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Early 1700’s, Ramazzini’s study – ill-effects of poor posture & poorly designed tools on the health of workers.

Greek Words “Ergon = work, Nomikos = law”

Ergonomics: Study of Work Laws
Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.
1. Physical ergonomics
2. Cognitive ergonomics
3. Organizational ergonomics
1. Physical ergonomics

- Body response to physical work
  - Working postures
  - Material handling
  - Repetitive movements
  - Workplace layout, safety and health
  - Work Related Musculo-Skeletal Disorders (WRMSD)
Material handling

Fitting the man to task?
1. Physical ergonomics

Areas of concern

- Lifting, pushing and pulling
- Repetitive work
- Heavy physical work
- Poor work organization
- Prolonged standing or sitting
- Extreme postures of the back (twisting, bending, stretching.)
Spatial Memory

Close your eyes and draw 3, 4, 5, 6 sided figures.
Measure your error.
Why?
Wehn I aws a samll cihld of evelen yaers I strated pliayng crikect. I loevd the gmae and wntaed to deevlop carerir as a susseccful crikecter.
2. Cognitive ergonomics

Cognitive ergonomics is concerned with mental processes, such as –

- perception
- memory
- reasoning

interactions among humans and other elements of a system.
User interface design

– Computer display
– Control systems
– Human-Computer Interaction
– Internet and Web Design
User centered design - inputs

Design a configuration for “cursor” keys 🡩🡨🡩🡫
Options
Which way should I go?
Visual search at 100km/s
3. Organizational ergonomics

- Socio-technical systems
- Organizational structures
- Policies and processes

Domain -
- Communication
- Work schedule design
- Teamwork
- Participatory approach
Employee and organizational profiling

- Role clarity, role efficacy and role stress
- Occupational and lifestyle stress
- Motivation level
- Behavioral change
- Absenteeism
- Presenteeism
Ownership feeling - productivity
We care for their health!
## Heat stress and ventilation at ware house

<table>
<thead>
<tr>
<th>Variables</th>
<th>DBT (°C)</th>
<th>WBT (°C)</th>
<th>RH (%)</th>
<th>GT (°C)</th>
<th>AV (Cm./Sec)</th>
<th>ET (°C)</th>
<th>CET (°C)</th>
<th>WBGT (Indoor) (°C)</th>
<th>WBGT (Outdoor) (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>36.8</td>
<td>28.9</td>
<td>50.1</td>
<td>38.6</td>
<td>22.5</td>
<td>30.6</td>
<td>31.0</td>
<td>31.8</td>
<td>31.2</td>
</tr>
<tr>
<td>±SD</td>
<td>0.97</td>
<td>0.56</td>
<td>2.77</td>
<td>1.44</td>
<td>4.53</td>
<td>0.72</td>
<td>0.72</td>
<td>0.82</td>
<td>0.76</td>
</tr>
<tr>
<td>Min</td>
<td>35</td>
<td>28.1</td>
<td>44</td>
<td>36.1</td>
<td>19.9</td>
<td>29.2</td>
<td>30.0</td>
<td>30.3</td>
<td>30</td>
</tr>
<tr>
<td>Max</td>
<td>38.1</td>
<td>29.7</td>
<td>55</td>
<td>40.1</td>
<td>29.6</td>
<td>31.7</td>
<td>31.9</td>
<td>32.8</td>
<td>32.1</td>
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</tbody>
</table>
### ACGIH TLV for Heat Stress and Heat Strain Sections 2 (screening criteria)

#### Table 2. Screening Criteria for Heat Stress Exposure (WBGT values in °C)

<table>
<thead>
<tr>
<th>Work Demands</th>
<th>Acclimatized</th>
<th></th>
<th></th>
<th>Unacclimatized</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Light</td>
<td>Moderate</td>
<td>Heavy</td>
<td>Very Heavy</td>
<td>Light</td>
<td>Moderate</td>
</tr>
<tr>
<td>100% Work</td>
<td>29.5</td>
<td>27.5</td>
<td>26</td>
<td></td>
<td>27.5</td>
<td>25</td>
</tr>
<tr>
<td>75% Work; 25% Rest</td>
<td>30.5</td>
<td>28.5</td>
<td>27.5</td>
<td></td>
<td>29</td>
<td>26.5</td>
</tr>
<tr>
<td>50% Work; 50% Rest</td>
<td>31.5</td>
<td>29.5</td>
<td>28.5</td>
<td>27.5</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>25% Work; 75% Rest</td>
<td>32.5</td>
<td>31</td>
<td>30</td>
<td>29.5</td>
<td>31</td>
<td>29</td>
</tr>
</tbody>
</table>

**Notes:**
- See Table 3 and the *Documentation* for work demand categories.
- WBGT values are expressed in °C, and represent thresholds near the upper limit of the metabolic rate category.
- If work and rest environments are different, hourly time-weighted averages (TWA) should be calculated and used. TWAs for work rates should also be used when the work demands vary within the hour.
- Values in the table are applied by reference to the “Work-Rest Regimen” section of the Documentation and assume 8-hour workdays in a 5-day workweek with conventional breaks, as discussed in the *Documentation*. When workdays are extended, consult the “Application of the TLV” section of the *Documentation*.
- Because of the physiological strain associated with Very Heavy work among less fit workers regardless of WBGT, criteria values are not provided for continuous work and for up to 25% rest in an hour. The screening criteria are not recommended, and a detailed analysis and/or physiological monitoring should be used.

The above information was taken from Minnesota OSHA Compliance’s heat-stress guideline, accessible at [www.doli.state.mn.us/mnosha.html](http://www.doli.state.mn.us/mnosha.html).
Observation: No exhaust system in the warehouse.

Intervention:
1. Wall exhaust and overhead air extractor in the ceiling
2. Workers to be provided –
   i) ORS supplement or any other electrolyte solution
   ii) green vegetable salad with meal (Sodium, Potassium and Calcium etc.)
How do you know you have a problem?
Workplace Indicators

- Fatigue, discomfort, Accident, Injury, MSD
- Performance deterioration
- Quality problems
- Absenteeism / turnover
QUICK EXPOSURE CHECKLIST
QEC CALCULATION

\[ E\% = \frac{X}{X_{\text{max}}} \times 100 \]
\[ X_{\text{maxMH}} = 176 \]
\[ X_{\text{maxOTH}} = 162 \]

QEC reference

<table>
<thead>
<tr>
<th>Body parts</th>
<th>values</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 40%</td>
<td>Acceptable</td>
</tr>
<tr>
<td>41 – 50%</td>
<td>Investigate further</td>
</tr>
<tr>
<td>51 – 70%</td>
<td>Investigate further and change soon</td>
</tr>
<tr>
<td>&gt; 70%</td>
<td>Investigate and change immediately.</td>
</tr>
</tbody>
</table>
Ergonomics @ NITIE
Center of Excellence in-

Ergonomics and Human Factor Engineering
thank you

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