



**OSC 10**  
Ohio Safety Congress & Expo

**Common Tools for Assessing Ergonomics Risk Factors**  
Part Two, Session #254

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Wednesday March 31, 2010

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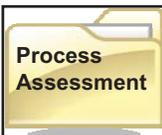
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**Process Assessment**

- **Three Ergonomics Assessment Tools**
  - HAL/TLV
  - RULA
  - NIOSH Lifting Equation

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**Process Assessment**

## Hand Activity Level (HAL/TLV)

**Hand Activity Level (HAL) TLV Scoring Sheet**

Hand Activity Continuum (0-100%)

Hand Activity Level (HAL) TLV Scoring Graph

Results

**RULA: RTU for Hand Activity**

Hand Activity Level (HAL) TLV Scoring Sheet

Hand Activity Level (HAL) TLV Scoring Graph

Results

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**Process Assessment**

## Hand Activity Level (HAL/TLV)

- Circle the hand activity on the **Hand Activity Continuum**

**Hand Activity Level (HAL) TLV Scoring Sheet**

Date: \_\_\_\_\_ Task: \_\_\_\_\_  
 Company: \_\_\_\_\_ Supervisor: \_\_\_\_\_  
 Dept.: \_\_\_\_\_ Evaluator: \_\_\_\_\_

**Hand Activity Continuum (circle one)**

|  |  |  |   |   |   |
|--|--|--|---|---|---|
| 0  | 2  | 4  | 6   | 8   | 10  |
| Hand idle most of the time; no regular exertions | Consistent, conspicuous, long pauses; or very slow motions | Slow, steady motion/exertions, frequent brief pauses | Steady motion/exertion, infrequent pauses | Rapid, steady motion/exertions, no regular pauses | Rapid, steady motion/exertions, continuously keeping up or continuous exertions |

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**Process Assessment**

## Hand Activity Level (HAL/TLV)

- Estimate the normalized peak force relative to 100% population capability on **Borg CR-10 Scoring table**

**Borg CR-10 Scoring**

|               |   |   |   |   |   |   |   |   |   |   |    |   |
|---------------|---|---|---|---|---|---|---|---|---|---|----|---|
| Rating        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | ♦ |
| Average Score |   |   |   |   |   |   |   |   |   |   |    |   |

OR

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**Process Assessment**

## Hand Activity Level (HAL/TLV)

| Estimation of Normalized Peak Force for Hand Forces |                  |                                   |   |     |
|---|------------------|-----------------------------------|---|-----|
| %MPC  | Subjective Scale |                                   | Moore-Garg Observer Scale (Alternative Method)    | NPF |
|   | Score            | Verbal Anchor                     |   |     |
| 0   | 0                | Nothing at all                    |   | 0   |
| 5   | 0.5              | Extremely Weak (Just Noticeable)  | Barely Noticeable or Relaxed Effort               | 0.5 |
| 10  | 1                | Very Weak                         |   | 1   |
| 20  | 2                | Weak (Light)                      | Noticeable or Definite Effort                     | 2   |
| 30  | 3                | Moderate                          |   | 3   |
| 40  | 4                |                                   | Obvious Effort, But Unchanged Facial Expression   | 4   |
| 50  | 5                | Strong (Heavy)                    |   | 5   |
| 60  | 6                |                                   | Substantial Effort with Changed Facial Expression | 6   |
| 70  | 7                | Very Strong                       |   | 7   |
| 80  | 8                |                                   |   | 8   |
| 90  | 9                |                                   | Uses Shoulder or Trunk for Force                  | 9   |
| 100   | 10               | Extremely Strong (almost maximum) |   | 10  |

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**Process Assessment**

## Hand Activity Level (HAL/TLV)

- Use this information find the color rating on the **HAL TLV Scoring Graph**

**HAL TLV Scoring Graph**

Normalized Peak Force (Y-axis, 0 to 10)  
 HAL (Hand Activity Level) (X-axis, 0 to 10)

Labels: Action Limit, TLV

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**Process Assessment**

## Hand Activity Level (HAL/TLV)

- Check the appropriate box under **Results**

**Results**

| Score                          | Action Level   | Check Box                |
|--------------------------------|--|--------------------------|
| Below Action Limit             | Maintain   | <input type="checkbox"/> |
| Above Action Limit & Below TLV | Slightly elevated risk of MSDs. Control measures, including surveillance, are recommended. | <input type="checkbox"/> |
| Above TLV                      | Significantly elevated risk of MSDs. Appropriate control measures should be utilized.      | <input type="checkbox"/> |

Questions? The Ergonomics Center of North Carolina  
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**Hand Activity Level (HAL) TLV Scoring Sheet**

Name: \_\_\_\_\_ Title: \_\_\_\_\_  
 Date: \_\_\_\_\_ Department: \_\_\_\_\_

**Hand Activity Continuum (circle one)**

0 2 4 6 8 10

Hand activity level of the limb (to the wrist or hand) is: 0 (no force), 2 (light, intermittent force), 4 (moderate, intermittent force), 6 (heavy, intermittent force), 8 (very heavy, intermittent force), 10 (maximum voluntary contraction)

**Borg CR-10 Scoring**

|               |   |   |   |   |   |   |   |   |   |   |    |
|---------------|---|---|---|---|---|---|---|---|---|---|----|
| Rating        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Average Scale |   |   |   |   |   |   |   |   |   |   |    |

**HAL TLV Scoring Graph**

Normalized Peak Force (Y-axis, 0 to 10)  
 HAL (Hand Activity Level) (X-axis, 0 to 10)

Labels: Action Limit, TLV

**Results**

| Score                          | Action Level   | Check Box                |
|--------------------------------|--|--------------------------|
| Below Action Limit             | Maintain   | <input type="checkbox"/> |
| Above Action Limit & Below TLV | Slightly elevated risk of MSDs. Control measures, including surveillance, are recommended. | <input type="checkbox"/> |
| Above TLV                      | Significantly elevated risk of MSDs. Appropriate control measures should be utilized.      | <input type="checkbox"/> |

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- Step 1:** Watch the video clip and estimate the HAL using the Hand Activity Continuum
- Step 2:** Determine the normalized peak force (NPF) using either the Borg scale or the combination chart
- Step 3:** Use the HAL TLV Scoring Graph to determine the Process Action Level Results
- Note:**
  - Rate Left Hand and Right Hand separately

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**Process Assessment**

## Rapid Upper Limb Assessment (RULA)

### A. Arm & Wrist Analysis

**Step 1: Locate Upper Arm Position**

**Step 1a: Adjust...**

If shoulder is raised: +1;  
 If upper arm is abducted: +1;  
 If arm is supported or person is leaning: -1

Final Upper Arm Score =

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**Process Assessment**

## Rapid Upper Limb Assessment (RULA)

**Step 2: Locate Lower Arm Position**

**Step 2a: Adjust...**

If arm is working across midline of the body: +1;  
 If arm out to side of body: +1

Final Lower Arm Score =

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**Process Assessment**

## Rapid Upper Limb Assessment (RULA)

**Step 3: Locate Wrist Position**

**Step 3a: Adjust...**

If wrist is bent from the midline: +1

Final Wrist Score =

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**Process Assessment**

## Rapid Upper Limb Assessment (RULA)

**Step 4: Wrist Twist**  
 If wrist is twisted mainly in mid-range =1;  
 If twist at or near end of twisting range = 2  
 Wrist Twist Score =

**Step 5: Look-up Posture Score in Table A**  
 Use values from steps 1,2,3 & 4 to locate Posture Score in table A.  
 Posture Score A =

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## Rapid Upper Limb Assessment (RULA)

**SCORES**

**Table A**

| Upper Arm | Lower Arm | Wrist       |             |            |             |   |   |   |   |
|-----------|-----------|-------------|-------------|------------|-------------|---|---|---|---|
|           |           | 1           | 2           | 3          | 4           |   |   |   |   |
|           |           | Wrist twist | Wrist joint | Wrist base | Wrist twist |   |   |   |   |
| 1         | 1         | 1           | 2           | 1          | 2           | 1 | 2 | 1 | 2 |
|           | 2         | 1           | 1           | 2          | 2           | 2 | 2 | 3 | 3 |
|           | 3         | 2           | 2           | 2          | 2           | 2 | 3 | 3 | 3 |
| 2         | 1         | 2           | 2           | 3          | 3           | 3 | 3 | 4 | 4 |
|           | 2         | 2           | 2           | 3          | 3           | 3 | 3 | 4 | 4 |
|           | 3         | 3           | 3           | 4          | 4           | 4 | 4 | 5 | 5 |
| 3         | 1         | 3           | 3           | 4          | 4           | 4 | 4 | 5 | 5 |
|           | 2         | 3           | 4           | 4          | 4           | 4 | 4 | 5 | 5 |
|           | 3         | 4           | 4           | 4          | 4           | 4 | 4 | 5 | 5 |
| 4         | 1         | 4           | 4           | 4          | 4           | 4 | 4 | 5 | 5 |
|           | 2         | 4           | 4           | 4          | 4           | 4 | 4 | 5 | 5 |
|           | 3         | 4           | 4           | 4          | 5           | 5 | 5 | 6 | 6 |
| 5         | 1         | 5           | 5           | 5          | 6           | 6 | 6 | 7 | 7 |
|           | 2         | 5           | 6           | 6          | 6           | 6 | 7 | 7 | 7 |
|           | 3         | 6           | 6           | 6          | 7           | 7 | 7 | 7 | 8 |
| 6         | 1         | 7           | 7           | 7          | 7           | 7 | 8 | 8 | 9 |
|           | 2         | 8           | 8           | 8          | 8           | 8 | 9 | 9 | 9 |
|           | 3         | 9           | 9           | 9          | 9           | 9 | 9 | 9 | 9 |

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**Process Assessment**

## Rapid Upper Limb Assessment (RULA)

**Step 6: Add Muscle Use Score**  
 If posture mainly static (i.e. held for longer than 1 minute) or;  
 If action repeatedly occurs 4 times per minute or more: +1  
 Muscle Use Score =

**Step 7: Add Force/load Score**  
 If load less than 2 kg (intermittent): -0;  
 If 2 kg to 10 kg (intermittent): +1;  
 If 2 kg to 10 kg (static or repeated): +2;  
 If more than 10 kg load or repeated or shocks: +3  
 Force/load Score =

**Step 8: Find Row in Table C**  
 The completed score from the Arm/wrist analysis is used to find the row on Table C.  
 Final Wrist & Arm Score =

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**Process Assessment**

## Rapid Upper Limb Assessment (RULA)

**+**  = Muscle Use Score

**+**  = Force/load Score

**=**  = Final Neck, Trunk & Leg Score

**Step 13: Add Muscle Use Score**  
 If posture mainly static or:  
 If action 4/minute or more: +1

**Step 14: Add Force/load Score**  
 If load less than 2 kg (intermittent): +0;  
 If 2 kg to 10 kg (intermittent): +1;  
 If 2 kg to 10 kg (static or repeated): +2;  
 If more than 10 kg load or repeated or shocks: +3

**Step 15: Find Column in Table C**  
 The completed score from the Neck/Trunk & Leg analysis is used to find the column on Chart C

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**Process Assessment**

## Rapid Upper Limb Assessment (RULA)

Write Table Score:

Table A:  +  =

Table B:  +  =

Table C: 

|   |   |   |   |   |   |   |   |   |    |
|---|---|---|---|---|---|---|---|---|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Final Score =

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**Process Assessment**

## Rapid Upper Limb Assessment (RULA)

– RULA score with guidance on further actions necessary

- 1 or 2=Acceptable
- 3 or 4=Investigate further
- 5 or 6=Investigate further & change SOON
- 7=Investigate further & change IMMEDIATELY

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## Rapid Upper Limb Assessment (RULA)

- Observe the video clip and determine the posture to evaluate.
  - Worst posture
  - Longest held
- Complete the worksheet
  - Remember to consider the posture relative to the joint you are reviewing (example: upper arm to trunk angle)
- Add the scores as directed and use the tables to determine the Final Score.
- Use the form to interpret the Final Score and the action needed.




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## NIOSH Lifting Equation

- Developed by National Institute of Occupational Safety and Health
- Length: 1-page
- Use for:
  - Evaluation of manual lifting tasks
  - Many assumptions about lifting conditions
- Inputs:
  - Object weight, H, V, D, A, F, Lifting duration, and Coupling
- Outputs:
  - Recommended Weight Limit (RWL)
  - Lifting Index (LI)

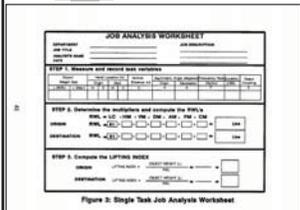


Figure 3: Single Task Job Analysis Worksheet

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## NIOSH Lifting Equation

- DOES NOT APPLY TO LIFTING/LOWERING:
  - With only one-hand
  - For more than 8 hours
  - While seated/kneeling
  - In a restricted workspace
  - Unstable objects
  - While carrying, pushing, or pulling
  - When using wheelbarrows or shovels
  - With high speed motions (faster than 30in/sec)
  - On slippery surfaces or poor footing
  - When it's too hot, cold, or humid

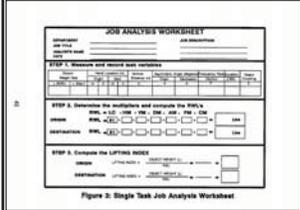


Figure 3: Single Task Job Analysis Worksheet

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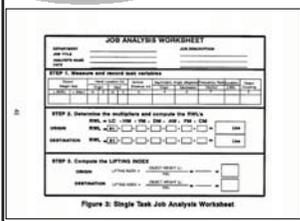
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**Manual  
Material  
Handling**

**NIOSH Lifting Equation**



- Analyze a lifting situation
- Take the appropriate measurements
- Look up the multipliers
- Perform the calculations
- What do the results tell you?

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