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Risk Assessment's New Era, Part 4:

Roadmap for Integrating Risk and Decision Making into Industrial Hygiene

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Assessing risk in the aggregate, cumulatively, and comparatively has entered a new era in which innovative technologies and methods are allowing health science professionals to explore and solve ever more complex problems.[1,2,3] Increasingly, risk assessments either support or are mandated by regulatory, management, business, and public policy decision making. They also support technical and lay educational efforts and behavior-based safety programs. Since the inception of our profession, industrial hygienists have been front and center in characterizing hazards and assessing exposures, which predates the four-step risk assessment paradigm articulated by the National Academy of Sciences (NAS) in its 1983 "Red Book": hazard assessment, exposure assessment, dose-response assessment, and risk characterization. Many industrial hygienists have also participated in more recent initiatives,

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such as resource allocation, enterprise risk management, sustainability, and cost-benefit analysis.

In 2008, NAS updated its recommendations for improving the risk assessment process. According to these recommendations, a risk assessment should have a clear scope and defined metrics for judging the information discovered during the assessment. Essentially, data should be gathered only after criteria are established for determining whether a risk is acceptable. Industrial hygienists have followed this approach by utilizing the scientific method, validating sampling and analytical methods, and establishing occupational exposure limits (OELs) to help us develop strategies and judge significance in our practice of Exposure Risk Assessment Management (ERAM).

But our world continues to evolve, requiring us to evolve with it. What if there is no OEL? What if there is a net-zero benefit for the feasible control? By what means will we make decisions regarding multiple independent stressors? How do we incorporate non-occupational sources into decisions regarding occupational health? How do we mitigate high-risk personal decisions that overshadow low-risk occupational activities? Industrial hygienists are well positioned to ensure that occupational, non-occupational, personal, business, global, engineering, and economic factors are integrated in risk-based decision making.

This article, which concludes a four-part series, presents a multistep roadmap for integrating risk and decision making (i.e., risk assessment, risk management, and risk communication) into the profession of industrial hygiene as a core competency. The key components of this roadmap are:

- development of a model for IH: risk and decision making
- development of risk-based decision metrics and tools
- collaboration, partnerships, and technology transfers
- improved risk-related training and education
- improved skills for communicating with our stakeholders

Incorporating these components into industrial hygiene will enhance our skills and value, refine our communication skills, and expand the profession beyond traditional OEL-based “acceptable/not acceptable” assessments.

Risk and Decision Making

Risk assessments are never conducted in a vacuum. Someone, somewhere is wondering whether the situation is safe or unsafe, risky or not risky, acceptable or not acceptable, causative or not causative. A technical assessment of risk is only one variable in political, economic, social, public health, regulatory, and risk management decision making. Although the results of a risk assessment can be used to identify, support, or evaluate appropriate risk mitigation options and public health interventions, other factors must be considered. Fortunately, a variety of analytical methods and tools, many of which are rooted in

techniques of economic analysis, are available for deriving health risk-based public health decisions (see Table 1).

Many of these approaches were developed outside of the IH profession, yet they are well-suited for use in occupational settings. For example, decision-analytic approaches can be used to prioritize workplace hazards (e.g., a ranking of chemical exposures weighted by toxic potential). Cost-benefit and cost-effectiveness analyses can identify which control options are the most effective for reducing workplace exposures and risks at the lowest cost (e.g., installing local exhaust ventilation versus using personal protective equipment). Additionally, comparative risk analyses can assess risk-risk tradeoffs and determine whether the control of one workplace hazard is likely to result in another (countervailing) hazard (e.g., substitution of perchloroethylene with n-propyl bromide in dry cleaners). Furthermore, value-of-information analyses can be used to assess the greatest sources of uncertainty in risk estimates and identify where additional data should be collected (e.g., targeted sampling of selected jobs or worksite locations where air monitoring data are lacking). A greater emphasis on training IH professionals on how best to use these decision-analytic approaches in their daily practice, along with illustrative case-study examples, could lead to improved risk-based decision-making in the workplace.

Collaboration, Partnerships, and Technology Transfers

The traditional emphasis of IH in health hazard anticipation, recognition, evaluation, and control aligns with similar concepts in other areas of public health practice. Like all professionals, industrial hygienists have their own set of tools and resources. The environmental and public health sciences follow a similar paradigm, but use somewhat different terminology. Recognition of the parallel structure of the allied health fields affords us an opportunity to add to our risk assessment tools through better science exchange and transfer of technology. Transfer of information requires reliable communication among industrial hygienists in our professional societies and among international partners, with risk assessment professionals in the allied fields of risk science, and with our sponsors (the workers we seek to protect and their employers).

Effective sharing of risk science information requires a common understanding of risk sciences. Efforts to harmonize risk assessment methods are ongoing. Harmonization is not the same as standardization. The goal of harmonization is to understand the underlying differences in methodologies and align methods over time.[4]

Embracing risk harmonization opens our field to additional resources for approaching risk. Rather than confining ourselves to a single resource, we can better understand the apparent differences in alternative assessments for the same chemical or scenario and make informed decisions about which resources best fit our needs. We can also adapt for our use the risk methodologies used in related fields, which will be necessary to address new types of risk assessments discussed in this series of articles (cumulative risk assessment, assessment of risk on the basis of risk probability, and use of enhanced tools for making risk management decisions).

The harmonization of risk assessment methods can be extended to a broader audience through liaisons with other organizations. A tremendous effort is underway to improve the science and application of risk assessment principles in occupational health. This effort spans all types of organizations but needs to be coordinated for maximum impact. A forum for information exchange is needed, as well as an improved understanding of the scientific products developed by each participant. The Internet facilitates sharing of information; the challenge is in coordinating the content in a way that increases its utility.

No single volunteer group, authoritative body, educational institution, or company has sufficient resources to integrate various novel approaches into occupational risk assessment. For this reason, the sharing of information is imperative for the integration of risk analysis into the IH profession. To accomplish this goal, an occupational risk assessment forum is needed that would allow organizations to share information, collaborate on related projects, and ensure that limited resources are being leveraged effectively to fill gaps in data that prevent the assessment and management of occupational hazards. More important, this forum could promote the methods summarized in Table 1 as standard practices in industrial hygiene. Efforts are underway to host this forum under the banner of the newly formed Occupational Alliance for Risk Science (OARS; www.tera.org/OARS/index.html).

Communicating with Stakeholders

The future success of our profession relies heavily on industrial hygienists learning to communicate “risk” in the language of our stakeholders and target audience. Whether this audience comprises regulators, plant managers or engineers, we must quantify and articulate risk in understandable terms. This would help IH professionals garner the needed attention and respect of entities capable of supporting our work through allocation of resources and implementation of appropriate control strategies. We must learn to quantify the risks of exposure–in the presence or absence of an OEL or another exposure recommendation. More importantly, we must learn to use the verbiage and context of “risk” when communicating. By conveying the risk of outcomes in a manner that aligns with the verbiage and context of “risk,” industrial hygienists will be able to sit at the planning table and pull the resources needed to adequately protect workers.

The New Era

Our profession is at a crossroads. It is challenged by complex questions concerning matters related to occupational health, public health, environmental health, sustainability of natural resources, and quality of life. Answering these questions requires understanding and putting risk into context.

We have much to offer our stakeholders through the risk sciences. Our role is to identify and prioritize health hazards and risks, mitigate unreasonable fear created by speculative paranoia, address unfounded intuitive toxicology (such as “natural chemicals are always good and man-made chemicals are always bad”), and articulate through sound science where best to expend precious natural, human, and monetary resources to achieve the best risk decision.

Grab ahold and come along in the new era of risk assessment.

References

1. Dotson GS, Rossner A, Maier A, Boelter FW. Risk Assessment's New Era, Part 1: Challenges for Industrial Hygiene. The Synergist. Apr.2012
2. Williams PRD, Dotson GS, Maier A. Risk Assessment's New Era, Part 2: Evolving Methods and Future Directions. The Synergist. May.2012
3. Rossner A, Dotson GS. Risk Assessment's New Era, Part 3: Vision of the AIHA Risk Assessment Committee. The Synergist. Jun-Jul;2012
4. World Health Organization International Program on Chemical Safety. Harmonization of Approaches to the Assessment of Risk from Exposure to Chemicals. 2012. [Online] Available at www.who.int/ipcs/methods/harmonization/en/

Table 1

Methods and Tools for Risk-Based Decision Making

Method/Tool	Description
Decision analysis	Systematic approach for making decisions under uncertainty, which accounts for underlying beliefs and preferences. Steps involve identifying a problem and viable actions, establishing a decision tree that provides for choices and accounts for chance events, and assigning probabilities to each chance event and utility values to the consequences associated with each choice.
Cost-benefit analysis (or benefit-cost analysis)	Systematic process of enumerating all tangible and intangible societal costs and benefits associated with an option or alternative options. Costs and benefits are valued in a common unit (typically monetary) and net benefits are calculated as the difference between total benefits and costs.
Cost-effectiveness analysis	Systematic approach for finding the lowest-cost means of achieving an objective or comparing the relative costs and effects of multiple options. Costs are measured in monetary terms, while effectiveness is expressed as some unit of output or outcome (e.g., number of lives saved).
Comparative risk analysis	Method of comparing multiple risks using a common metric. This procedure is often used to rank environmental hazards by their relative risk for purposes of setting priorities.
Value-of-information analysis	Method of evaluating the benefit of collecting additional information to reduce or eliminate uncertainty in a specific decision-making context. The newly acquired information should affect a behavior, decision, or outcome (or it is not worth obtaining).