**AIHA ERGONOMIC COMMITTEE**

# Ergonomic Assessment Toolkit

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# Introduction to the AIHA Ergonomic Tool Kit

The AIHA Ergonomic Tool Kit provides a variety of ergonomic assessment tools and information on ergonomic analysis for the general public. The AIHA Tool Kit was created so that users with a range of experience in ergonomic analysis would be able to employ it to analyze task in a workplace. The Tool Kit comprised of 20 ergonomic assessment tools that can be used to analyze jobs for a variety of ergonomic risk factors. The AIHA Ergonomic Tool Kit provides information for each assessment tool including purpose of the tool, the body regions and ergonomic risk factors considered by the tool, types of jobs the tool is appropriate for, the inputs needed for the tool, the expected output of the tool, limitations of the tool, and location of electronic version of the tool. Please carefully read this information as it is very helpful in selecting the appropriate tool to assess a task.

Before selecting ergonomic assessment tools from this tool kit, it is important to first observe the task; familiarize yourself with the elements, movements, and tools used for the task; and perform an informal ergonomics assessment of the job. The informal assessment should include general ergonomic risk factors observed such as awkward postures, forceful movements, and repetitively movements. Also, it is important to know the weights of all the parts and/or tools handled during the task. An ergonomic screening tool may help with the initial ergonomic assessment.

To better assess a job for ergonomic hazards, it is helpful to break the job into its basis tasks and assess each task instead of the complete job. To divide the job into individual tasks, it is useful to first observe the job for several cycles to ensure that you are familiar with the job and how it is regularly performed. During the observation, write down each task that is included in the job. A job task is a segment of the operation necessary to advance the

work.  Each task should be easily identified and should have distinct beginning and end. Once the job is broken down into tasks, select the appropriate ergonomic assessment tool for each task to analyze the ergonomic risk factors associated with that task.

When selecting ergonomic assessment tools to use to analyze a task, it is important to select a tool that: 1. analyzes the risk factors found in the informal assessment, 2. analyzes the body regions used for the task, 3. includes duration if the task is complex or multi-tasked, and 4. provides the results needed (qualitative vs. quantitative).  The information in this tool kit is provided to help you select the appropriate ergonomic assessment tool.

# Overview of Ergonomic Assessment Tools

**Whole Body Screening Tools (Qualitative Tools)**
OSHA Screening Tool
OSHA Video Display Terminal checklist
Washington State's Caution Zone
Washington State's Hazard Zone

**Whole Body Assessment Tools (Semi-Quantitative)**
Quick Ergonomic Checklist (QEC)
Rodger's Muscle Fatigue Assessment
PLIBEL
Rapid Entire Body Assessment (REBA)

**Upper Limb Assessment Tool (Semi-Quantitative)**
Rapid Upper Body Assessment (RULA)
Occupational Repetitive Action Index (OCRA)

**Upper Limb Assessment Tools (Quantitative)**
ACGIH® TLV® for Hand Activity Level
ACGIH® TLV® for Hand Arm Segmental Vibration
Strain Index
Utah Shoulder Moment Model

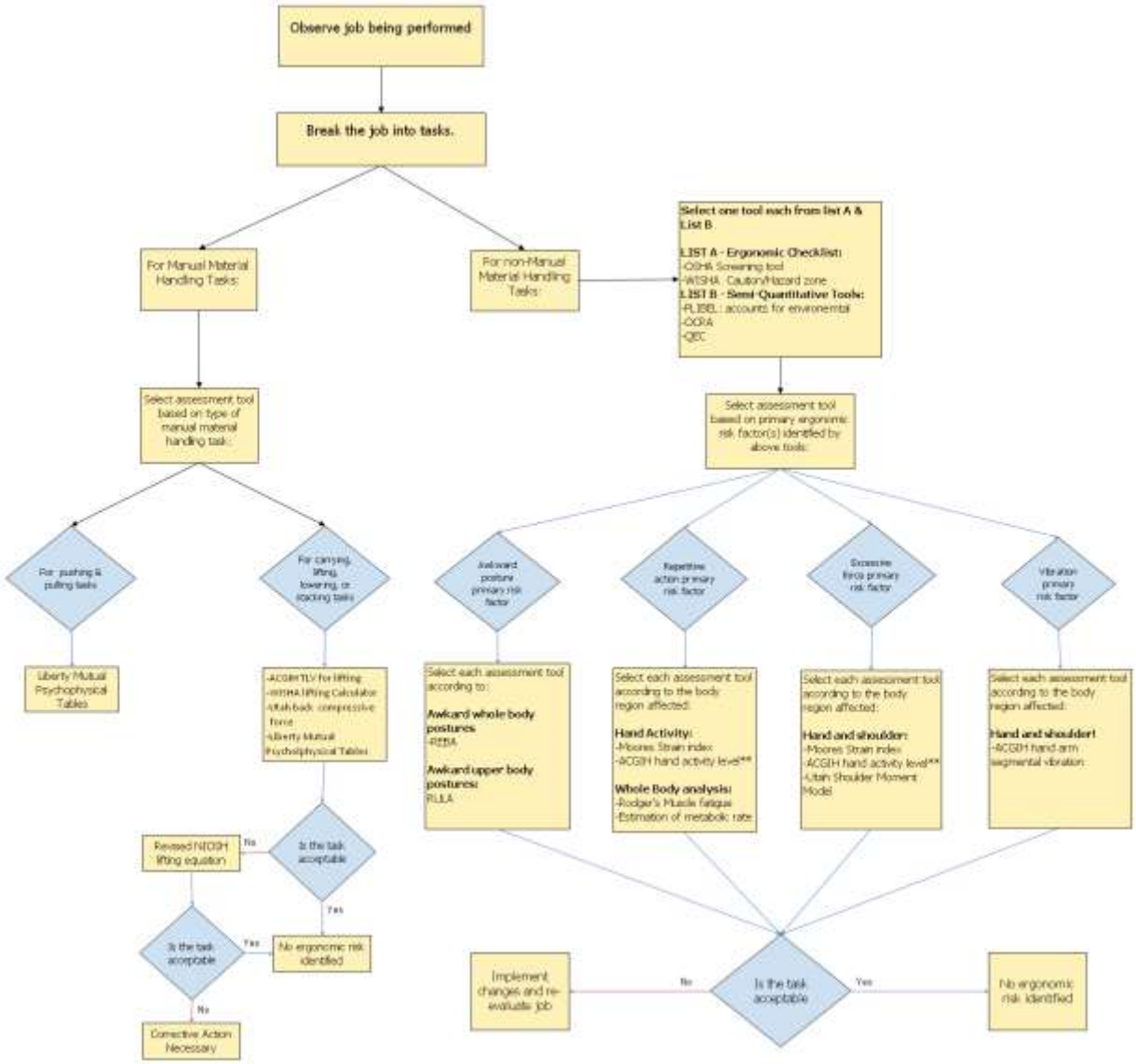
**Physiology Based Assessment Tools (Quantitative)**
Estimation of Metabolic Rate

**Lifting Assessments (Qualitative)**
ACGIH® TLV® for Screening for Lifting

**Lifting Assessments (Semi-Quantitative)**
Liberty Mutual (Snook) Psychophysical Tables
Washington State Lifting Calculator

**Lifting Assessments (Quantitative)**
NIOSH Lifting Index (1991)
Utah Back Compressive Force Model

# FLOW CHART FOR SELECTION AN ERGONOMIC ASSESSMENT TOOL




* A manual material handling task is defined as the moving of materials by hand by pushing, pulling, carrying, lifting, lowering, or stacking.
** Best for monotask jobs only

# ACGIH® TLV® for Hand Activity Level

## Purpose:
To provide basic general tool that maybe used by the Health and safety professional to determine job safety as it pertains to the repetitive motion, force exertion, rest/recovery period and work demands place on the hand region during the act of hand manipulation.

## Developed by:
TLV adopted by American Conference of Governmental Industrial Hygienists

## Developed When:
2002

## Musculoskeletal Disorder Risk Factors Considered:
Repetition, duration, force, rest and recovery, and loads

## Body Regions Considered:
Wrist and hands

## Type of Jobs Appropriate For:
Mono-task jobs performed longer than 4 hours per day

Seated or standing dynamic hand activities

## Type of Jobs Not Appropriate For:
Static hand activities and activities requiring body regions other than hands

## Limitations:
Limited to stress on the hand
No consideration of local area that might be effected
Does not consider posture, vibration, or contact stress

## Inputs:

Repetitiveness of hand activity
Force exerted by hands

## Outputs:

Comparison of hand activity to the Threshold Limit Value (TLV) for hand activity

## Who is the Tool Design For:
Professionals trained in ergonomics and general users

## Studies That Provide Evidence of Validation of the Tool:
Spielholz P, Bao S, Howard N, Silverstein B, Fan J, Smith C, Salazar C. (2008). "Reliability and validity assessment of the hand activity level threashold limit value and strain index

using expert ratings of mono-task jobs", J. Occupational Environmental Hygiene, 5(4): 250-7, Apr. 2008.

## Minimal Amount of Training:
2 hours

## Electronic Version:
http://personal.health.usf.edu/tbernard/HollowHills/HALTLVM15.pdf

## Reference of Peer-Reviewed Publication:
Franzblau, Alfred; Armstrong, Thomas J.; Werner, Robert A.; Ulin, Sheryl S.; (2005). "A Cross-Sectional Assessment of the ACGIH TLV for Hand Activity Level." Journal of Occupational Rehabilitation 15 (1): 57-67.

## Industries and Jobs Where Tool Has Been Applied:
Any task that requires hand and finger manipulation

## Is Tool Copyrighted:
Yes

## Instructional or Supplemental Information:
Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices, (2009), American Conference of Governmental Industrial Hygienists, 181-184.

## Equipment Needed to Use Tool:
None

## Time Required Analyzing Typical Job:
<30 minutes

# ACGIH® TLV® for Hand Arm Segmental Vibration

## Purpose:
To provide recommendations for hand-arm vibration exposure limits through a combination of frequency-weighted, RMS, component accelerations, and vibration exposure duration.

## Developed by:
TLV adopted by American Conference of Governmental Industrial Hygienists from ISO 5349 and ANSI S3.34-1986

## Developed When:
1984-2004

## Musculoskeletal Disorder Risk Factors Considered:
Vibration

## Body Regions Considered:
Hands, arms, shoulders

## Type of Jobs Appropriate For:
Jobs requiring hand-held vibrating tools

## Type of Jobs Not Appropriate For:
Whole body vibration jobs and jobs without vibration

## Limitations:
Limited to hand vibration
Ignores other MSD risk factors

## Inputs:

Cycle Time
Orthogonal components of vibration provided transducer

## Outputs:

Comparison of hand activity to the Threshold Limit Value (TLV) for hand vibration

## Who is the Tool Design For:
Professionals trained in ergonomics, above a novice

## Minimal Amount of Training:
High level of training and expertise required to identify vector directions, install lightweight measurement transducer, properly use low pass mechanical filter, interpret results, including frequency weightings of vibration and advanced mathematic calculations.

## Studies That Provide Evidence of Validation of the Tool:
None currently found in literature

## Electronic Version:
http://personal.health.usf.edu/tbernard/HollowHills/HAV50.xls

## Reference of Peer-Reviewed Publication:
None currently found in literature

## Industries and Jobs Where Tool Has Been Applied:
Grinding, sanding, chipping, drilling, sawing, production using vibrating or power hand tools, regular use of vibrating hand tools

## Is Tool Copyrighted:
Yes, purchase price of $60 (2009) for ACGIH Threshold Limit Value guide

## Instructional or Supplemental Information:
ISO 5349 and ANSI S3.34-1986 both describe how to measure and evaluate human exposure to hand transmitted vibration

Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices, (2009), American Conference of Governmental Industrial Hygienists, 185-188.

## Equipment Needed to Use Tool:
Small and lightweight transducer mounted to accurately record one or more orthogonal components of source vibration in the 5-1500 Hz range

Frequency-weighted filter network needed for human response measuring

## Time Required Analyzing Typical Job:
8 hours

# ACGIH® TLV® for Screening for Lifting

## Purpose:
To identify the appropriate and safe weight to lift for different conditions based on lift frequencies, durations, and object placement.

## Developed by:
TLV adopted by American Conference of Governmental Industrial Hygienists

## Developed When:
1995-2004

## Musculoskeletal Disorder Risk Factors Considered:
Lift frequencies; lift duration, height of lift, and horizontal distance, awkward postures, overhead postures, one-hand lifting, unstable loads, and environmental conditions (high heat and humidity)

## Body Regions Considered:
Low back

## Type of Jobs Appropriate For:
Lifting of objects in any type of industries

## Type of Jobs Not Appropriate For:
Non-lifting manual material handling tasks, sitting work

## Limitations:
Weight-based
Focused on pure lifting conditions only (e.g. mono-lifting)
Under TLV, no health risk is assumed

## Inputs:

Weight of load
Height of origin and destination of load
Distance of load from body
Frequency of lifting
Duration of lifting

## Outputs:

Comparison of hand activity to the Threshold Limit Value (TLV) for lifting

## Who is the Tool Design For:
Health professionals with a basic understanding of ergonomics and general users

## Minimal Amount of Training:
Reviewing the TLV guide (<1 hour)

## Studies That Provide Evidence of Validation of the Tool:
unknown

## Reference of Peer-Reviewed Publication:
None currently found in literature

## Electronic Version:
http://personal.health.usf.edu/tbernard/HollowHills/LiftingTLV11.pdf

## Industries and Jobs Where Tool Has Been Applied:
Virtually all industries where jobs are isolated to lifting

## Is Tool Copyrighted:
Yes, purchase price of $60 (2009) for ACGIH Threshold Limit Value guide

## Instructional or Supplemental Information:
Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices, (2009), American Conference of Governmental Industrial Hygienists, 181-184.

## Equipment Needed to Use Tool:
Scale, Tape Measure, and Stop Watch

## Time Required Analyzing Typical Job:
<1 hour

# Estimation of Metabolic Rate

## Purpose:
To provide methods for the determination of metabolic rate in the context of ergonomics of the climatic working environment. It can also be used for assessment of working practices, the energetic cost of specific jobs or sport activities, and the total energy cost of an activity.

## Developed by:
ISO committee TC 159/SC 5

## Developed When:
1990-2004

## Musculoskeletal Disorder Risk Factors Considered:
Fatigue

## Body Regions Considered:
Whole Body

## Type of Jobs Appropriate For:
Most jobs

## Type of Jobs Not Appropriate For:
Sitting jobs and non-metabolic taxing jobs

## Limitations:
Estimation of job metabolic cost used

Only give actual number for a few specific tasks, most jobs require extrapolation

Limited to the knowledge of the user ability to determine appropriate metabolic rating.

## Inputs:

*ISO Method:*
Energy for posture, activity, horizontal travel, and vertical travel
*Bernard & Joseph Method:*
Energy for movement, lifting, pushing/pulling, horizontal travel, and vertical travel
*General Activity and Manual Material Handling Methods:*
Speed of travel, grade, distance of travel, lift characteristics

## Outputs:

*ISO and Bernard & Joseph Methods:*
Energy expended in Watts
*General Activity Method:*
Energy expended in $V_{O2}$ (ml/kg*min)
*Manual Material Handling Method:*
Energy expended in kcal/min

## Who is the Tool Design For:
Professionals and non-specialist users

## Minimal Amount of Training:
<4 hours

## Studies That Provide Evidence of Validation of the Tool:
Comparing the metabolic rates estimated for both methods with the actual measured metabolic rate (MMeas) in 6 manual material handling tasks simulated under laboratory conditions. The metabolic rate was calculated from oxygen consumption VO2(19 participants) according to Standard No. ISO 8996 (ISO, 1990). Additionally, the participants estimated perceived exertion using the Borg scale

## Electronic Version:
http://personal.health.usf.edu/tbernard/HollowHills/EstMetRateM20.pdf

User's guide and recommendations for metabolic rate:
http://personal.health.usf.edu/tbernard/HollowHills/DynWorkDesignM11.pdf

## Reference of Peer-Reviewed Publication:
None currently found in literature

## Industries and Jobs Where Tool Has Been Applied:
Construction, packaging, shipping, manual material handling

## Is Tool Copyrighted:
Yes

## Instructional or Supplemental Information:
None currently found in literature

## Equipment Needed to Use Tool:
None

## Time Required Analyzing Typical Job:
<1 hour

# Liberty Mutual (Snook) Psychophysical Tables

**Purpose:**
To provide guidance for manual material handling tasks.

**Developed by:**
Stover Snook (1978) with Vincent Ciriello (1991)

**Developed When:**
1978-1991

**Musculoskeletal Disorder Risk Factors Considered:**
Force, posture, frequency, gender, percentage of population capable

**Body Regions Considered:**
Whole Body, Low Back

**Type of Jobs Appropriate For:**
Manual material handling

**Type of Jobs Not Appropriate For:**
Repetitive task jobs except manual material handling

**Limitations:**
Based on psychophysical ratings of industrial work groups, not strength or probability of injury.

Only be used to rate one task at a time, not effect of multiple MMH tasks.

**Who is the Tool Design For:**
Novice to expert

**Studies That Provide Evidence of Validation of the Tool:**
None currently found in literature

**Minimal Amount of Training:**
1 hour

**Electronic Version:**
http://libertymmhtables.libertymutual.com/CM_LMTablesWeb/pdf/LibertyMutualTables.pdf

**Reference of Peer-Reviewed Publication:**

Snook, S.H., The design of manual handling tasks, Ergonomics, 21:12-963-985, 1978.

Ciriello, V. M., The effects of box size, vertical distance, and height on lowering tasks. International Journal of Industrial Ergonomics, 28:61-67, 2001.

Ciriello, V. M. and Snook, S. H., A study of size, distance, height, and frequency effects on manual handling tasks, Human Factors, 25:5, 1983.

Ciriello, V. M., Snook, S. H. and Hughes, G., Further studies of psychophysically determined maximum acceptable weights and forces. Human Factors, 35:11, 175-186, 1993.

Ciriello, V. M., Snook, S. H., Blick, A. C. and Wilkinson, P. L., The effects of task duration on psychophysically-determined maximum acceptable weights and forces, Ergonomics, 33:2, 187-200, 1990.

Ciriello, V.M., McGorry, R.W., Martin, S., and Bezverkhny, I.B., Maximum acceptable forces of dynamic pushing: comparison of two techniques. Ergonomics, 42:1, 32-39, 1999a.

Snook, S. H. and Ciriello, V. M.; The design of manual handling tasks: revised tables of maximum acceptable weights and forces, Ergonomics, 34:9 1197-1213, 199l.

## Industries and Jobs Where Tool Has Been Applied:
All industries

## Is Tool Copyrighted:
Yes

## Instructional or Supplemental Information:
http://libertymmhtables.libertymutual.com/CM_LMTablesWeb/pdf/LibertyMutualTables.pdf

## Equipment Needed to Use Tool:
Measuring tape, stopwatch

## Time Required Analyzing Typical Job:
<< 1 hour

# NIOSH Revised Lifting Equation (1991)

## Purpose:
To provide an easy-to-use and simple job analysis tool to control overexertion injuries associated with manual material handling and lifting.

## Developed by:
Tom Waters, Vern Putz-Anderson, Arun Garg
National Institute for Occupational Safety and Health

## Developed When:
1991-1993

## Musculoskeletal Disorder Risk Factors Considered:
Lifting Force, Posture, Repetition, Duration

## Body Regions Considered:
Low Back

## Type of Jobs Appropriate For:
Two hand lifting and lowering with stable loads

## Type of Jobs Not Appropriate For:
Repetitive tasks, static tasks, dynamic tasks, seated tasks

## Limitations:
Does not factor in whole-body vibration, direct trauma to the back, or non-lifting MSD hazards.

Cannot be used for :

- 1-handed lifts
- >8hr lifting
- Seated or kneeling lifting
- Tight work space lifting
- Lifting unstable objects
- Carrying / pushing / pulling tasks

Slippery or uneven surfaces

Cannot predict injuries to individual operators.

Does not account for individual risk factors including gender, age, or medical history.

## Who is the Tool Design For:
Professionals trained in ergonomics and general users

## Minimal Amount of Training:
Reviewing user guide or self training (<4 hours)

## Studies That Provide Evidence of Validation of the Tool:
1. Hidalgo and Associates, 1995
   Results: NIOSH limits are different than psychophysics at low and high lift frequencies; small and large horizontal distances. NIOSH limits highly correlated to Snook

Tables in low frequency range. 3400 N limit for biomechanics can not protect majority of population on basis of damage load concept. Energy expenditure limits can be sustained for 57 to 99% of worker population

2. Waters and Associates (1999)
   Results: As LI increased from 1 to 3, the odds of LBP increased
   Greatest OR when LI between 2 and 3 (OR=2.45)
   When LI > 3, OR decreased (OR = 1.45)

3. Marras and Associates (1999)
   Results: OR = 3.1 95%CI (2.6, 3.8)
   Moderate specificity - 55% correct for low-risk jobs
   Good sensitivity - 73% correct of high-risk jobs

## Reference of Peer-Reviewed Publication:

Waters, T.R., Putz-Anderson, V., Garg, A. and Fine, L.J, 1993, Revised NIOSH equation for the design and evaluation of manual lifting tasks, ***Ergonomics***, 36(7): 749-776

## Electronic Version:

http://www.cdc.gov/niosh/docs/94-110/

Free online calculator based on 1991 Lifting Equation:
http://www2.worksafebc.com/calculator/llc/Default.htm

http://www.emcins.com/losscontrol/quick_links/employee_safety_health/ergonomicsNIOSH.aspx

## Industries and Jobs Where Tool Has Been Applied:

Package sorting and handling, package delivery, beverage delivery, assembly work, manual handling of less than 10 pounds, production jobs with forceful exertions, stationary lifting

## Is Tool Copyrighted:

No

## Instructional or Supplemental Information:

Waters TR, Putz-Anderson V, Garg A [1994]. Applications manual for the revised NIOSH lifting equation. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94–110.

## Equipment Needed to Use Tool:

Scale and Tape Measure

## Time Required Analyzing Typical Job:

<1 hour

# Occupational Repetitive Action Index (OCRA)

## Purpose:
To provide a measurement tool that quantifies the relationship between the daily number of actions actually performed by the upper limbs in repetitive tasks, and the corresponding number of recommended actions.

## Developed by:
Enrico Occhipinti

## Developed When:
1998

## Musculoskeletal Disorder Risk Factors Considered:
Repetitiveness, force, awkward posture and movements, and lack of recovery time

## Body Regions Considered:
Upper Limbs

## Type of Jobs Appropriate For:
Repetitive tasks where upper limbs are used majority to handle materials

## Type of Jobs Not Appropriate For:
Jobs where considerable risk is inherit due to use of the lower extremities

## Limitations:
Tool cannot predict risk associated with vibration or contact stress or disorders of the shoulder, neck or back.

## Who is the Tool Design For:
Professionals trained in ergonomics

## Minimal Amount of Training:
8 hours

## Studies That Provide Evidence of Validation of the Tool:
None currently found in literature

## Electronic Version:
http://www.epmresearch.org/html/ocra/A-Work_papers/the_Ocra_checklist_june2006.pdf

## Reference of Peer-Reviewed Publication:
E. Occhipinti. OCRA: A concise index for the assessment of exposure to repetitive movements of the upper limbs. ***Ergonomics***, 41 (9), 1290 – 1311.

Colombini D and Occipinti E. "Preventing upper limb musculoskeletal disorders (UL-WMSDS): New approaches in job (re)design and current trends in standardization" (2006). *Applied Ergonomics*, 37: 441-450.

Colombini D, (1998). “An observational method for classifying exposure to repetitive movements of the upper limbs”. Ergonomics 41(9), 1261-1289.

Grifco A. “Application of the concise exposure index (OCRA) to tasks involving repetitive movements of the upper limbs in a variety of manufacturing industries: preliminary validations (1998). Ergonomics, 41(9), 1290-1312.

## Industries and Jobs Where Tool Has Been Applied:

Package sorting and handling, package delivery, beverage delivery, assembly work, manual handling of less than 10 pounds, production jobs with forceful exertions, stationary lifting

## Is Tool Copyrighted:

Yes

## Instructional or Supplemental Information:

None currently found in literature

## Equipment Needed to Use Tool:

Computer, stopwatch, counter, and software

## Time Required Analyzing Typical Job:

<30 minutes

# OSHA Screening Tool

## Purpose:
To provide a basic screening tool that can be used to identify areas of concern for potential MSD risk factors, or used when a MSD is reported to an employer.

## Developed by:
Occupational Health and Safety Administration (OSHA)

## Developed When:
Not Known

## Musculoskeletal Disorder Risk Factors Considered:
Repetition, force, contact stress, awkward posture, and vibration

## Body Regions Considered:
All joints and total body

## Type of Jobs Appropriate For:
Most jobs that may cause a MSD or has particular risk factors

## Type of Jobs Not Appropriate For:
None.

## Limitations:
Screening tool does not have a quantitative measurement to guide the user on how hazardous the job is. It is purely for screening and identifying the hazards of the job

No ranking or risk assessment number

## Who is the Tool Design For:
Professionals trained in ergonomics and general users

## Minimal Amount of Training:
2 hours

## Studies That Provide Evidence of Validation of the Tool:
None currently found in literature

## Electronic Version:
http://personal.health.usf.edu/tbernard/HollowHills/OSHAChecklists.pdf

## Reference of Peer-Reviewed Publication:
None currently found in literature

## Industries and Jobs Where Tool Has Been Applied:
Manual material handling, bulk manufacturing, assembly line, general manufacturing, and construction

## Is Tool Copyrighted:
No

## Instructional or Supplemental Information:
None currently found in literature

## Equipment Needed to Use Tool:
Protractor

## Time Required Analyzing Typical Job:
<30 minutes

# OSHA Video Display Terminal Checklist

## Purpose:
To provide a way for employers to comply with OSHA requirement to identify, analyze, and control MSD hazards in VDT tasks.

## Developed by:
Occupational Health and Safety Administration (OSHA)

## Developed When:
Not Known

## Musculoskeletal Disorder Risk Factors Considered:
Awkward posture

## Body Regions Considered:
Neck, shoulder, hand, wrist, arm, back, and legs

## Type of Jobs Appropriate For:
Jobs requiring use of video display terminals (VDT)

## Type of Jobs Not Appropriate For:
Jobs without a VDT

## Limitations:
Doesn't address individual employee postures, only examines the work station

Doesn’t address employee eye strain and fatigue

## Who is the Tool Design For:
Professionals trained in ergonomics and non-specialist users

## Minimal Amount of Training:
Reviewing user guide or self training (<4 hours)

## Studies That Provide Evidence of Validation of the Tool:
None currently found in literature

## Electronic Versions:
http://www.ipsamerica.com/ergo/vdt_checklist.PDF

http://www.osha.gov/Publications/videoDisplay/videoDisplay.html

## Reference of Peer-Reviewed Publication:
None currently found in literature

## Industries and Jobs Where Tool Has Been Applied:
Office buildings, laboratory settings, and any occupational setting using a Video display terminal

## Is Tool Copyrighted:
No

## Instructional or Supplemental Information:

http://www.osha.gov/Publications/videoDisplay/videoDisplay.html

U.S. Department of Health and Human Services. National Institute for Occupational Safety and Health (NIOSH), Public Health Service. NIOSH Publications on Video Display Terminals (Revised). NIOSH, Cincinnati, OH, 1991.

## Equipment Needed to Use Tool:

VDT questionnaire checklist

## Time Required Analyzing Typical Job:

<30 minutes

# PLIBEL

## Purpose:
To provide a valid and rapid checklist to identify potential risk factors in the workplace

## Developed by:
Kristina Kemmlert

## Developed When:
1995

## Musculoskeletal Disorder Risk Factors Considered:
Repetition, duration, coupling force, lift force, push/pull force, awkward posture, and contact stress/impact

## Body Regions Considered:
Neck, Shoulder, Upper Back, Elbows, Forearm, Hands, Foot, Knees, Hips, and Low Back

## Type of Jobs Appropriate For:
Manual handling, repetitive tasks, static tasks, dynamic tasks, seated and standing

## Type of Jobs Not Appropriate For:
Vibration intensive

## Limitations:
Inter-observer reliability not high (Kemmlert 1995)

It is difficult to justify the magnitude of 'risks' when the combination of several factors is presented within a job

Answers limited to yes or no

## Who is the Tool Design For:
Non-specialist users

## Minimal Amount of Training:
<4 hours

## Studies That Provide Evidence of Validation of the Tool:
Kemmlert, K. 1995

Technique:

- Comparison to German ergonomic job analysis procedure AET
- Relevant items were placed into the checklist
- Checklist was field tested for validity at 200 workplaces through workplace observations and against a well-documented existing method (AET).
- Reliability was evaluated by having 24 ergonomically skilled people perform four assessments using PLIBEL

Results:

- Percentage of agreement Ranged from 72% to 100%
- Kappa values ranged poor to perfect (-0.06 to 1.00)
- PLIBEL is dichotomous vs. AET is graded on steps of 0 to 5

PLIBEL concentrates on one extreme event (occurrence of hazard) vs. AET analyzes all components of job
PLIBEL relates to individual capacity vs. AET relates to job and workplace
The reliability test yielded fair to moderate agreement
The checklist did not make use of graded steps; rather it required only dichotomous answers
PLIBEL analysis was directly related to the individual observed worker, and not to the job and workplace, as was done in AET
The author concludes that the continued use of PLIBEL would probably increase the understanding of ergonomics hazards at workplaces and improve ergonomic working conditions.

## Electronic Version:

User's guide:
http://www.ttl.fi/en/ergonomics/methods/workload_exposure_methods/table_and_methods/Documents/PLIBEL.pdf
Filled out and part of a case study (Table 5):

http://www.cdc.gov/niosh/topics/ergonomics/ergship/PIQRFAHalterMossPoint.pdf

## Reference of Peer-Reviewed Publication:

Kemmlert K. A method assigned for the identification of ergonomic hazards – PLIBEL. ***Applied Ergonomics*** 1995; 26:199-211.

## Industries and Jobs Where Tool Has Been Applied:

Suitable for all industries

## Is Tool Copyrighted:

No

## Instructional or Supplemental Information:

None currently found in literature

## Equipment Needed to Use Tool:

None

## Time Required Analyzing Typical Job:

<1 hour

# Quick Ergonomic Checklist (QEC)

## Purpose:
To provide an easy to use and practical tool to assess physical exposures and predict risk for work-related musculoskeletal disorders

## Developed by:
Peter Buckle and Guangyan Li

## Developed When:
1998

## Musculoskeletal Disorder Risk Factors Considered:
Repetitive movements, lifting force, push/pull force, awkward postures, task duration, and vibration

## Body Regions Considered:
Neck, shoulder, hand, wrist, arm, back, and legs

## Type of Jobs Appropriate For:
Manual handling, repetitive tasks, static tasks, dynamic tasks, seated and standing

## Type of Jobs Not Appropriate For:
None

## Limitations:
Only allows for looking at the 'worst' task and, for each body area; when the body area is most heavily loaded

Requires judgment when selecting tasks to assess and deciding when the body part is most heavily loaded

Hand force and weight of objects handled is determined by the worker, who may not understand how to estimate them

Only examines individual tasks, not cumulative effects of all activities performed

Cannot predict injuries to individual operators

Does not account for individual risk factors including gender, age, or medical history

## Who is the Tool Design For:
Professionals trained in ergonomics and general users

## Minimal Amount of Training:
4 hours

## Studies That Provide Evidence of Validation of the Tool:
QEC Compared to video, but not validated for its ability to quantitatively predict risk of MSD. QEC results had 78.2% agreement with video

## Electronic Version:
http://www.broadwayergonomics.com/resources/qec.pdf

Interpreting the scores (p 37): http://www.hse.gov.uk/research/rrpdf/rr211.pdf

## Reference of Peer-Reviewed Publication:
Li, G and Buckle, P., 1999, Evaluating change in exposure to risk for musculoskeletal disorders - a practical tool. HSE Contract report 251/1999 HSE Books ISBN 0 7176 1722 X, pp82.

Li, G. and Buckle, P., 1998, A practical method for the assessment of work-related musculoskeletal risks - Quick Exposure Check (QEC). In the Proceedings of the Human Factors and Ergonomics Society 42nd Annual Meeting, October 5-9, Chicago, Human Factors and Ergonomics Society, 1351-1355.

Brown, R. and Li, G., 2003, The development of action levels for the 'Quick Exposure Check' (QEC) system. In: Contemporary Ergonomics 2003, (ed. P.T. McCabe), London: Taylor & Francis, 41-46

## Industries and Jobs Where Tool Has Been Applied:
Suitable for all industries

## Is Tool Copyrighted:
No

## Instructional or Supplemental Information:
"User Guide" for QEC (Part 2): http://www.hse.gov.uk/research/rrpdf/rr211.pdf\

## Equipment Needed to Use Tool:
Questionnaire for employee, weigh scale, force gauges

## Time Required Analyzing Typical Job:
<1 hour

# Rapid Entire Body Assessment (REBA)

## Purpose:
To develop a postural analysis system sensitive to musculoskeletal risk in variety of jobs that is based on body segment specific ratings within specific movement planes, using a scoring system for muscle activity including static, dynamic, rapidly changing or unstable postures, and provide a benchmark for urgency of action.

## Developed by:
S. Hignett and L. McAtammey

## Developed When:
2000

## Musculoskeletal Disorder Risk Factors Considered:
Awkward postures, load/force, coupling, activity level

## Body Regions Considered:
Trunk, neck, legs, knees, upper and lower arms, wrists

## Type of Jobs Appropriate For:
Jobs with a range of frequencies, involving multiple body regions, standing or sitting or combination

## Type of Jobs Not Appropriate For:
None

## Limitations:
Some factors (e.g. twisting, lateral bending, abduction) are weighted equally no matter to what degree they exist (e.g. $5^{o}$ twisting or $20^{o}$ of twisting)

## Who is the Tool Design For:
General Users

## Minimal Amount of Training:
1 hour

## Studies That Provide Evidence of Validation of the Tool:
Inter-observer reliability was found to be 62-85% for 14 users. (S. Hignett and L. McAtammey)

## Electronic Version:
http://personal.health.usf.edu/tbernard/HollowHills/REBA.pdf

## Reference of Peer-Reviewed Publication:
Hignett, S., McAtammey L., Rapid entire body assessment (REBA), Applied Ergonomics, 2000, 31, 201-205.

## Industries and Jobs Where Tool Has Been Applied:
Suitable for all industries

## Is Tool Copyrighted:
No

## Instructional or Supplemental Information:
None found in the literature

## Equipment Needed to Use Tool:
Worksheet, protractor, scale

## Time Required Analyzing Typical Job:
<1 hr

# Rapid Upper Limb Assessment (RULA)

## Purpose:
To investigate the exposure to risk factors for upper limb disorders and provide a method of screening work population quickly so the results that could go into a wider, more versatile ergonomic assessment, while eliminating the need for assessment equipment.

## Developed by:
L. McAmney, E.N. Corlett

## Developed When:
1992

## Musculoskeletal Disorder Risk Factors Considered:
Repetition, awkward/static postures, force, time worked without break

## Body Regions Considered:
Upper arms, lower arms, wrists, trunk, neck, legs

## Type of Jobs Appropriate For:
Jobs with a range of frequencies, involving multiple body regions, standing or sitting or combination

## Type of Jobs Not Appropriate For:
None

## Limitations:
Some factors (e.g. twisting, lateral bending, abduction) are weighted equally no matter to what degree they exist (e.g. $5^{o}$ twisting or $20^{o}$ of twisting)

## Who is the Tool Design For:
General users

## Minimal Amount of Training:
1 hour

## Studies That Provide Evidence of Validation of the Tool:
None found in literature

## Electronic Version:
http://personal.health.usf.edu/tbernard/HollowHills/RULA.pdf

http://ergo.human.cornell.edu/Pub/AHquest/CURULA.pdf

http://www.rula.co.uk/

## Reference of Peer-Reviewed Publication:
McAamney, L., Corlett, E.N., RULA: a survey method for the investigation of work-related upper limb disorders, Applied Ergonomics, 24(2), 91-99.

## Industries and Jobs Where Tool Has Been Applied:
Suitable for all industries

## Is Tool Copyrighted:

No

## Instructional or Supplemental Information:
None found in the literature

## Equipment Needed to Use Tool:
Worksheet, protractor, scale

## Time Required Analyzing Typical Job:
<1 hr

# Rodger's Muscle Fatigue Assessment

## Purpose:
To provide a method of evaluating the physiological demands of a task against published criteria of acceptable levels of oxygen consumption for whole body or upper bodywork.

## Developed by:
Suzanne Rodgers

## Developed When:
1978-1992

## Musculoskeletal Disorder Risk Factors Considered:
Fatigue

## Body Regions Considered:
Neck, shoulder, hand, wrist, arm, back, legs, elbow, and knee

## Type of Jobs Appropriate For:
Jobs that require high frequency and duration, and have awkward postures

## Type of Jobs Not Appropriate For:
Non-fatiguing job analysis, and seated jobs

## Limitations:
Any task evaluated is limited to 30 seconds of continuous effort and 15 minutes of effort frequency. After this point, the job is considered very high priority. No numerical value is assigned after this point

## Who is the Tool Design For:
Professional users

## Minimal Amount of Training:
8 hours

## Studies That Provide Evidence of Validation of the Tool:
None currently found in literature

## Electronic Version:
http://personal.health.usf.edu/tbernard/HollowHills/Rodgers_MFA_M20.pdf

## Reference of Peer-Reviewed Publication:
Suzanne H. Rodgers, A functional job evaluation technique, in *Ergonomics*, edited by J.S. Moore and A. Garg, Occupational Medicine: State of the Art Reviews. 7(4):679-711, 1992.

Suzanne H. Rodgers, Job evaluation in worker fitness determination; Occupational Medicine: State of the Art Reviews. 3(2):219-239, 1988.

## Industries and Jobs Where Tool Has Been Applied:
General manufacturing, construction, and healthcare

## Is Tool Copyrighted:

No

## Instructional or Supplemental Information:
http://personal.health.usf.edu/tbernard/HollowHills/Rodgers_MFA_M20.pdf

## Equipment Needed to Use Tool:
None

## Time Required Analyzing Typical Job:
1-2 hours

# Strain Index

## Purpose:
To provide a relatively simple risk assessment method designed to evaluate a job's level of risk for developing a disorder of the distal upper extremities

## Developed by:
J. Steven Moore and Arun Garg

## Developed When:
1995

## Musculoskeletal Disorder Risk Factors Considered:
Lifting Force, push/pull force, Awkward Posture, Repetition, Duration

## Body Regions Considered:
Hands, wrists, forearms, and elbows

## Type of Jobs Appropriate For:
Hand intensive repetitive tasks

## Type of Jobs Not Appropriate For:
Static tasks and awkward posture tasks

## Limitations:
Does not account for contact stress, cold temperatures, hand-arm vibration, or recovery time between exertions

Only looks at MSD risk for the upper extremity, from the elbows to hands

User must estimate intensity of exertions, postures, & speed of work

Multiplier values used in the method are primarily based on the authors' professional opinions with support from physiological, biomechanical, and epidemiological principles as opposed to a mathematical relationship between task variables

Cannot predict injuries to individual operators

Does not account for individual risk factors including gender, age, or medical history.

## Who is the Tool Design For:

Professionals trained in ergonomics and general users

## Minimal Amount of Training:
4 hours

## Studies That Provide Evidence of Validation of the Tool:

Knox and Moore (2001)

Predictive Validity:
Turkey processing plant with 28 single-task jobs
All tasks were video taped for 10 job cycles
OSHA 200 logs over a 3-year period

Moore and Garg (1994)

Predictive Validity:
Pork processing plant with 32 jobs categories
All tasks were video taped
OSHA 200 logs over a 20-month period

Rucker and Moore (2002)

Predictive Validity :
Manufacturing plants, Hose connecting plant, Chair manufacturer
28 jobs categories, tasks video taped
OSHA 200 logs over a 3-year period

Overall, Provides evidence of good sensitivity (0.86-1.0) and evidence of good specificity (0.79-0.94) depending on population

Spielholz P, Bao S, Howard N, Silverstein B, Fan J, Smith C, Salazar C. "Reliability and validity assessment of the hand activity level threashold limit value and strain index using expert ratings of mono-task jobs", J. Occupational Environmental Hygiene, 5(4): 250-7, Apr. 2008.

## Electronic Version:

http://ergo.human.cornell.edu/ahJSI.html

http://personal.health.usf.edu/tbernard/HollowHills/StrainIndexM12.pdf

## Reference of Peer-Reviewed Publication:

J. Steven Moore and Arun Garg, (1995), The Strain Index: A Proposed Method To Analyze Jobs For Risk Of Distal Upper Extremity Disorders, ***American Industrial Hygiene Association Journal***, 56:443-458.

## Industries and Jobs Where Tool Has Been Applied:

Small parts assembly, inspecting, meatpacking, sewing, packaging, keyboarding, data processing, and highly repetitive hand motion jobs

## Is Tool Copyrighted:

No

## Instructional or Supplemental Information:

None currently found in literature

## Equipment Needed to Use Tool:
Stopwatch

## Time Required Analyzing Typical Job:
1-2 hours

# Utah Back Compressive Force

## Purpose:
To provide a screening tool the can be use to get an early insight to the compressive forces placed on the back when performing manual material handling (MMH) tasks and should be used to identify potential areas of concern

## Developed by:
Donald S. Bloswick

## Developed When:
2000

## Musculoskeletal Disorder Risk Factors Considered:
Load, posture, frequency, duration and static positions

## Body Regions Considered:
Upper and lower Back

## Type of Jobs Appropriate For:
Manual material handling tasks

## Type of Jobs Not Appropriate For:
Non-lifting job, high risk postural jobs may present false positive

## Limitations:
Very primitive and general in terms of usable data for change

## Who is the Tool Design For:
General users

## Minimal Amount of Training:
2 hours

## Studies That Provide Evidence of Validation of the Tool:
None currently found in literature

## Electronic Version:
http://personal.health.usf.edu/tbernard/HollowHills/UtahBackCompForc11.pdf

## Reference of Peer-Reviewed Publication:
None currently found in literature

## Industries and Jobs Where Tool Has Been Applied:
None currently identified

## Is Tool Copyrighted:
Yes

## Instructional or Supplemental Information:
None currently found in literature

## Equipment Needed to Use Tool:
None

## Time Required Analyzing Typical Job:
1 hour

# Washington State's (WISHA) Caution Zone

## Purpose:
To control exposure to MSD hazards in workplace by using a screening tool for typical work activities to find jobs that have a sufficient degree of risk

## Developed by:
Washington State's Department of Labor and Industries

## Developed When:
Not Known

## Musculoskeletal Disorder Risk Factors Considered:
Repetitive movements, lifting force, push/pull force, grip force, awkward postures, task duration, and vibration

## Body Regions Considered:
Neck, shoulder, hand, wrist, arm, back, and legs

## Type of Jobs Appropriate For:
Most tasks

## Type of Jobs Not Appropriate For:
Non-labor intensive jobs

## Limitations:
The checklist is general in nature

Best used as a preliminary  measurement to assess a hazardous job

Must be followed-up with a finite risk analysis

## Who is the Tool Design For:
Professionals trained in ergonomics and general users

## Minimal Amount of Training:
4 hours

## Studies That Provide Evidence of Validation of the Tool:
None currently found in literature

## Electronic Version:
http://www.lni.wa.gov/Safety/Topics/Ergonomics/ServicesResources/Tools/default.asp

## Reference of Peer-Reviewed Publication:
None currently found in literature

## Industries and Jobs Where Tool Has Been Applied:
General manufacturing, construction, and healthcare

## Is Tool Copyrighted:
No

## Instructional or Supplemental Information:
None currently found in literature

## Equipment Needed to Use Tool:
Tape measure and stop watch

## Time Required Analyzing Typical Job:
1-2 hours

# Washington State (WISHA) Hazard Zone

## Purpose:
To provide a regulatory effort for performing further risk assessment on jobs that had been identified as caution zone jobs. The checklist criteria are at levels that most workers would be at a high risk of developing a work-related MSD if exposed on a regular basis.

## Developed by:
Washington State's Department of Labor and Industries

## Developed When:
Not Known

## Musculoskeletal Disorder Risk Factors Considered:
Repetitive movements, lifting force, push/pull force, grip force, awkward postures, task duration, and vibration

## Body Regions Considered:
Neck, shoulder, hand, wrist, arm, back, and legs

## Type of Jobs Appropriate For:
Most tasks

## Type of Jobs Not Appropriate For:
Non-labor intensive jobs

## Limitations:
Some of the criteria on the hazard zone checklist were increased above levels suggested in the research literature due to political interference or practical limitations

## Who is the Tool Design For:
Professionals trained in ergonomics and general users

## Minimal Amount of Training:
4 hours

## Studies That Provide Evidence of Validation of the Tool:
None currently found in literature

## Electronic Version:
http://www.lni.wa.gov/Safety/Topics/Ergonomics/ServicesResources/Tools/default.asp

## Reference of Peer-Reviewed Publication:
None currently found in literature

## Industries and Jobs Where Tool Has Been Applied:
General manufacturing, construction, and healthcare

## Is Tool Copyrighted:
No

## Instructional or Supplemental Information:
None currently found in literature

## Equipment Needed to Use Tool:
None

## Time Required Analyzing Typical Job:
1-2 hours

# Washington State (WISHA) Lifting Calculator

## Purpose:
To perform a quick analysis of a lifting job in order to determine the need for more detailed analyses

## Developed by:
Washington State's Department of Labor and Industries

## Developed When:
Not Known

## Musculoskeletal Disorder Risk Factors Considered:
Lifting force, repetitive movements, most awkward lifting and lowering position

## Body Regions Considered:
Low Back

## Type of Jobs Appropriate For:
Manual Material Handling

## Type of Jobs Not Appropriate For:
Any non-lifting job

## Limitations:
Not concerned with the compression forces at any region within the body

Sole purpose is to predict if the weight lifted is less than the limit set

## Who is the Tool Design For:
Professionals trained in ergonomics and general users

## Minimal Amount of Training:
4 hours

## Studies That Provide Evidence of Validation of the Tool:
None currently found in literature

## Electronic Version:
http://www.lni.wa.gov/wisha/ergo/evaltools/ergocalc.pdf

## Reference of Peer-Reviewed Publication:
None currently found in literature

## Industries and Jobs Where Tool Has Been Applied:
General manufacturing, construction, and healthcare

## Is Tool Copyrighted:
No

## Instructional or Supplemental Information:
None currently found in literature

## Equipment Needed to Use Tool:
None

## Time Required Analyzing Typical Job:
<1 hour