

AIC NEWS

September 1999

Vol. 24, No. 5

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Conserving Your Health and Safety: Using Consistent Choices to Minimize Exposure

Safety is the degree to which risks are judged acceptable.¹

—William W. Lowrance

We know that a single, catastrophic event can cause devastating effects—a car accident, a single exposure to an acutely hazardous chemical. Often this single, catastrophic event is the culmination of our small, daily choices, the ramifications of which we have not stopped to consider fully. This article addresses these choices. How do we make good choices? How does our perception of risk affect our choices? Can we take positive steps to encourage others to make better choices? What information is available to us to help us make better choices?

Three things cause accidents: unsafe conditions, unsafe actions, and personal attitude. Michaud refers to apathy, complacency, distraction, and deviation as the “four horsemen of safety.”² Without proper appreciation of the value of our safety and health, our commitment to safe practice is tenuous. Thus, our first small choice is the most profound: the choice to care about our health and safety—every time, all the time. To say to our colleagues, our families, and ourselves: No task is so urgent or project so important that we can't take the time to do it safely.

Risk and Its Perception

One of the points that is deeply ingrained in us—all of us—is a tremendous distinction between risk undergone voluntarily, and risk undergone involuntarily.³

—Sir Hermann Bondi

Although legal instruments exist regarding health and safety issues, it can be argued that the commitment to make health and safety the number one priority in one's activities is a lifestyle choice, a personal philosophy. When we make health and safety choices, we are actually analyzing the risk associated with the choice we are

about to make. The analysis of risk requires the evaluation of three elements: 1) a hazard—a thing or action that can cause harm; 2) an event(s) that creates the possibility of harm; and 3) an estimate of the likelihood harm will occur.

Professional risk analysts use statistical evidence to estimate risk. However, we, as individuals, often make our choices based not on *actual* risk, but rather *perceived* risk.

One of the initial steps in making better safety choices is observing the ways in which we perceive risk. Risk perception and the way you estimate the likelihood of harm will directly affect your daily actions. Human beings tend to perceive risk in very specific ways and weigh risk factors by some organizing principles (see Table 1). Risk is perceived as greatest when the outcome is severe, irreversible, involuntary, uncontrollable, and manifestation of the effect is delayed.

When risk perception is associated with daily, routine tasks, we often become inured to risks to which we are continuously exposed, are familiar with, and/or regard as necessary. For example, many technically trained persons, who are familiar with chemical hazards do not wear protective eyewear or other personal protective equipment (PPE) when handling hazardous chemicals (e.g., ammoniated cleaners, caustic drain cleaners) in the home. The familiarity of the environment (the home) and the perceived low probability of a traumatic event tend to favor behavior that this same individual would consider inappropriate and indefensible in the workplace. In fact, data from the National Safety Council for 1997 show that the number of disabling injuries in the home is more than five times that in the workplace.⁵

It is a worthwhile endeavor to take some time to think about how you, colleagues, and family members perceive and evaluate risk. How individuals perceive and estimate risk has direct effects on their ability to recognize, man-

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age, and communicate risk information to others. Talking about conditions, exchanging hazard information, and encouraging safe behaviors are all ways to evaluate and make better safety choices. For some individuals, even simple awareness that a hazardous situation exists is an encouraging first step.

Prudent Practice and Consistent Behavior

*"Several hundred new substances come into commercial use every year and we have no evolutionary experience or traditional knowledge of how to deal with them."*⁶

—Andre E. M. McLean

As a safety consultant with the Laboratory Safety Workshop and as a private consultant, I often hear the statement: "Safety is just common sense." This statement always brings an apt proverb to mind: "Common sense is not so common." With the number and kinds of chemical compounds (more than 68,000 chemicals are in U.S. workplaces, according to EPA estimates) to which we can be potentially exposed, habituating ourselves to safe behaviors in regard to their handling, use, and disposal requires more than common sense. Developing and maintaining a consistent pattern of safe behaviors requires a personal commitment to four things:

- Self-accountability for behavior
- Proper education and training
- Consistent application of education and training
- Use of fail-safe devices where appropriate

Developing safe behaviors is a process of continuing education and constant re-evaluation of our working environment and professional practice. Often, one of the best places to start thinking about safe practice is by reviewing the basics and recommitting ourselves to simple methods of minimizing exposure, thus mitigating potential health effects.

In the laboratory, three types of controls are used to minimize exposures: en-

TABLE 1: RISK PERCEPTION⁴

Risk Dimension	Perceived Lower Risk	Perceived Higher Risk
Origin	Natural	Manmade
Severity of Outcome	Ordinary (small numbers of people injured)	Catastrophic (large numbers of people injured)
Probability of Occurrence	Low	High
Exposure	Continuous	Occasional
Familiarity of Risk	Familiar	Unfamiliar
Manifestation of Effect	Immediate	Delayed
Reversibility of Effect	Reversible	Irreversible
Necessity	Necessary	Luxury
Benefit	Clear	Unclear
Volition	Voluntary	Involuntary
Controllability	Controllable	Uncontrollable

gineering controls, administrative controls, and PPE. These three control methods are listed in order of decreasing preference; that is, it is better practice to control personnel exposure through engineering and administrative controls than by the use of personal protective equipment. PPE is used when all other forms of control have been instituted and concern still exists about personnel exposure. Hence, PPE is the last line of defense, not the first.

Whether we work at an institution, on a job site, or in our home, it is imperative we remember and appreciate the four common exposure routes for chemical hazards: inhalation, skin absorption, ingestion, and injection. For those of us outside the health care or biotech industries, injection is an unlikely chemical exposure route. In a similar way, if we consistently adhere to good laboratory practice by not eating, drinking, or applying cosmetics in work areas where chemicals are in use, and we keep hazardous materials out of the reach of children, ingestion is also a non-routine exposure route. For many conservators, the two most common exposure routes are inhalation and skin absorption. Common control methods often seek to minimize these two exposure routes (see table 2).

Planning is key to the effective use of all levels of exposure control. Planning any work involving a specific chemical entails understanding its proper storage, handling, and use. Any potential health effects, their symptomology, and treat-

ment should also be studied. A material safety data sheet (MSDS) is a place to start, but other sources of information should also be consulted (see Table 3). Planning should also include the actual placement of materials in your work area and the sequence of operations to be performed. Thus safe action becomes an integral part of how the task is performed. Prior to working with a new chemical or when reviewing our current practice, we need to ask ourselves four basic questions:

- What are the hazards?
- What is the worst thing that could happen?
- What do I need to do to be prepared?
- What are the prudent practices, facilities, and personal protective equipment needed to minimize my risk?

When evaluating use of a chemical, we need to make sure that we have access to current information, and that we know how to use it. For example, if a compound we are about to use has a TLV of 10 PPM, what inference can we draw about its toxicity? If it is a volatile compound, how will we plan our work to minimize the amount of vapor to which we are exposed? What engineering controls will we use to remove vapors as they are evolved? Is it also flammable? How will we minimize the risk of fire? What emergency equipment should we have available?

Simple individual choices, made on a

consistent basis, can minimize our exposures. These include the following practices:

- Plan your work prior to starting
- Read labels and MSDSs
- Buy, store, and work with smaller quantities
- Substitute less toxic alternatives
- Work with adequate ventilation
- Keep containers, including waste containers, tightly closed when not in use
- Label all secondary containers correctly
- Use good housekeeping practices during and after your procedure
- Do not eat, drink, smoke, or apply cosmetics when working with chemicals
- Wash thoroughly after working with chemicals

Conserving Your Health and Safety

"The cost of a thing is the amount of what I will call life which is required to be exchanged for it."

—Henry David Thoreau

When we make a health and safety decision that impacts both ourselves and others, we are placing a value on "that amount of life" we are willing to put at risk. Unsafe behaviors are caused by misplaced priorities. The attitudes and beliefs that place time, comfort, and convenience ahead of safe actions can result in tragic consequences. Taking the time to use your safety training—all the time, every time—will help preserve the health and safety of yourself, your colleagues, your family, and your community. The single-most important safety choice that you can make today is to make a commitment to making safety an integral and important part of your work and life.

—Patricia Hamm, The EdY Group,
Stoughton, MA 02072; ()

Notes

1. Lowrance, W. W. 1976. *Of acceptable risk: Science and the determination of safety*. Los Altos, Calif.: William Kaufmann, Inc.

2. Michaud, P. A. 1995. *Accident prevention and OSHA compliance*. Boca Raton, Fla: CRC Press.

3. Bondi, H. 1985. Risk in perspective. In *Risk: Man-made hazards to man*, ed. M. G. Cooper. New York, N.Y.: Oxford University Press.

4. American Chemical Society. 1996. *Chemical risk: A primer*. Washington, D.C.: American Chemical Society.

5. National Safety Council. 1998. *Accident facts, 1998 edition*. Itasca, Ill.: National Safety Council. See also <http://www.nsc.org>

6. McLean, A.E.M. 1985. Hazards in the control of industrial chemicals. In *Risk: Man-made hazards to man*, ed. M. G. Cooper. New York, N.Y.: Oxford University Press.

TABLE 2: CONTROL METHODS TO MINIMIZE EXPOSURES

<p>Engineering Controls:</p> <ul style="list-style-type: none"> • Prevention • Substitution • Process Automation • Enclosure • Process Elimination • Isolation • Process Change • Ventilation
<p>Administrative Controls:</p> <ul style="list-style-type: none"> • Substitution • Job Placement • Worker Rotation • Job Timing • Maintenance • Housekeeping
<p>Personal Protective Equipment:</p> <ul style="list-style-type: none"> • Air-supplied and Air Purifying Respirators • Hearing Protectors • Eye, Face, and Foot Protection • Protective Clothing • Barrier Creams • Personal Hygiene

TABLE 3: SOME INFORMATION RESOURCES FOR CHEMICALS AND THEIR EFFECTS

Resource	Contact Information
MSDS	Generic MSDSs are available online for general information. See http://www.epa.gov/enviro/hm/Vemci/chemref/index.html However, insist that the most current manufacturer-produced MSDS be shipped with chemicals you are using. Emergency procedures and contact information vary from manufacturer to manufacturer.
National Institute for Occupational Safety and Health (NIOSH) Criteria Documents for Specific Compounds or Classes of Compounds	Visit http://www.cdc.gov/niosh or call (800) 35-NIOSH for a catalog of publications related to chemical handling, use, and effects. NIOSH also has a fax information service
American Conference of Governmental Industrial Hygienists (ACGIH) TLVs and BEIs	Visit http://www.acgih.org
Online Laboratory Safety Information from Howard Hughes Medical Institute*	Visit http://www.practicing safescience.org
Chemical Health and Safety Publications from the American Chemical Society	Call (800) ACS-5558 or visit http://www.acs.org
Center for the Evaluation of Risks to Human Reproduction (CERHR)*	Visit the National Toxicology Programs website at http://ntp-server.niehs.nih.gov or http://ntp-server.niehs.nih.gov/hdocs/Liason/ReproCtrFITA.html