



Threshold Limit Values for Physical Agents (TLV[®]-PA) Committee

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Updates for 2006

- RF&MW: Note on Ultra-wide bandwidth
- Sub-RF Magnetic Fields: Note on Contact Currents
- Sub-RF Static Fields: Note on Contact Currents
- Noise: Note on Ototoxicity
- Note on carcinogenicity

NICs for 2006

- Visible and Near Infrared Radiation
- Heat Stress and Strain



Visible and Near Infrared Radiation

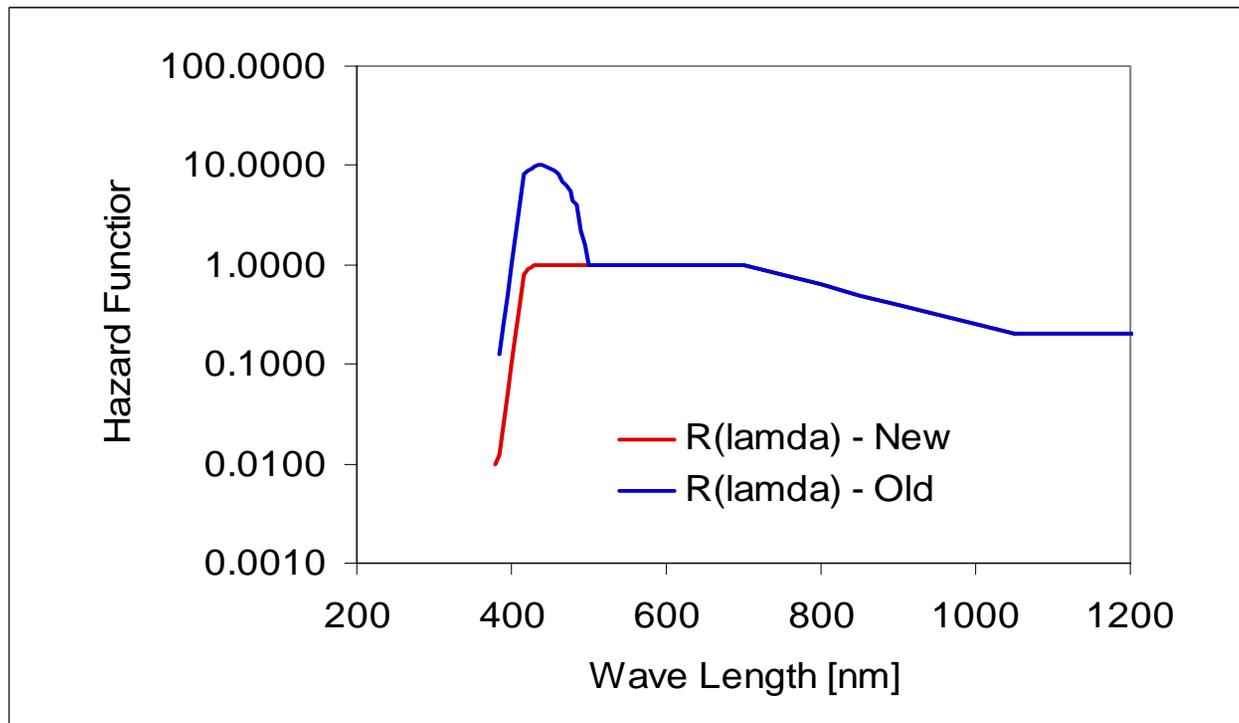
Thermal Effects Hazard Function



Overestimated Risk

- The risk of thermal effects between 380 and 500 nm was higher than necessary.
- The hazard function $[R(\lambda)]$ in this range was reduced accordingly.

Graphically Speaking





Heat Stress and Strain

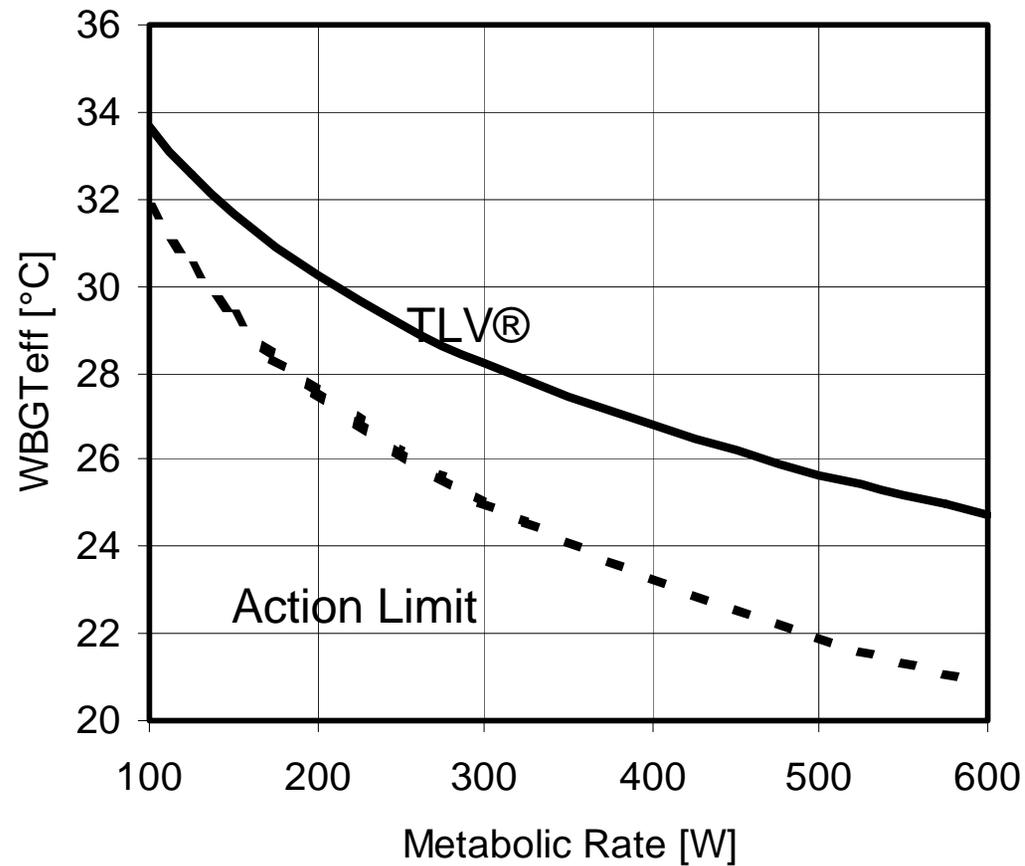
Major Changes



Action Limit

- Action Limit
 - ✓ Replaces the Unacclimatized TLV[®]
- Work below the Action Limit is presumptively low stress for any healthy worker.

TLV[®] for Heat Stress



Accounting for Clothing

- Clothing makes an environmental condition seem worse. It reduces both evaporative and dry heat exchange.
- Intuitively, there should be a factor that adjusts the environmental measures to an equivalent condition in work clothes.



Changed and Expanded for 2006

Clothing Adjustment Factors [$^{\circ}\text{C}$ -WBGT]

	Previous	2006
Work Clothes (Baseline)	0	0
Cloth Coveralls	3.5	0
Double Layer Cloth Clothing	5	3
SMS Coveralls	---	0.5
Polyolefin Coveralls	---	1
Limited-use Vapor-Barrier Coveralls	---	11





Environment Plus Clothing

Effective WBGT ($WBGT_{eff}$) =

Measured WBGT

+ Clothing Adjustment Factor (CAF)





Heat Stress and Strain TLV[®]

Process Flow

(See TLV[®] Decision Flow Chart)



Screening

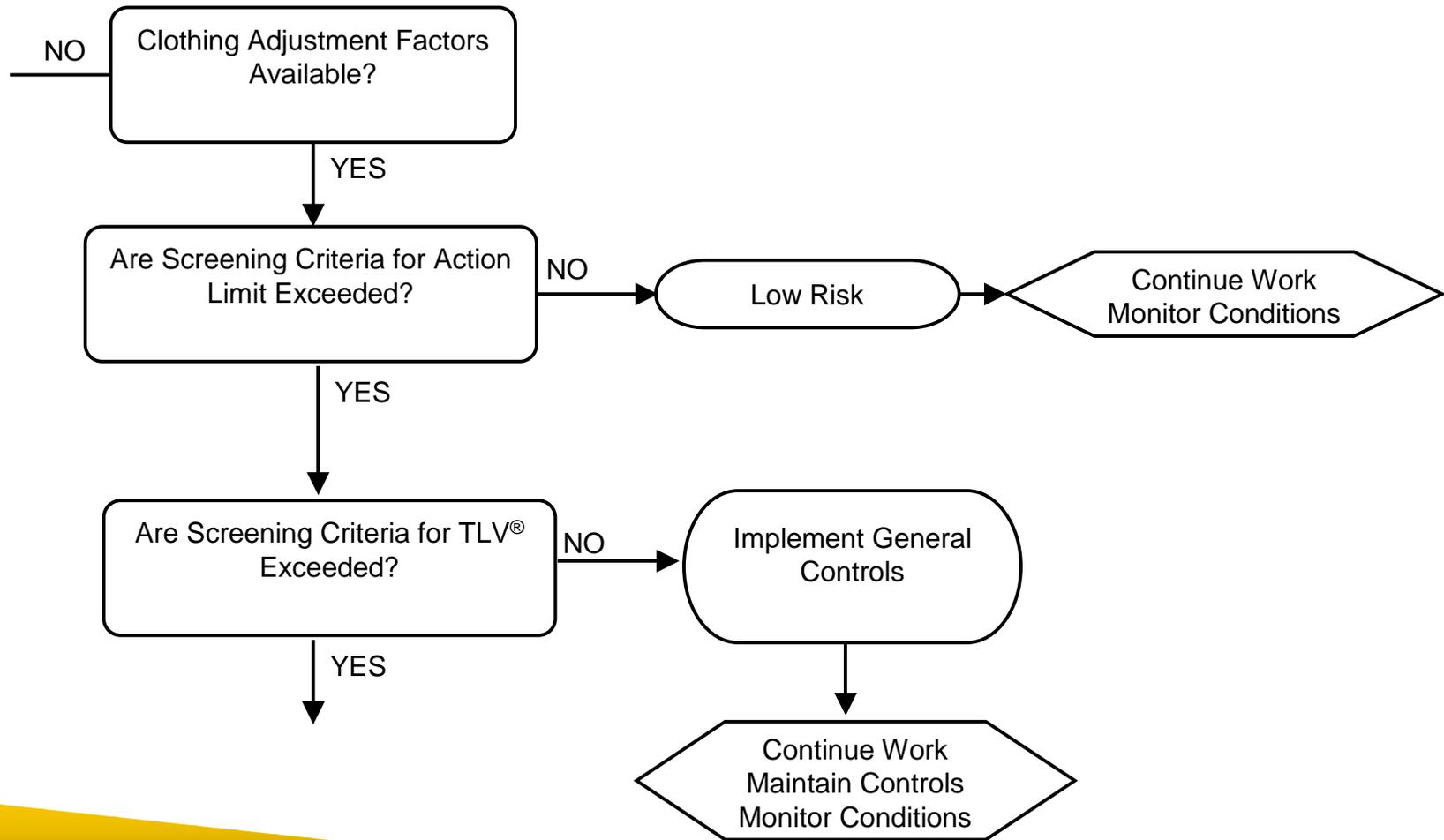


Table Changes for 2006

- Assigned metabolic rate in each category has a lower value.
 - ✓ Better reflects work physiology principles and other standards.
 - ✓ Means higher WBGT values.
- Allocation of Work/Rest described as a range of % work in the cycle.

Metabolic Rate by Category

Reference Metabolic Rate [W]

	Previous	2006
Rest (Baseline)	115	115
Light	230	180
Moderate	350	300
Heavy	465	415
Very Heavy	580	520

Screening Action Limit

%Work	L	M	H	VH
75 to 100	28.1	25.0	--	--
50 to 75	28.7	26.0	24.2	--
25 to 50	29.3	27.2	25.7	24.6
0 to 25	30.0	28.8	27.8	27.0

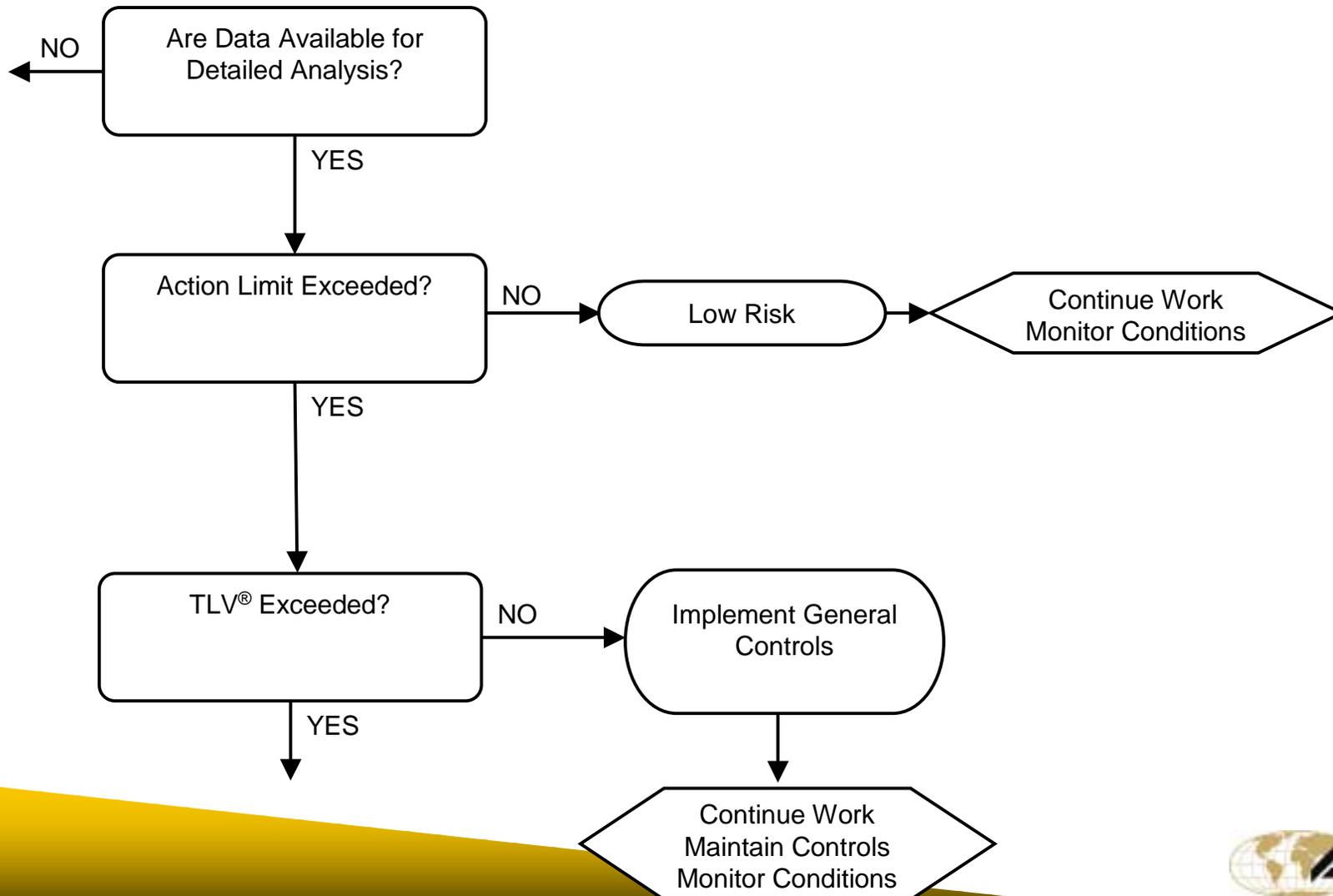
Note: *TLVs[®]* and *BEIs[®]* Book rounds these numbers to the nearest 0.5 °
C-WBGT

Screening TLV[®]

%Work	L	M	H	VH
75 to 100	30.8	28.2	--	--
50 to 75	31.2	29.0	27.6	--
25 to 50	31.8	30.1	28.8	27.9
0 to 25	32.3	31.3	30.5	29.8

Note: *TLVs[®] and BEIs[®]* Book rounds these numbers to the nearest 0.5 °
C-WBGT

Detailed Analysis



Task Analysis

- Breakdown by Location
- Breakdown by Homogeneous Activities
- Time Assigned for Each Location/
Activity

Metabolic Rate Categories

- Light
 - ✓ 180 W
 - ✓ sitting, standing, light hand/arm work
- Moderate
 - ✓ 300 W
 - ✓ walking, moderate lifting
- Heavy
 - ✓ 415 W
 - ✓ heavy materials handling
- Very Heavy
 - ✓ 520 W
 - ✓ pick and shovel work

Potential Error

- Broad Range
- Over-Estimation

ISO Estimation Method

Earlier Methods in NIOSH Criteria Document

Components of Metabolic Rate

- ✓ Basal (Base) Metabolism (B)
- ✓ Posture (P)
- ✓ Type of Work (W)
- ✓ Walking (D)
- ✓ Climbing (C)

$$\text{Total Metabolic Rate (M)} = B + P + W + D + C$$

Clothing Adjustments to WBGT

$WBGT_{\text{measured}}$

+ Clothing Adjustment

$WBGT_{\text{eff}}$

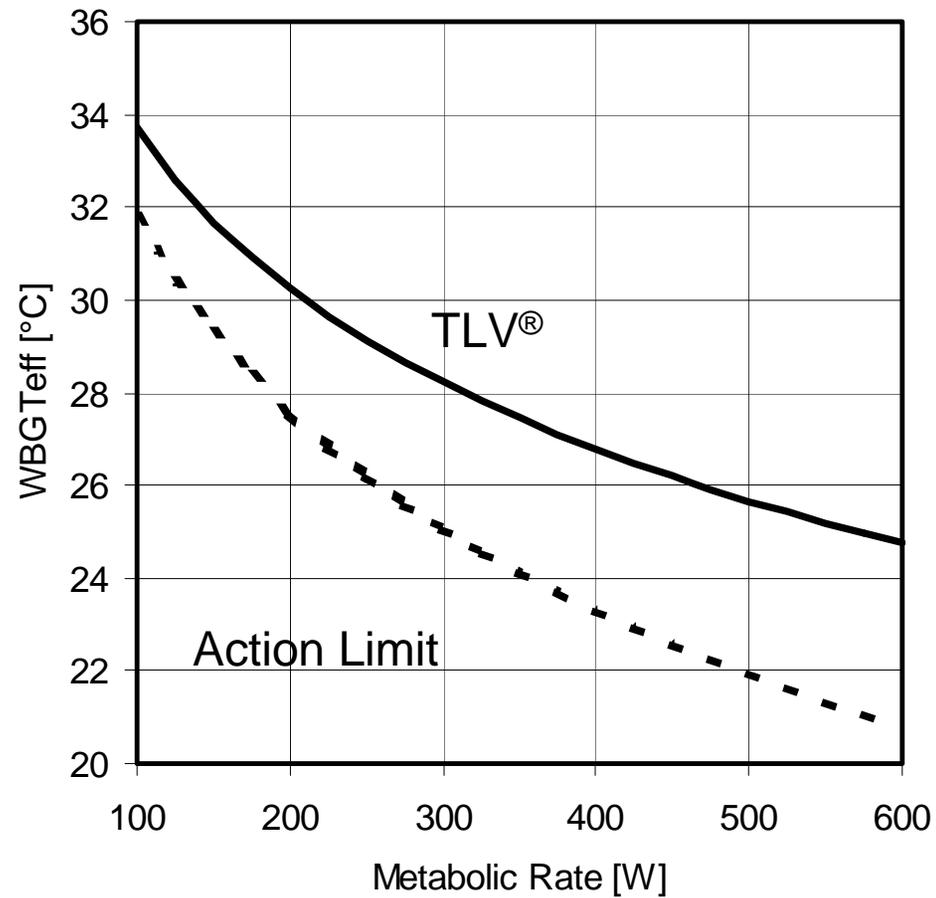
Time-Weighted Average

$$\text{TWA-WBGT}_{\text{eff}} = \frac{\text{WBGT}_{\text{eff1}} \times t_1 + \dots + \text{WBGT}_{\text{effn}} \times t_n}{t_1 + \dots + t_n}$$

$$\text{TWA-M} = \frac{M_1 \times t_1 + \dots + M_n \times t_n}{t_1 + \dots + t_n}$$

Over one to two hour time period.

Where is the job?

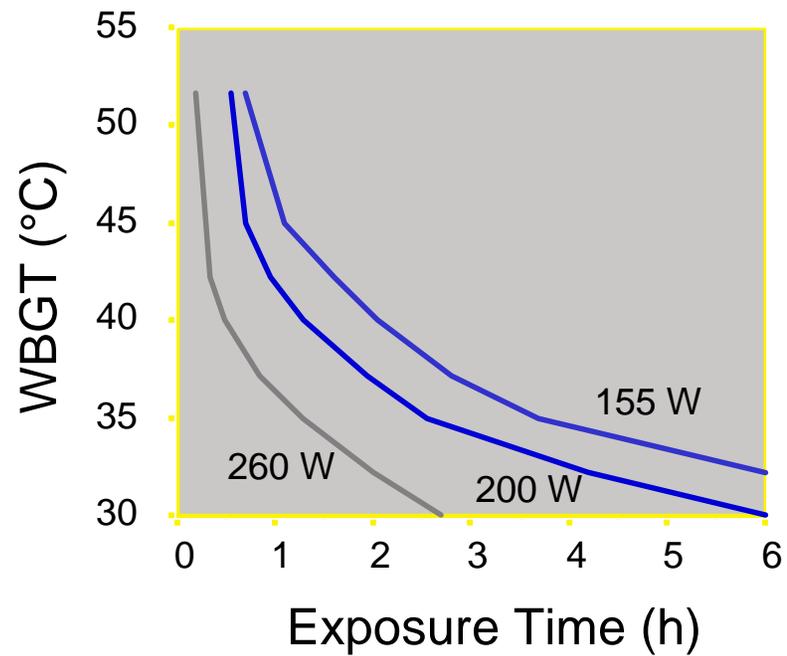


Job Risk Factors

- Traditional
 - ✓ Environment
 - ✓ Work Demands
 - ✓ Clothing Requirements
- Plus Time

Empirical Time Limits

US Navy PHEL Charts



Rational Time Limits

- ISO 7933 (2004)
- PHS: Predicted Heat Strain

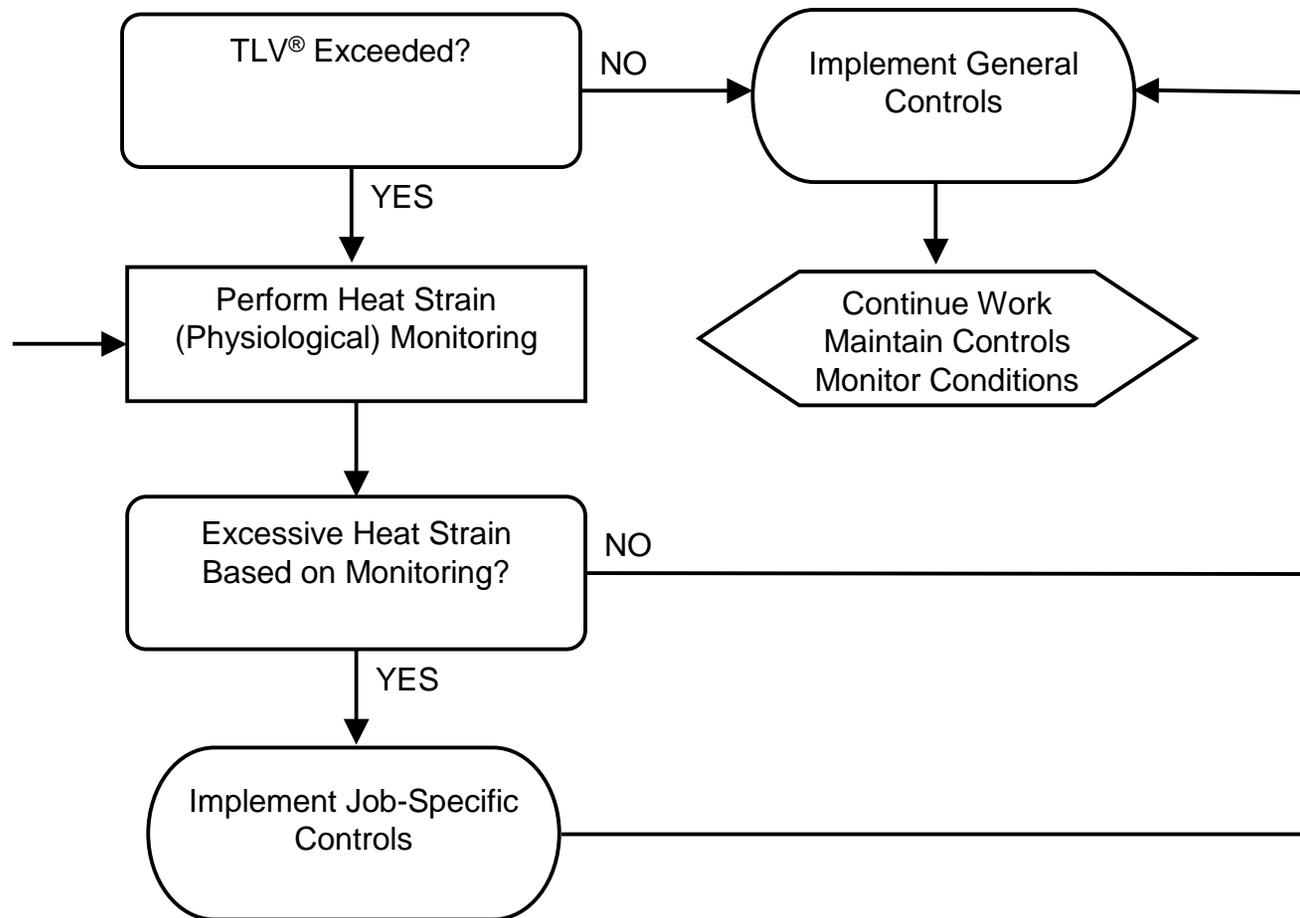


Heat Strain Monitoring

When working above the TLV[®] or under conditions when a detailed analysis cannot be performed.



Heat Strain Monitoring



Body Core Temperature

- Acceptable Limit

- ✓ Acclimatized, Healthy, Experienced: 38.5 °C

- ✓ Unacclimatized and Unselected: 38 °C

- Oral Temperature

- ✓ No recent drinks/food, mouth closed

- ✓ Core is Oral plus 0.5 °C

Heart Rate

- Sustained heart rate greater than $(180 - \text{Age})$
- Recovery heart rate greater than 120 bpm at one minute

Symptoms

- Sudden or severe fatigue, nausea, dizziness, or lightheadedness.

MEDICAL EMERGENCY

- Disorientation, irritability, malaise, chills, unconscious.

Patterns of Strain

- No pattern of excessive strain
- Pattern of excessive strain



Under Study*

- Ergonomics
 - ✓ Hand-Arm Vibration
 - ✓ Localized Fatigue
- Lasers
- Nonionizing Radiation
 - ✓ Light and Near Infrared
 - ✓ Radiofrequency and microwave radiation
 - ✓ Static Magnetic Fields
 - ✓ Ultraviolet Radiation
- Cold Stress

*Refer to the ACGIH® website for the up-to-date list. This list is evergreen and can change during the year.





Thank You

Thanks to
the Committee members

