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

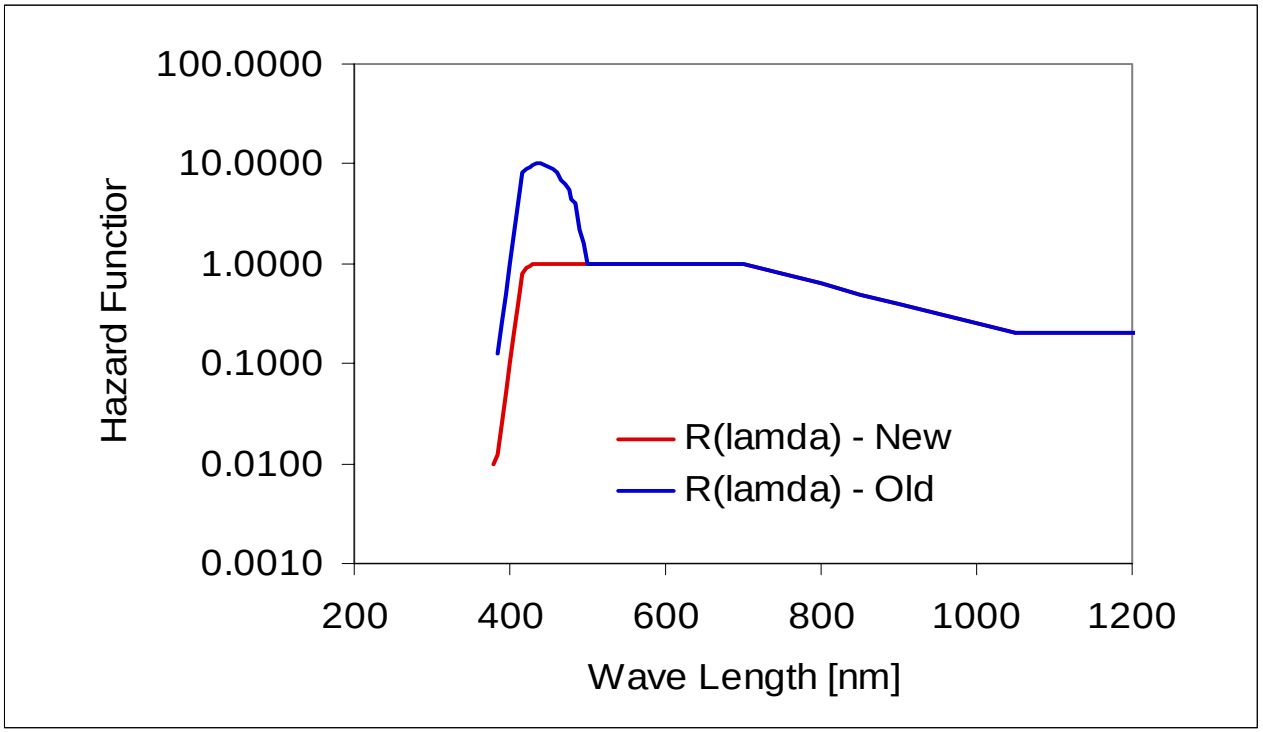
Visible and Near Infrared Radiation

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



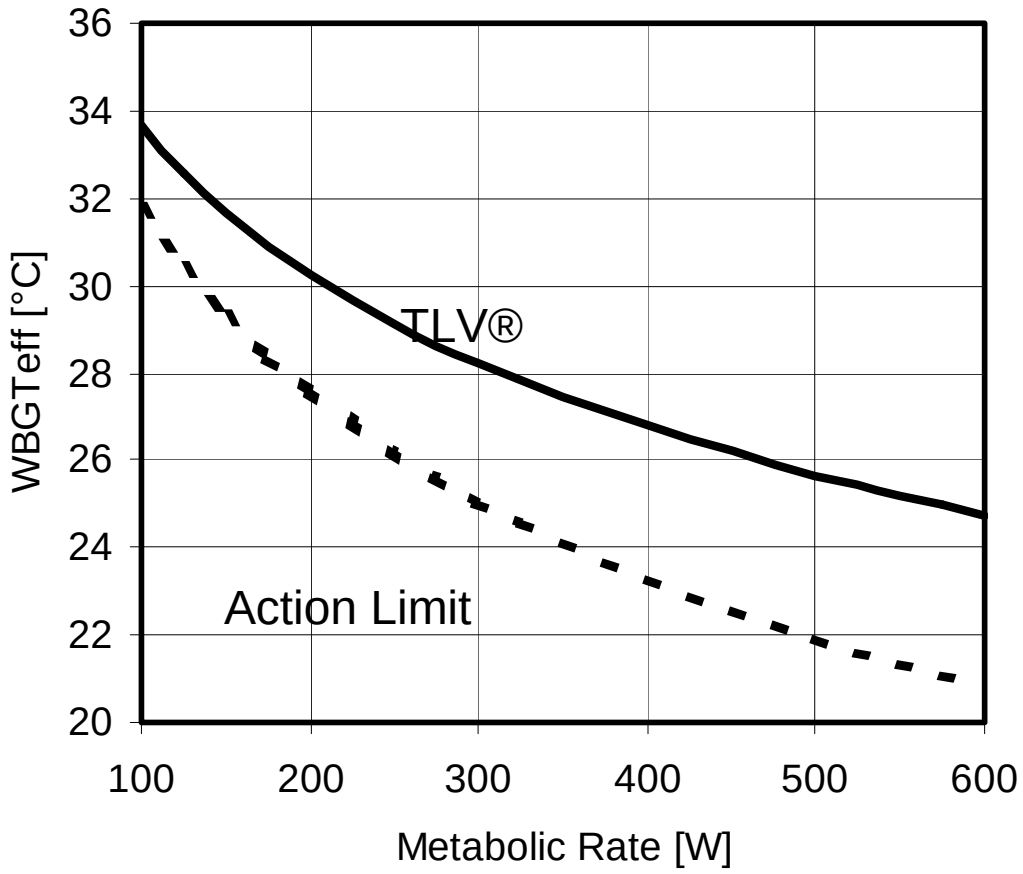
Heat Stress and Strain

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 [°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

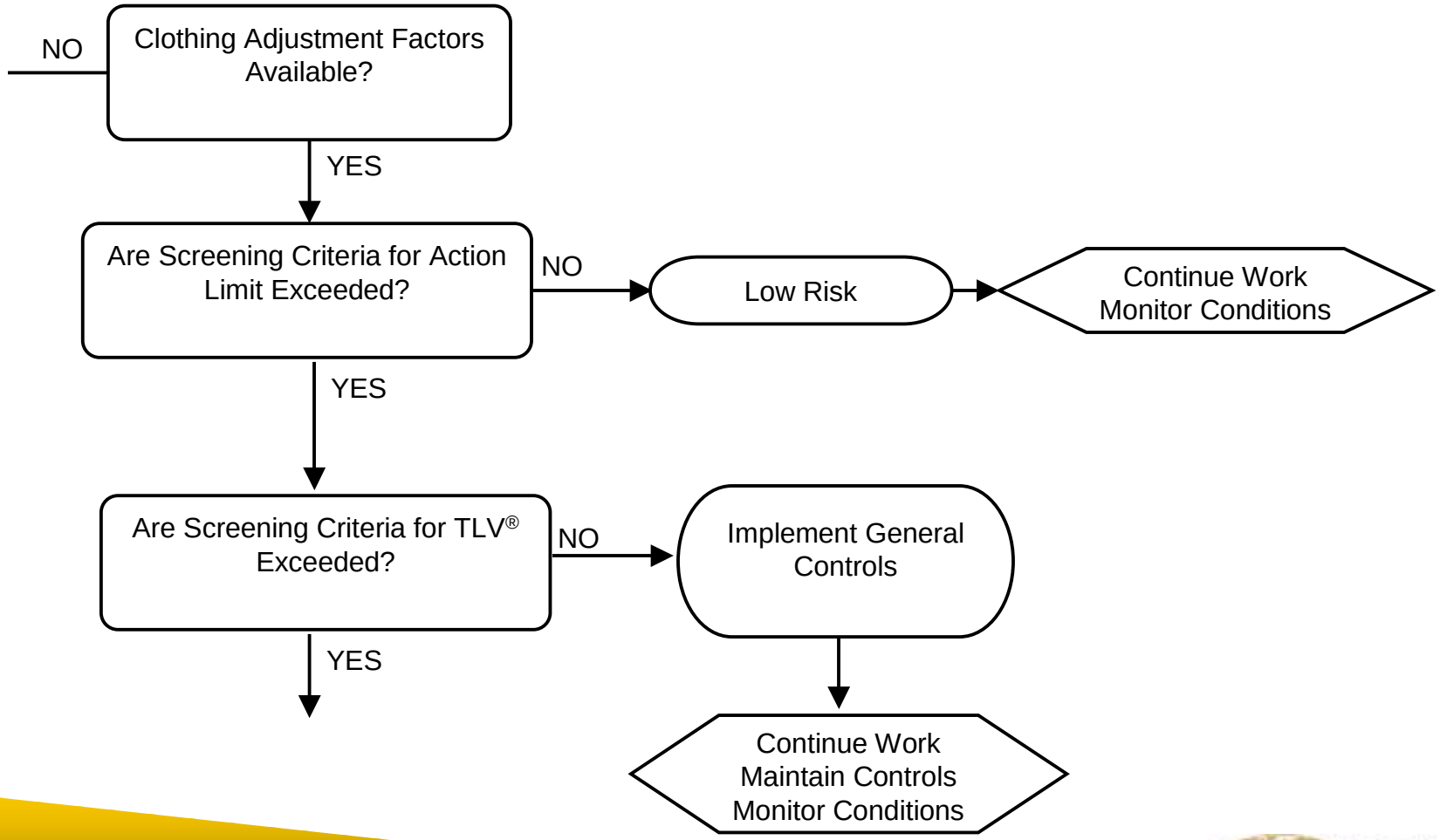

NO
Clothing Adjustment Factors Available?
YES
Are Screening Criteria for Action Limit Exceeded?
NO
Low Risk
Continue Work
Monitor Conditions
YES
Are Screening Criteria for TLV® Exceeded?
NO
Implement General Controls
YES
Continue Work
Maintain Controls
Monitor Conditions

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

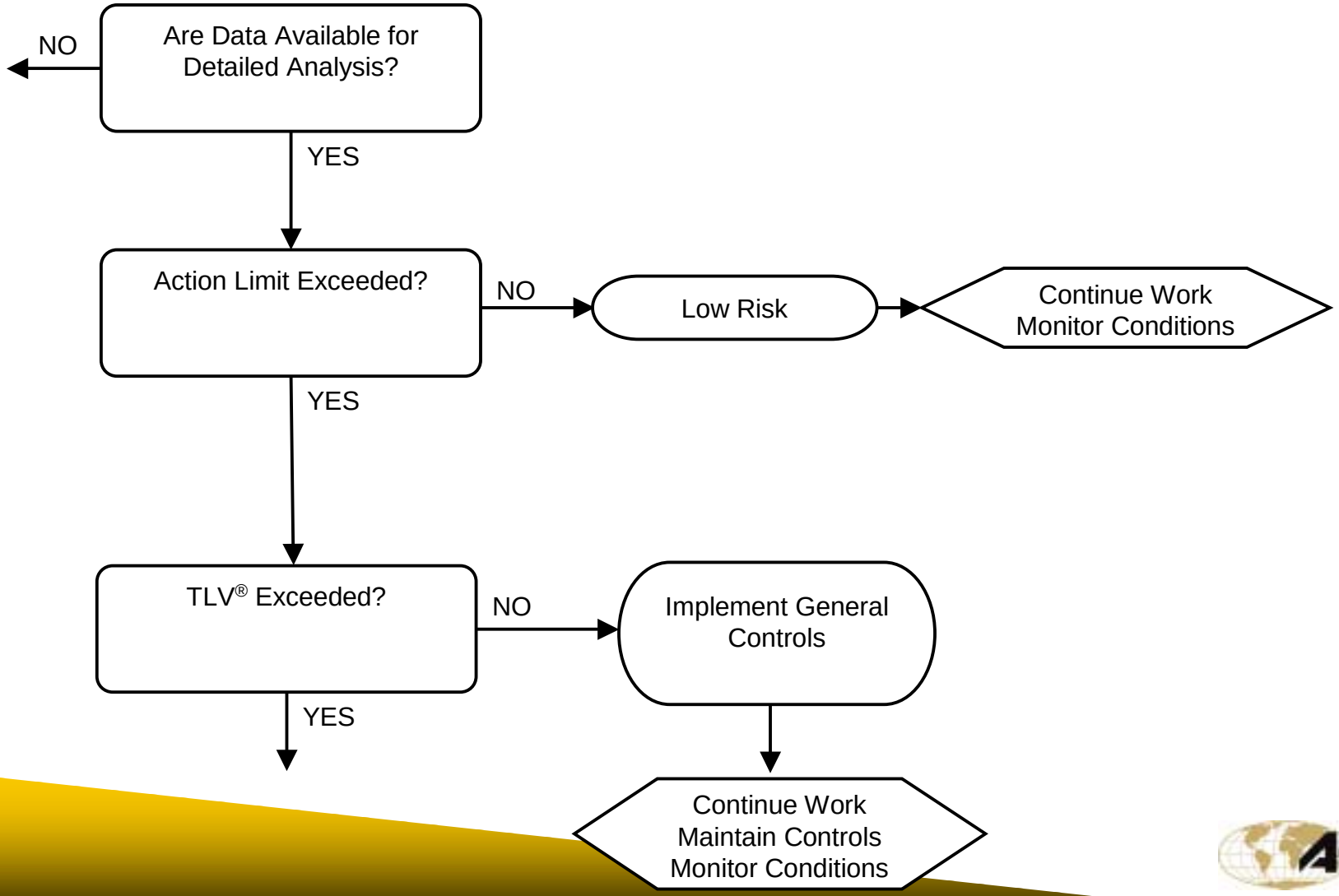
Note: *TLVs*® *and BEIs*® Book rounds these numbers to the nearest 0.5 °C-WBGT

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)

Total Metabolic Rate (M) = B + P + W + D + C

Clothing Adjustments to WBGT

$WBGT_{measured}$

\+ Clothing Adjustment

$WBGT_{eff}$

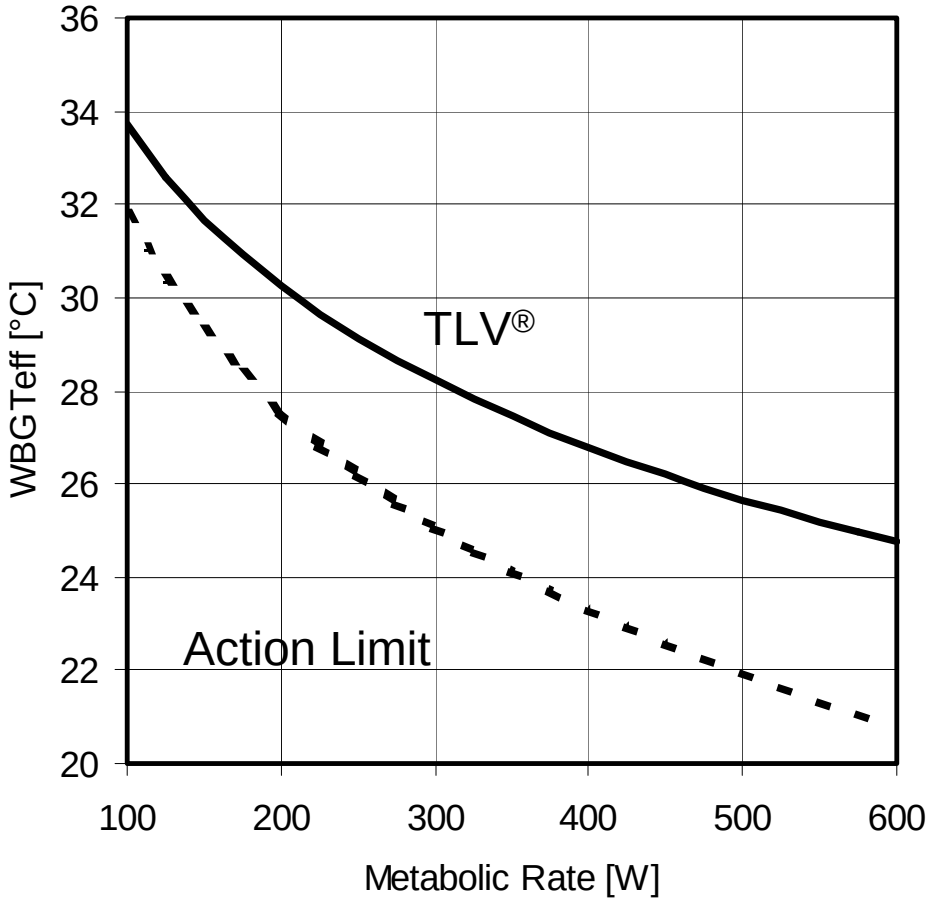
Time-Weighted Average

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

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

Over one to two hour time period.

Where is the job?

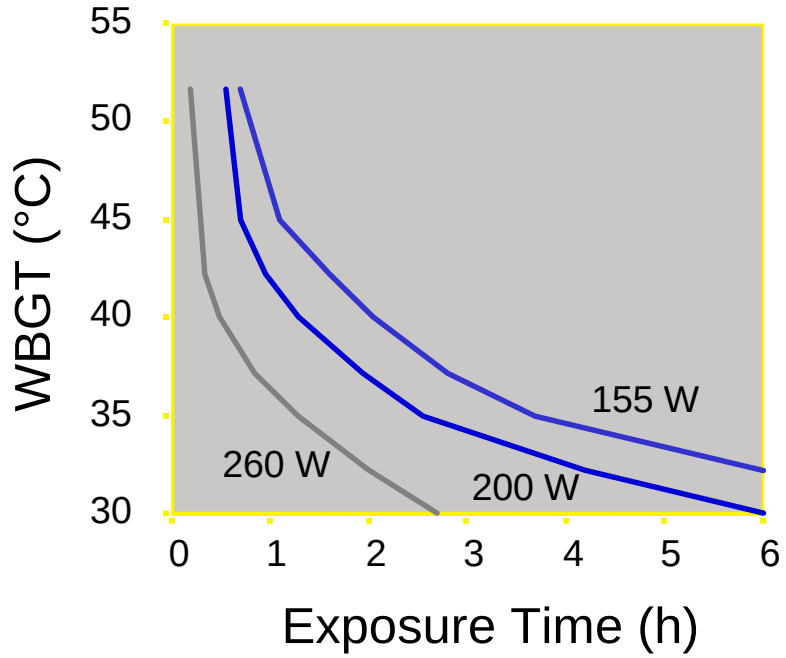


Job Risk Factors

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

Empirical Time Limits

US Navy PHEL Charts



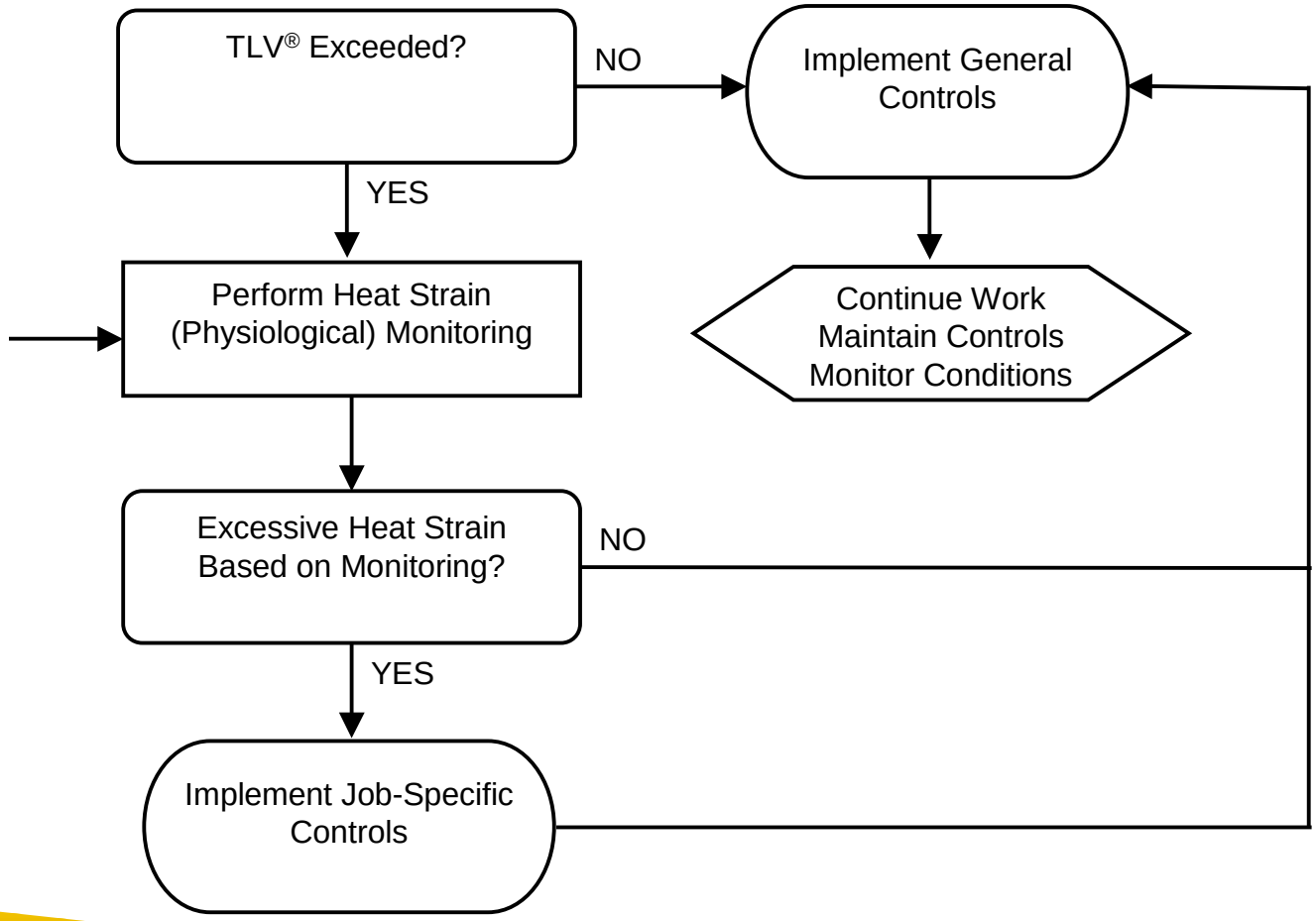
Rational Time Limits

- 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 - 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