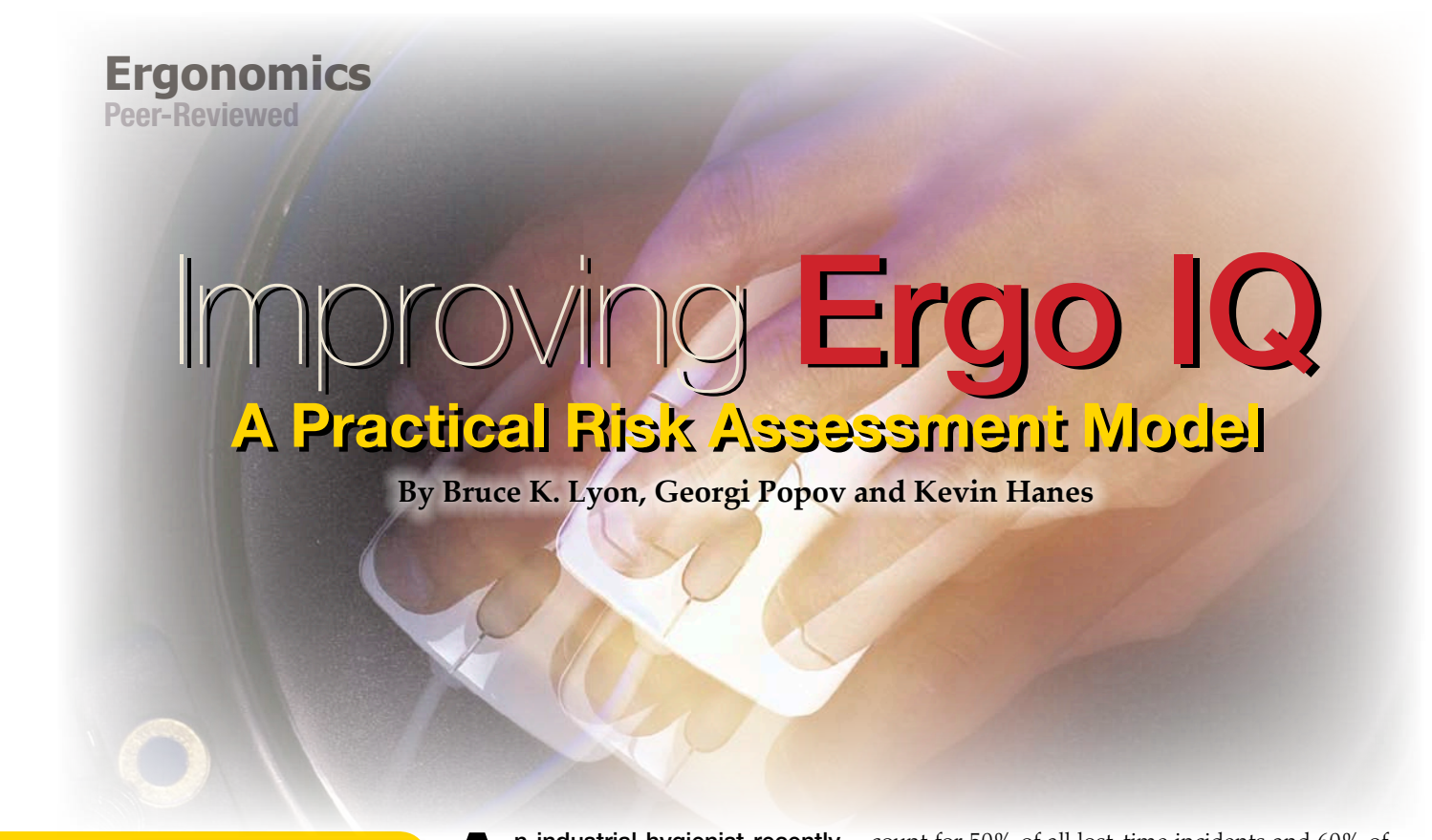
Improving Ergo IQ

A Practical Risk Assessment Model

By Bruce K. Lyon, Georgi Popov and Kevin Hanes



IN BRIEF

- **Ergonomic risks exist in most workplaces and can negatively affect safety and health, quality, efficiency and overall operational success.**
- **Musculoskeletal disorders (MSDs) represent one-third of all disabling workplace incidents and more than 40% of workers' compensation costs in the U.S., making ergonomics a required core competency for SH&E professionals.**
- **This article presents a model and simplified tool that can be used to help manage ergonomic risks and reduce MSDs.**

An industrial hygienist recently told one of the authors that he despised ergonomics since there are no established threshold limit values or permissible exposure limits, and it's difficult to measure risk reduction from added control measures. Other SH&E professionals may share similar sentiments and avoid tackling ergonomics-related risks in favor of safety and health concerns they feel more comfortable measuring and controlling.

Nearly every industry or workplace has ergonomics-related risks. In 2010, soft-tissue disorders known as musculoskeletal disorders (MSDs) accounted for 33% of all disabling occupational injuries (BLS, 2012) and more than 42% of total workers' compensation costs (Liberty Mutual, 2012). Some believe these figures are conservative. For example, Manuele (2013) cites sources that suggest ergonomics-related incidents account for 50% of all lost-time incidents and 60% of direct costs. OSHA has estimated that MSDs costs U.S. businesses more than $20 billion a year. By any measure, ergonomic risks are costly.

Workplaces that ignore ergonomic risks also spend more, often much more, to produce less at lower quality and generally suffer low employee morale. All of this translates to being less competitive and unsustainable.

A Framework for Assessment

Ergonomics, the science (and art) of designing workplace demands and environment to human capabilities and limitations for optimum performance, is often not considered when designing the workplace, equipment or work methods. The lack of ergonomic principles in workplace design can lead to inherently flawed systems that are costly to retrofit and correct.

Many companies do not know how to identify, assess and manage ergonomic risks. Key risk factors, such as force, repetition, extreme posture, compression and environment, are not always easy to detect or measure, especially for those with no specific training or experience. Several ergonomic risk assessment tools are available, and they differ in areas such as ease of use, skills and time required for application, software and equipment needs, application, targeted body segment and other variables.

Larger organizations with sufficient internal resources are more likely to have defined processes and tools with supporting guidance and training. However, in the authors' experience, many smaller-sized organizations are overwhelmed by the complexity and time demands associated with using many of these assessment tools. The challenge is to select a tool that stakeholders with limited ergonomics training and experience can use to produce reliable, useful results in a timely manner.

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This article presents an ergonomics risk assessment (ERA) model and a simplified ergonomics risk assessment tool (ERAT) that can be used to help manage ergonomic risks and reduce MSDs. The authors developed both as a result of working with organizations that needed a simplified means of identifying and controlling workplace ergonomic risks to frontline workers, supervisors, in-house engineers and local management.

Specifically, the ERA model provides a defined, systematic process that stakeholders can use to:

- identify existing jobs/tasks with ergonomic risks;
- assess, prioritize and track ergonomic risk factors in the workplace;
- select and implement effective controls;
- prevent new ergonomic risks from being introduced into the workplace;
- support continuous improvement with team-based problem solving.

As with any SH&E initiative, to be effective, an ERA process must be applied as a collaborative effort with full management commitment and active employee involvement.

Establishing an Ergonomics Risk Assessment Process

Ultimately, ergonomics should be part of an organization's SH&E management system. A written ergonomics management system that outlines the organization's ERA process should be developed and communicated to stakeholders to provide clear guidance. Management systems standards such as ANSI/ASSE Z10-2012, Occupational Health and Safety Management Systems, provide a framework to consider.

The ergonomics management system should include the following considerations.

Scope & Context

An organization should develop and communicate a clear and concise scope for the system. Key considerations include the context of the process in terms of who will be involved and affected; what will be included; time period and time requirements necessary; and application.

Preferably, the scope would extend to the design phase and encompass ERAs of new equipment, workstations, tools and work methods. ANSI/ASSE Z590.3-2011, Prevention Through Design, provides guidance in assessing and designing for safety in the conceptual phase and is strongly recommended. Additionally, the scope should encompass management of change and redesign efforts.

Goals & Objectives

Although goals for an ERA process may seem obvious, they should not be overlooked. Goal setting identifies the target(s) an organization is pursuing and must address specific, measurable elements. For example, an organization may want each operation to develop and train a cross-functional ergonomics task force to assess and improve three high-risk jobs per quarter. Such a goal is specific, measurable, actionable, realistic and time-oriented.

Goals and objectives must be realistic and achievable. Some goals may seem realistic and achievable at first, but obstacles may arise as the process unfolds. Therefore, an organization should revisit and refine goals and objectives as the process advances. As with any initiative, an organization must effectively communicate with stakeholders throughout the process.

Responsibilities

Once goals are set, an organization must clearly define and communicate stakeholder roles, responsibilities and accountabilities in specific terms that will ensure accountability. The matrix in Table 1 (p. 28) shows the types of roles and responsibilities that may be considered.

Training

Stakeholders must receive training that outlines the ERA process, sequence of steps, ergonomic risk factors and controls, and problem-solving methods. Through this training, stakeholders are able to perform their assigned tasks effectively.

Training content must be customized and appropriate to each group, and must include stakeholder participation and interaction. In the authors' experience, workers rarely favor scientific and medical terms. Keeping terms simple, clear and understandable helps improve comprehension and participation. ANSI/ASSE Z490.1-2009, Criteria for Accepted Practices in Safety, Health and Environmental Training, provides solid guidance on this subject.

Organizations should determine the types of ergonomics training required for each level, who will participate, specific learning objectives, the time frame and frequency of training. Table 2 (p. 29) provides a sample matrix.

Ergonomics Team

Establishing a well-trained ergonomics team is vital to ERA success. The ergonomics team along with a team coordinator performs essential risk assessment functions to drive the improvement process.

To increase participation and ownership, as well as leverage necessary skills, management should form a cross-functional group that includes operators, maintenance, engineering, quality, SH&E, department managers, human resources and plant management. The ergonomics coordinator facilitates the process, and leads and directs the team's efforts. This individual must be able to collaborate, mentor and provide technical resources as needed.

Ergonomics Improvement Process

Similar to quality, lean and SH&E management systems, ergonomics should be managed as an ongoing, integrated and sustainable process of continuous improvement (Figure 1, p. 30) (Rostykus, 2005). Once the infrastructure is in place, an operation can initiate the ergonomics improvement process and begin ERAs.

Select Jobs

A good first step is to identify jobs or tasks with a history of MSD incidents in both frequency and

The lack of ergonomic principles in workplace design can lead to inherently flawed systems that are costly to retrofit and correct.

Once goals are set, an organization must clearly define and communicate stakeholder roles, responsibilities and accountabilities in specific terms that will ensure accountability.

Table 1

Roles & Responsibilities Example

Role	Responsibilities
Senior management	•Establish goals, objectives and scope of ERA process •Communicate with stakeholders monthly •Enable operations to accomplish objectives •Participate in assigned ergonomics training •Review and track progress •Provide visible support and reinforcement of process
Operations manager	•Participate in assigned ergonomics training •Enable and support stakeholders •Hold stakeholders accountable and ensure that objectives are met •Identify ergonomics coordinator •Review and track progress •Provide visible support and reinforcement of process
Ergonomics coordinator	•Participate in assigned ergonomics training •Develop and coordinate plan •Verify elements of process are implemented and maintained •Ensure that three assessments of priority jobs are successfully completed quarterly •Review and track progress •Provide leadership and direction to ergonomics team •Report progress monthly to operations management •Participate in monthly ergonomics team meetings
Ergonomics team	•Participate in assigned ergonomics training •Assess three priority jobs each quarter •Identify risk reduction measures and use cost-benefit analysis •Develop selected measures and assign implementation •Confirm implement and follow up •Review and track progress •Assist in incident analysis and corrective actions
Engineers	•Participate in assigned ergonomics training •Participate in all ergonomics team meetings •Work with team to identify engineering solutions •Work with team to develop cost-benefit analysis •Apply ergonomics guidelines in new designs, equipment and workplace changes
Maintenance	•Participate in assigned ergonomics training •Participate in all ergonomics team meetings •Participate in solution development and cost-benefit analysis •Provide insight in maintenance and service needs •Help implement selected solutions
Supervisors	•Participate in assigned ergonomics training •Enable and ensure that employees have assigned training •Assist ergonomics team in identifying priority jobs •Assist in defining task requirements in priority jobs •Participate in incident analysis •Reinforce and recognize safe work practices •Mentor and coach employees •Communicate with employees
Employees	•Participate in assigned ergonomics training •Help identify ergonomic risk factors using the defined assessment tool •Follow ergonomics guidelines and safe work instructions •Report discomfort, symptoms immediately •Participate in incident analysis •Provide input and feedback on control measures
Medical care and workers' compensation	•Participate in assigned ergonomics training •Assess and treat employees with reported symptoms •Inform management/ergonomics coordinator of symptoms, concerns, disorders •Participate in incident analysis •Manage and track incidents •Report trends to management and ergonomics coordinator •Help identify proper modified duties for employees with restrictions

severity. This information can be derived from workers' compensation claims, incident investigation reports, incident analysis data, first-aid logs and OSHA incident data. Although the OSHA 300 log does not have an MSD column, SH&E professionals should track and measure ergonomics-related incidents in the workplace.

Often, employees can best identify high-risk jobs, so their feedback, reported concerns and discomfort surveys should be used to determine problem areas. When asked, employees will likely report many situations that they perceive as stressful. Any such report should receive a quick response or employees may perceive the effort as nothing more than another flavor-of-the-month program.

Workplace observations by the ergonomics team or other trained personnel are another good source of information. Modifications made to chairs, tools and other workplace items are indicators that further investigation is needed.

One method the authors use is known as the priority path. It involves a sequential series of techniques to identify and prioritize jobs by perceived risk. First, the team brainstorms to identify a set of jobs and tasks with perceived ergonomic risk. Brainstorming may be conducted in a structured or nonstructured manner. In a structured session, each person takes turns to offer ideas. In an unstructured session, group members offer their ideas as they come to mind; this approach may create a

Organizations should determine the types of ergonomics training required for each level, who will participate, specific learning objectives, the time frame and frequency of training.

Table 2

Ergonomics Training Matrix Example

Role	Training	Objectives	Frequency
Senior management	Ergonomics management system •2 hours	•Understand the purpose, scope and goals of process •Overview of ergonomics process •Responsibilities and accountabilities for senior management •Resources necessary and available •Time and budget requirements •Managing and reinforcing the process steps •Process metrics and methods—tied to goals	•Initially •2 years •Changes
Operations management	Plant ergonomics process •3 hours	•Understand the purpose, scope and goals of process •Understand basic ergonomics principles and risk factors •Understanding of plant ergonomics process steps •Responsibilities and accountabilities for operations management •Resources necessary and available •Time and budget requirements •Managing and reinforcing the process steps •Process metrics and methods—tied to goals	•Initially •2 years •Changes
Ergonomics coordinator Ergonomics team members	Ergonomics team and risk assessment •16 hours initial •4 hours refresher	•Understand the purpose, scope and goals of process •Responsibilities and accountabilities for team •Understand ergonomics principles, risk factors and control measures •Understand ergonomics process steps •Understand how to use ergonomics risk assessment tool •Ergonomic incident analysis and root cause •Problem solving and solution building •Resources necessary and available •Time and budget requirements •Process metrics and methods—tied to goals	•Initially •2 years •Changes
Engineers maintenance	Design guidelines for ergonomics •16 hours initial •4 hours refresher	•Understand the purpose, scope and goals of process •Responsibilities and accountabilities for designers and engineers •Understand engineering ergonomics principles, risk factors and control measures •Understand ergonomics process steps •New workstation design guidelines •Problem solving and solution building •Resources necessary and available •Time and budget requirements •Process metrics and methods—tied to goals	•Initially •2 years •Changes
Supervisors	Ergonomics process for supervisors •2 hours	•Understand purpose, scope and goals of process •Understand basic ergonomics principles and risk factors •Understanding of ergonomics process steps •Responsibilities and accountabilities for supervisors •Reinforcing the process steps •Process metrics and methods—tied to goals	•Initially •2 years •Changes
Employees	Ergonomics process for employees •2 hours	•Understand the purpose, scope and goals of process •Understand basic ergonomics principles and risk factors •Responsibilities and accountabilities for employees	•Initially •2 years •Changes

more relaxed atmosphere, but it introduces the potential that more vocal members may dominate. In either setting, brainstorming should promote an environment free of judgment of ideas/items; no criticism or favoritism; creative thinking; and quantity over quality (at this stage).

Once the list is populated, team members will individually select their top three to five jobs and write them on index cards. Cards are collected and the numbers are tallied to rank the jobs. A white board, flip chart or projected spreadsheet is used to list the jobs by priority ranking.

Next, the 5 to 15 jobs at the top are placed on a risk assessment matrix. To do this, the team evaluates each job to determine its severity level and likelihood level, which is then plotted on the matrix. This provides an ergonomic risk ranking of jobs that the team can begin to address.

Select Assessment Tools

Many ERA tools are available (Table 3), and most have general or specific applications. An organization must select the appropriate tool to fit the ERA's scope and purpose as well as the application and targeted body segment.

In addition, those involved should consider the complexity or degree of difficulty involved in using the tool and the skill level required to use it. All ERA tools require some level of training and experience to be used properly and effectively.

Similar to quality, lean and SH&E management systems, ergonomics should be managed as an ongoing, integrated and sustainable process of continuous improvement.

Qualitative Tools

Qualitative tools are common, and they are effective for screening jobs. Most are manual or spreadsheet-based. Examples include the OSHA basic screening tool, NIOSH checklists, Washington Industrial Safety and Health Act checklists and American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) for lifting. Many other tools developed by insurance carriers and consulting firms can be used for basic screening and postural assessment. The simple tool discussed in this article is one example.

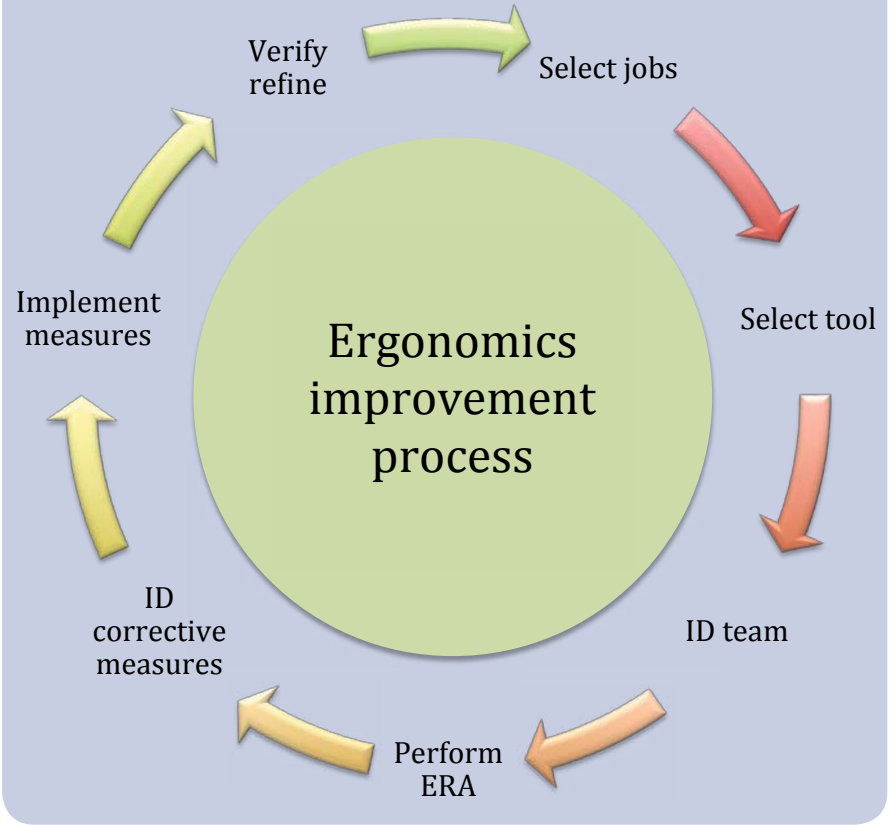
Semiquantitative Tools

Using semiquantitative tools requires more expertise. These tools typically target specific risk factors and body regions. Examples include rapid upper limb assessment, rapid entire body assessment, Snook tables, ACGIH TLV for hand activity and Utah back compression tool.

Quantitative Tools

A third group of tools are quantitative assessment tools. These tools require a higher degree of training, knowledge and skill, and are used to perform in-depth analysis. Examples include NIOSH's revised lifting equation, University of Michigan's 3-D static strength prediction model and energy expenditure prediction program, strain index, dynamic work analysis and static work analysis.

Figure 1
Ergonomics Improvement Process



Identify the Assessment Team

As noted, ERAs are best performed by a qualified cross-functional team. Safety committees that have a diverse and experienced membership can be used in this process. The team coordinator should be proficient in workplace ergonomics and risk assessment.

The team should be properly trained and must be knowledgeable about the jobs and tasks being assessed. Members must also be able to identify ergonomic risk factors. In addition, team members should have some training and experience in problem solving and ergonomics principles.

Perform the Assessment

Ensure that adequate resources and time are allotted to properly perform the assessment. Equipment such as digital cameras and tape measures are typically employed; other instruments may include light meters, sound level meters, infrared thermometers, force gauges and goniometers (which measures angles or allow objects to be rotated to a precise angular position). At the time of the assessment, verify that the job is being performed at its typical capacity or rate, and is representative of its normal operation.

Certain workplaces (e.g., manufacturing) have jobs that involve varied or long-cycle tasks; this presents a challenge to observing and analyzing a complete

job. In such cases, assessors should review an observation plan that includes a workflow diagram before conducting the assessment. The work can then be split into segments or tasks much like a job hazard analysis in which each task is assessed individually.

The ERA process involves three basic steps:

1) Identify and collect data. This process includes involving operators and gathering their input; observing task cycles and identifying task details; collecting digital video and photos of tasks and operator interactions for further analysis; and collecting data regarding work area, materials, tools and environment.

2) Analyze data. Analyze collected data to understand the nature and types of ergonomic risks and use the selected ERAT inputs to determine risk levels.

3) Evaluate. Evaluate each risk's severity, likelihood and exposure/duration, then input the resulting risk factor in the ERAT.

Once the assessment is complete, risk factors are entered into an ERAT according to its defined risk criteria. The resulting risk priority number or action level value is used to determine whether the assessed job's ergonomic risk is at a tolerable level or requires additional controls. For example, the ERAT tool the authors developed (see p. 33) specifies three different levels (Action Level 3: high risk; Action Level 2: moderate risk; and Action Level 1: low risk) and indicates whether additional action is required or desired.

Table 3
Partial List of ERATs

Assessment tool	Application	Body segment	Type	Degree of complexity
OSHA screening tool	General industry Repetitive tasks	Whole body	Qualitative checklist	Low
WISHA checklists	General industry Repetitive tasks	Whole body	Qualitative checklist	Low
ACGIH TLV for lifting	General industry Lifting tasks	Trunk	Qualitative tables	Moderate
RULA	General industry Repetitive tasks	Upper extremities Trunk	Semiquantitative worksheet	Moderate
REBA	General industry Repetitive tasks	Whole body	Semiquantitative worksheet	Moderate
Snook tables	General industry Manual handling	Trunk	Semiquantitative tables	Moderate
ACGIH TLV for hand activity	Office settings Hand work	Upper extremities	Semiquantitative worksheet	Moderate
NIOSH revised lifting equation	General industry Manual handling	Trunk	Quantitative formula	High
UM energy expenditure prediction program	General industry Manual handling	Upper extremities Trunk	Quantitative software program	High
UM 3-D static strength prediction model	General industry Manual handling	Trunk Lower extremities	Quantitative software program	High

An organization must select the appropriate tool to fit the ergonomic risk assessment's scope and purpose as well as the application and targeted body segment.

Identify Corrective Measures

The ultimate goal of an ERA is to help organizations minimize risk to a tolerable level. Jobs with high risk scores require immediate corrective measures. The ergonomics team should help identify and develop effective solutions. Again, brainstorming can be used to identify potential improvements and controls. Therefore, the team must understand and use the hierarchy of controls to select the most effective measures (Table 4, p. 32). This often requires use of cost-benefit analysis and return-on-investment calculations to select feasible options and help persuade decision makers.

Implement Controls

Before initiating any changes, an organization should inform affected workers about what will occur, why it is necessary and when it will take place. Workers should receive any special training needed to use controls effectively before changes are implemented. Most experienced SH&E professionals have witnessed the negative effects of installing ergonomically designed equipment or tools without warning or input from employees. One author learned this lesson when his recommendation to replace nonadjustable chairs with ergonomically designed, user-adjustable chairs was implemented with no input from employees. A quiet revolt occurred, and the new chairs were replaced with a similar model that operators helped select.

Many improvements will require engineering, maintenance and production staff to complete. Therefore, site management must ensure that task assignments, target dates, needed resources and other items are communicated and tracked.

Verify & Refine

Soon after controls are implemented, the ergonomics team and engineering personnel should meet with affected operators to verify that the measures are working properly. Some applications may need to be fine-tuned while others may require more extensive fixes. An organization should also collect operator feedback or concerns about factors such as ease of operation, comfort and speed to identify further adjustments or corrections.

Following a sufficient break-in period, site management should conduct a more in-depth review of the new controls and their effectiveness. To conduct this review, ergonomics team members and engineering personnel will use the selected ERAT to measure risk levels following the successful implementation of controls.

Communicate Results

For the process to be effective, assessment results must be tracked, measured and communicated. The ergonomics team should establish short- and long-term metrics that demonstrate the effectiveness of the ERA process. Many of these metrics are already tracked by groups such as production,

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Table 4

ERAT Hierarchy of Ergonomic Risk Controls

Control method	Phase/Application	Control examples	Effectiveness
Avoidance	Conceptual state design/redesign	Prevent entry of hazard into workplace by design through selection of technology and work methods	**High**
Elimination	Existing processes redesign	Eliminate hazard by changes in design, equipment and methods	**High**
Substitution	Existing processes	Substitute materials, sizes, weights and other aspects to a lower hazard severity or likelihood	**Moderately high**
Engineering controls	Existing workstations redesign	Reduce hazard by changes to workplace, tools, equipment, fixtures, adjustability, layout, lighting, work environment	**Moderate**
Administrative controls	Practices and procedures	Reduce exposure to hazard by changes in work practices, training, job enlargement, job rotation, rest breaks, work pace	**Moderately low**
PPE	Workers	Reduce impact of hazard to employee by use of PPE and materials such as vibration attenuation gloves	**Low**

quality or human resources. Common measures include results-based metrics that provide a long-term measure of performance. These may include the number of ergonomics-related incidents, number of ergonomics-related lost-time incidents and number of ergonomics-related lost days, restricted days or transferred days, as well as reductions in piece rework and non-value-added tasks, and less waste and scrap.

In addition, the process should encompass action or activity-based metrics. Action-based metrics are short-term measures that highlight the impact of workplace improvements and risk reductions. Examples include percent of jobs/tasks assessed for ergonomic risk; percent of jobs/tasks with reduced risk; percent of ergonomic risk reduction or reduction in risk levels; number of employees trained; and number of employee-generated improvements.

As with any successful risk assessment model, an ERA should involve stakeholders. As goals are achieved, the organization should celebrate, recognize and reinforce involved stakeholders.

Results of an initial analysis of a pork processing task using a spreadsheet-based assessment tool.

Figure 2

ERAT: Initial Evaluation

Ergonomics Risk Assessment Tool (ERAT) - Initial Assessment

Job Task	Belly Grader	**Dept**	Pork Processing Line
Evaluator(s)	John Doe, Jane Ergo	**Date**	1/9/2012

Risk Factor	Duration of Task				Score C1	Controls Comments
Repetition	<1hr	1-4hrs	>4hrs	N/A		10 bellies per minute
Every few minutes	0	0	1		0	
Every few seconds	0	1	3		3	
Lift	<1hr	1-4hrs	>4hrs	N/A		8 hour shift; pork bellies weigh between 12 - 14 lbs
5 to 15 lbs	0	0	1		1	
15 to 30 lbs	1	1	2		0	
30 to 50 lbs	2	2	3		0	
Over 50 lbs	3	3	3		0	
Push/Pull	<1hr	1-4hrs	>4hrs	N/A		Throwing bellies into bins 8' away
Easy	0	0	1		0	
Moderate	0	1	2		0	
Heavy	1	2	3		3	
Carry >10ft	<1hr	1-4hrs	>4hrs	N/A		N/A
5 to 15 lbs	0	0	1	N/A	0	
15 to 30 lbs	0	1	2	N/A	0	
Over 30 lbs	1	2	3	N/A	0	
* C1 = Category 1			Sub-total C1		7	

Risk Factor	Duration of Task				Score C2	Controls Comments
Postures	<1hr	1-4hrs	>4hrs	N/A		Extreme postures
Head Tilt	0	1	2		1	
Shoulder Reaching	0	1	2		2	
Flying Elbow	0	1	2		2	
Bent Wrist-Pinch Grip	0	1	2		2	
Bending/Twisting	0	1	2		1	
Environment	<1hr	1-4hrs	>4hrs	N/A		1) Excessive pace for physical effort required; 2) visual inspection requires better quality lighting
Noise	0	1	2		2	
Lighting/Glare	0	1	2		2	
Impact/Compression	0	1	2	N/A	0	
Power Tools/Vibration	0	1	2	N/A	0	
Keyboard Use	0	1	2	N/A	0	
Excessive Pace	0	1	2		2	
Extreme Temperature	0	1	2		2	
				Sub-total C2	16	
				Total (C1 + C2)	23	
* C2 = Category 2				**Total**	**23**	

Action Level 1	**Total score of 10 or less may require further analysis**
Action Level 2	**Total score of 11 -22 requires intervention in the near future**
Action Level 3	**Total score of 23 -36 requires immediate intervention**

ERAT: A Simple Assessment Tool

Sometimes, a simple assessment tool is all that is needed. The authors developed such a tool to help clients self-assess their workplaces. This ERAT was developed based on the ergonomics checklist that was part of a working draft document developed by the Management of Work-Related Musculoskeletal Disorders Accredited Standards Committee (withdrawn in 2003) (NSC, 2002).

The relatively simple tool provides a standardized way to quickly identify, assess and score ergonomic risks to upper extremities in most work environments. It is spreadsheet-based and has an initial assessment worksheet (Figure 2), a postcontrols assessment worksheet (Figure 3, used after the initial assessment and control implementation to establish a current risk factor score) and a hierarchy of ergonomic risk controls.

One advantage of such a tool is the limited amount of training time required to learn how to use the tool. The authors have successfully trained supervisors, lead persons and operators to use this ERAT in less than 4 hours. This training should include a review of the checklist, explanation of risk factors with examples of scoring, followed by hands-on application.

Instructions for using the tool follow:

> For each row that applies, the assessor scores the task based on the duration and observed risk factor. For individual scores of 2 or more, control measures may be needed and included in the screening tool worksheet. Add the scores in the subtotal and total columns. If the total sum of ergonomic risk factors identified is equal to or less than 10 (Action Level 1) the need for further evaluation may be required; for scores between 11 and 22 (Action Level 2) intervention in the near future is required; and for scores exceeding 22 (Action Level 3) immediate intervention is required.

It is suggested that videotape analysis be used to study task repetition, postures, lifts, pulls, pushes, carries and other factors covered by the assessment tool. As an illustration, consider this example of an assessment of a pork processing task using this ERAT.

ERAT Example: Pork Processing Belly Grader

Task description: Two operators standing at the end of an incoming conveyor approximately waist high manually grab each pork belly with one hand and place it on an adjacent scale, visually grade the belly, then toss it (with one arm) into one of several bins approximately 6 to 8 ft away.

The work pace for each worker performing this task is approximately 10 bellies per minute, equating to approximately 60 per hour or 480 per 8-hour shift. Pork bellies weigh between 11 and 14 lb each, with an average of 13 lb.

After controls were implented, the risk level dropped from Action Level 3 to Action Level 1.

Figure 3
ERAT: Postcontrol Evaluation

Ergonomics Risk Assessment Tool (ERAT) - Post Controls Assessment

Job Task	Belly Grader	**Dept**	Pork Processing Line
Evaluator(s)	John Doe, Jane Ergo	**Date**	1/9/2012

Risk Factor	Duration of Task				Score C1	Controls Comments
Repetition	<1hr	1-4hrs	>4hrs	N/A		
Every few minutes	0	0	1		0	No change
Every few seconds	0	1	3		3	
Lift	<1hr	1-4hrs	>4hrs	N/A		
5 to 15 lbs	0	0	1		1	Engineering control: Scale placed inline with conveyor; bins beneath
15 to 30 lbs	1	1	2		0	
30 to 50 lbs	2	2	3		0	
Over 50 lbs	3	3	3		0	
Push/Pull	<1hr	1-4hrs	>4hrs	N/A		
Easy	0	0	1		1	Engineering controls reduces pulling effort
Moderate	0	1	2		0	
Heavy	1	2	3		0	
Carry >10ft	<1hr	1-4hrs	>4hrs	N/A		
5 to 15 lbs	0	0	1	N/A	0	N/A
15 to 30 lbs	0	1	2	N/A	0	
Over 30 lbs	1	2	3	N/A	0	
* C1 = Category 1			Sub-total C1		5	

Risk Factor	Duration of Task				Score C2	Controls Comments
Postures	<1hr	1-4hrs	>4hrs	N/A		
Head Tilt	0	1	2		0	Engineering controls eliminate elevated reach
Shoulder Reaching	0	1	2		0	
Flying Elbow	0	1	2		0	
Bent Wrist-Pinch Grip	0	1	2		1	
Bending/Twisting	0	1	2		0	
Environment	<1hr	1-4hrs	>4hrs	N/A		
Noise	0	1	2		2	Engineering controls reduced physical demand allowing work pace to be acceptable
Lighting/Glare	0	1	2		0	
Impact/Compression	0	1	2		0	
Power Tools/Vibration	0	1	2		0	
Keyboard Use	0	1	2		0	
Excessive Pace	0	1	2		0	
Extreme Temperature	0	1	2		2	
				Sub-total C2	5	
				Total (C1 + C2)	10	
* C2 = Category 2				**Total**	**10**	

Action Level 1	**Total score of 10 or less may require further analysis**
Action Level 2	**Total score of 11 -22 requires intervention in the near future**
Action Level 3	**Total score of 23 -34 requires immediate intervention**

Companies have a significant opportunity to improve their ergo IQ using an effective ERA process.

ERAT Initial Assessment Scores

- Repetition score = 3 (cycle every few minutes with duration more than 4 hours).
- Lift score = 1 (average weight is 13 lb, with duration more than 4 hours).
- Push/pull score = 3 (repetitive one-arm throwing motion is considered physically demanding, with duration more than 4 hours).
- Postures:
  1) Head tilt score = 1 (periodic head tilt forward approximately 45°).
  2) Shoulder reaching score = 2 (repetitive shoulder extension postures performed more than 4 hours).
  3) Flying elbow score = 2 (repetitive elevated elbow/shoulder abduction postures performed more than 4 hours).
  4) Bent wrist/pinch grip score = 2 (repetitive bent wrist and pinch grip during grasping of bellies performed more than 4 hours).
  5) Bending/twisting score = 1 (periodic twisting at waist while tossing bellies to bins).
- Environment
  1) Noise score = 2 (hearing conservation area with protection used).
  2) Lighting score = 2 (light levels and quality inadequate for inspection tasks).
  3) Excessive pace score = 2 (physical effort required at a 10 per minute pace performed for more than 4 hours).
  4) Extreme temperature score = 2 (cold ambient temperatures require use of protective gloves and clothing).

Initial assessment score for this task is 23, which is categorized as Action Level 3 and requires immediate intervention (Figure 2, p. 32).

Risk Control Selection & Implementation

Following the initial assessment, the ergonomics team identified appropriate risk controls using the hierarchy of ergonomic risk controls principles (Table 4, p. 32). The resulting interventions involved engineering controls, including in-line scales placed in a new conveyor system; and placement of chutes and bins beneath the conveyor system to eliminate the need for the excessive handling and throwing tasks. These measures also helped to eliminate or reduce several extreme, repetitive postures.

Post-Control Assessment

After controls were implemented, a second assessment was performed using the postcontrol assessment worksheet (Figure 3, p. 33). The resulting score was 10 (Action Level 1: low risk), down from 23 (Action Level 3: high risk).

Conclusion

As prevalent as they may be, ergonomics risk factors are often missed in standard risk assessment efforts. Companies that are uncertain of the ergonomic risk levels in their operations or the impact of these risks on business, have a significant opportunity to improve their ergo IQ using an effective ERA process. This also presents SH&E professionals with the opportunity to help decision makers recognize the value of this process and guide them in establishing it. Keeping it simple, yet effective, is a key to success. **PS**

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