

ACTS FACTS

THE MONTHLY NEWSLETTER FROM

ARTS, CRAFTS AND THEATER SAFETY (ACTS)

181 THOMPSON ST., # 23,

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ACTS wishes you a healthy, happy 2016.

BOARD of DIRECTORS: Monona Rossol, Tobi Zausner, Elizabeth Northrop, Kathy Hulce, John Fairlie.

RESEARCH: Brian C. Lee, Sharon Campbell, Robert Pearl, Ted Rickard, Pamela Dale, Pat Sheffield; Janet Sellery. **STAFF:** Kathy Frost, John S. Fairlie, Sr.

ACTS FACTS BEGINS ITS 30TH YEAR OF PUBLICATION

Hard as it is to believe, we've been at this for 30 years, thanks to you, our generous subscribers. I hope we both persist for many more years together. Happy holidays to all.

LA SCALA WORKERS HOLD MEMORIAL FOR ASBESTOS VICTIMS

SOURCE: http://www.ansa.it/english/news/2015/12/07/smoke-bombs-at-la-scala-in-memory-of-asbestos-victims-2_5ab6bf87-4ba6-49cf-b78c-d5ecde36ee12.html, "Smoke bombs at La Scala in memory of asbestos victims,"

Redazione ANSA Milan, 07 December 2015 18:12 News [Agenzia Nazionale Stampa Associata (ANSA) is a not-for-profit wire service in Italy]

On December 7, 2015, a brass band played while colored special effects smoke and black balloons were released in a memorial demonstration in front of the La Scala opera house in Italy. Rank and file members of the opera company's union held the event in remembrance of seven La Scala workers who have died of plural mesothelioma cancers caused by asbestos in the theater.

The union demonstrators also brandished placards blaming Milan mayor Giuliano Pisapia. In fact, four former Milan mayors are being investigated for evidence of manslaughter and grievous bodily harm in connection with the deaths. A former La Scala superintendent, Carlo Fontana, who served was also named in the investigation. In Italy, the mayors and superintendent can be charged because they are actually La Scala's employers in this city-owned opera company.

These workers were probably exposed to the asbestos in the 1970s and 1980s. The renovation that finally removed the deadly material more than a decade ago was too late for these people. And this cancer's 20 to 50 year latency period makes it almost certain that more workers will be diagnosed with the fatal asbestos-related disease in future years.

The people who died were identified by the news report as a curtain operator, a machine operator, a fire watcher,* a carpenter, a stagehand and an opera singer. It should be clear to theater workers that once there is asbestos insulation, wiring or asbestos fire curtains that are not enclosed or encapsulated, everyone who works in the theater can be at risk.

* This worker is a professional city brigade fire fighter who is sent to work at the theater where he deals professionally with all of the fire issues and precautions. Having a professional fire fighter on a theater's staff is a strategy we should consider here.

VOCs & CARBON DIOXIDE: EFFECTS ON BRAIN FUNCTION

A very important study on the cognitive effects of pollution levels in indoor air has, in ACTS opinion, clearly shown that building pollutants must be controlled by providing greater amounts of fresh air through ventilation systems and by using green building materials and cleaning products. The study, which can be downloaded free, is:

“Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers...,” Josephe G. Allen, et al., *Environmental Health Perspectives*, 26 October, 2015, <http://dx.doi.org/10.1289/ehp.1510037>

VOLATILE ORGANIC COMPOUNDS (VOCs).¹ People notice the odors and irritation from offgasing building materials and chemical products used in cleaning and maintenance. We all have an intuitive sense that these odors affect us adversely in some way and this *Environmental Health Perspectives (EHP)* study proves us right. Our ability to perform mental tasks, as demonstrated on standard performance tests, is shown to be impaired by these airborne chemicals.

The *EHP* study also summarizes data from another study² that showed the VOCs from two hours of painting with latex paints was associated with the reduction of three of the five measures of intellectual performance measured—a statistic consistent with our dislike of the odor of drying wall paints.

CARBON DIOXIDE (CO₂). The *EHP* study also looked at the effects of CO₂ levels on mental performance. Levels of CO₂ have been used for years as a marker for poor ventilation and the build-up of VOCs and other indoor pollutants. However, it was assumed that CO₂ at these low levels did not cause the adverse effects.

It is well-known that exceedingly high levels of CO₂ are unsafe. For example, if you’re exposed to CO₂ at 90,000 parts-per-million (ppm) for five minutes, you’ll die. The Occupational Safety and Health Administration sets an exposure limit way below that level, at 5,000 ppm on CO₂ over an eight-hour work shift. Buildings usually have far lower concentration than that.

The CO₂ in buildings is generally assumed to be safe if the ventilation standards of the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) are met. These are found in Ventilation for Acceptable Indoor Air Quality (ASHRAE 62.1). The current standards recommend maintaining CO₂ levels at 700 ppm or less, above outdoor CO₂ levels. Depending on local conditions, acceptable outdoor air contains 300-500 ppm CO₂. An ASHRAE-compliant system, then, should limit CO₂ levels indoors to between 1000 and 1200 ppm.

This 2015 *EHP* study tested this ASHRAE assumption by altering CO₂ simply by adding it to the air rather than by restricting ventilation which would also raise the VOCs. In this way, the effects of CO₂ could be isolated from those of the VOCs. The study found measurable effects at the ASHRAE lower limit:

We found statistically significant declines in cognitive function scores when CO₂ concentrations were increased to levels that are common in indoor spaces (approximately 950 ppm). In fact, this level of CO₂ is considered acceptable because it would satisfy ASHRAE’s ventilation rate guidance for acceptable indoor air quality. Larger differences were seen when CO₂ was raised to 1400 ppm. Page 18

This is only the most recent of many articles and studies discussing the effects of carbon dioxide alone on performance, two of which are referenced below.^{3,4} It now is becoming accepted that levels

of CO₂ previously thought to be negligible will have toxic effects on intellectual performance. And there may be other issues as yet undetected.

RECOMMENDATIONS. These studies are the reason that ACTS does not endorse the more recent ventilation standards of ASHRAE. These newer standards, in response to energy costs, have reduced the fresh air requirements from those in previous standards.⁵ In their defense, they also recommend greener building materials and better placement of the air supply and return grilles in these recirculating systems. However, ever since the Ventilation for Indoor Air Quality - ASHRAE 62-2004 was published, ACTS has recommended that building planners use the larger amounts of fresh air required in ASHRAE 62-2001, combined with the better placement of supply and return suggested in later standards. And the objective should be to keep the levels closer to 800 ppm and below. And this level should not be tied to the outdoor levels. In areas of the country where high outdoor CO₂ levels are common, the ventilation should provide more fresh air.

Green building and cleaning materials should be used and actual air testing should be done regularly to confirm that VOC levels are below the guidelines of an organization called Leadership in Environmental and Engineering Design (LEED). Their limit is 500 micrograms per cubic meters. However, do **not** follow LEED's recommendation to use the latest ASHRAE 62.1 standard.

Footnotes:

1. Note: VOC as used in this article, refers to any hydrocarbon associated with building materials or products that accumulates indoors. The EPA definition of VOC seen on product labels only refers to a list of over 150 chemicals listed as being capable of reacting with sunlight to cause smog in sufficient amounts to require regulation. Many toxic and irritating hydrocarbons are not EPA-defined VOCs.
2. Satish U, Cleckner L, & Vasselli J. 2013. Impact of VOCs on decision making and productivity. *Intelligent Buildings International*, 5(4), 213-220. doi: 10.1080/17508975.2013.812956
3. "Is CO₂ Indoor Pollutant?" Wm J. Fisk, Usha Satish, Mark J. Mendell, Toshifumi Hotchi, Douglas Sullivan, *ASHRAE Journal*, March 2013, pp. 84-85.
4. "Carbon dioxide levels and dynamics in elementary schools: results of the TESIAS study." Corsi, R.L., et al. *Proceedings of Indoor Air*, 2002, pp. 74-79.
5. The 1981 ASHRAE standard was designed to keep CO₂ levels below the 5000 ppm OSHA limit. The energy crisis in this period of time caused building owners and designers to make buildings "tight" and well-insulated. This kept fresh air from leaking in and led to many serious issues in air quality, humidity damage and mold. The 1989 ASHRAE 62 standard codified a level of 1,000 ppm CO₂ which reduced this problem. Next the ventilation rates were tied to outdoor levels. CO₂ levels which were 280 ppm in pre-industrial times, 315 ppm in 1960 and are now just under 400 ppm worldwide. In cities levels over 500 ppm are not uncommon. And now the ASHRAE 62.1-2013 ventilation rates are in the same range as those in the 1981 standard.

RECYCLED PRODUCTS ARE NOT "GREEN" FOR USERS

SOURCE: "Flooring Firm Won't Reuse PVC," *Chemical & Engineering News*, www.acs.org, November 23, 2015, p. 14

Lumber Liquidators announced it will stop using recycled polyvinyl chloride (PVC) in its flooring products as part of an agreement with the advocacy group Safer Chemicals, Healthy Families. The recycled material, present in vinyl flooring, can contain lead, cadmium, brominated flame retardants, phthalates and other undesirable chemicals. Safer Chemicals says testing found 60% of the floor's inner layers contained elevated concentrations of heavy metals; samples showed lead content as high as 10,000 parts per million (ppm) and cadmium at 20,000 ppm.

Some of the contaminants enter the recycle stream from PVC stripped from discarded wires and cables. Some of these contaminants are scheduled for reduction in the future. For example, this year, the European vinyl industry will complete a voluntary phaseout of lead stabilizers, which are being replaced with calcium based additives. Another group, Healthy Building Network, says future sources of used PVC may be better for recycling. They say that “many manufacturers are moving away from lead and cadmium stabilizers and phthalate plasticizers in new products, and those should be preferred, because they reduce exposure to toxicants, as well as provide a cleaner feedstock for future materials recycling...”

But ACTS says: “wait and see before using recycled building materials, especially indoors. Always be aware that recycled materials contain more contaminants by far than virgin ones. Until there is control on the products entering the recycling stream, recycled plastics belong in outdoor products like park benches, fencing and siding.”

SPRAY BOOTH FILTERS CAUSE FIRE

SOURCE: “Cedar Falls Business ‘Lucky’ after Small Fire, Chief Says,” *WCF Courier*. December 23, 2015, http://wfcourier.com/news/local/cedar-falls-business-lucky-after-small-fire-chief-says/article_f6fce6d3-403b-5470-a698-75fb53eb4f1e.html

An early morning fire at a business in northern Cedar Falls, Iowa, was determined to have been caused by some paint booth filters disposed of in a 40-gallon trash can that spontaneously combusted and smoldered overnight. When employees arrived at about 6 a.m., they tried to douse the fire. It had burned itself out by the time authorities arrived.

The burning 40-gallon trash can created massive amounts of smoke and was leveled to a mess about 4 1/2 inches high by 3 feet in diameter. Fire Chief John Shilling said, “They were incredibly lucky that can wasn’t near anything else combustible, or they might have had a lot bigger mess than what they have to clean up.” The building was full of combustible items typical of those found in a painting operation.

COMMENT. Any paint, lacquer or varnish that contains a setting oil (e.g., tung, linseed, etc.) or any solvent product that contains natural solvents like citrus oil are capable of creating heat when they dry or set. Discard filters containing such materials in air-tight containers to be picked up by certified toxic waste disposal company. Keep waste holding areas away from combustible storage or paint spray production areas.

ACTS FACTS sources: the *Federal Register (FR)*, the *Mortality and Morbidity Weekly Report (MMWR)*, *Environmental Health Perspectives (EHP)*, and many other publications. Call for further information on sources. Editor: Monona Rossol; Research: Tobi Zausner, Sharon Campbell, Robert Pearl, Brian Lee, Pamela Dale, Kathy Hulce, Pat F. Sheffield, Janet Sellery; Staff: Kathy Frost, John Fairlie, OES.

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March 2016

Vol. 30, No. 03

CADMIUM & ARSENIC POLLUTION SOURCE IS BULLSEYE GLASS

SOURCES: <http://www.opb.org/news/article/portland-heavy-metals-emissions-linked-to-glass-facility/>;
<http://www.deq.state.or.us/nwr/metalsemissions.htm>;
<http://m.portlandmercury.com/BlogtownPDX/archives/2016/02/03/arsenic-cadmium-levels-near-two-se-p>
[ortland-schools-are-alarmingly-high-state-finds](http://www.oregonlive.com/environment/index.ssf/2016/02/12_key_questions_and_answers_a.html);
http://www.oregonlive.com/environment/index.ssf/2016/02/12_key_questions_and_answers_a.html;
http://www.oregonlive.com/environment/index.ssf/2016/02/portland_pollution_hotspot_ide.html and
<http://www.deq.state.or.us/nwr/docs/PowellSE22nddata.pdf>

THE BACK STORY. The U.S. Forest Service researchers had a plan: collect moss from trees around Portland, analyze the moss which acts like a living air pollution indicator, then publish the results in a scientific journal. This is a promising method of providing air monitoring without stationary and expensive air monitoring equipment, since moss grows everywhere in this region.

But after completing their analysis of moss samples from nearly 350 spots citywide, researchers found something alarming—so alarming they notified environmental regulators. Robert Mangold, station director of the U.S. Forest Service's Pacific Northwest Research Station, contacted the Oregon Department of Environmental Quality in May 2015 with data showing that there were two hotspots where cadmium and arsenic concentrations were remarkably high. One was in Southeast Portland; the other an area between Interstate 5 and the Fremont Bridge.

"We usually don't share these kinds of results until a journal article is out in print," Mangold said. But the Southeast Portland hotspot included two high schools, a K-8 (elementary) school and a 100-child, private day care facility that serves children as young as six weeks old.

DEQ GETS IN THE ACT. It took five months for the Department of Environmental Quality (DEQ) to act. But according to Sarah Armitage, a DEQ air toxicity specialist and the agency's point person on its investigation, they now have their own data to substantiate these findings. During the month of October, 2015, the DEQ placed an air monitor in a parking lot right next to the Bullseye Glass facility. The results of the tests came in at the end of January:

- * All of the cadmium readings were above the 0.6 nanograms/cubic meter (ng/m³) DEQ's safe-air goal, with two as high as 195 ng/m³ and 133 ng/m³. Those levels are 325- and 222-times the goal.
- * All of the daily readings for arsenic were also over the 0.2 ng/m³ DEQ safe-air goal, with high readings of 101, 97 and 93 ng/m³, which is hundreds of times above the limit.

It's unknown how representative these October, 2015, levels are of air quality during the rest of the year, but this facility has been operating since 1974 when cadmium and arsenic were even more common glass colorants. It is likely there have been significant emissions for 42 years. Bullseye is an art and architectural glass manufacturer that boasts 140 employees at its Portland headquarters and operates satellite facilities north of Oakland, in Sante Fe and in a suburb north of New York.

BULLSEYE RESPONDS. Once they were notified of the findings, Bullseye began doing some testing of its own, ceased using arsenic and cadmium, and agreed to suspend use of chromium in all forms for a while. These actions are all voluntary since Oregon's environmental regulations do not empower the DEQ to force a small manufacturer like Bullseye to alter its manufacturing processes and limit its emissions. The regulations are geared to much larger facilities.

Under its state permit, Bullseye is legally allowed to emit 10 tons of any given air pollutant a year, or 25 tons for any combination of two or more toxics spewing from their stacks. Those weights, expressed in tons, apply not to the physical raw material involved, but to the actual amount of dust and fume emitted from their stacks— the weight of the smoke, or smog or plume.

THE OTHER HOTSPOT. The area of the second hotspot between the Fremont Bridge and Interstate 5 hasn't been air monitored, but there are two glassmakers that operate in this area. So it isn't proven that they're the sources. "That will be the next area for this rapidly evolving investigation," Armitage said.

COMMENT. Art glass is an important industry in Oregon and Washington and it will be interesting to see how glass advocates spin this issue. They will have their work cut out for them since the moss and air sampling data was used to develop maps outlining areas where metal concentrations are at levels of concern. The three maps are at: <http://www.deq.state.or.us/nwr/metalsemissions.htm>. The first map is of the whole Portland area, the second shows the Bullseye hot spot with the surrounding area cadmium levels designated by estimated cancer risk due to concentrations found in air. The third map is the other hotspot area near the Uroboros glass works.

Metals other than cadmium and arsenic should also be monitored. According to the DEQ review of Bullseye's permit, "materials used at the facility may include arsenic trioxide, cadmium, selenium, chromium, and lead as coloring agents or to produce trade-mark characteristics in the glass." Other colorants are also listed on their product literature and safety data sheets such as cobalt, manganese, antimony, nickel, titanium and vanadium. Even some rare earth metals can be used to color glass. Uranium is used in some dichroic (iridescent) glass as well. Artists working in stained or blown glass are also exposed to these metals when they heat, grind and polish colored glass.

CREW MEMBER KILLED IN PYROTECHNIC EXPLOSION IS SEVENTH DEATH ASSOCIATED WITH 'TEXAS' SHOW

SOURCES: "Producer of 'Texas' musical issued fine in fatal fireworks explosion," Aaron Davis, *Lubbock Avalanche-Journal*, February 2, 2016, www.lubbockonline.com;
<http://www.oshatoday.com/news-digest-item/fed-osa-fines-the-texas-panhandle-foundation-42000/>; "Texas' cast mourns for woman killed in explosion," Chip Chandler, August 1, 2015,
<http://amarillo.com/news/latest-news/2015-08-01/texas-cast-mourns-woman-killed-explosion>;
"TABC halts 'Texas' probe into alcohol furnished to minors before 2013 crash that killed 5 cast members in West Texas," March 10, 2014;
<http://www.stopteendrinkinaustin.com/2014/03/10/tabc-halts-texas-probe-into-alcohol-furnished-to-minors-before-2013-crash-that-killed-5-cast-members-in-west-texas/>

On February 2, 2016, a *Lubbock Avalanche-Journal* article appeared on the OSHA Today website which announced that OSHA had cited a producer of the musical 'Texas.' A \$42,000 fine and six serious citations were filed against the Texas Panhandle Heritage Foundation, Inc., after an OSHA investigation into the death of Peyton Trueblood, 21, of Tuscaloosa, Alabama last July. She was killed at the Pioneer Amphitheatre in Palo Duro Canyon State Park as she was checking the inventory of fireworks and pyrotechnics before the night's performance began. The explosion also caused a minor grass fire that sparked hot spots within a 200-yard perimeter.

The cause of the explosion has not been determined at this time. The State Fire Marshal's Office also is investigating the incident. Kris Miller, executive director of the Texas Panhandle Heritage Foundation, which produces 'Texas,' said that about 1,600 rounds of fireworks—enough to last until the end of the show's season on Aug. 15, plus rounds stored for homecoming at West Texas A&M University—went up in the explosion.

The six serious violations and the order for the Texas Panhandle Heritage Foundation to pay \$42,000 in penalties were all related to failing to do four things: 1) train workers on the use of explosives; 2) provide fire retardant clothing; 3) perform a hazard assessment; and, 4) develop a written hazard communication program. Each of the six citations carries a \$7,000 penalty.

Elizabeth Linda Routh, area director of the Occupational Safety and Health Administration in Lubbock said, "A 21-year-old worker, with three months of work experience under her belt lost her life because the Texas Panhandle Heritage Foundation failed to provide appropriate training and protective equipment to workers handling pyrotechnics."

OTHER DEATHS IN CAST AND CREW. One of the articles I read mentioned the deaths of other cast and crew members in car accidents and a little internet searching revealed the following:

- * In 2001, "Texas" dancer Elise Carlton, age 19, an Amarillo native, was killed in a one-vehicle rollover on her way to the show.

- * Clint Diaz, age 20, Amarillo, who was driving 6 cast member home after they all had attended a BYOB (bring your own bottle) end-of-summer cast party on August 12, 2013. . Despite the age 21 drinking law, Diaz' blood alcohol was over twice the legal limit and marijuana also was found in his blood . According to the trooper's report, alcohol containers were in the car and Diaz' car "pulled out into the path of a southbound semi-truck tractor trailer...." Also killed were:

- * Andrew Duncan, 20, student, West Texas A&M, musician, dancer and singer

- * Eric Harrison, 21, Fort Worth, college student

- * Amanda Starz, 20, Timonium, Md., dancer

- * Julian Arredondo, 24, Halt, Tx, singer and budding playwright

Passenger and crew member Timothy Johnson, was the only survivor. He was seriously injured and still works at the theater. The truck driver was also seriously injured.

The BYOB party was held at the Coldwater Cattle Company's ranch owned by former foundation board member Joe Batson. The Texas Alcoholic Beverage Commission (TABC) investigators opened a probe into whether Batson was responsible for serving "Texas" troupe members younger than 21 alcoholic beverages during a private party. Furnishing alcohol to a person younger than 21 is a criminal Class A misdemeanor punishable by a fine of no more than \$4,000 and as much as a year in jail. The TABC report cites crash scene photos "indicating several bottles of distilled spirits were found in backpacks of the victims." This included alcohol and marijuana found in the driver's back pack.

Johnson, the only survivor of the wreck, filed a lawsuit claiming Batson, the Coldwater Cattle Company and the foundation were negligent in their roles as party hosts. The defendants in the civil case denied responsibility, asserting that those in the car, including Diaz, "were adults, according to the laws of the state of Texas," and therefore competent to make their own choices.

The TABC probe started in August, but was halted in March when the investigation “hit a wall,” according to a TABC complaint summary obtained through an open records request filed by the *Amarillo Globe-News*. “I am not getting any cooperation out of the staff at ‘Texas’ the musical,” a Sept. 9, 2014, TABC notation states. Representatives for Batson stopped providing information to TABC in January after Johnson dropped a civil lawsuit against Batson, his Coldwater Cattle Company . and the foundation on Dec. 23, the TABC complaint summary shows.

COMMENT. Johnson has recovered and still works for the musical. The news reports make it clear that after Johnson’s suit was dropped, the TABC found it could not find out where even one of the alcoholic beverage containers found in the wreck were obtained and not one person at the party testified as to the driver’s condition when at the party.

As for Peyton Trueblood’s death, “This is not supposed to happen once, much less twice,” Miller said. “She’s now joined our other ‘Texas’ angels.” Clearly, Payton Trueblood is angel number seven, far too many young people ranging in age from 19 to 24. Adults owe novices in our business better guidance and protection than this.

GOT OLD LATEX PAINTS? WE MAY WANT THEM.

We have been made aware of a special study being planned to evaluate a previously unknown and unexpected hazard associated with certain water-based latex paints made prior to 2008. If you have old Sherman Williams® paints that you know were purchased prior to 2009, please contact us at:

ACTSNYC@cs.com or 212-777-0062.

Any information, recollections or paperwork you have substantiating the date on which they were purchased is very important. If you live near the NYC area, Houston, Tx, or Glen Carbon, Il, that’s even better. But if not, we can make arrangements to get the paints. We don’t need a truck load. A gallon or two will suffice. And you are likely to be helping people who may have been harmed by exposure to latex paints.

ACTS FACTS sources: the *Federal Register (FR)*, the *Mortality and Morbidity Weekly Report (MMWR)*, *Environmental Health Perspectives (EHP)*, and many other publications. Call for further information on sources. Editor: Monona Rossol; Research: Tobi Zausner, Sharon Campbell, Robert Pearl, Brian Lee, Pamela Dale, Kathy Hulce, Pat F. Sheffield, Janet Sellery; Staff: Kathy Frost, John Fairlie, OES.

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MONONA ROSSOL TO TEACH SUMMER ART SAFETY COURSE

I will be teaching a 40 hour course called "Health and Safety in the Art Studio: The Global Harmonized System for Art Hazards," for the University of Massachusetts-Amherst this summer from July 11 to 15. The course description on the college's website reads:

Health and safety in the art studio: a guide to safety and environmental laws for working or potential visual artists, teachers and safety professionals. To protect both artists and the earth, this course focuses on using art materials in compliance with OSHA and EPA regulations. Solvents, pigments, dyes, metals, minerals, plastics and adhesives are studied for their applications in all disciplines for painting, drawing, printmaking, photography, textile, leather arts, ceramics, glass, sculpture, metals and woodworking.

I am covering studio safety requirements for professional studios and classroom for all student populations including children, college age, seniors and art therapy patients. The course is designed for both potential professional artists and teachers and safety professionals with an interest in arts.

This will be the first course in a program on art safety which I am endowing at UMass-Amherst. I am personally certifying that participants who have passed the test at the end of the course are trained in the new OSHA Hazard Communication Standard and a number of other regulations. For Certified Industrial Hygienists taking the course, we provide a letter attesting to course completion, a copy of the subject matter outline and trainer's background, which we expect will be sufficient to qualify for 6.68 Certification Maintenance (CM) points.

The text for the course will be a PDF version of the 4th Edition of the *Artist's Complete Health & Safety Guide* scheduled for publication in 2017. Additional information about the course can be obtained by contacting me at actsnyc@cs.com. Registration is at:

<https://www.umasslearn.net/classes/summer-2016?view=class&clid=14853>

AT LAST: A NEW OSHA SILICA STANDARD

81 FR 16285-16890, March 25, 2016

On March 25, 2016, the Occupational Safety and Health Administration (OSHA) published their Final Rule on Occupational Exposure to Respirable Crystalline Silica in the Federal Register. The new permissible exposure limit (PEL) is 0.05 milligrams/cubic meter (mg/m^3) for respirable silica (particles under 10 microns in diameter) as a time-weighted, 8-hour average (TWA)*. The old limit PEL was 0.1 mg/m^3 will still be used for certain workers.

HOW DOES THIS AFFECT US? First, the standard, like all OSHA standards, only applies to workplaces in which there is an employer and employees. Artists and hobbyists working alone in their studios, for example, are not covered. But those schools and business that come under this new standard must develop the following:

- Written Program. A full written exposure control plan detailing how employers will monitor and control their workers' exposures.
- Medical Surveillance. OSHA requires medical surveillance be made available to employees exposed to respirable crystalline silica at or above the action level of 0.025 mg/m³ for 30 or more days per year. Employers need to obtain a written medical opinion from physicians or other licensed health care professionals for medical examinations. For medical privacy, the employers will only be provided with the date of the examination, a statement that the examination has met the requirements of the standard and provide any recommended limitations on the employee's use of respirators. [This also means that employers must have a full respiratory protection program which includes medical certification, fit-testing and training under the Respiratory Protection Standard (1910.134)].

EXEMPTIONS: The standard says it “applies to all occupational exposures to respirable crystalline silica except” for two types of silica exposures:

- **EXEMPTION:** Exposures that result from the “processing of sorptive clays.” By “processing,” OSHA means mining, milling and preparation of these clays for market. “Sorptive clays” are bentonite, attapulgite and similar clays mined and sold for the purpose of sopping up spills of toxic substances or oils. There are not enough studies of these workers to quantify their risk. These workers will continue to be protected by the old PEL.
- **EXEMPTION:** Exposures where employee exposure to respirable crystalline silica will remain below 0.025 mg/m³ as an 8-hour TWA** under “any foreseeable conditions.” Schools and art businesses should seek this exemption to avoid setting up expensive medical surveillance programs. I would call attention to the “any foreseeable conditions” language in this exemption. It means that employers must consider worst case scenarios (e.g., the dustiest work they do).

GETTING THE EXEMPTION. The way most schools and business will probably do this is to have an industrial hygienist monitor those of its employees exposed to silica at a time during which the work they are doing represents the highest foreseeable exposure. Personal monitoring is done by placing a sampling cassette on the workers lapel which is connected to a small pump worn on the belt which “breathes” about the same amount of air as a worker would. This apparatus usually remains in place for 7 hours or longer. Then the cassette is sent to a lab for analysis to determine the amount of silica that would have been inhaled that day by the worker.

If those tests document exposures below the 0.025 mg/m³ action limit (half of the PEL), they provide evidence for the exemption. This means a one-time expense of clearly documenting the low exposures provides a great benefit. The business or school only has to retest if they change procedures, location, processes or anything else that would influence the amount of airborne dust.

WHO IS MONITORED? Any worker with a potential silica exposure should be monitored. In a school this may include:

- Teachers in ceramics, sculpture, jewelry or other media using silica-containing materials
- Custodians cleaning up these areas
- All high dust activities such as clay mixing, making and breaking of sculpture and jewelry molds, use of sand (cement, ceramic shell molds), glaze mixing, abrasive blasting, etc.
- All maintenance, grounds keepers and other employees using silica-containing materials, repairing or demolishing structures, etc.

WHAT ARE THE LIKELY TEST RESULTS? Schools or businesses in which silica-containing clay, stone or ceramic dust that is visible on floors and surfaces are likely to exceed the 0.025 mg/m³ action limit. I know this from various sampling results at a number of schools I am privy to and from a NIOSH study (NIOSH HETA 97-0189-2668) done in 1997 at a high school in West Des Moines, IA. This study included personal monitoring of an instructor at 0.03 mg/m³ of respirable silica. The same level was also measured in an air sample taken over the wedging table. In 1997, these levels were below the NIOSH recommended limit of 0.05 mg/m³ so they were not considered unsafe. But today they are both over the new 0.025 mg/m³ action limit.

Spanking clean, well-operated studios will probably qualify for the exemption. For example, custodians who wet mop, power wash or HEPA-vac floors are unlikely to be breathing much silica. If teachers require students to clean up their work areas thoroughly and daily are likely to pass. The silica exposures also should be very low if teachers or employers only allow dusty procedures to be done in local exhaust such as a spray booth or slot hood exhaust.

One task that is almost sure to fail is making clay from scratch from powders. I have never seen a ventilation system for clay mixing that did not need respirators for back up.

WHO SEES THE AIR SAMPLING DATA. In addition to having this data on file to show OSHA, employers must provide all of the reports to their workers or their representatives. This is true of all types of testing of the workplace that affects safety or health. It is a worker's right under regulation 1910.1020. The new Silica standard clearly states at the end of both the sections on air monitoring and medical surveillance that "the employer shall ensure that objective data are maintained and made available in accordance with 29 CFR 1910.1020."

ADDITIONAL BENEFITS. If a school or business can document that their workers will be under the action limit, they also can cease running a full respiratory protection program for employees. They now can distribute masks to those workers who want them under OSHA Voluntary Use program which doesn't require medical certification, fit testing and training. The employer only needs to provide each employee a copy of appendix D of 1910.134 which covers some of the risks. (However, ACTS thinks it is a good idea for teachers to be in this program even if it is not required.)

STUDENTS. Students do not come under the OSHA regulations (except in a few states). Instead, schools must protect students under liability laws which are far more protective than the OSHA standards. For example, it is foreseeable that lawyers for an asthmatic student could use the same silica studies done of the school's air to qualify for the exemption as proof that there were levels of dust that are unhealthy for people with respiratory problems! I have always recommended that course descriptions include information about potential toxic exposures to forewarn such students.

WHEN DOES THIS HAVE TO BE DONE? The date for getting all the sampling done is June 23, 2018. Two years is more than enough time, especially since air monitoring should actually have been done years ago as a job risk assessment under hazard communication years ago.

Footnotes:

* The OSHA Silica Standard refers to the PELs in micrograms/cubic meter which reads 50 µg/m³. For continuity with most other PELs and TLVs for particulates, this article will consistently refer to them in mg/m³.

** Savvy people will recognize that this action limit is the same as the ACGIH TLV-TWA. OSHA found an economic incentive to encourage schools and small businesses keep silica levels below it. Way to go, OSHA!

EYE/FACE PROTECTION STANDARD UPDATE

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=NEWS_RELEASES&p_id=30582
OSHA's Eye and Face Protection regulations now recognize the ANSI/ISEA Z87.1-2010, Occupational and Educational Personal Eye and Face Protection Devices standard, while deleting the outdated 1986 edition of that same national consensus standard. OSHA is also retaining the 2003 and 1989 (R-1998) versions of the ANSI standard already referenced in its standard. Now there is an even greater incentive for manufacturers of eyewear to provide the marks which identify the precise use for which each item is approved ([get a copy of ACTS PPE data sheet: actsnyc@cs.com](mailto:actsnyc@cs.com)).

NATIONAL STANDARD FOR STAGE FALL PROTECTION APPROVED

<http://tsp.esta.org/tsp/StandardsWatch/Swatch02b2016.pdf>, announced by Karl Ruling, ESTA Technical Standards Manager, Technical Editor, *Protocol*

On February 29, 2016, the American National Standards Institute has accredited a fall protection standard developed by Entertainment Services Technology Association. It is now available as **ANSI E1.46-2016, Standard for the Prevention of Falls from Theatrical Stages and Raised Performance Platforms**. The need for the standard was summarized in the text as follows:

Because a standard guardrail historically has not been installed across the front of a stage, and because a guardrail would be visibly obtrusive in most stage shows, there is the common perception that stages and raised performance platforms are special places where fall protection is not needed. The expectation is that people understand that the edge of a stage or raised platform, or an open trap in a stage floor, is a danger and will take appropriate action to protect themselves. This expectation is often proven to be unfounded, with expensive results.

The standard "offers guidance to people working in the entertainment industry on preventing falls by performers, technicians, and members of the public from theatrical stages and raised performance platforms into orchestra pits, into audience areas, into stage traps, and from raised surfaces to surfaces that are lower." The requirements include a written fall protection standard such as OSHA already requires, but the standard provides guidance on how to assess the risks and set up this program. One appendix also includes all applicable OSHA regulations.

ACTS strongly suggests all theatrical employers and technicians obtain a copy of this document and use it to institute a new, or upgrade an existing, fall protection program for their stages, sets, traps, and all non-routine stage effects that involve a potential fall. We also have updated our Stage Fall Protection data sheet which is available without cost. Request a copy at actsnyc@cs.com.

ACTS FACTS sources: the *Federal Register (FR)*, the *Mortality and Morbidity Weekly Report (MMWR)*, *Environmental Health Perspectives (EHP)*, and many other publications. Call for further information on sources. Editor: Monona Rossol; Research: Tobi Zausner, Sharon Campbell, Robert Pearl, Brian Lee, Pamela Dale, Kathy Hulce, Pat F. Sheffield, Janet Sellery; Staff: Kathy Frost, John Fairlie, OES.

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BULLET HIT SPECIAL EFFECTS: THE LEAD IS FLYING!

Editorial- M. Rossol

HISTORY. I became interested in the use of lead compounds in pyrotechnic special effects in 1996 when I wrote an item for *ACTS FACTS* (October 1996) about a film worker injured by a car bomb effect. But of most interest to me was that this explosion and smoky car fire effect was created with lead azide – a chemical that releases large amounts of lead to the environment.

Then the November 1997 *ACTS FACTS* covered a lead-free product called the TiTAN e-match distributed by Martinez Specialities. Electronic matches or e-matches are used to set off larger pyrotechnic effects. (I was pleased to see this company is still providing these e-matches and to learn that most e-matches sold today are lead-free.)

In 2004, as a consultant for a union worker at an opera company, I calculated the release of lead from a chandelier effect that would light suddenly with the aid of 150 lead-peroxide e-matches. At that time, the only information I could find on the amount of lead peroxide in each e-match is that it ranged somewhere between 10 and 80 milligrams (mg). I used both the high and low numbers to calculate the weight of lead that would be added to the dust in the theater from this effect from the seven scheduled performances. These amounts were between 9 and 73 grams! That's a lot of lead.

Recently I have become interested in the bullet hit effects (sometimes called squibs*) which are used on actors that appear to be shot, and in walls and objects to simulate a bullet hitting these surfaces. These bullet hit devices can release tiny particles (< 10 microns) of lead fume right into the actor's breathing zone. Or bullet hits can be activated in walls or objects on the set which expose cast and crew to lead fume and to casing fragments contaminated with lead.

BULLET HITS. Safety data sheets from manufacturers indicate lead styphnate is a common bullet hit explosive. The special effects industry doesn't provide information on the exact amounts of the explosives in their bullet hits. Tradition says that the key to the weight of explosive is the number at the end of the model which indicates the number of "grains." So a bullet hit labeled D80-1 is assumed to have somewhere around a single grain of lead styphnate in it. Another labeled D80-1/4 would have a quarter grain, and one labeled D60-3 would have 3 grains. And so on.

The number of grains in these devices range from 1/32 of a grain to a whopping 100 grains. But the special effects people I have talked to say that safety dictates that the bullet hits used on or near actors should be in the range of 2 grains and under, while bullet hits in walls and objects are usually 6 grains and under.

HOW MUCH LEAD IS RELEASED? One grain is 64.8 milligrams. The empirical formula of lead styphnate is $C_6H_9N_3O_8Pb$. However, there is usually a water molecule attached to this substance which changes the formula with hydration to $C_6H_9N_3O_8Pb \cdot H_2O$. Using this formula, each grain of lead styphnate will release 28.6 mg of lead (see footnote for calculation**).

This is a theoretical calculation and there may be a little wiggle room here in terms of the purity of the chemical, the amount of hydration and other factors. But we are in the ball park.

CONCENTRATION OF LEAD RELEASED. The OSHA permissible exposure limit (PEL) for lead is an 8-hour, time-weighted average of 0.05 mg/m³. If we release 28.6 mgs of lead in the air, it could theoretically contaminate 572 cubic meters of air ($28.6/0.05 \text{ mg/m}^3 = 572 \text{ m}^3$) to the PEL. This is equivalent to 20,200 ft³ or a little more than the area of five rooms that are 4000 ft³ (20 x 20 x 10). That one grain of lead styphnate can contaminate the air to the OSHA PEL in all five rooms!

Or we can suspend the whole 28.6 mg into one 10 x 10 x 10 room which raises the mg/m³ to about 1 mg/m³ which is more than 20 times the PEL.** Worse, if the bullet hits are on or very near an individual, the entire charges are released in or near the individual's breathing zone. One single-grain bullet hit releasing 28.6 mg in one meter of air (28.6 mg/m³) is 572 times the PEL!

And all of these calculations are based on a single grain. Multiple and larger bullet hits can be used. One recently filmed machine gun run out scene involved 250 hits occurring within minutes.

FLAW IN THE REASONING. The OSHA PEL-TWA is an 8-hour, time-weighted average and the calculations assume that the lead fume generated by these effects will remain airborne for the 8 full hours. While lead fume can stay airborne for long periods of time, good ventilation, for example, could clear the fume in a much shorter time. But the very high exposure levels calculated indicate that an individual could be over-exposed even if the exposure lasts only a few minutes.

In addition, lead fume is a particle. It can settle and become part of the dust on surfaces. And while physics dictates almost all the lead in each bullet hit will be made airborne as a fume, a small amount of lead will remain on casing fragments and other particles created by the mini blasts. These bits, combined with the settled fume, can contaminate clothing, hair, furnishings, and even cameras and equipment. This dust can expose the cast, crew, spectators, and people occupying the space to lead long after the effect was used there.

PURPOSE OF THE CALCULATIONS. Proving that these devices violate an OSHA air quality standard is not the job of workers, unions or ACTS. Instead, OSHA requires employers to assess the risk to their worker. These rough calculations provide clear evidence that employers are obligated under the OSHA regulations to assess and quantify this risk by methods such as personal and area monitoring (testing the air) for lead during use of the effects. And sellers of these lead-bearing devices have been, in ACTS opinion, remiss by not providing exact lead content and some potential exposure data to insure clients use the products safely and in compliance with OSHA regulations.

LEAD-FREE. All of these problems could be avoided by switching to the lead-free bullet hits that are on the market. It just makes good safety, health and economic sense to get the lead out. The footnote *** provides some web sites at which information on lead-free effects are available.

RECOMMENDATIONS. Whenever the lead-bearing effects will be used, workers and their representatives should insist on the following:

1. Employers must quantitatively assess the risk from airborne lead exposure in locations where lead-containing pyrotechnic effects are used as per OSHA (1910.1025 and 1910.132(d)(2) and (3)). In addition, dust sampling (wipe tests) should be done in indoor sites after effects have been used unless exhaust fans are set up to exchange air efficiently.****

2. All the employer's air and personal monitoring tests, reports and assessments must be made available to workers and their representatives as required by OSHA (1910.1020), and information about lead exposure hazards should be provided to cast and crew as per (1910.1200 and 1910.1025).
3. Based on the quantitative data assessment, proper precautions should be instituted with the appropriate OSHA training as required.

Footnotes:

* **SQUIBS.** This word is used very loosely to mean a number of things including e-matches, detonators (used as initiators to trigger larger pyrotechnics) and bullet hits. One of several definitions of a squib is two electrical leads which are separated by a plug of insulating material, a small bridge wire or electrical resistance heater, and a bead of heat-sensitive chemical composition in which the bridge wire is embedded. To avoid confusion, this article will only use the terms "e-match" for initiators and "bullet hits" for the effect of a bullet hitting a person or an object

** **CALCULATIONS** for the amount of lead in the fume released from lead styphnate as $C_6H_3N_3O_9Pb$:

Element	MW	x Number	= total MW (molecular weight)	
H	1.008	3	= 3.024	
C	12.011	6	= 72.066	207.2/468.3 x 100 = 44.245% Pb
N	14.007	3	= 42.021	
O	15.999	9	= 143.991	1 grain = 64.8 mg,
Pb	207.2	1	= 207.2	
			468.30	44.2% of a grain = 28.6 mg of lead

One 1000 ft³ room = 28.3 m³. 28.6 mg/28.3 m³ = ~ 1.0 mg/m³. = 20 times the 0.05 PEL

*** **WEB SITES.** Providing web sites does not constitute product endorsement nor imply that these products are without hazards. For example, one of the substitute products also contains nickel powder which will be released as a fume. The nickel is safer than lead, but its release also needs to be assessed, since nickel is a carcinogen and sensitizer with an OSHA PEL-TWA of 0.2 mg/m³.

There are two basic types of bullet hits: those made with high explosives (e.g. lead styphnate, DDNP/diazo dinitrophenol, etc.) and pyro types. Some DDNP versions also contain nickel. Some lead-free bullet hits (e.g. "Cork Hits") are classified as pyrotechnic articles and thus subject to less regulation. Air squibs use air pressure and involve no reactive chemicals. Selecting bullet hits for a scene requires training in both safety and artistic objectives. Some helpful web sites may include.

<http://leadfreepyro.com/> - a NEXT FX division that distributes European products from http://www.pyrochemie.com/e_bleifrei.htm and http://www.pyrochemie.com/e_produkte.htm

<http://www.lemaitreusa.com/p/Microdets/0zzjc%5B%5DyA98g>

<http://www.martinezspecialtiesinc.com/pyrotechnics/>

Air squibs can be found at <http://squibfx.com/>, <http://www.airsquib.com/> and <http://www.rogergeorge.com/special-effects/equipment-sales/air-squib-bullet-hit>

**** **VENTILATION.** Exhaust fans do not include propeller fans (E-fans) which only provide turbulence causing the dust and fume to be blown around. Instead, the site must have an exhaust fan fitted into a wall or window at one end and a make-up air supply unit or open window at the other end. The fan must be sized to the room to provide a complete air exchange in under 5 minutes.

ART BUILDING WINS AIA GREEN PROJECTS AWARD

Source: <http://www.aia.org/press/AIAB108782>

On April 22, 2016, the American Institute of Architects (AIA) and its Committee on the Environment (COTE) announced their selection of the top ten examples of sustainable architecture and ecological design projects to be honored at the 2016 AIA Convention in Philadelphia. The COTE Top Ten Awards program, now in its 20th year, is the profession's most rigorous recognition program for sustainable design excellence.

One of the award winners is the new Visual Arts Facility at the University of Wyoming in Laramie. The architects were Hacker Architects and Malone Belton Able PC. And their industrial hygiene consultant was Monona Rossol. The COTE committee's statement about the building says:

The Visual Arts Facility (VAF) consolidates the fine arts program from its scattered locations throughout the campus. The building provides a teaching and learning environment that is both state-of-the-art in occupational safety and in its concern for discharge of pollutants from building. The roof area is fitted with one of the largest solar evacuated tube installations in the U.S. Heat flows from the evacuated tubes to support the hydronic radiant floors, domestic hot water, and pretreat outside air for ventilation. The building was oriented and shaped through a process of studying the sun's interaction with interior spaces, simultaneously distributing reflected light while eliminating solar gain.

The jury's comments calling this a "model for how do this type of facility" are important:

A contextually appropriate design that fits the landscape very well. The jury was impressed by the attention paid to the health and well-being of the building occupants, the way the design addressed air quality in the studios, and the way this was expressed by the ventilation stacks on the exterior. Art materials contain many toxic chemicals; this project is a model for how to do this type of facility.

Hopefully, this award-winning, "how-to-do-it" building, along with another similarly well-ventilated art building at UMass-Amherst (on which I consulted) will set precedent for future art buildings.

ACTS FACTS sources: the *Federal Register* (FR), the *Mortality and Morbidity Weekly Report* (MMWR), *Environmental Health Perspectives* (EHP), and many other publications. Call for further information on sources. Editor: Monona Rossol; Research: Tobi Zausner, Sharon Campbell, Robert Pearl, Brian Lee, Pamela Dale, Kathy Hulce, Pat F. Sheffield, Janet Sellery; Staff: Kathy Frost, John Fairlie, OES.

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UNION SAFETY DIRECTOR SAVES HIGH SCHOOL MUSICAL

SOURCES: Personal correspondence and "Violations put Pioneer High School musical in jeopardy," Anu Prakash, Apr 28, 2016, <http://www.wxyz.com/news/region/washtenaw-county/violations-put-pioneer-high-school-musical-in-jeopardy>

HISTORY. A little over a year ago, April 23, 2015, a high school stage extension (thrust) collapsed during a musical performance (see *ACTS FACTS*, May 2015). The cast dropped 12 feet into the pit injuring 16 people. One of these people was still hospitalized a week after the accident.

The accident occurred because the previous January, the auditorium director purchased building materials and with the help of students, constructed a new "pit lid" or cover. The previous pit lid and support system was removed. The pit lid served as a thrust to bring stage action closer to the audience. It wasn't until a large group of dancing performers were on the pit lid that it failed.

I wondered at the time, what would have happened if some smart parent would have noticed this construction error and brought it to the attention of the school. This past month, my question was answered. An alarmingly similar situation arose this past April. This time parent with professional safety experience spoke up. But before you assume all went well, here's the story.

ANDREW COMAI is the Coordinator of the United Auto Worker (UAW) International's Health and Safety Department. He's also a husband and father. So it is only natural that he would spend an evening at his daughter's high school in Ann Arbor, Michigan, to sit through a tech rehearsal of *Rock of Ages*, a musical staged by the local community theater at Pioneer High School auditorium.

Andrew's daughter, Olivia, was the show's stage manager. She had told her Dad that there were problems back stage with low lighting, painted-over exit signes, expired fire extinguishers, and other hazards. She had pointed out the problems to superiors to no effect other than being made to feel her job with the community theater group might be in jeopardy. For this reason, Olivia made it clear to her Dad that he was not to get involved. In a later public statement, Olivia explained it this way:

—if I report safety issues to this group of adults they will just use this as another reason to get rid of me. My Dad encouraged me to report the hazards to an adult. I told him Dad I can't. People around here hate me so much already that if I raise a safety issue and slow down the production they will only hate me more. And anyway last time I brought an expired fire extinguisher to the producer she just told me it wasn't her job. And to stick the extinguisher in the hall.

But as Olivia's Dad watched the rehearsal he noticed that at one point in the show, the kids were shoulder-to-shoulder, swaying and singing "Every Rose Has a Thorn" on that trust stage. Then nineteen (Andrew counted them) cigarette lighters were simultaneous lit and held over head and waved. And after the rehearsal, our hero couldn't resist a peek under the black drape covering the stage supports where he saw a jumble of repurposed wood.

That's when Andrew called me. After hearing the whole story, I told him that his daughter would only hate him for a few weeks at most. But if anything went wrong he would kick himself the rest of his life. I suggested calling in the Fire Marshall. To be fair to the school, Andrew first called the Principle and left messages. One of these e-mails said:

In our meeting you asked for a list of safety hazards at the Pioneer auditorium. I have watched the rehearsals over the week end and talked to some of the kids there. I think there are immediate hazards that need to be addressed before rehearsals continue.

What followed was a list of 12 significant hazards Andrew found in the theater including:

The stage extension is constructed of recycled wood. Some of the wood is 1" by 4". OSHA ... recommends 2"x4." It is not [high]... grade lumber. It is full of holes from previous use. I estimate 19 kids at 125 pounds per kid equals 2375 pounds of kid. They are placed on the extension in an area of 90 square feet. The stage extension below them is made of scrap wood. Diagonal cross bracing is missing.

That day I got advice from Karl Ruling of ESTA and others familiar with theater safety issues and e-mailed the following to Andrew:

A stage extension must meet the load requirements of a stage. NFPA 5000-2015, clause 35.6.3.3 (1) says, "Stage floors shall be designed to support not less than a 2000 lb (8.9 kN) concentrated load on a 1 ft² [square foot] (0.09 m²) area at any point."

The IBC [International Building Code] has similar rules. And it sounds like that load rating can't even be calculated because the lumber is compromised. And if that thing is over 4 ft high, then 1910.23 [OSHA General Industry Standard] kicks in.

Andrew also obtained further stage safety information in the form of a copy of ESTA-ANSI E1 46 "Standard for the prevention of falls from theatrical stages and raised platforms" Feeling it was urgent, Andrew did not wait for the Principle's response. He began e-mailing the local Marshal until he heard back that the State Inspector would be visiting the school. Later that State Inspector told the school to get the stage shored up and approved by an engineer or take it down. It was removed. Instead of thanks, the school struck back through the media. According to Detroit's WXYZ TV:

A spokesperson [Andrew Cluley] for Ann Arbor Public Schools says a state fire inspector came to the school on Wednesday and discovered some violations. "We're told they were mostly simple things like moving fire extinguishers and working on lights. The main issue centered around a stage extension."

"There were some concerns about that. We had an engineer and architect come out this morning to look it over and because we always want to make sure the safety of our children is top priority, we decided we're gonna pull it down. Most likely, it was safe, but just to make sure, better safe than sorry. We're bringing it down," says Cluley."

Notice the fire violations are trivialized and Cluley implies the stage was probably safe. And then the spokesperson puts the blame on the complainer when he told the WXYZ reporter:

"Dozens of students and staff have been working for a few months on *Rock of Ages*. It's not clear what prompted the state inspection, but there is some talk that it was a disgruntled parent."

The report also did not say that a scene involving 19 cigarette lighters had been cut!

THE TEACHING MOMENT. Like all of us in the safety field, Andrew wanted to use this crisis to inform and educate. He took copies of the NFPA information and ACTS' Fall Protection Data Sheet to the Pioneer Theater Guild Booster Club board meeting in hopes of talking about the safety issues to the 13 parents gathered there. What happened next is best told by Andrew.

Before I could speak a very surly mother “made a motion” to make me leave the room; it was seconded and a few people started voting “aye”. Then another person made a motion to adjourn the meeting which was also seconded.

I pointed out that the chair person (who happens to be my wife) had to first recognize any person making a motion. So there were no current motions on the floor. I asked to be recognized by the chair person and after being recognized made a motion (I had to yell over several people still making motions) that was something to the effect that “All people in the room who do not think safety was important could go outside and pound sand.” There was no second but there was discussion and some yelling. My daughter was amazed at how mean the adults were-- she was also worried because she had never seen my head turn red like that....

The principal showed up amidst the yelling and we did get a commitment to have a public meeting to discuss stage safety. He has received about 60 requests from concerned parents to have such a meeting.

THE SHOW. The show went on as scheduled. It was performed on a smaller stage, with safer back stage conditions and, instead of lighters, the kids held up their hands with forefinger and pinky fingerraised--just as John Lennon did on the cover of *Yellow Submarine*. Lennon used the hand sign to ward off the “malocchio,” the evil eye. It must have worked. There were no injuries.

THE LESSONS. This story will probably only be in *ACTS FACTS* since it is about a disaster that didn't happen. But there is still much to learn from it. Included are the following lessons for people who see dangerous conditions and have the courage to act:

- Save lives first and argue about it later. Don't fear the disapproval of the people you protect. Olivia and her Dad are firmly on the same side now and all is well in the Comai house. And in an amazingly mature public statement to the Pioneer Theater Guild, young Olivia has called for establishment of common sense safety procedures and compliance with building codes and theatrical safety codes. In ACTS' opinion, both Olivia and her Dad are heroes.
- Be fully aware that your only reward will be your own knowledge you did the right thing. There are no Tony awards for safety. If you are lucky, a couple of family members and a handful of smart people will know did the right thing.
- Prepare for the retaliation that is sure to come. Have your facts documented with photos, measurements and copies of the violated the laws and standards. Be ready to defend your position.
- Reach out to experts. Reach out especially to experts who can figure out which authority will be best able to address the problem. In this case, the Fire Marshal was the only one with the power to act quickly. (Later Andrew found that school thrust stages are covered by section 3103 of the Michigan Building Code. The Michigan Licensing and Regulatory Affairs enforcers have jurisdiction. But building departments usually move slowly.)

And if the problem is related to art or theater, call ACTS. We'll do everything we can to help.

MORE WEST COAST ART GLASS INDUSTRY PROBLEMS

SOURCES: www.DEQ.gov and Portland news outlets

In the March issue of *ACTS FACTS*, we covered a Forest Service study of moss in Portland, Oregon, that led to the identification of two art glass manufacturing plants as sources of pollution to both ground cover and the city's air. Tests near one of the glass factories confirmed that lead, arsenic, cadmium and other toxic metals were being emitted, some above air quality standards. After a warning to Bullseye glass to cease releasing metal dusts and fumes, monitoring near a day care center showed lead levels 4 times the 24-hour benchmark on May 19.

That same day, the Mayor of Portland responded with a Cease and Desist Order forbidding Bullseye to use lead, arsenic, beryllium, cadmium, all chromium compounds, cobalt, manganese, nickel and selenium in any uncontrolled furnace (a furnace unequipped to capture these emissions). This essentially stops most colored glass production. The Mayor's Order was for 10 days, but Oregon's Governor, Kate Brown, extended it for another 10 days. We await further developments.

Bullseye has laid off workers and is retooling to add a furnaces to be operational sometime in August. A Washington state glass manufacturer, Spectrum Glass, announced it will be closing because it can't afford environmental upgrades. There is a major shake up in the art glass world. Portland citizens are learning that those beautiful glass colors are obtained by using highly toxic metals and that making beautiful glass can have a serious environmental impact.

BULLET-HITS ARTICLE MAKES THE LA TIMES

The article written in the May *ACTS FACTS* on lead-containing bullet hits was of interest to staff writer, Daniel Miller of the LA Times. His article citing *ACTS FACTS* appeared on the front page of the Entertainment Section on May 10th. The link is: <http://www.latimes.com/entertainment/envelope/cotown/la-et-ct-gun-smoke-lead-safety-20160510-snap-story.html>. Or search the site for: "Are lead-based squib explosives a health hazard for film crews?"

TV Channel 7 in Los Angeles also called me for a phone interview on the subject. It is nice to know we are relevant to more than our small circle of safety-conscious people.

ACTS FACTS sources: the *Federal Register (FR)*, the *Mortality and Morbidity Weekly Report (MMWR)*, *Environmental Health Perspectives (EHP)*, and many other publications. Call for further information on sources. Editor: Monona Rossol; Research: Tobi Zausner, Sharon Campbell, Robert Pearl, Brian Lee, Pamela Dale, Kathy Hulce, Pat F. Sheffield, Janet Sellery; Staff: Kathy Frost, John Fairlie, OES.

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ACTS FACTS

THE MONTHLY NEWSLETTER FROM

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Vol. 30, No. 07

DAMN! THE CHEMICAL SAFETY ACT PASSED.

SOURCES: 10 years of following the CSA versions.

BACKGROUND. Of the many flaws in the new Chemical Safety Act (CSA), the major flaw is the small number of chemicals that it requires to be tested. To understand how serious an error this is, the CSA must be seen in the context of regulatory history in both the U.S. and the European Union.

1. THE TSCA CHEMICAL LIST. When the old Toxic Substances Control Act (TSCA) was passed in 1976, the law covered about 70,000 chemicals. These chemicals were on a list compiled by the National Institute for Occupational Safety and Health (NIOSH). The list was limited to chemicals for which there was some mention related to their toxicity in scientific publications.

Chemicals which are not on the list include those that were never tested and chemicals tested by industries that chose to withhold the data. It is incorrect to assume this list included all the chemicals in our products. Even today, EPA (nor any other agency) has no list of the chemicals in commerce.

2. HOW MANY CHEMICALS HAVE BEEN STUDIED? Of the 70,000 TSCA chemicals, EPA tested around 500 and most of the tests were for environmental effects rather than human toxicity. The numbers are low because the TSCA required the EPA to prove untested chemicals posed a significant risk before testing could be mandated. Proving risk without data is done by guesswork such as assuming similar chemicals will have similar effects. This guesswork allowed industry to successfully contest EPA's orders to test in court, where the level of proof is higher.

The EPA had limited data from which to extrapolate. Worldwide, under 1,000 chemicals have enough data to be classified for cancer potential. There is even less data on other chronic effects.

3. HOW MANY CHEMICALS ARE THERE? The Chemical Abstract Service monitors patents, chemical catalogs and research from all over the world and registers each new chemical. They have registered over 115 million chemicals (see www.cas.org) and that number is increasing at a rate around 20 per minute. The website also reveals that 32 million different registered chemicals are currently available for catalog purchase. Who buys these chemicals or where they go is unknown.

4. HISTORY OF E.U. REGULATIONS. There were only about 40 million registered chemicals in 2007 when the European Union instituted a regulation called the Registration, Evaluation and Authorization of Chemical Substances (REACH). The new law's first task was to find out how many chemicals are in commerce. REACH required manufacturers to register all chemicals which would be used in products to be sold in the E.U. The requirement only applied to chemicals manufactured in amounts over a tonne a year (it excluded low production volume chemicals). By REACH's 2008 deadline, over 143,000 chemicals were registered.

5. CHEMICALS IN U.S. COMMERCE. Most science writers and activists estimate the number of U.S. commercial chemicals at 80,000 to 100,000. But unless you believe that we use fewer chemicals than the E.U., it is more likely that the number of chemicals manufactured in amounts over a ton/year is closer to 150,000 – even higher if chemicals made in small amounts are included.

6. DATA ON CHEMICALS. All over the world, regulators were becoming aware that most commercial chemicals were untested. Worse, REACH's list included 30,000 high production volume chemicals (produced in amounts >1000 tonnes/year) on which there was no data. In 2008, REACH required manufacturers to test these 30,000 chemicals by 2018, at which time a "no test, no market" policy would be instituted – meaning that products containing them could not be sold in the E.U.

The requirement was reasonable since the cost for all 10 of the REACH tests is estimated to be between \$100,000 and \$200,000. This would only add \$10 to \$20 to the price of each ton of chemical, much less for chemicals manufactured in amounts over 1,000 tons – as many are.

6. RESULTS. Manufacturers did NOT test. Instead, our government is pushing the Transatlantic Trade Investment Program (TTIP) which will include provisions forcing the E.U. to accept our untested products in the name of "fair trade." This will void REACH's "no test, no market" policy.

NOW COMES THE SAFE CHEMICALS ACT. The original CSA introduced in 2011 had a list of 200 chemicals scheduled for testing. This is still an inadequate number, but numbers in successive versions of the bill got even smaller as the House and Senate seemed to race for the lowest number they could get. As a result, the CSA requires industry to start 3.5 years from now to test **20 chemicals**. Manufacturers have 5 or more years to complete the tests – perhaps longer.

WHICH CHEMICALS ARE TESTED. These 20 chemicals are ones we already know. They are for the most part the chemicals discussed in the popular press. They were apparently picked to make activists and citizens, who see their pet-peeve chemicals listed, think they have won a battle.

Worse, the bill will not stop industry from replacing the pet chemicals with *untested* substitutes from the arsenal of similar chemicals already in commerce that may be just as toxic. Only chemicals that have not been manufactured before or used for the new purpose come under any EPA scrutiny.

COULD "NO TEST, NO MARKET" HAVE WORKED? If you think the E.U. couldn't have pulled off their "no test, no market" game, consider what they already did – worldwide. REACH required importers to provide the new and more informative Safety Data Sheets on all products imported into the E.U. by June 1, 2015. Over 160 countries passed similar laws. The U.S. and Canada were the *last* to adopt the SDSs, but failure to do so would have ended our ability to export!

WHAT SHOULD WE DO? The U.S. activists that supported CSA are now soliciting donations based on their success in getting CSA passed. Instead of donating, maybe we should ask them, what the hell they were thinking. And perhaps we need to expand our definition of "free trade" to include forcing E.U. citizens to accept our untested products. Other than this, there's not much we can do. The CSA also restricts the states rights to regulate chemicals on their own.

NIOSH: 3D PRINTERS SHOULD BE ENCLOSED AND VENTED

SOURCE: "Control Measures Critical for 3D Printers, *NIOSH Research Rounds*. Volume 1, Number 12, June 2016
NIOSH (the National Institute for Occupational Safety and Health) reported on two studies of 3D printers and has provided recommendations for their safe use. The two studies are covered below:

STUDY #1: "Emission of particulate matter from a desktop three-dimensional (3D) printer, *Journal of Toxicology and Environmental Health, Part A: Current Issues*, Jinghai Yi, et al., 79:11, 2016.

This study documents that significant amounts of chemicals are emitted from many types of 3D printers. While all types of plastics used in fused filament printers emitted particulates, natural polymers based on corn released smaller and more hazardous particles. The amounts of particles

released to the room was shown to be reduced by two times when manufacturer-supplied cover was used. But since the reduced number of particles was still high, investigators recommend these steps:

1. Always use the manufacturer's supplied controls (full enclosure appears more effective at controlling emissions than a cover).
2. Use the printer in a well-ventilated place, and directly ventilate the printer.
3. Maintain a distance from the printer to minimize breathing in emitted particles, and choose a low-emitting printer and filament when possible.
4. Turn off the printer if the printer nozzle jams, and allow it to ventilate before removing the cover.
5. Use engineering measures first, such as manufacturer-supplied equipment and proper ventilation, then use materials with lower emissions. Finally, wear protective equipment, such as respirators.

STUDY #2. NIOSH also covered an unpublished study that was presented at a poster session at a recent American Industrial Hygiene Association Conference. NIOSH reports that the study compared emissions from common laser printers with a desktop 3D printer. Laser printers produce images or text on paper by using heat to melt toner powder, which is composed of carbon, plastic, and metals such as iron. To compare emissions between 3D and laser printers, the investigators measured emissions from both types of printers in a testing chamber that simulates real-world conditions.

The investigators found that a desktop 3D printer emitted smaller particles than those from common laser printers and also released far greater amounts of certain chemicals linked to asthma. They also found that 3D printers emit chemicals that combine to form new compounds, including yet another chemical linked to asthma.

COMMENTS. I have been recommending enclosure and venting of 3D printers for a number of years. It is time to address this problem in colleges in particular where I am likely to encounter a room with multiple unvented printers in them. They are common in art and architecture departments and occasionally found in theater shops.

BLACK & BLUE: PIGMENT MANIA IN THE ARTWORLD

SOURCES: *Nature Nanotechnology* 11, 490-491, 2016. DOI: 10.1038/nnano.2016.99 and "Integrated Analysis of Dysregulated ncRNA and mRNA Expression Profiles in Humans Exposed to Carbon Nanotubes." Anna A. Shvedova, et al., *PLoS ONE*, March 1, 2016, <http://dx.doi.org/10.1371/journal.pone.0150628>.

CARBON NANOTUBES. These tiny, thin-walled tubes of carbon are everywhere. They are part of the new black in your tires, in electronics, auto and boat parts, water filters and coatings. They also are examples of chemicals that entered commerce without much toxicity testing – until recently.

NANOTUBE HAZARDS. An article in *Nature Nanotechnology* (cited above) summarizes studies documenting that single- and multiwalled carbon nanotubes can cause "transient pulmonary inflammation, and rapid and persistent development of granulomatous lesions and interstitial fibrosis" in rodents. They also "cite data indicating that inhaled long and thin multiwalled carbon nanotubes can move to the lining surrounding the lungs and penetrate it, where they can potentially cause mesothelioma." The nanotubes also can "act as a cancer promoter."

Now a new study published in *PLoS ONE* (cited above) is the first to investigate changes in genes (two types of RNA), in the blood of humans exposed to multiwalled carbon nanotubes. The study found significant changes in several of the gene's expression as well as in their regulatory networks. Translated, this means that the carbon nanotubes are messing with the workers' DNA.

NEW USE. *Artnet News* reports that artist Anish Kapoor secured exclusive rights to use the nanotubes produced in the UK for military uses such as for spray painting stealth jets. Known as

Vantablack, the paint absorbs 99.96% of the light. *Artnet News* reports other artists resent Kapoor's monopoly (<https://news.artnet.com/art-world/anish-kapoor-vantablack-exclusive-rights-436610>).

Clearly, Kapoor can't control use since there are many commercial sources of carbon nanotubes. One supplier called Cheap Tubes (www.cheaptubes.com) will ship to anyone. But their material safety data sheet lists the hazards of the carbon nanotubes as being the same as those of synthetic graphite – a very different form of carbon. Carbon nanotubes are vastly more hazardous than graphite.

YInMn-BLUE. *Artnet News* ran an article called "The Chemist Who Discovered the World's Newest Blue Explains Its Miraculous Properties." It interviews a chemist who was experimenting with new electronics materials when he and his team mixed manganese oxide with other chemicals and heated them in a furnace to nearly 2,000 degrees Fahrenheit. One of their samples turned out to be a vivid blue (<https://news.artnet.com/art-world/yinmn-blue-to-be-sold-commercially-520433>).

The chemist named the new pigment YInMn Blue. It is made with the oxides of three metals, yttrium, indium and manganese. The new blue is already being used by an artist whose work can be seen on the *Artnet News* website along with a quote from the inventor saying it is "safe." Another website (<http://www.elledecor.com/design-decorate/color/news/a8842/shades-of-blue-color/>) calls the pigment "nontoxic." But is it? Below are the workplace air quality standards for the metals:

METAL	TLV-TWA* in mg/m ³	EFFECTS THE TLV WAS SET TO PREVENT
Indium	0.1	pulmonary edema, pneumonitis, dental erosion, malaise
Yttrium	1	pulmonary fibrosis
Manganese	0.1I** 0.02R**	central nervous system impairment (similar to Parkinsonism)

* Threshold limit values which are workplace air quality guidelines from the American Conference of Governmental Industrial Hygienists in milligrams/cubic meter of air.

** I = inhalable, R = respirable (<10 micron particles)

In addition to the TLV guidelines above, the Occupational Safety and Health Administration (OSHA) has enforceable limits for yttrium and manganese. These limits apply to this new pigment as well since the OSHA limits are applicable to both the metals and compounds containing them. In other words, this pigment is regulated if it becomes airborne as a dust or spray in our workplaces.

COMMENT. The YInMn blue and the black carbon nanotube spray paints and pigments seem to indicate that some artists are engaging in yet another badly thought-out human experiment. And shame on *Artnet News*, an organization claiming to support artists, for uncritically publicizing these new pigments without fact-checking the statements made by their inventors and promoters.

ACTS FACTS sources: the *Federal Register (FR)*, the *Mortality and Morbidity Weekly Report (MMWR)*, *Environmental Health Perspectives (EHP)*, and many other publications. Call for further information on sources. Editor: Monona Rossol; Research: Tobi Zausner, Sharon Campbell, Robert Pearl, Brian Lee, Pamela Dale, Kathy Hulce, Pat F. Sheffield, Janet Sellery; Staff: Kathy Frost, John Fairlie, OES.

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COMBUSTIBLE DUSTS IN ART AND THEATER

There are a hazards from dust and powdered materials in art studios, theater shops and in special effects that should be considered when training employees or students. While dust fires and explosion only rarely occur in art and theater, I have seen situations in which such fires and explosions could reasonably be expected to occur under the right conditions. Some of these are:

- * wood shops with heavy dust deposits on surfaces and overhead pipes and ducts
- * wood shops using vacuum collectors that were not rated for combustible dusts
- * both wood and aluminum cutting dusts routed into the same dust collector
- * aluminum dust being collected by a vacuum not rated for aluminum dust collection
- * aluminum and iron dust accumulating together over time or being collected by the same vacuum (a hot fire called a thermite reaction can occur between aluminum and rusty iron).
- * colored dust special effects used in hazardous concentrations in air.

THE PROBLEM. Many dusts suspended in air can burn rapidly, even explosively, if a source of ignition is provided, such as a flame, spark or electrostatic discharge. This burning/explosion process is called “deflagration.” Deflagration can result in an explosion when it occurs in a confined space such as a room or a dust collector.

Dusts can be tested and rated for their propensity to deflagrate. This deflagration index is called the K_{st} (bar.m/s) value. While this test is complicated¹, the K_{st} values can be used easily to compare a dusts ability to deflagrate.

EXAMPLES OF K_{st} VALUES FOR DIFFERENT TYPES OF DUSTS

Dust explosion class	K_{st} (bar.m/s)*	Characteristic*	Typical materials
St class 0	0	No explosion	Silica, clay, plaster, glaze chemicals, cement, stone, joint compound, minerals (e.g., fullers earth)
St class 1	>0 and ≤ 200	Weak explosion	Starch (e.g., the carrier of colored dust effects), charcoal, sulfur, sugar, zinc
St class 2	>200 and ≤ 300	Strong explosion	Wood flour, and poly methyl acrylate (plastic dust from fine cutting or use of some new plastic abrasives, walnut dusts (abrasive blasting dust)
St class 3	>300	Very strong explosion	Anthraquinone (the base chemical for hundreds of organic dyes and pigments), aluminum dusts, metal pigments, magnesium dusts

* The actual St class is sample-specific and will depend on varying characteristics of the material such as particle size or moisture.

Any combustible dust with a K_{st} value greater than zero can be subject to dust deflagration. Even weak explosions can cause significant damage, injury and death. For example, sugar has a relatively low K_{st} but it fueled a tragic explosion in a sugar refinery in 2008 that killed 14 workers.

SIZE MATTERS. The smaller the dust particles, the higher their K_{st} values. Different dusts of the same chemical material can have different ignitability and explosibility characteristics, depending upon physical characteristics such as particle size, shape and moisture content. These physical characteristics can change during use or when processes creating the dusts change (e.g., changing from sawing to sanding wood produces a finer and more hazardous dust)..

Colored special effects can be particularly hazardous since many of the organic pigments and dyes used to color them usually are nano-sized particles. It is not surprising that the special effects powders made of colorants mixed with starch resulted in deflagration in Taiwan that killed two and put hundreds of party goers in the hospital in 2013 (see ACTS FACTS, August, 2015).

CONCENTRATION IN AIR. The minimum explosible concentration (MEC), is the minimum amount of dust dispersed in air required to spread an explosion. The MEC is analogous to the Lower Flammable Limit (LFL) or Lower Explosive Limit (LEL) for gases and vapors in air. MECs are likely to be exceeded in vacuums and dust collectors, which is why wood dust collectors have special blow out features, spark arresters and other systems to prevent deflagration. And it is why vacuums for aluminum dusts are specifically designed for this dust.

CONTROLLING WORKSITE CONDITIONS. Simple rules can make dusty locations safer.

- **Capture dust** before it escapes into work areas with properly designed, and installed ventilation systems that terminate in well-maintained dust collection systems approved for the purpose.
- **Contain dust** within equipment and ventilation systems that are designed for collection of combustible dust and protected from deflagration initiation.
- **Clean dust** from work surfaces, including overhead pipes and beams, frequently and thoroughly using safe housekeeping methods and collection devices approved for that particular dust.

HAZARD COMMUNICATION TRAINING. A publication that should be included in art and theater hazard communication training as a handout is the OSHA FactSheet “Protecting Workers from Combustible Dust Explosion Hazards.” I suggest the trainer briefly explain that dusts can be classified for their potential to explode and show them how to use the K_{st} values. Three publications which provide the necessary information are:

<https://www.osha.gov/Publications/combustibledustposter.pdf> Large list of combustible dusts in poster form, “COMBUSTIBLE DUST: does your company or firm process any of these products or materials in powdered form?”

<https://www.osha.gov/Publications/3371combustible-dust.pdf> Hazard Communication Guidance for Combustible Dusts

<https://www.osha.gov/Publications/OSHA3878.pdf> OSHA FactSheet: Protecting Workers from Combustible Dust Explosion Hazards.

FOOTNOTE 1. How K_{st} 's are determined: A weighed quantity of combustible dust is placed into the dust container. The main explosion chamber is then evacuated to 0.4 bar absolute. An automatic test sequence is initiated to pressurize the dust container to 20 bar gauge, and then the fast acting valve on the dust container outlet is opened to allow material into the explosion chamber. A special nozzle ensures an even distribution of dust within the explosion chamber and the control system activates two chemical igniters at the center of the sphere 60 minutes after the dust has been dispersed. Explosion pressures are measured for a range of dust concentrations. The tests are carried out over three series to ensure a thorough investigation of the explosion properties. From the tests, the arithmetic mean of the maximum values (both maximum pressure and maximum rate of pressure rise) is obtained.

DON'T CALL US!

Sorry, our land line phone is not working and it has not worked for over a month. There seems to be some kind of problem between our carrier and Verizon who is responsible for repairing the line. My carrier keeps sending Verizon complaints and Verizon says they need to install a whole new fiber optic cable to our building and this is on a schedule with a tentative September 24th date. If anyone out there knows how to get these problems resolved more quickly, we'd welcome advice.

In the meantime, our e-mail address is unchanged at actsnyc@cs.com.

SWIMMING POOLS ARE CHEMICAL REACTORS

SOURCE: "The chemical reactions taking place in your swimming pool," *C&EN* Cover Story, Vol 94 Issue 31, pp. 28-32 Celle Henry Arnaud, August 1, 2016

Pool water has to be disinfected to make it safe for swimming. Untreated water can accumulate harmful *Escherichia coli* and *Salmonella* bacteria, protozoans such as *Cryptosporidium parvum* and *Giardia lamblia*, and more.

But the August 1, 2016 *Chemical & Engineering News* cover story explains how swimming pools function as big recirculating liquid reactors promoting chemical reactions that result in the production of unwanted complex substances called "disinfectant byproducts" (DBPs).

DISINFECTANTS. The most common compounds used to disinfect swimming pools are forms of chlorine. Other common disinfectants include bromine, ozone and ultraviolet radiation (UV). A combination of disinfectants is usually used since no single one is effective in killing all of these organisms.

For example, *Cryptosporidium*, a common source of illnesses in swimmers, is resistant to chlorine. Ultraviolet (UV) light doesn't kill it, but it renders the organism unable to reproduce. UV radiation can't be used directly in the pool because it would put swimmers at risk for skin cancer. Therefore, many pools have a hidden UV radiation source tucked away inside the pool's sand filtering, rechlorination and pH adjustment recirculating system.

Coupling UV light with chlorine can control almost any microbial pathogen that might be present in pools. But the UV radiation (and also ozone) can promote reactions between the disinfectants and the organic chemicals swimmers bring into pools to produce DBPs.

CHEMICALS ADDED BY SWIMMERS. The disinfectants react with organic matter, most of which was brought into the water by swimmers themselves. Examples include urine, sweat, body lotions, other personal care products, hair, skin cells and dirt.

The biggest contributor to DBPs, by far, is urine. Researchers estimate that swimming pools contain an average of 30 to 80 mL (1/3 of a cup) of urine for each person that has entered the water. Some of that is released accidentally or without the person being aware. But for competitive swimmers, peeing in the pool is an accepted part of the culture and is commonplace in competitive swimming. It's a frequent topic of conversation and joking. Competitive practices and meets can last for hours and swimmers chug water in brief intervals between activities. Swimmers rarely leave the pool during that time. The conclusion is obvious.

And today, urine also is likely to contain various medications and drugs, some of which will also react with pool chemicals to form strange new DBPs.

WHAT ARE THE DBPs? Everyone who goes near a pool is going to be exposed to these DBPs – in the water, in the pool or in the air around it. Every swimmer knows the “chlorine” odor around swimming pools. This odor is not chlorine. Freshly chlorinated pool water has very little odor. Instead, that odor is due to a chemical formed by chlorine reacting with the urea in urine. Urea is a nitrogen-laden molecule that reacts with chlorine to create trichloramine – a chemical associated with respiratory symptoms.

Trichloroamine and other DBPs commonly found in pool water are listed opposite this column. However, there are many, many more.

DO SWIMMERS ABSORB DBPs? Researchers recently studied* conditions that might increase the uptake of DBPs by swimmers’ bodies. They measured the trihalomethanes in swimmers’ exhaled breath and trichloroacetic acid in their urine as markers of DBP exposure. The team took samples before and after the swimmers exercised in a chlorinated pool for about 40 minutes.

They found that the levels of trihalomethanes and trichloroacetic acid—standard DBPs used as indicators for all disinfection by-products – both went up after swimming. And the more swimmers exercise and the harder they breathe, the more DBPs they are likely to take up.

WHAT SHOULD WE DO? The *C&EN* article quotes an expert who says swimmers could fix most of this by changing their culture and behavior by showering before getting into a pool and refraining from peeing in it. Well, those were the rules for the pool I used 57 years ago when I was in Japan. Maybe it is high time we just apply some common sense.

FOOTNOTE: *“Environmental and personal determinants of the uptake of disinfection by-products during swimming.” *Environmental Research*. 2016 Aug;149:206-15. [doi: 10.1016/j.envres. 2016.05.013. Epub 2016 May 20.]

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**DISINFECTANT BYPRODUCTS (DBs)
COMMON IN POOL WATER**

Monochloramine
Dichloramine
Trichloramine
Dichloromethylchloramine
Chloroform
Bromoform
Dichlorobromomethane
Dibromochloromethane
Cyanogen chloride
Cyanogen bromide
Dichloroacetonitrile

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SAFETY DATA SHEETS ON EVERYTHING? REALLY?

SOURCE: The many smart people on the American Chemical Society's safety list (DCHAS-L).

If you are part of a university or institution that holds a lot of art, science, shop and other materials, you should have professionals on site to deal with the safety and environmental issues. These people are usually called your Environmental Health & Safety (EH&S) department. They should be professionals with expertise in OSHA, EPA and other regulatory issues. This is not a job for faculty members – even ones from the chemistry department – unless they have had special training.

So it was with surprise that I saw many of these school EH&S people have a standard operating procedure requiring safety data sheets (SDSs) on absolutely everything. Like other people in chemistry, I thought that was a bit of overkill. After all, there is a big stash of plain old salt at many schools for deicing sidewalks. Surely they don't need SDSs on salt. Or sodium carbonate and bicarbonate of soda (baking soda), both of which might be used to fire a soda kiln in ceramics.

But I learned that EH&S needs to know all the chemicals on the campus in order to assess storage needs, segregation strategies, training needs, permit limits and emergency response exigencies. This need to know includes the salt, baking soda, and all chemicals and the amounts being held.

The reason is that they need to consider how far away they want the salt to be stored from the sulfuric acid (with which it can react), which chemicals they need to report to the wastewater treatment facility in the event of a flood or spill and how to alert first responders to exactly what is located, where it is, and the quantity they can expect to find during an emergency response. Plain old salt, for example, is a deadly runoff chemical if it makes it to waterways after a fire.

This SDS requirement should even include metals such as aluminum or magnesium in sculpture since they can seriously exacerbate a fire condition. And though lead metal shouldn't be in a school in any amount, if it is, EH&S needs to know where it is and how much is there.

The EH&S people also may want all new orders of chemicals centralized so they can keep tabs on what is brought into the facility. And this means brought in by anyone including students.

While my art and theater consultations include chemical incompatibility and fire safety within an art or theater department, EH&S is looking at the whole school and projecting events such as fires, earthquakes, explosions or spills. Get those SDSs on EVERYTHING to them when they ask.

No EH&S department at all? That's a problem. Schools need to budget for these people, train appropriate staff members or set up a plan with consultants. A full-fledged disaster plan that includes all chemical holdings is a must today.

PROPOSED EPA TESTS MISS METABOLITE TOXICITY

Endocrine Information and Metabolic Issues - Making Sure Chemical Toxicity Tests Don't Miss Metabolites,
Chemical & Engineering News, Britt E. Erickson . Volume 94 Issue 32 | pp. 16-19, 8-8-16, PP. 16-19
<http://cen.acs.org/articles/94/i32/Making-sure-chemical-toxicity-tests.html>

The new Chemical Safety Act gives the EPA 90 days to decide if a brand new chemical is toxic and requires testing. Since chronic animal tests for effects such as cancer or birth defects take two to five years to complete, this means that only short term-tests can be done in this time. This 90-day clause is one of the worst of many Catch 22 provisions in this Act.

THE 90-DAY WONDER. The EPA is limited by that deadline to short-term (two-week long animal tests), to cell tests done in petri dishes called “in vitro” tests and/or to chemical screening provided by computer-generated toxicity evaluations called “in silico” test methods. The in vitro cell tests only look at the toxicity of the chemical itself and the computer-generated in silico tests are only as good as the animal data entered into the programs – data that is woefully inadequate.

FAILURE OF SHORT-TERM TESTS. The pesticide called methoxychlor is an example of how the short-term tests fail. Methoxychlor is one of the insecticides thought to be a safe alternative to DDT. It was widely used for decades to fight household pests such as flies, mosquitoes and roaches and it was extensively applied to fruits and vegetables, grains and livestock. Acute animal tests showed methoxychlor to be very “safe.” But subsequent chronic tests using laboratory animals linked the substance to developmental and reproductive side effects – including miscarriages, reduced fertility, small litter size and cancer. Regulators took action. The European Union banned sales of methoxychlor in 2002 and the U.S. followed suit in 2003.

Without data from long-term animal studies, regulators had no way of knowing methoxychlor had chronic adverse effects. The chemical itself is relatively benign. Once methoxychlor enters the body, however, metabolic enzymes in the liver convert it into a substance that can cause cancer by disrupting the body's endocrine system. The sad fact is that the current short-term tests can't yet detect the effects of unrecognized metabolites.

WHERE ARE METABOLITES GENERATED? Ingested chemicals may generate metabolites from the time they enter the mouth and encounter enzymes and chemicals in saliva, to the time they encounter hoards of different bacteria in the colon. In between there are stomach acids, alkali substances in the small intestine, enzymes, micro and macrophages (cells that try to break down chemicals) and much more.

If at any juncture, the chemical is altered or broken down, the new chemicals will continue to wend their way through the body's elimination systems. And the metabolites even may be metabolized further into more chemicals. This chain of reactions is called a metabolic pathway. The metabolites may be eliminated in feces or urine or may be stored in the body. Chronic toxicity can only be determined when each chemical and its metabolites are known.

Toxicity tests are most often done by ingestion, but chemicals also can be inhaled or skin-absorbed. Inhaled chemicals can be acted on by mechanisms in the lung or can be absorbed into the blood to the liver or other organs to be metabolized. Skin absorption of chemicals is a poorly studied route. The chemicals migrate from cell to cell where they may be metabolized by cell mechanisms on their way to either the blood stream or the lymph system. Our May 2016 issue of *ACTS FACTS* discussed tattoo pigments that partially deposit in lymph nodes. Only time will tell what they will do there.

In summary: metabolites can be created in many, many locations in the body and by many mechanisms. The only way to really know what a chemical does when ingested is to have it ingested by a functioning animal. And it is the same with inhalations and skin absorption. The only tests by all three routes into the body are being done today by consumers without their awareness or consent.

PLAN TO OBTAIN TOXICITY INFORMATION IN 90 DAYS. The EPA has a program called ToxCast that aims to screen thousands of chemicals for biological activity using hundreds of the short-term assays. The data then are integrated with the pitifully small amount of existing animal data plus surmises from analogous (similar) chemical structure behavior in hopes that the combined data will adequately predict the toxicity of chemicals in the long-term.

The EPA also launched a challenge grant earlier this year to accelerate the attempt to find short-term tests that will at least look at the metabolites created in the liver. The ten semifinalists are now competing for five \$100,000 awards, to be announced in December. Many of the semifinalists for these grants are developing approaches that rely on primary human hepatocytes (or liver cells) to metabolize a chemical that is under study. Metabolites are then subjected to the in vitro cell assay.

Beware of the claims these scientists will make in order to secure their grants. In two cases, researchers are using new gene-editing tools to put genes that encode for metabolic enzymes into cells. Another semifinalist is planning to grow liver and brain tissue on a single three-dimensional culture plate in the hopes of assessing both neural toxicity and the liver metabolites. Others involve magnetic beads or gel microspheres, and so on.

All the methods ignore the fact that a few cells is not the same as a functioning liver or that metabolites can be created in many locations in the body other than the liver. In addition, researchers are piling new and unproven technologies together to solve a problem for which we already have a better and proven answer: long-term animal testing. And while we like to think we are very different from rats, we are even less like a dish of liver cells.

Remember, too, that it is your money that pays the EPA to try to fix this problem. We are paying them to find a method which, by definition, will be inferior to actual animal testing. The EPA is forced to find this short-term toxicity evaluation because the Chemical Safety Act has preserved industries “right” not to test chemicals fully before putting them in our products.

INDUSTRY’S “RIGHT” TO USE UNTESTED CHEMICALS IN OUR PRODUCTS. The old Toxic Substances Control Act passed in 1976 required the EPA to prove, usually in court to a high degree of certainty, that a new, untested chemical posed a “significant hazard” before the EPA could compel industry to test it. That Catch 22 clause resulted in almost no chemical testing for 40 years. Now industry seems to have assumed it has an established right to bring chemicals into the market without expensive testing. They feel the consumer’s tax money through the EPA should be used to save them the \$100,000 to \$200,000 per chemical it would cost to do the proper animal tests.

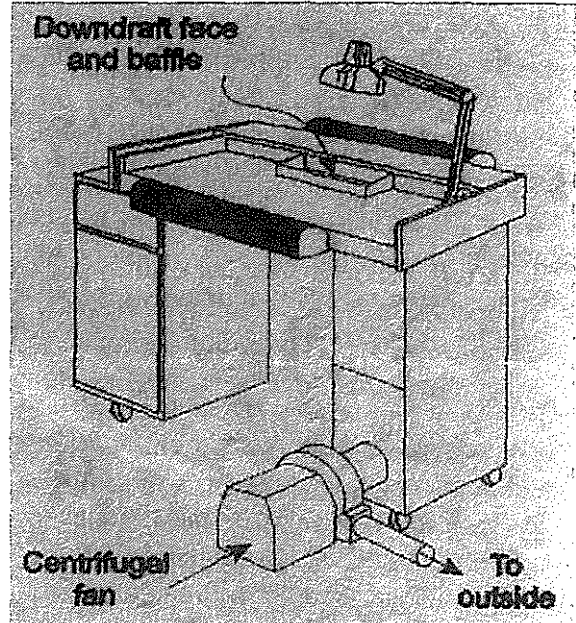
By teaming up with the animal activists, industry has influenced the framers of the new Chemical Safety Act to encourage alternatives to animal testing and to provide no correction for the 40 years during which only a handful of chronic tests were done on new chemicals. Worse, industry now will tell consumers with an even straighter face that the chemicals they are using have been “tested.” The public, sadly, is not educated enough to see that this short-term testing still does not provide a full picture of a chemical’s potential for long-term toxicity.

VENTED NAIL SALON TABLES NEEDED

SOURCES: Nail salon information: Want to really know what's in the air in the nail salon and what should be done? http://www.health.ny.gov/press/reports/docs/nail_saloon_chemical_report.pdf and Review of Chemicals Used in Nail Salons, NYC Department of Health, Center for Environmental Health, July 2016

New York is requiring nail salons to meet ventilation standards designed to protect workers from hazardous chemicals wafting from polish and other nail products. The chemicals for which control is needed include polish remover and nail hardener chemicals such as acetone, toluene, dibutyl phthalate, formaldehyde, benzene and methylene chloride, plus the particulates from filing and sanding both nails and the various plastics and adhesives used to cover or extend nails.

The New York State Department of Health reports that exposure to these substances has been linked to health problems. A new state regulation says that starting in October, all new nail salons in the state must meet the standard, which requires ventilation to exhaust vapors, fumes, dust and other air contaminants from nail salon workstations. Existing nail salons have until October 2021 to meet the standard.



COMMENT. ACTS hopes that competent industrial ventilation engineers will find this project of interest and design more sophisticated tables than the one in the picture. In addition to a possible business opportunity, this industry's predominantly minority and immigrant workers need good inexpensive systems that will protect their health.

* Drawing from a PowerPoint presentation by the Local Hazardous Waste Management Program (LHWMP) in King County, Washington, where there is a similar law.

ACTS FACTS sources: the *Federal Register (FR)*, the *Mortality and Morbidity Weekly Report (MMWR)*, *Environmental Health Perspectives (EHP)*, and many other publications. Call for further information on sources. Editor: Monona Rossol; Research: Tobi Zausner, Sharon Campbell, Robert Pearl, Brian Lee, Pamela Dale, Kathy Hulce, Pat F. Sheffield, Janet Sellery; Staff: Kathy Frost, John Fairlie, OES.

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Vol. 30, No. 10

WHEN WILL ALL ART MATERIALS HAVE SAFETY DATA SHEETS?

ACTS has been hearing from artists and schools claiming they can't get proper safety data sheets (SDSs) on some art materials. Now we are in receipt of a copy of a letter sent to the Arts & Creative Materials Institute (ACMI) asking when we can expect to see SDSs from the makers of the 60,000 products ACMI certifies. We are reprinting the whole letter and inviting readers to use these arguments to obtain SDS from their suppliers. We will report any reply ACMI makes to this letter.

Ms Debbie Monroe,
Certifications Program Director
Art & Creative Materials Institute
99 Derby Street, Suite 200
Hingham, MA 02043

September 22, 2016

Dear Ms. Munroe,

I am a professional hazard communicator, oftentimes representing manufacturers of art supplies as well as downstream users of those products. Frequently, your agency is cited as advising that Safety Data Sheets are not necessary for art supplies, despite their usage in workplaces such as art institutions or schools. Yet all of the employees in these schools who have regular contact with the art materials are covered under the hazard communication standard administered by the United States Occupational Health and Safety Administration, 29 CFR1910.1200. I cite below from your FAQ page:

Should I get a SDS for each product I use?

Not necessarily. Actually, the most accurate place to get information on the products you use is right on the label! The label will tell you the ingredients in the product that may cause any potential hazards; what the potential hazards are if the product is not used properly; and how to use the product properly. Safety Data Sheets (SDSs) do provide helpful information but are intended for potential workplace exposure to bulk chemicals in the manufacturing process, not to individual products that a consumer would use. SDSs are also quite complex and highly technical and may be difficult for someone who does not have a scientific background to understand, and may not be useful or appropriate for a consumer. That said, workplaces and schools in some states require SDSs under right-to-know laws.

The statement above says that "all the information required is available on the label provided by ACMI, under the CPSC standard and LHAMA" is not necessarily accurate. OSHA has been very clear in their stance issued in this Letter of Interpretation that:

*The CPSC exemption applies only to labels; employers must comply with all remaining provisions of the Hazard Communication Standard. (September 17, 1987. Application of the Hazard Communication Standard to art materials industry)**

This means that Safety Data Sheets, if these consumer products are being used in the workplace, are required if assessed under the classification criteria and found to be hazardous under 29 CFR 1910.1200.

Further, the statement above that “Safety Data Sheets are intended only for workplace exposure to bulk chemicals in the manufacturing process, not to individual products that a consumer would use” is not accurate. The only requirement for coverage under 29 CFR 1910.1200 is that the consumer product be used by a worker in amounts or ways other than they would be used by household consumers. Some of the workers so exposed include the following job categories.

- Art teachers may work with art materials for a 40 hour work week or even longer which is not a typical household consumer use pattern.
- Technicians who are hired to dispense, mix or prepare art materials for use by professional artists, students or teachers may work a 40 hour week with art materials.
- Custodians who clean up art rooms and studios every day will be exposed to amounts of art material waste, spills, rags, and discarded art projects in ways not expected to be seen in ordinary consumer use.
- Facilities managers and custodians may also be responsible for many storage areas where each art department holds a year or more supply of various art materials—vastly larger amounts than those held by household consumers. The art materials in these storage areas must be assessed for compatibility with other chemicals held here and spill procedures must be planned.

In addition, environmental safety department or facilities workers are required to develop the institutions or school’s OSHA and EPA required emergency plans. To do this they need SDSs on everything used and stored in their buildings to determine the potential hazards of these materials when involved in a fire, flood or other disaster.

Some art material manufacturers routinely advise their institutional customers that use of their product in any way other than a household consumer would use it is not recommended in order to justify the process of declining to provide the institutional customer the SDS for the material. In a separate letter of interpretation, OSHA makes it very clear this is a violation of 1910.1200:

*“... Should an institutional customer contact my client regarding the need for a MSDS for a particular product, where the customer intends to use the product in a manner dissimilar to that in which a homeowner would use the same product, my client intends to inform the customer that such use is not appropriate and to decline to provide the customer with a MSDS for the product.” Such action on the part of your client would constitute a violation of OSHA’s HCS which requires “all employers to provide information to their employees about the hazardous chemicals to which they are exposed by means of a hazard communication program, labels and other forms of warning, material safety data sheets, and information and training.” (See 1910.1200(b)(1))” (January 9, 1990, Provision of MSDSs for consumer products used in the workplace)**

It is clear from the above that manufacturers of art supply products sold to household consumers are subject to the CPSC standards. However, these same art materials are also subject to the OSHA workplace standards when they are sold to institutions or schools whose workers may include but are not limited to artists, instructors, custodians, facilities managers, and environmental safety personnel, all of whom are potentially exposed to said products with a frequency and duration of use or under circumstances not anticipated in household consumer situations.

Another letter of interpretation makes clear that although labeled in accordance with the CPSC and for consumer use, that does not render the product safe to use by workers, as it speaks to the frequency and duration of use that is atypical of consumer use and further the burden of proof of the usage meeting the exemption from the workplace standard, rests with the employer not discrete industry organizations. Please see the relevant text [OSHA interpretation letter] below:

It is important to note that the use of consumer products can be hazardous. The fact that a product is labeled in accordance with the provisions of the Consumer Product Safety Act and exempt from OSHA HCS labeling, does not render that product “safe” to use by workers. This is especially pertinent when, as a condition of employment, an employee must utilize a (hazardous) consumer product with a greater frequency and resultant greater duration of exposure than what is typical of a normal consumer or household use. In these situations, the employee has a “right to know” about the hazards of the chemicals he or she is expected to work with and therefore is exposed to. This is the obvious intent of the standard with regard to workplace consumer product exposure.

We have been advised by the Solicitor's Office that in cases involving employee workplace exposures to hazardous consumer products, the employer has the initial burden of proving that the product is used in its workplace in a manner contemplated by the exemption language of 1910.1200(b)(6)(vii). That is, the employer must demonstrate that the consumer product is used by employees in the same manner as normal consumer use and that the duration and frequency of exposure is not greater than that experienced by the general public. (August 15, 1991, Hazard Communication and Consumer Products)*

Can you advise how soon ACMI can provide current, GHS classified Safety Data Sheets for the more than 60,000 products that have been evaluated and certified as qualifying to bear the ACMI labels?

Sincerely,

Nicole Shoshenskiy (*note: in the original letter, these are active links to the OSHA letters.)

DID FOUR BIG CORPORATIONS HIDE URETHANE HAZARDS?

SOURCES: 90 billion whistleblower suit targets country's biggest chemical companies, EcoWatch, by Lorraine Chow, September 16, 2016, <http://www.ecowatch.com/whistleblower-lawsuit-chemical-companies-2005784783.html> and: “Isocyanates and the Foam Insulation Disaster,” Metropolitan Engineering Consulting and Forensics - Expert Engineers, September 18, 2016, <http://metroforensics.blogspot.com/2016/09/isocyanates-and-foam-insulation.html>

BASF, Bayer, Dow, and Huntsman International have been named in a False Claims Act lawsuit for intentionally concealing toxicity data on isocyanate chemicals from consumers and from the Environmental Protection Agency (EPA). The Defendants are companies that manufacture and sell the isocyanate chemicals that are used in polyurethane products such as paints, flexible foam, rigid foam, and adhesives. Lawyers brought this action to recover more than \$90 billion in damages and penalties under the False Claims Act for both themselves and for the federal government.

The lawsuit states that: “Between at least 1979 and 2003, each defendant obtained and developed discrete and separate items of scientific and medical information that TDI, MDI and PMDI [three common isocyanates] can cause and had caused permanent respiratory injury in humans when inhaled at levels below applicable inhalation exposure limits (low-level inhalation).” This means that the defendants knew that the OSHA limits were not protective and that workers could be permanently injured at these levels.

In addition, the lawsuit says that “Each defendant also knew during this time period that a very small quantity of TDI, MDI or PMDI on the skin—as little as one drop or 50 microliters—could cause respiratory injury in humans.”

WHAT ARE TDI, MDI & PMDI? TDI is toluene diisocyanate. MDI is methylene diphenyl diisocyanate and PMDI is polymeric MDI. It is that PMDI data that ACTS is most interested in.

PMDI chemicals are unregulated because manufacturers have changed regulated MDI into “new” chemicals by polymerization, that is, by sticking two or more MDI molecules together into a single molecule. It is ridiculous to assume that two toxic chemicals stuck together are now safe. However, our U.S. chemical laws are equally ridiculous. These “new” chemicals have no air quality limits or standards. Promotional material for products containing PMDI often imply that they are safe.

Other countries see this differently. Regulations in the United Kingdom and Australia only consider the total number of active isocyanate groups present on the molecule, not the molecule to which the isocyanate groups are attached. The U.S. should adopt this sensible strategy. It may be easier to institute such a regulation when the hidden data from these corporations show that PMDI is toxic.

HOW DOES THIS AFFECT ARTISTS? These are the same chemicals used in many paints, mold-making products, two-part spray foams and adhesives used by artists. Most of these products are only safe to use while wearing air-supplied respiratory protection, gloves and Tyvek suits. But artists may not think these precautions are necessary when they read the glowing promotional materials and when they see enthusiastic demonstrators on YouTube mixing and using these two-part chemical products with no protection whatsoever.

Many artists also may think the products are safe because they’ve used them without incident. The reason that many users do not have symptoms is because these chemicals cause damage through the immune system as allergies do. Usually many exposures can be tolerated before the onset of the effects. But once the skin or lung reaction occurs, it can be life-changing and even life-threatening. (I personally know of over 10 artists that have been sensitized to isocyanates.)

Artists also have the notion that if they were that toxic, the government would have done something. Our government needs proof beyond a shadow of doubt to act. This lawsuit claims that the manufacturers had this proof all along.

WHAT SHOULD ARTISTS DO? These products really are too dangerous to be used safely in typical art studios, shops, or schools. They should be replaced. Artists need to be taught to identify these products by looking at their SDSs and checking for chemicals that have “isocyanate” somewhere in their long names.

If artists really need to use them, they can contact ACTS at actsnyc@cs.com and ask for a data sheet on urethane products that has a full list of precautions for using them safely. However, this lawsuit implies that the OSHA air quality limits we recommended are not low enough.

ACTS FACTS sources: the *Federal Register (FR)*, the *Mortality and Morbidity Weekly Report (MMWR)*, *Environmental Health Perspectives (EHP)*, and many other publications. Call for further information on sources. Editor: Monona Rossol; Research: Tobi Zausner, Sharon Campbell, Robert Pearl, Brian Lee, Pamela Dale, Kathy Hulce, Pat F. Sheffield, Janet Sellery; Staff: Kathy Frost, John Fairlie, OES.

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TRAINING NEEDED FOR ART & SCIENCE TEACHERS

College and University science departments usually are regulated under federal or state version of the OSHA Laboratory Standard. The Chemical Hygiene Plan required by this standard involves development of standard operating procedures (SOPs) and risk assessments prior to using the various potentially toxic materials and equipment. While science teachers have always been legally responsible for their students, the written SOPs and risk assessments formalize this responsibility.

These documents cannot be written without a deep understanding of the hazards of the chemicals used – information which has often been lacking in undergraduate and graduate training. Now, the American Chemical Society (ACS) has published a booklet* outlining the subjects that should be included in students' training to equip them to participate in risk assessments as graduates. Included was a list of 50 terms and concepts with which students must be familiar.

- Acute toxicity
- Asphyxiant
- Autoignition temperature
- Biological hazards (infectious agents, blood-borne pathogens)
- Boiling liquid expanding vapor explosion
- Carcinogen
- Chemical Abstracts Service (CAS)
- Chronic toxicity
- Compressed gas
- Corrosive
- Cryogen
- Electrical hazard
- Environmental Protection Agency (EPA)
- Explosives
- Fetotoxicant
- Flammability
- Flash point
- Globally Harmonized System (GHS)
- Halogen
- Hazard
- High- and low-pressure systems
- Immediate danger to life or health (IDLH)
- Incompatible chemicals
- Lachrymator
- Lethal concentration, 50% (LC50)
- Lethal dose, 50% (LD50)
- Long-term exposure limit (LTEL)
- Mutagen
- National Fire Protection Association (NFPA)
- Organ toxicant
- Occupational Safety and Health Administration (OSHA)
- Occupational exposure limit (OEL)
- Permissible exposure limit (PEL)
- Peroxide
- Personal protective equipment (PPE)
- Pyrophoric
- Radioactive and radiological hazards
- RAMP system
- Reactive/unstable chemicals
- Risk
- Runaway reaction
- Safety Data Sheet (SDS)
- Sensitizers (allergens)
- Short-term exposure limit (STEL)
- Sublimation
- Teratogen
- Threshold limit value (TLV)
- Time-weighted average (TWA)
- Toxicity
- Ultraviolet radiation

* Guidelines for Chemical Laboratory Safety in Academic Institutions, *American Chemical Society*, 1155 Sixteenth Street, NW, Washington, DC 20036, © 2016

In addition, the booklet has 104 questions that undergraduate students should be able to answer on toxicology, basic lab safety, the regulatory agencies, labels and safety data sheets, lab inspections, risk assessments, personal protective equipment, ventilation sharps, inventory, storage, security, waste disposal, spills, emergency response, first aid, and fires.

The booklet includes further training for graduate students in order to equip them as professionals and/or teacher to assess the risks of their projects. In other words, ACS realizes that significant time and training of science students must be devoted to safety render them capable of writing SOPs and writing risk assessments when they graduate.

WHY SHOULD ARTISTS CARE? Many colleges and universities have also placed their art departments under the OSHA Laboratory Standard because art teachers use many of the same chemicals such as acids and electrolytes for etching, solvents, metals, minerals, pigments, dyes, and more. However, this means that many art teachers are now being asked to write SOPs and do risk assessments for their many projects.

I would ask administrators in these schools to look at the list of terms and subjects with which chemists must be familiar to assess chemical risks and to consider how many of these terms were covered in the undergraduate and graduate training of their art faculty. Clearly, most art teachers have not even heard of many of them. Worse, art teachers also need additional terminology applicable to some of the chemicals either used, or which are emitted, during processes such as laser cutting, 3D printing, welding, ceramics, foundry, and real glassblowing instead of the small scale lamp work done to make chemical laboratory glassware.

Writing SOPs for these art processes requires familiarity with industrial standards for some of these processes as well as knowing the potential hazards of the many hundreds of chemicals used.

RECOMMENDATIONS. It is absurd to think that a few training sessions will render an art teacher with no science background capable of writing a competent risk assessment. Instead, schools should consider the following actions:

1. Do not demand that art teachers try to cobble up a risk assessment and sign it. For those schools whose internal rules require a faculty signature, have Environmental Health & Safety (EH&S) departments work with the faculty member to write risk assessments. To protect their liability, teachers should include a disclaimer in the risk assessment stating they are relying on the expertise of EH&S in the development of this document.
2. Begin a regular training program for art teachers developed by EH&S to cover the regulatory, safety, and toxicology information needed to do SOPs and risk assessments one subject at a time. Hold sessions at least every month.
3. As faculty members are trained, have them add this technical safety information to their curriculum and begin training students to eventually be capable of writing SOPs and risk assessments in their professional work.
4. Negotiate with art program certifiers such as the National Association of Schools of Art and Design (NASAD) to require fewer completed art projects to allow time for more in depth preparation for doing these projects safely.

ACTS, hereby, appeals to NASAD to consider this action.

GET THE SMELL OUTTA HERE!

SOURCE: Steinemann, A, *Air Qual Atmos Health* (2016). doi:10.1007/s11869-016-0442-z

A study from an Australian University researcher published in *Atmosphere, Air Quality and Health* found that over one-third (34.7%) of Americans report health problems—from asthma attacks to migraine headaches—when exposed to common fragranced consumer products such as air fresheners, cleaning supplies, laundry products, scented candles, cologne, and personal care products.

The research was conducted by Professor Anne Steinemann, from the University of Melbourne School of Engineering, a renowned expert on environmental pollutants. Professor Steinemann studied a representative population in the United States, using a random sample of 1,136 adults from a large web-based panel held by Survey Sampling International (SSI).

Professor Steinemann is especially concerned with involuntary exposure to fragranced products, or what she calls “second-hand scents.” She found over 20% of the population suffer health problems around air fresheners or deodorizers, and over 17% can’t use public restrooms that have air fresheners. In addition, over 14% of the population wouldn’t wash their hands with soap if it was fragranced.

Over 12% of the population experience health problems from the scent of laundry products vented outdoors, over 19% from being in a room cleaned with scented products, and over 23% from being near someone wearing a fragranced product.

Over 22% of the Americans surveyed can’t go somewhere because exposure to a fragranced product would make them sick. For these individuals, the effects are potentially disabling, as defined by the Americans with Disabilities Act. There have been a growing number of ADA lawsuits for involuntary exposure to fragranced products.

Professor Steinemann’s abstract says that “[w]hile prior research found that common fragranced products, even those called green and organic, emitted hazardous air pollutants, more than two-thirds of the population were not aware of this, and over 60% would not continue to use a fragranced product if they knew it emitted such pollutants.” However fragranced products sold in the US (and other countries) are not required to list all ingredients on their labels or safety data sheets. Nearly two-thirds of the population surveyed were not aware of this lack of disclosure, and would not continue to use a fragranced product if they knew it emitted hazardous air pollutants.

Professor Steinemann has also completed a survey of the Australian population, with results expected to be published soon. “The numbers are similarly striking,” she said.

COMMENT. It seems strange that businesses and product formulators would continue to use fragranced products that clearly are losing them customers. The paper’s abstract says the study found that “[o]ver 50% of the population would prefer that workplaces, health care facilities and professionals, hotels, and airplanes were fragrance-free. The study also found that more than 20% of survey respondents said they leave businesses as quickly as possible if they smell air fresheners or fragranced products.”

As one of those people who flee fragranced venues, I was happy to learn I’m not alone.

SCHOOL BOARD FINED: TEACHER DIDN'T MODEL SAFE BEHAVIOR

SOURCES: The Times Colonist. The Canadian Press, October 25, 2016 <http://www.timescolonist.com/quebec-school-board-must-pay-boy-who-had-chemical-substance-poured-over-his-head-1.2373220>;
<http://montrealgazette.com/news/local-news/laval-school-board-ordered-to-pay-15000-for-students-burns>;
<http://www.cbc.ca/news/canada/montreal/laval-school-board-must-pay-15k-to-boy-who-was-burned-in-chemistry-class-1.3821581>

A 15 year-old boy, in a science class in a Montreal-area school, was seriously injured when a friend sprinkled some sodium hydroxide in his hair as a joke. Solid dry sodium hydroxide is slow to react and the boy was unaware that he needed to take immediate action. After a while, he felt a burning sensation and put water and snowflakes on his head in an attempt to stop the pain.

Adding water to solid sodium hydroxide generates a lot of heat and dramatically increases the chemical's ability to react with organic substances like skin. The boy was treated in the hospital every day for about six weeks and had to undergo plastic surgery. He will be scarred for life and hair will not grow back in the burned area. He also suffered psychological trauma.

The teacher claimed everyone knows that sodium hydroxide (lye) is in drain cleaner and dangerous. But the teenager who put the powder on his friend's head testified he did not know his gesture was dangerous. He said he saw their teacher touch the substance and tell the class it felt funny.

The victim's parents sued the school where the incident occurred and the Commission scolaire de Laval school board. Judge Richard Landry of the small claims division of Quebec Court ruled the boy's professor did not adequately warn students and that the teacher trivialized the properties of the chemical with his comment and his actions.

The judge evaluated the extent of the damages inflicted at \$20,000, but lowered them to \$15,000, the maximum that can be paid out in small claims court.

COMMENT: A risk assessment and SOP for experiments using sodium hydroxide would probably have been a good thing for this school district.

ACTS FACTS sources: the *Federal Register (FR)*, the *Mortality and Morbidity Weekly Report (MMWR)*, *Environmental Health Perspectives (EHP)*, and many other publications. Call for further information on sources. Editor: Monona Rossol; Research: Tobi Zausner, Sharon Campbell, Robert Pearl, Brian Lee, Pamela Dale, Kathy Hulce, Pat F. Sheffield, Janet Sellery; Staff: Kathy Frost, John Fairlie, OES.

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ACTS FACTS

THE MONTHLY NEWSLETTER FROM

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EPA CHOOSES TEN CHEMICALS TO INVESTIGATE

SOURCE: <https://www.epa.gov/newsreleases/epa-names-first-chemicals-review-under-new-tsca-legislation>

The Environmental Protection Agency (EPA) has announced the ten priority chemicals it has selected to investigate for potential risks to human health, or to the environment, under the Toxic Substances Control Act (TSCA), as amended by the Frank R. Lautenberg Chemical Safety for the 21st Century Act. Nine of these chemicals are well-known to the public and activists including:

NINE OF THE TEN CHEMICALS SELECTED BY EPA FOR STUDY

CHEMICAL	USES (consumer and art)	HAZARD
1,4-Dioxane	In many consumer products and a contaminant in many art pigments	Possible carcinogen
1-bromopropane	In many consumer products	Possible carcinogen
Asbestos	In old and new consumer products and in some ceramic talcs	Known carcinogen, other lung diseases
Carbon tetrachloride	Environmental contaminant, old fire extinguishers and dry cleaners	Probable carcinogen
Cyclic aliphatic bromide cluster	Fire retardant in textiles and foam	Probable carcinogen
Methylene chloride	Paint strippers and some consumer products, air and water pollutant	Probable carcinogen
N-methylpyrrolidone	In strippers, lacquer thinners, and other consumer products.	Possible reproductive hazard
Trichloroethylene (TCE)	In many consumer and art products	Probable carcinogen
Tetrachloroethylene (perc).	Dry cleaning and consumer products	Probable carcinogen

THE TENTH CHEMICAL—PIGMENT VIOLET 29 (PV 29). This is not a major art pigment, but it is used in some artist's paints, inks and textile dyes. Artists also can buy it in powdered form from many sources and under its many synonyms. It can be called Colour Index (C.I.) 71129, Chemical Abstract Service (CAS) Number 81-33-4, perylene violet, perylenebis(dicarbimide) or other chemical names like Anthra[2,1,9-def:6,5,10-d'e'f']diisoquinoline-1,3,8,10(2H,9H)-tetrone. It is also used as a vat dye called PV-Fast Bordeaux B.

WHY STUDY PV 29? There is almost no information about either the acute or chronic toxicity of PV 29. But the EPA is not planning to study its toxicity to humans. They are only concerned about whether or not it is harmful to aquatic environments. And this fact is potentially very important to artists for two reasons:

1. Until now, artists and schools only needed to collect and test paint and ink waste if it contains pigments with regulated metals in them. The metal-free organic art pigments were unregulated. PV 29 contains no metals. It is composed of 24 carbon, 10 hydrogen, four oxygen and two nitrogen atoms. If PV 29 or any of the chemicals it degrades to in the environment are aquatic hazards, art schools and businesses would have to be certain that PV 29 was not in any of their art materials or they would have to test their waste for it.
2. If PV 29 does indeed adversely affect aquatic environments, there are many other dyes and pigments with similar organic structures that may cause similar problems. It could mean that all paint and ink wastes would need to be collected. That could be a large volume of waste. For example, collecting all the waste water from power washing silk screens could be costly.

ACTS will be watching for the data that EPA develops on Colour Index PV 29.

GOLF CLUBS ACCUSED OF STARTING FIRES?

<http://patch.com/california/missionviejo/titanium-alloy-clubs-can-cause-golfers-scream-fire-instead-fore> - By Ashley Ludwig (Patch Staff) - *The Mission Viejo Patch*, September 7, 2016 and

<http://www.golf.com/tour-and-news/study-finds-sparks-titanium-coated-golf-clubs-ignites-fires>
Study finds sparks from titanium-coated golf clubs ignites fires.

Fire investigators were laughed at when they first floated the theory that golf clubs could start fires. But the witness statements at all these fires from the golfers themselves backed the firefighters.

THE EVIDENCE. Golfer Steve Parsons, trying to get out of the rough at the Arroyo Trabuco Golf Course in Mission Viejo, California, in September of 2016 said, "I just punched a 3-iron to get the ball back in play." The next thing he knew, he was standing in "a ring of fire." On that day, the wind changed direction, and the fire burned itself out. The golfers escaped with no more than singed legs.

An earlier fire in 2013 at the club burned areas very close to homes and was described by the golfers in similar words. And at another area golf course in Shady Canyon in 2010, a similarly described fire burned 25 acres. Clearly, some research was needed.

THE PROOF. On September 7, 2016, Orange County Fire Authority Capt. Steve Concialdi said that the results of a study done at the University of California, Irvine, has confirmed that titanium alloy clubs were the cause of at least two blazes on area golf courses. "The common denominator [in] each fire was that the golfer used a titanium club, and hit the ball just out of bounds next to dry vegetation where the ground was extremely rocky," he said.

In the lab, scientists painstakingly re-created conditions like those on the days of the fires. Using high-speed cameras and electron microscopes, they found that clubs containing titanium hit on a rock can produce sparks of up to 3,000 degrees that will burn for more than a second.

James Earthman, a chemical engineering and materials science professor and an author of the study said that the full second of burning "gives the spark plenty of time" to ignite nearby foliage and that "[t]itanium reacts violently with both oxygen and nitrogen in the air."

Most golf clubs have ordinary steel heads which do not react this way. But many manufacturers also make clubs with a titanium alloy component in the head. Such alloys are 40 percent lighter, which can make the club easier to swing, the researchers said.

FIRE PREVENTION. Concialdi said the Fire Authority is giving golfers using titanium clubs permission to break the rules and “improve their lie,” that is, to move their ball away from rocks and dry vegetation. “If they need to take a penalty, take a penalty,” he said.

COMMENT. Perhaps every Eagle Scout and camper should have a chunk of titanium alloy steel in their back packs. And maybe wilderness survival tests should not employ the single match trial, but allow applicants to whack at rocks with their titanium miracle metal. And all those bulky flint and steel strikers in some current back packs can be replaced with a piece of an old golf club recycled by a clever entrepreneur.

TWO BAD REPORTS OF CHEMICAL EXPOSURES

FIRST INCIDENT. The November 17, 2016, *Wisconsin State Journal* covered a fire department response to a strong chemical odor on East Side of Madison, Wisconsin. “Someone smelled a vapor comparable to paint thinner coming from a storm drain,” said Fire Department spokeswoman Cynthia Schuster. “Area business owners said the smell was also permeating into their basements.”

A white haze that was unidentifiable by monitoring equipment was seen coming out of a storm sewer drain, so firefighters called in the hazardous incident team. “Air samples identified the chemical as styrene,” Schuster said. “The level of styrene in the air, including in the basements, was not harmful.” The styrene was traced to a company that was lining sewers in the neighborhood; the chemical is a component of the work.

COMMENT. Madison citizens are entitled to more information. Styrene can cause serious nervous system damage and is listed by several agencies as a carcinogen. Information about the level found in the air should have been provided. And a “white haze” coming out of the drain needed more investigation. Styrene is a clear liquid with an invisible vapor. Something else was occurring.

SECOND INCIDENT. CBS (New York) reported on November 17, 2016, the Office of Emergency Management announce that 27 people were decontaminated at the scene of an accidental chemical exposure at the Northeaster Academy school on 215th Street. The report said that several students were exposed to copper sulfate.

COMMENT. This is not a very toxic chemical. Solutions of copper sulfate used to etch zinc plates in printmaking release no significant odor and even putting ones hands in the bath, while not encouraged, can be easily rinsed off with no harm. The solid copper sulfate is an aqua blue color that would make it easy to see if it was on the skin or clothing.

These two incidents are typical of those we review every week. The styrene was an example of insufficient response to a potentially serious exposure. The copper sulfate exposure was an over-reaction to a chemical of very low toxicity by skin contact. Clearly, reporters need to be trained to ask better questions about chemical exposures, or at least to check their facts with experts, instead of reporting only what the spokespeople for agencies say.

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