

stances that arts institutions could meet in most cases. Several California museums with conservation departments have filed commentaries calling attention to the professional qualifications and training of conservation staff and the excellent safety records of conservation x-radiography in arts institutions. They have urged consideration of inclusion of a similar exemption in the new California regulations.

It should be noted that OSHA has recently conducted a series of stakeholder meetings on occupational exposures to ionizing radiation. The agendas included consideration of the uses of ionizing radiation, controls utilized to minimize exposures, available exposure data, and training. Currently, OSHA allows agreement states to set their own regulations for the use of ionizing radiation in industrial processes as long as these regulations require adherence to certain federal standards.

Thanks to Scott Fife, senior safety officer, The J. Paul Getty Trust, for his invaluable help in evaluating the proposed regulations and writing commentary.

—Terry Schaeffer

Los Angeles County Museum of Art

## Some Chemical Things Considered: Acetone

Conservators have typically used acetone as a solvent in a variety of treatment applications, such as surface cleaning. It is also widely used as a thinner for commonly used adhesives, consolidants, and coatings. Because acetone is one of the most widely used chemicals in conservation, it is important to not take the health and safety considerations for granted.

### Characteristics

*Chemical formula:* C<sub>3</sub>H<sub>6</sub>O

*CAS#:* 67-64-1

*Molecular weight:* 58.08

*Synonyms:* Dimethyl ketone, 2-propanone, beta-ketopropane

*Selected trade names:* Acetone

Acetone is a clear, colorless liquid with a pungent, fruity odor. It is highly

flammable and potentially explosive. Acetone is a chemical that is found naturally in the environment and is normally found in the body in low levels from the breakdown of fat. It appears normally in the blood, urine, and breath.<sup>1</sup> It is derived by fermentation as a by-product of butyl alcohol manufacture, or by chemical synthesis from isopropanol (isopropanol dehydrogenation) or from cumene (cumene peroxidation).<sup>2,3</sup>

Industrially acetone is used as a solvent for fats, oils, waxes, resins, rubber, plastics, lacquers, varnishes, and rubber cements. It is also used as a component in methacrylates and in some paint, varnish, and nail polish removers.<sup>3</sup> Conservators have typically used acetone as a solvent and thinner in a variety of treatment applications.

### Hazards

Acetone is listed by the EPA as a Group D chemical, which means that it is considered not classifiable as a human carcinogen. However, a list of symptoms of varying degrees of severity that can result from exposure to acetone is listed below, as well as the targeted organs and systems.

*Exposure routes:* inhalation, dermal absorption, ingestion

*Target organs and systems:* eyes, skin, respiratory system, central nervous system, liver, kidneys

*Acute Symptoms:*<sup>1,5</sup>

*(inhalation)* cough, sore throat, dizziness, drowsiness, headache, unconsciousness. *At high concentrations:* CNS depression, cardio-respiratory failure, death

*(eyes/skin)* irritated eyes, redness, blurred vision, possible corneal damage, dry skin, possible dermatitis

*(ingestion)* nausea, vomiting

*Exposure Limits:*

*LD50(rats):* 10.7 ml/kg (ingestion)<sup>3</sup>

*LD50(rats):* 5800–7138 mg/kg (ingestion)<sup>1</sup>

*NIOSH REL:* TWA 250 ppm (590 mg/m<sup>3</sup>);<sup>5,6</sup>

*OSHA PEL:* TWA 1000 ppm (2400mg/m<sup>3</sup>) (inhalation)<sup>5,6</sup>

*ACGIH TLV:* TWA 500 ppm (inhalation); STEL 750 ppm (inhalation)<sup>6</sup>

*IDLH (immediately dangerous to life and health) concentration:* 2500 ppm [10% LEL]<sup>5</sup>

*Odor Threshold Values:*<sup>2</sup>

*Water:* 20 ppm (w/v)

*Air (absolute):* 13–20 ppm (v/v)

*100% recognition:* 100–140 ppm

*Personal Protection:*

*For skin:* prevent exposure to skin by wearing protective gloves and protective clothing. Neoprene, Latex, and Butyl gloves are recommended by the Ansell glove guide for immersion and Nitrile, Neoprene, PVC, Natural, and Polyethylene gloves for splash protection.<sup>7</sup>

*For eyes:* prevent exposure by wearing protective eyewear such as goggles

*For ingestion:* do not drink, eat, or smoke while working

For potential exposures up to IDLH levels of 500 ppm, NIOSH recommends wearing one of the following:

- A chemical cartridge respirator with organic vapor cartridges
- A powered, air purifying respirator with organic vapor cartridges
- A supplied air respirator
- A self-contained breathing apparatus with a full face piece.<sup>5</sup>

—Marilen Pool, objects conservator  
AIC Health & Safety Committee

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## Titanium Dioxide Listed as a Carcinogen

*IARC: Titanium dioxide (IARC Group 2B) Summary of reported data, Feb 2006, updated, March 10, 2006 & MSDSs of many art and industrial materials.*

It's been over a year since the International Agency for Research on Cancer (IARC) updated their standards to include titanium dioxide as a 2B carcinogen, that is, possibly carcinogenic to humans. This IARC determination supports the opinion of the National Institute for Occupational Safety and Health (NIOSH). NIOSH listed TiO<sub>2</sub> as a carcinogen in 1988, but until recently, no other major agency or governmental organization had listed it.

The change in IARC's listing came about after the agency reevaluated all of the previous studies, concentrating this time on particle size. Essentially, the differences in the size of the TiO<sub>2</sub> particles used in the experiments explained why some studies showed no lung tumors in animals and others did. There is now enough animal data to support TiO<sub>2</sub> being a carcinogen when inhaled. And by the same causal mechanisms, IARC says it is a possible human carcinogen.

The good news is that IARC found no evidence that nanoparticle size TiO<sub>2</sub> will absorb through the skin. Instead, studies of sunscreens containing ultra fine TiO<sub>2</sub> on healthy skin of human volunteers revealed that the particles only penetrate into the outermost layers of the skin (stratum corneum). This suggests that healthy skin is an effective barrier to titanium dioxide. There are no studies on penetration of TiO<sub>2</sub> on damaged or diseased skin.

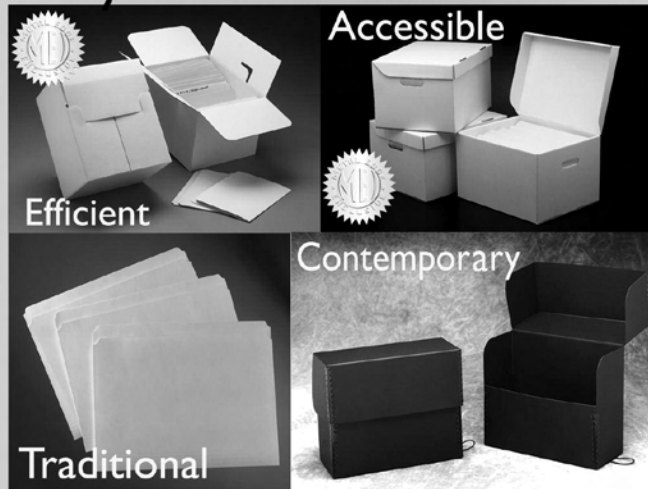
TiO<sub>2</sub> is a white pigment found in consumer and art paints, inks, cosmetics, and more. The TiO<sub>2</sub> in these products is not hazardous if it does not become airborne. However, artists should be concerned because the titanium white gessoes are likely to be sanded to create a dust. In addition, conservators who use titanium dioxide as a powdered pigment additive should take care when dispensing and mixing this substance. Airbrushing or spraying of titanium-containing materials would also be another cause for concern.

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