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The Power of Professional Judgment

BY GARY W. CARTER

In the January 2014 *Synergist*, the article "Judgment Day: How Accurate Are Industrial Hygienists' Qualitative Exposure Assessments?" by Gurumurthy Ramachandran and Susan Arnold presented recent findings revealing poor accuracy among industrial hygienists' qualitative assessments. While I agree with the authors that IHs can achieve more accurate judgments through the use of algorithms and modeling, I would also recommend the use of cost/benefit analysis and caution against quantitative assessments that do not achieve statistical significance.

The hygienist's experienced professional judgment and perspective are what make a particular measurement tool powerful and useful.

In today's fiscal environment, IHs rarely have the fiscal resources to properly execute costly quantification of exposure and may need to rely more frequently on less expensive qualitative techniques. The trouble, as Ramachandran and Arnold correctly point out, is that we often fall short in our qualitative efforts. Given the shortcomings and inherent error of both qualitative assessment and quantitative sampling, professional judgment in selecting the appropriate tool and using it correctly is the key to protecting the health of workers.

STRIVING FOR STATISTICAL SIGNIFICANCE

One might say that the most essential tool available to an industrial hygienist is sampling and analysis. Certainly, accurately determining levels of exposure is of paramount importance; however, equally important is the *skill* of the industrial hygienist in using the many available tools. The hygienist's experienced professional judgment and perspective are what make a particular measurement tool powerful and useful.

Quantitative sampling is an indispensable tool, but only when the data are statistically significant. Normally the goal is to achieve a 95 percent confidence level at a p-value of 0.01. While absolute truth can never be achieved, one can ensure close proximity to truth through strong statistical meaning that informs conclusions and actions. Very often, however, achieving statistical significance requires more samples than can be afforded in terms of both cost and time. Yet the sampling often goes forward anyway, too few samples are collected, and the results are either fortuitously meaningful at best or false negatives at worst.

Overemphasizing quantitative sampling to infer exposure levels may mask the importance of applying all-encompassing professional judgment that uses less costly approaches, such as algorithms and mathematical modeling.

PROFESSIONAL JUDGMENT

Professional judgment is *the* primary tool used when following NIOSH's recommended *a priori* determination of the need for exposure measurements.[1] AIHA's *Strategy for Assessing and Managing Occupational Exposures* defines "professional judgment" as

> *the application and appropriate use of knowledge gained from formal education, observation, experimentation, inference, and analogy. It is fed by the sum and substance of what industrial hygienists know and learn. It allows an industrial hygienist with even a minimum amount of data to estimate the exposure in nearly any scenario.*[2]

In other words, a practicing IH should exert significant energy observing, contemplating, reviewing, and discussing the exposure problem as part of an algorithm that is often followed by physical chemistry calculations and mathematical modeling. Only then should the IH consider air sampling.

COST/BENEFIT ANALYSIS OF CONTROLS

Ah, but Ramachandran and Arnold reported on recent work demonstrating that initial, qualitative judgments have a mean accuracy of approximately 30 percent. Of the incorrect estimates, a significant number underestimated the actual exposure. While these results seemed rather dismal, Ramachandran and Arnold advocated for improvement in qualitative methods through increased use of algorithms and mathematical modeling.

One simple step that should be incorporated into any qualitative algorithm would be to perform a cost/benefit analysis for implementing controls—that is, deciding to implement a

control early in the qualitative assessment if its cost/benefit ratio is low. A recent case involving glutaraldehyde exposure at a health clinic demonstrates this point.

The health clinic was using glutaraldehyde to perform high-level disinfection on endoscopes. The solution was in an open-top, three-gallon tub where the endoscopes were scrubbed after being dismantled and soaked in an enzymatic cleaner. A qualitative assessment led us to believe that the highest exposure would likely occur each month when the old solution was dumped out and a new solution mixed up. To achieve statistical significance we would have had to sample several monthly "dumpings." In addition to the monetary cost of such an approach, conducting the sampling would have required significant time and disrupted the health clinic's operations. For approximately $25,000, an automatic endoscope reprocessor (AER), which had been shown to significantly reduce exposure, was procured and installed. The cost/benefit ratio as a qualitative measure was acceptable. As IH professionals concerned with reducing or eliminating chemical exposure, we were satisfied that we had done our job and no sampling was required. In fact, had we sampled in a manner to achieve statistical significance, we might not have been able to afford the AER.

VARIABLE AND NON-ROUTINE PROCESSES

The power of professional judgment (with efforts to improve qualitative assessment) is particularly strong in work settings that have variable and non-routine processes such as research and development industries (for example, research laboratories) or where homogenous exposure groups and routine operations are not self-evident.

Most operations in laboratories, for instance, present unique challenges to exposure assessment due to their non-routine nature. In general, research laboratory processes, hazards, and hazard quantities change daily. The AIHA exposure assessment strategy characterizes non-routine operations as having some of the following features[2]:

- short lead-time
- short duration
- transient work force
- non-repetitiveness
- variable work sites
- poorly defined tasks
- variable work practices
- multiple environmental agents
- limited health effects data on the environmental agents

The strategy also states that once a non-routine operation is complete, there are no more opportunities to collect data. Moreover, non-routine operations do not provide the luxury of time to plan and prepare; therefore, industrial hygienists must perform "just-in-time" industrial hygiene. Recognition, evaluation, and control of exposure must occur rapidly. Direct-reading instruments are the quantitation tools most often used by industrial hygienists when performing these rapid assessments; however, by no means does the use of direct-reading instruments in this manner result in a statistically meaningful quantitative assessment.

OELS AND OSHA SAMPLING PROTOCOLS

Further confounding efforts to quantify airborne exposure are the limitations of occupational exposure limits (OELs). A complete discussion of the limitations and controversies surrounding OELs appears in volume 3 of *Patty's Industrial Hygiene and Toxicology* (1994); for this article, it will suffice to point out two significant limitations of OELs: that OELs do not exist for many chemicals, and that they do not take into account individual susceptibility to a given chemical and are typically based on "safe" levels for the average healthy male worker.

Upon deciding to perform air sampling, industrial hygienists bear the burden of identifying a trustworthy OEL appropriate for their purposes or establishing some other exposure limit based on knowledge of a health risk posed by the substance in question. Given the limitations and possibly arbitrary selection of a suitable exposure limit, IHs would again be wise to carefully consider the need to sample at all and to examine the possibility of ensuring adequate control using their power of professional judgment.

A further concern is that once sampling is decided upon, industrial hygienists often consult the OSHA sampling protocols to ensure a standardized approach. However, OSHA sampling methods are designed to determine compliance during a safety inspection and provide only a snapshot of exposure with no historical or future context. Taking a minimal number of samples based on OSHA protocols is not truly representative of someone's exposure because the data generated is statistically insignificant due to the small sample size. Also, controlling for spatial and temporal variability is often not part of the sampling plan. Again, exposure data is only as useful as the statistical analysis says it is, and achieving statistical meaning usually requires numerous samples on numerous days at a very high cost.

PRIMARY DUTY

Given today's austere fiscal environment, professional judgment emphasizing sound qualitative considerations should be highly regarded, especially if one's scope of responsibilities largely encompasses non-routine and variable processes.

Clearly, for purposes of compliance or legal documentation, the need for quantitative information is unquestionable; however, if the main goal is strictly worker health protection, as is the primary duty of most industrial hygienists, then professional judgment using algorithms, mathematical modeling, and a cost/benefit process to decide on controls is clearly the most effective, efficient, and least costly approach.

REFERENCES

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