material/equipment, with one instance of failure/malfunction.
    - **Environmental.** The predominant finding was location or position of either the person or the equipment, with one instance due to weather conditions.
    - **Engineering Controls.** In this category, controls to eliminate or reduce overexertion through the use or substitution of engineered machinery or equipment were (a) not available in two instances, (b) available but not used in two instances, (c) improperly used in one instance and (d) defective/not operating properly in one instance.
- Following is the breakdown of Overexertion injuries by Worker Type:
    - Maintenance/Utilities = 7 instances
    - Food Service = 6 instances
    - Custodial = 5 instances
    - Office = 4 instances
    - Agriculture/Landscape = 3 instances
    - Laboratory = 3 instances
    - Material Handler/Mover = 2 instances

What does all this mean? First let's look at Worker Type. Injuries due to overexertion occurred across most Worker Types at UNL during the time period reviewed. This type of injury generally results in strains, sprains, dislocations and sometimes can lead to repetitive motion injury. Note that Office workers, for example, who may not consider that their jobs involve any hazards, accounted for 2.9% of the overexertion injuries over the past four quarters.

Considering the Causal Factors noted in overexertion injuries, what are some general recommendations? Here are a few:

- Personal Causal Factors are those by definition within the control of the worker.
    - Avoid fatigue, either brought into the workplace or developed during the day from trying to "rush" rather than maintaining a steady pace. Vary body position within safe parameters when performing tasks which might be considered repetitive.
    - Follow processes and procedures established for your work area. Never "cut corners."

    - Think about the tasks you may be periodically asked to do before you proceed. Do you know how to proceed safely or do you need a reminder for a rarely performed task? Do not attempt to lift/move items too heavy for one person. Secure assistance.
- When using tools or equipment to complete your work tasks, always make sure that such items are functioning properly, have been properly maintained, and have not developed a defect since last use.
- Before performing work tasks think about how best to position your body so as to avoid injury.
- Items that weight more than 50 pounds or are large or awkwardly shaped (even if they weigh less) should not be lifted by one person. When lifting items with others, make sure to maintain voice communication so one person does not abruptly "let go."
- When carrying items appropriately, focus on the walking surface rather than visiting with others, listening to iPod music, or other distractions.
- If your task would benefit from use of an engineering control, use one. For example, use carts or dollies to move items rather than carrying themby hand.

Don't become a statistic in the quarterly UNL Injury Incident report!

4. Check It Out

If you haven't reviewed the ***"Training Needs Assessment for EHS-Related Topics"*** in awhile, now is the time. As regulatory requirements change and EHS develops additional training (mostly web-based) to meet the training need, this document is updated.

UNL Media Hub aggregates videos on a wide variety of topics produced by various entities throughout the University. The EHS & Office of Research and Economic Development co-sponsored Laboratory Safety Colloquia are now available on UNL's Media Hub through a "channel" called ***"Laboratory Safety Colloquium."***

Colloquia since February 2006, covering a variety of safety topics relevant to laboratory research, have been available since the beginning through the EHS web site and Office of Research and Economic Development (ORED) web site. Availability through this new "channel" that feeds into iTunesU will broaden accessibility to content of interest to PIs, research staff, and graduate students. Working safely protects people and facilities, and the valuable research ongoing at UNL.

Due to technical difficulties, the October 2011 Colloquium, ***"Safe Handling: Highly Toxic Chemicals, Reproductive Toxins (Mutagens & Teratogens) and Biologically-derived Toxins,"*** upload was delayed. It is now available for review on Media Hub. The video, handouts and the PowerPoint are available through the EHS and ORED web sites.

- Resources: Training Needs Assessment for EHS-Related Topics
  http://ehs.unl.edu/pamphlets/Training_Needs_Assessment.pdf
- UNL Media Hub: Laboratory Safety Colloquium Channel
  http://mediahub.unl.edu/channels/138
- EHS Laboratory Safety Colloquium http://ehs.unl.edu/training/Colloquium/
- ORED Laboratory Safety Colloquium http://research.unl.edu/lsi_9-06.shtml

5. Revised Safe Operating Procedures

- Biosafety Training http://ehs.unl.edu/sop/s-bio-training.pdf
- Pathological Waste Incinerators – Operating Permit Requirements
  http://ehs.unl.edu/sop/s-p_waste_incinerators_permit.pdf

NEW & Revised Training

- NEW--NIH Guidelines http://ehs.unl.edu/onlinetraining/NIHGuidelines
- NEW--Biosafety Basics http://ehs.unl.edu/onlinetraining/BioBasics
- Biosafety in the BSL-2 Laboratory http://ehs.unl.edu/onlinetraining/BSL2
- General Electrical Safety Training
  http://ehs.unl.edu/onlinetraining/ElectricalSafety

Remember...SAFETY IS AN ATTITUDE!

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