Critical Features of an ISO 9001/14001 Harmonized Health and Safety Assessment Instrument

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Conformity assessment to the International Organization for Standardization (ISO) 9001 quality assurance and ISO 14001 environmental management standards create numerous procedural and technical performance issues. Specific challenges include auditor qualification and credentialing concerns, mutual recognition of foreign accreditor findings, as well as intranational and international auditing performance consistency. An ISO 9001/14001-harmonized occupational health and safety management system standard (OHSMS) would likely confront analogous difficulties. The purpose of this research was to evaluate the critical features of a credible ISO 9001/14001-compatible OHSMS assessment instrument, or auditing tool. ISO 9000 series standards, the 14000 series draft international standards, and numerous assessment instruments currently employed in industry have been reviewed. The findings suggest that an OHSMS assessment instrument be: (1) generally applicable in any industry; (2) fashioned for auditors lacking health and safety expertise; and (3) congruent with preexisting ISO system assessment instruments. Future research should be conducted on assessment instrument reliability and validity.

Keywords: auditing, occupational health and safety management system

An estimated 58% of the world's population above the age of 10 is employed.[1] Eighty percent of these individuals reside in developing countries or newly industrialized nations where only 5–10% of workers have access to occupational health services.[1] As a consequence, numerous attempts to reconcile disparities in health and safety practices among and between developed and developing nations have been made. Organizational efforts by the European Union (EU), the Organization for Economic Cooperation and Development (OECD), the World Health Organization (WHO), the International Labour Organisation (ILO), as well as provisions contained in the North American Free Trade Agreement (NAFTA) and General Agreement on Tariffs and Trade (GATT) have proposed various solutions to minimize inequities.[2–6]

Efforts to harmonize health and safety practices would necessarily involve the 35,000 multinational corporations that maintain manufacturing operations throughout the world via their 147,000 foreign affiliates.[7] Although these organizations are generally headquartered in the northern hemisphere, they provide substantial investment in the developing world. For example, in 1992 multinational companies invested $42 billion in industries located within developing countries.[8]

Most multinational enterprises conduct business in the highly competitive global economy where value-added services, products, and in some cases credentials, provide an advantage or perceived advantage over competitors. In the latter case, credentialing, particularly quality system credentialing, has encouraged many organizations to apply for and acquire International Organization for Standardization (ISO) 9000 registration. Industry's preoccupation with ISO 9000 is readily observed in the context of its explosive growth. In excess of 70,000 ISO 9000 certificates have been awarded in 76 countries since the standard's initial 1987 publication.[9]

Against this backdrop of ISO 9000 activity a technically distinct but parallel effort to develop internationally accepted standards for corporate environmental practices has been proceeding. The ISO Technical Management Board created Technical Committee 207 (TC 207) in 1992 to develop internationally recognized environmental

management standards. The standards are commonly referred to as the ISO 14000 series and presently contain six major groups of standards. Three are organizational standards: Environmental Management Systems (i.e., ISO 14001), Environmental Auditing, and Environmental Performance Evaluation. Three are product oriented: Life Cycle Assessment, Environmental Labeling, and Environmental Aspects in Product Standards.[10]

In July 1995 TC 207 approved final committee versions of the Environmental Management System Specification Standard, a companion guidance standard (i.e., a document that provides potential ISO 14001 users with a conformance road map), and an auditing standard. These documents are currently considered draft international standards. Formal publication of the final standards is anticipated for September 1996.[11]

Concurrent with TC 207 efforts, published articles have posed questions regarding the applicability of the ISO 9000 quality system and its potential benefits to health and safety management systems.[3,12–17] Some organizations recognize a compatibility and have subsequently integrated occupational health and safety within the framework of their respective ISO 9000 system.[18–19] Irrespective of what standard or practice is employed, there appears to be an increasing trend within industry to link quality, productivity, and occupational health with emphasis on sound managerial systems.[20] Furthermore, businesses are increasingly not managing health and safety to simply comply with statutory requirements, but plan to achieve a marketplace advantage through gains in efficiency.[21]

The American National Standards Institute (ANSI) International Advisory Committee Task Group on Occupational Health and Safety Management convened a workshop in May 1996 to determine national consensus on the merits of developing an ISO 9000/ISO 14000 health and safety analog.[22] The meeting will be followed by an international meeting on the same subject in September 1996 in Geneva, Switzerland.

Both the ISO 9000 and 14000 series standards were written to facilitate first-, second-, or third-party assessment and registration processes. Assuming ANSI or ISO develops an ISO 9001/14001 health and safety analog, a prodigious number of conformity assessment considerations will arise. Issues concerning which professionals will be eligible to conduct verification audits, how the new standard will be interpreted by auditors, distortion of audit findings, and related matters will require resolution.

The purpose of this article is two-fold. First, the critical features of an ISO 9000/14000 harmonized OHSMS assessment instrument (or auditing tool) will be described. Second, the critical features will be examined as they correlate with conformity assessment protocols. The authors reviewed accessible ISO 9001 and 14001 assessment instruments, published and unpublished draft ISO standards, investigated industry and governmental auditing practices, and reviewed correspondence from various organizations involved in ISO activities.

ISO 9001 AND ISO 14001 GENERAL AUDITING PROCEDURES AND ASSESSMENT INSTRUMENTS

ISO 9001—Quality Management and Quality Assurance Systems

ISO 9001 is a deep, vertical, quality system that tracks and controls factors primarily aimed at consistent product quality and customer service.[23] The standard is interpretative with conformity assessment generally relegated to independent third-party registrars or auditors. Nations that formally participate in the ISO 9000 process accredit or approve auditing organizations through either a governmental or nongovernmental process. In the United States a nongovernmental organization, the Registration Accreditation Board (RAB), accredits registrars. In other countries accreditation may be provided by quasi-governmental organizations. One example is the United Kingdom's National Accreditation Council for Certification Bodies.[24]

Although specific auditor approaches vary, most ISO 9000 site evaluations will examine five major categories of company quality system performance. The auditors will generally verify (1) the presence of a quality policy; (2) the adequacy of the quality system; (3) that the quality system is fully documented; (4) that the system is effectively implemented; and (5) that the system complies with the specific requirements of the respective ISO 9000 standard.

A single boiler-plated ISO 9000 auditing method does not exist. Each accredited registrar develops and implements auditing procedures consistent with ISO guidance and a personal auditing philosophy.[25] One practice common among registrars is the use of an assessment instrument to guide them through the auditing process.[26–27] The instrument typically presents each element of the standard in a systematic fashion. In practice the use of an assessment instrument assures users that during the review no portion of the standard will be inadvertently omitted.

ISO does not produce or provide assessment instruments to registrars. Each assessment instrument is developed and owned independently. Most assessment instruments currently used by consultants produce qualitative audit findings.[26–31]

Although specific auditor conformity measurement approaches vary, most categorize adherence to the various aspects of the standard into one of three performance levels. Elements are rated as "in conformance" if system deficiencies are absent. Elements may be rated as "minor nonconformance" where easily resolved problems are detected. A rating of "major nonconformance" may be conferred where critical management systems are absent, ineffective, or undocumented. A minor nonconformance can usually be corrected during the site visit and is typically not detrimental to the registration process. One major nonconformance terminates registration activities until the issue is favorably resolved.

As a simple illustration, Figure 1A presents a portion of a hypothetical ISO 9001 assessment instrument. The "Item" section contains an element of the standard that the auditor is assessing. The auditor would place his finding (i.e., full conformance, minor nonconformance, or major nonconformance) in the "Results" section. The "Comments" section would contain a decision summary justification. Major or minor nonconformances are accompanied by a nonconformance report (NCR). An NCR states the applicable clause of the standard, the objective evidence, and the conclusion, which is based on root cause.

ISO has published procedures for third-party auditing protocols.[32] ISO standard 10,011 Part 1 contains guidance on audit team makeup and responsibilities, audit execution, and report content. Part 2 contains auditor qualification and evaluation criteria. Part 3 describes the actual audit program management including monitoring and maintaining auditor performance, auditor consistency, and ethics.

As previously noted, accredited registrars develop and use their own respective assessment instrument to gauge a company's conformance to ISO 9000.[33] In this case there are probably as many different assessment instruments as there are accredited registrars conducting audits. Currently there are roughly 200

companies providing registration services, 67 of which operate in the United States.[34]

ISO 14001—Environmental Management Systems (EMS)

ISO 14001 (and the other draft 14000 standards) is similar in design to ISO 9001 to the degree that it is flexible and performance oriented. The scope of the standard specifies requirements for an EMS within the context of the environmental effects an organization controls or can reasonably influence. The management system, if properly implemented, should enable organizations to establish procedures that facilitate compliance with the company's stated environmental policy objectives. However, unlike its quality cousin, which by industry covention uses third-party verification to acquire registration, conformance to ISO 14001 may be achieved either through self-assessment (i.e., first-party) or through the ISO 9000 external third-party registration methodology.[35]

A.

ITEM	*RESULTS*	*COMMENT*
4.1.1.a The Supplier's management with executive responsibility shall define and document its policy for quality, including objectives for quality and its commitment to quality.		
4.1.1.b The supplier shall ensure that this policy is understood, implemented and maintained at all levels of the organization.		

B.

ITEM	*RESULTS*	*COMMENT*
4.1.1.a The organization shall define and document its policy, goals and objectives for, and commitment to, the prevention of occupationally-related fatalities, illnesses, and injuries.		
4.1.1.b The organization shall ensure that this policy is understood, implemented and maintained at all levels of the organization.		

FIGURE 1. (A) A representative section of a hypothetical ISO 9001 assessment instrument; (B) a representative section of a hypothetical OHSMS assessment

The EMS specification standard as currently drafted contains five major elements against which internal or external auditors will assess conformance. The auditors will likely verify:

- The presence of an environmental policy—Has the organization clarified its intentions and principles in the context of its overall performance?
- Adequacy of environmental planning—Does the organization maintain a procedure to identify and control activities, products, and services in its sphere of influence?
- EMS implementation criterion—Is the system appropriately designed and implemented by competent professionals? As with ISO 9001, system documentation must be thorough and properly controlled.
- Checking and corrective action—Does the supplier monitor and measure environmental performance; does it address nonconformances and manage in-house environmental audits and maintenance records adequately?
- Management review—Does management conduct meaningful suitability and effectiveness reviews of the EMS at defined intervals?

ISO TC 207 also developed standards for basic auditor qualifications, audit planning, and execution. These include:

- ISO 14010.2 Guidelines for Environmental Auditing—General Principles of Environmental Auditing.[36] This guideline provides definitions of commonly used terms and the general principles associated with competent environmental auditing.
- ISO 14011.2 Guidelines for Environmental Auditing—Audit Procedures Part I: Auditing of Environmental Management Systems.[37] This guideline describes the planning and execution phases of an EMS audit.
- ISO 14012.2 Guidelines for Environmental Auditing—Qualification Criteria for Environmental Auditors.[38] This guideline addresses qualification criteria for lead environmental auditors (those qualified to manage and perform audits) and environmental auditors (those qualified to perform audits).

In addition, an environmental management vocabulary compendium is being developed. This will be the analog to the quality management and quality assurance vocabulary document provided in ISO 8402.[38-39]

Formalized ISO 14001 auditor training and certification mechanisms have yet to be established either in the United States or abroad.[40] It is unknown if one training and certification procedure will be developed, or if the ISO 9000 model of dissimilar nationalized auditor accreditation will materialize. Regardless, EMS conformity assessment audits will result in a rating system similar to the one currently employed in ISO 9000 audits.[41]

The absence of a formalized auditor certification process has not dissuaded consultants from developing EMS business strategies pursuant to the anticipated publication of ISO 14001. Large accounting and management firms, such as Grant Thorton LLP, KPMG, and Arthur D. Little have publicly acknowledged they will provide ISO 14001 consulting and registration services.[36] In fact, consultants have already registered organizations to the ISO 14001 precursor, British Environmental Standard 7750.[34]

CRITICAL FEATURES OF AN OHSMS ASSESSMENT INSTRUMENT

Assumptions

TC 207 structured the ISO 14000 standards so that they are, to the extent feasible, aligned with the ISO 9000 series.[42] This precedent and the current development of an OHSMS congruent with ISO 9001 and ISO 14001 suggests that critical features of an OHSMS assessment instrument would likely parallel those found in ISO 9001 and emerging 14001 assessment instruments.

Assessment Instrument Structure and Scope

Traditional environmental health and safety audits are conducted to assess numerous endpoints. These include regulatory compliance assurance, program effectiveness, training adequacy, liability identification, and appropriate resource allocation, among others.[43] Alternatively, ISO 9000 and 14000 conformity assessments evaluate the extent to which an organization maintains and documents its management systems, not necessarily the end points. For example, an ISO 14001 audit would verify that the

supplier maintains a system that ensures environmental regulatory compliance. The audit itself would not verify compliance.

An occupational health and safety management system is an orderly arrangement of interdependent activities and related procedures that drives an organization's occupational health performance. An OHSMS assessment instrument would need to evaluate these system features. As such, the assessment instrument would not require the capture, analysis, or evaluation of exposure samples.

An ISO 9000/14000 harmonized OHSMS standard would likely contain five major elements. These elements are presented below accompanied by the implications for the assessment instrument. The assessment instrument would evaluate:

- The presence of occupational health and safety policy and performance objectives—An assessment instrument would have to contain elements to evaluate that the health and safety policy legitimately addresses relevant site conditions and activities. Does the policy guide the setting of appropriate performance objectives? Is there a written commitment to comply with statutory requirements and industry practices?
- The adequacy of the occupational health management systems to achieve the policy objectives—The management system review would examine factors such as planning and organizational procedures. The effective presence of these two factors should indicate the organization has deliberate viable mechanisms to achieve health and safety policy objectives.
- The competency of individuals implementing the systems—The best designed systems may be poorly implemented unless capable individuals ensure maximum performance. Assessment instrument contents would have to include an evaluation of personnel adequacy.
- Risk assessment, risk management, risk communication, and risk documentation—The assessment instrument should evaluate the effectiveness of the company's efforts to assess environmental working conditions. The adequacy of the management system would be evaluated in light of policy objectives and statutory requirements. The assessment instrument would also contain instructions to auditors to verify that root causes of identified health and safety problems are methodically mitigated. Company communication efforts to both internal and external stakeholders would also be assessed. Finally, information management systems and support documentation would be examined.
- Organizational continuous review and improvement—An important component of ISO 14000 currently absent in ISO 9000 is the continuous improvement feature. An ISO OHSMS would likely require health and safety continuous quality improvement. The OHSMS assessment instrument would evaluate the effectiveness of organizational efforts to continuously review and improve working conditions.

Figure 1B presents a hypothetical section of an OHSMS assessment instrument. At its most fundamental level the assessment instrument should be potentially applicable to all organizations in all situations.[44] The structure and word smithing of the standard and the assessment instrument should be general enough to apply to any production unit or organization, regardless of size.

Nested Statutory Requirements

The assessment instrument would ideally contain auditor instructions to evaluate the company's compliance with applicable governmental specification standards, without listing the standards individually. ISO 14001 does not mandate compliance with statutory requirements. Under the ISO 14000 model companies are required to show commitment to compliance with governmental environmental regulations.[10]

Related Considerations

Health and safety conformity assessment issues are potentially complex. The authors have identified the following issues that merit evaluation.

Assessment Instrument Synchronic Reliability

Synchronic reliability refers to the consistency or repeatability of the results of a measurement instrument when two or more surveys are conducted under similar conditions at the same time.[45] In the context of occupational health, if two audit teams conduct evaluations under similar operating conditions at the same facility within the same relative time frame, would they come to the same general conclusions regarding site conformance to an ISO OHSMS standard?

Assessment Instrument Predictive Validity

Predictive validity describes the ability of correlating assessment instrument results to be useful predictors of professional interest. For example, would successful acquisition of OHSMS registration correlate with a reasonably safe workplace? Can registration be used as a health and safety performance indicator?

Auditor Bias

Auditor bias refers to purposeful or incidental conduct of misleading activities that may affect an audit's outcome. This is of particular concern due to the interpretative nature of ISO registration audits. Specifically, do auditors actually measure what they are intending to measure? There are many possible sources of bias in an audit or field survey. Examples include biased or leading questions, biased interviews, field selection of particular review documents, and failure to interview appropriate individuals.[46] Spurious factors may also play a role in biased results. For example, key ISO phrases such as "management commitment," "standard conformance," and "assure regulatory compliance" may not be universally interpreted and evaluated in an identical fashion by individuals with dissimilar cultural backgrounds.[47]

Continuous Improvement Metric

Measurement of occupational health and safety performance defines and demonstrates success or failure of a management system. In the United States professionals generally evaluate federally mandated illness and injury records to identify improvement or decay in health and safety performance. These figures are often criticized for understating existing problems and for being of marginal utility in root problem identification and resolution.[48] Others have attempted to measure percent safe behavior to gauge health and safety improvement. If continuous improvement is an integral part of the OHSMS standard, useful performance metrics must be developed and agreed on.

Beneficial Aspects

One outcome potentially generated from an OHSMS assessment instrument, presumably either to register or not register a facility to the standard, would ideally be caveated with specific useful recommendations to improve health and safety management systems and site working conditions. Boiler-plate reporting, or favorable audit findings provided by auditors untrained in the health and safety profession, may be considered specious by some stakeholders. Although many ISO 9000 supporters cite the beneficial aspects of conformance, a yet-to-be-released European study suggests that two-thirds of surveyed companies found no significant

difference between ISO 9000 certified and noncertified suppliers with respect to reliability and product quality.[49]

Implication to Organizations of Modest Resources

The technical and financial challenges associated with formal management system implementation, document development, and retaining a third-party to conduct an OHSMS audit may prove insurmountable for some organizations. Industry observers have already questioned whether small companies can underwrite the expenses associated with direct and indirect registration costs. Other experts have suggested small organizations can and should participate.[50-52] Direct costs of retaining a third-party auditor for registration to ISO 9000 have been estimated at $10,000–30,000.[53-54] Therefore, the assessment instrument would ideally be fashioned to minimize time and costs associated with the audit.

Comparison with Public and Private Assessment Instruments

Numerous public and private health and safety assessment instruments currently exist.[55-58] While some reflect unique corporate philosophy and appear compliance driven, some such as the federal Voluntary Protection Programs (VPP) and the International Loss Control Institute's International Safety Rating System (ILCI ISRS) merit closer inspection due to their systems, nonindustry-specific assessment approach.

The ILCI ISRS is a comprehensive health and safety assessment instrument that uses a numerical scoring system to rate organizational conformance to safety systems/practices that ILCI considers important. The auditing tool contains 20 basic element areas that cover issues including accident/incident investigations, communications, and management of change. An ISO OHSMS assessment instrument would likely evaluate similar factors. The ISRS also attempts to measure specifics that would likely fall outside the purview of an OHSMS assessment instrument. For example, the ISRS requires the presence of loss control bulletin boards, an off-the-job-safety program, and detailed health and safety training for senior management.

Where the ILCI ISRS is very detailed, the substance of the federal VPP is considerably more general and will likely be compatible with the forthcoming OHSMS. Under the VPP model, participant companies must adequately implement a comprehensive health and safety management system that contains six major areas of emphasis. These include management commitment and planning, hazard prevention and control, worksite analysis, health and safety training, employee involvement in program planning, and annual evaluation of health and safety management systems.[59] Additionally, companies must over the three years preceding the site inspection maintain an average of lost workdays and injury case rates at or below the rates of the most specific industry national average published by the Bureau of Labor statistics. The federal Occupational Safety and Health Administration (OSHA) conducts on-site reviews every three years to ensure that participant companies are committed to continuous health and safety improvement.

Although the VPP is broadly compatible with the OHSMS concept, site assessments would likely differ from OHSMS conformity assessment in several key areas. First, the OHSMS would probably encourage employee participation in health and safety program planning, but not require it. Second, the OHSMS would not prescribe acceptable specific lost workday rates. Third, some system elements required under VPP need to be implemented for at least a year prior to the site inspection. Specific time constraints would not be evaluated under an OHSMS model. Fourth, VPP site inspectors do not utilize a formal assessment instrument. Site evaluations are conducted by answering broad-based open-ended questions that evaluate the six major program elements.

DISCUSSION

A major weakness associated with the present research is the lack of a benchmark reference standard or straw man document. The authors have attempted to anticipate substantive issues based on the ISO 9000/14000 experience and academic rigors typically associated with social science field instrument development. The features of an OHSMS may or may not not parallel those of ISO 9000 or ISO 14000.

Financial auditing firms intend to provide ISO 14000 registration services. Considering the generally subjective nature of conformity assessment, professional judgment takes on added significance. If financial firms proceed as planned, considerable responsibility would be placed with individuals untrained and uneducated in occupational hygiene. This trend is particularly worrisome for technically complex occupational health issues that do not readily lend themselves to superficial review. An OHSMS assessment instrument should at minimum be accompanied by an attendant guidance document that provides clear and substantial instruction.

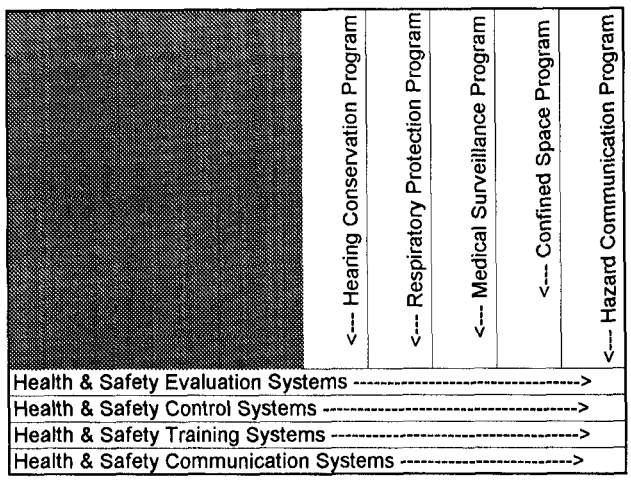
On the other hand, the interpretative nature of conformity assessment can be useful if appropriately managed. Knowledgeable auditors should have the opportunity to employ professional judgment with respect to the discovery of objective evidence and root causes. Unfortunately, heterogenous national auditor accreditation methods and multiple assessment instruments may produce inconsistent audit results. The Europeans have acknowledged this matter and may develop a formal program to train and qualify ISO 9000/14000 auditors regardless of nationality.[47]

Perhaps the most vexing questions about an OHSMS assessment instrument pertain to instrument validity and reliability. The authors have been unable to identify published studies evaluating the accuracy and repeatability of either publicly or privately held occupational health and safety assessment instruments. An appropriately designed assessment instrument should be reliable and valid. These attributes would facilitate parity among conformance evaluations, generate user confidence, and assist in outcomes research.

ISO 14010.2 (environmental auditing guidance) does contain verbiage that promotes consistency and reliability. ISO suggests audits be conducted by "well-defined methodologies and systematic procedures."[36] Furthermore it states "different audits may require different procedures."[36] The absence of specific guidance coupled with the inherent difficulties associated with interpreting the intent of the standard, may lead to uneven interpretation and place companies at audit risk.

"Audit risk" refers to the depth of detail that site assessors may require in their data collection efforts. For example, if a U.S. site auditor is assessing the adequacy of a company's respiratory protection program (CFR 1910.134), how much data is it reasonable to review? A respiratory protection program should contain, at minimum, 10 basic components. Should the auditor review all 10 or terminate his actions after assessing the written operating procedures? (Recall, ISO 9000/14000 are performance standards, not specification standards.) What if one auditor examines all 10 parts of the program while a second reviews only written operating procedures? The conclusions drawn from the differing approaches may not coincide.

Under an OHSMS standard, health and safety auditors would also have to rethink traditional approaches to site assessments. Many U.S. federal and state health and safety inspections and private sector audits tend to be reactive and prescriptive. Alternatively, an OHSMS conformity assessment would evaluate proactive management systems in an approach somewhat similar to the federal VPP.[44] As illustrated in Figure 2, a systems assessment cuts across traditional program evaluations. This philosophy encourages root-cause problem identification and minimizes the checklist philosophy.



A vexing issue associated with the ISO performance standards is achievability. Can organizations with modest resources invest critical time and financial resources to acquire registration? If the OHSMS is overly complex and registration excessively time-consuming or expensive, many small or financially unstable organizations will undoubtedly question their ability to achieve registration. On the other hand, the potential for a negative impact on the health of workers and the attendant liability exposure may be of equal or greater importance than the cost of registration. By nature, small- and medium-sized firms often do not have a large pool of resources dedicated to occupational health and safety issues. Consequently, it is these firms that may achieve major health and safety improvements by submitting the organization to a comprehensive health and safety management systems analysis. Accommodations for small or poorly capitalized organizations should be considered prior to development of audit tools and audit procedures.

The European study that suggests customers generally do not perceive a difference between ISO 9000 registered and nonregistered suppliers raises an interesting question. If stakeholders do not perceive a benefit from conducting business with an OHSMS-registered company, can the expense associated with acquiring registration be rationalized? If employee working conditions do not continuously improve to stakeholder satisfaction, the credibility of the entire process may fall suspect.

Modifications to the Occupational Safety and Health Act of 1970 (i.e., OSHA reform) currently under consideration include proposals that exempt employers from routine OSHA inspections if the place of employment has received a workplace review provided by a "certified person."[60-61] If this amendment is approved as drafted, a well-designed nationally accepted health and safety assessment instrument may be useful for both governmental and nongovernmental purposes.

Ultimately, development of an organization-wide management system assessment instrument might be practical. The assessment instrument would integrate all features of organizational performance. Elements such as accounting, personnel, environmental aspects, occupational health, information systems, and quality system considerations would necessarily be included in one seamless assessment instrument. This would reduce audit fatigue associated with multiple site assessments and place employee health and safety along side of business aspects as equals in organizational priorities.

CONCLUSIONS

In past years government agencies have attempted to regulate industry with visible occupational health aspects by imposing rigorous regulatory inspections. Recently, government has recognized the failings of such an approach. Many organizations are assessing the value of moving beyond a posture of basic compliance into a proactive position that will lead to less government intervention, increased efficiency, and better integration of occupational health matters with business practices. A realistic, coherent ISO 9000/14000-compatible OHSMS, if carefully crafted, has the potential to improve workplace hygiene and safety management systems while providing the value-added attribute of integrating seamlessly with desirable international business standards and environmental practices. A valid, reliable OHSMS assessment instrument is critical to continuous health and safety system improvement efforts.

REFERENCES

1. **World Health Organization (WHO):** *Global Strategy on Occupational Health for All.* Geneva: WHO, 1995. pp. 1–4.

2. **Ashford, N.A.:** International control of occupational and environmental health hazards. *Occup. Environ. Health 1(2):*142–146 (1995).

3. **Smith, B.:** Labor secures its role within NAFTA. *Occup. Health Saf. 63(10):*37–44 (1994).

4. **Passer, S.:** "Publication of ISO 1401." Aug. 5, 1996. [Private communication] International Organization for Standardization, ISO Central Secretariat, Case postale 56, CH1211, Geneva, Switzerland.

5. **Marash, S.A. and D. Marquardt:** Quality, standards, and free trade. *Qual. Prog. 27(5):*27–30 (1994).

6. **International Labour Office:** *International Labour Standards.* Geneva: International Occupational Safety and Health Information Center, 1989.

7. **Van Der Vliet, J.:** Multinational corporations. *Occup. Environ. Health 1(2):*210–214 (1995).

8. **Fowler, R.J.:** International environmental standards for transnational corporations. *Environ. Law 25(1):*1–30 (1995).

9. **Anonymous:** More than 70,000 ISO 9000 certificates issued worldwide. *ISO 9000 News 4(1):*1–2 (1995).

10. **Anonymous:** *Unofficial ISO Draft International Standard 14001.* Geneva: ISO Technical Committee 207, June 26, 1995.

11. **Hemenway, C.:** From Oslo with love: ISO 14001 moves toward adoption. *Environ. Today 6(7):*17–19 (1995).

12. **Hansen, M.:** ISO 9000: Effect on the global environmental safety and health community. *Prof. Saf.* pp. 44–47 (June 1994).

13. **Dyjack, D.T. and S.P. Levine:** Development of an ISO 9000 compatible occupational health standard: defining the issues. *Am. Ind. Hyg. J. 56:*599–609 (1995).

14. **Berkey, B.D., W.M. Dowd, and P.I. Jones:** "Integration of Quality, Process Safety, and Environmental Management Systems." Paper presented

at the International Safety Management Conference and Workshop, San Francisco, CA, September 1993. pp. 93–100.

15. **Redinger, C.F. and S.P. Levine:** National performance review in OSHA: ISO-harmonized third party registration of occupational safety and health management systems. *Am. Ind. Hyg. Assoc. J.* (Submitted)

16. **Markey, D., S.P. Levine, and C.F. Redinger:** Conformance of ISO OSHMS standards in public sector procurement specifications to the GATT/WTO requirements. *Am. Ind. Hyg. Assoc. J. 57*:936-944 (1996).

17. **Levine, S.P. and D.T. Dyjack:** Development of an ISO 9000 compatible health standard—II: Defining the potential benefits and open issues. *Am. Ind. Hyg. Assoc. J. 57*:387–391 (1996).

18. **Raychem Corp.:** "Raychem EHS Standard." Raychem Corp., Menlo Park, CA 94015-1164, 1995.

19. **Maxson, R.:** "Re-engineering Industrial Hygiene with ISO 9000." Paper presented at American Industrial Hygiene Conference and Exhibition, Kansas City, MO, June 1995.

20. **Dennison, C.:** "An Integrated Approach to Managing Quality Safety and Environmental Protection." Paper presented at the 1993 ICHEME—Manosafe conference. pp. 83–91.

21. **Bell, C.:** "Managing for Business Advantage: Optimizing Health and Safety Performance at Tenneco." Paper presented at the Tenneco Risk Management Conference, Houston, TX, November 1994.

22. **ANSI/IAC Task Force:** Proceedings from "International Standardization of Occupational Health and Safety Management Systems: Is There a Need?", May 7-8, 1996, Rosemont, IL. American National Standards Institute, 11 W. 42nd St., New York, NY 10036.

23. **Lutman, W.:** ISO 9000: Can America demonstrate a commitment to quality? *Prod. Inven. Manag. J. 35(2)*:81–85 (1994).

24. **Breitenburg, M.:** *More Questions and Answers on the ISO 9000 Standard Series and Related Issues.* [NISTR 5122] Gaithersburg, MD: Department of Commerce, National Institute of Standards and Technology, 1993. pp 24–25.

25. **International Organization for Standardization (ISO):** *ISO 9000 International Standards for Quality Management.* Geneva: ISO Central Secretariat, 1994. pp. 323–341.

26. **DNV Industry Inc.:** "International Certification Process." Quality Rating & Certification, 16340 Park Ten Place, Ste. 100, Houston, TX 77084. 1995.

27. **NSF International:** "Environmental Management Systems Registration Program." NSF International, 3475 Plymouth Road, Ann Arbor, MI 48105, 1995.

28. **Kleckner, S.:** "ISO 9000 Assessment Instruments." September 13, 1995. [Private communication] Quality Systems Registrars, 13873 Park Center Road, Suite 217, Herndon, VA 22071-3279.

29. **Dell, C.:** "ISO 9000 Assessment Instruments." September 13, 1995. [Private communication] Lloyd's Registrar Quality Assurance Ltd., 33-41 Newark St., Hoboken, NJ 07030.

30. **Cumings, S.:** "ISO 9000 assessment instruments." September 13, 1995. [Private conversation] DNV Industry Inc., Quality Rating & Certification. 16340 Park Ten Place, Suite 100, Houston, TX 77084.

31. **Appleby, M.:** "ISO 9000 Assessment Instruments." September 20, 1995. [Private communication] KPMG Peat Marwick, 150 John F. Kennedy Parkway, Short Hills, NJ 07078-2778.

32. **International Organization for Standardization (ISO):** *ISO 9000 Quality Management,* 5th ed. Geneva: ISO Central Secretariat, 1994. pp. 321–354.

33. **NSF International:** "ISO 9000 Registration System Documentation." NSF International, 3475 Plymouth Road, Ann Arbor, MI 48105, 1993.

34. **Harris, P.:** ISO 14000 bandwagon looks for riders. *Environ. Today 6(7)*:1,19 (1995).

35. **Anonymous:** *Environmental Management Systems—General Guidelines on Principles, Systems and Supporting Techniques.* Geneva: ISO Technical Committee 207, June 1995. p. 4.

36. **Anonymous:** "ISO/CD 14010.2 TC 207 2nd committee draft." Geneva: ISO Technical Committee 207, February 1995.

37. **Anonymous:** "ISO/CD 14011.2 TC 207 2nd committee draft." Geneva: ISO Technical Committee 207, February 1995.

38. **Anonymous:** "ISO/CD 14012.2 TC 207 2nd committee draft." Genveva: ISO Technical Committee 207, February 1995.

39. **International Organization for Standardization (ISO):** ISO 8402:1994. In *ISO 9000 Quality Management,* 5th ed. Geneva: ISO Central Secretariat, 1994. pp. 15–68.

40. **Dodds, O.:** "ISO 14001—Conformity Assessment for EMS." Paper presented at the Conformity Assessment for Environmental Management ISO/CASCO—ISO/TC 207 Workshop, Geneva, June 12–13, 1995.

41. **Cascio, J.:** "Conformity assessment for EMS and EL: case for international harmonization." Paper presented at the Conformity Assessment for Environmental Management ISO/CASCO—ISO/TC 207 Workshop, Geneva, June 12–13, 1995.

42. **Anonymous:** Other ISO rules en route. *Environ. Today 6(7)*:19 (1995).

43. **Liebowitz, A.J. (ed.):** *Industrial Hygiene Auditing—A Manual for Practice.* Fairfax, VA: American Industrial Hygiene Association, 1994. pp. 6–7.

44. **Wenmonth, B.:** Quality systems and environmental management. *Environ. Health Rev.—Australia 23(2)*:41–54 (1994).

45. **Kirk, J. and M. Miller:** The problem of reliability. In *Reliability and Validity in Qualitative Research.* Newberry Park, CA: Sage Publications, 1990. pp. 41–59.

46. **Abbey, D. and R. Ford:** Characteristics of a good sample design. In *Health Survey Methods.* Loma Linda, CA: Loma Linda University, 1991. pp 59–64.

47. **European Commission:** "A European Quality Promotion Policy." Brussels, 1995.

48. **Oleinick, A., K. Guire, V. Hawthorne, M. Schork, et al.:** Current methods of estimating severity for occupational injuries and illnesses: data from the 1986 Michigan Comprehensive Compensable Injury and Illness Database. *Am. J. Ind. Med. 23(2)*:231–252 (1993).

49. **Dusharme, D.:** European Commission wants companies to rethink ISO 9000's use. *Qual. Dig.* p. 9 (August 1995).

50. **Parzybok, W.:** ISO 9000: Can it help U.S. industry compete abroad? *Ind. Week 243(11)*:95 (1994).

51. **Nestel, G. and J. DelRossi:** ISO 14000: Good business sense—even for smaller firms. *Environ. Prot. 6(8)*:37–38 (1995).

52. **Grant, A. and E. Arnold:** "Applying Total Quality Environmental Management to Mid-Size and Small Companies." Paper presented at Global Environmental Management Initiative Conference, Washington, DC, March 24–25, 1993. pp.87–93.

53. **Thayer, A.:** Chemical companies see beneficial results from ISO 9000 registration. *Chem. Eng. News* pp. 10–26 (April 25, 1994).

54. **Dougherty, R.:** "Fees associated with ISO 9000 registration." June 22, 1994. [Personal communication] National Sanitation Foundation International, Certification Services, 3475 Plymouth Road, Ann Arbor, MI 48105.

55. **Tenneco, Inc.:** "Tenneco Health and Safety Assessment System." 1010 Milam St., Houston, TX 77252-2511.

56. **Goodyear Industrial Hygiene Management Services:** *Plant Systems Review and Reference Manual.* Goodyear Tire and Rubber Co., Industrial Hygiene, Dept. 1081, 1144 E. Market St., Akron, OH 44316.

57. **International Loss Control Institute, Inc.:** "International Safety Rating System." International Loss Control Institute, Inc., 4546 Atlanta Highway, Loganville, GA 30249. 1994.

58. **U.S. Department of Energy:** *Procedures Manual, Part II.* Washington, DC: Office of Safety and Quality Assurance, Office of Occupational Safety, February 1994.

59. "Voluntary Protection Programs to Supplement Enforcement and to Provide Safe and Healthful Working Conditions; Changes," *Federal Register 53*:133 (12 July 1988) pp. 26339–26348.

60. *Amendment to the Occupational Safety and Health Act of 1970.* 104th Cong., 1st sess., H.R 1834.

61. **Trippler, A.:** "Testimony to the U.S. House of Representatives Economic and Educational Opportunities Committee Workforce Protections Subcommittee." July 27, 1995. [Unpublished information]