

3M Occupational Health & Environmental Safety Division

# Quest Technologies, a 3M company

Noise Measurement & Heat Stress Monitoring, a "Best Practices Approach"



Engineered for Durability  
Designed for Ease-of-Use  
Supported by Professionals

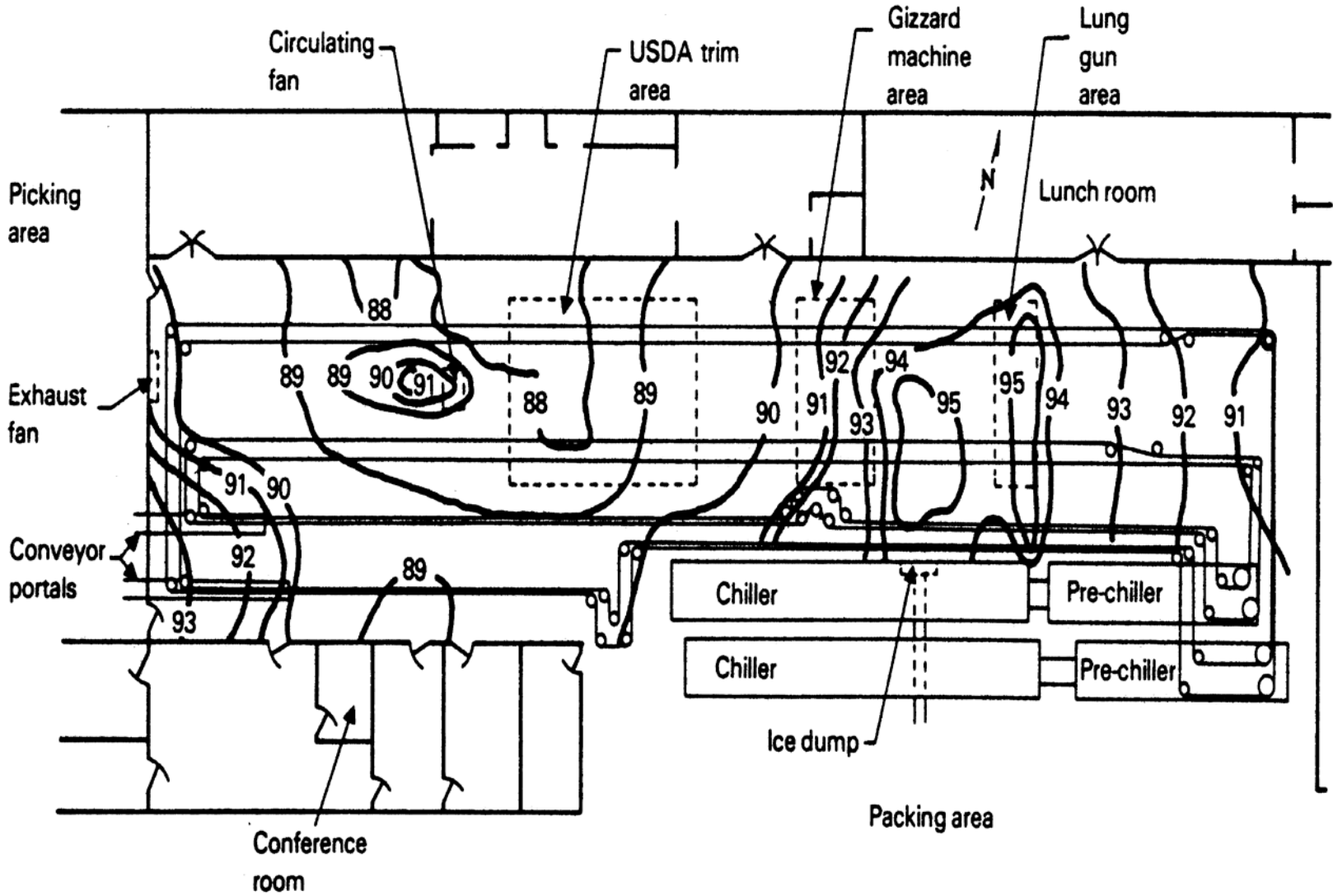


# Why Measure Noise?

- I. Determine if the employee(s) are at risk for Noise Induced Hearing Loss (NIHL) & should be in a Hearing Conservation Program (HCP)
- II. Differentiate between on-the-job & off-the-job noise exposure
- III. Determine most effective hearing protection
- IV. Engineering Controls
- V. Administrative Controls
- VI. Compliance with applicable Provincial or Federal Standards

# Survey Techniques

- I. Individual Full Exposure Assessment
- II. Representative Sampling
- III. Task-Based Exposure Assessment Modeling  
(T-Beam)
- IV. Area Mapping



# Noise Terminology

- **Criterion Level:** If exposed to SPL, on average for eight hours, it would result in a maximum allowable exposure.
- **Dose:** The allowable daily exposure value. A maximum allowable exposure is equal to 100% dose.
- **Exchange Rate:** Results in a doubling or having of the maximum allowable exposure.

# Noise Terminology

- **Average (Lavg or Leq):** The average sound level measurement over the run time.
- **Time Weighted Average (TWA):** The TWA always averages the sampled sound over an 8 hour period. (TWA is less than Lavg or Leq for a sample duration of **less** than 8 hours.
- **Threshold (Cut Off):** All sound below the threshold is considered non-existing noise for the averaging and integrating functions.

# A Basic Concept...

TWA = Lavg @ exactly 8 hours

Lavg



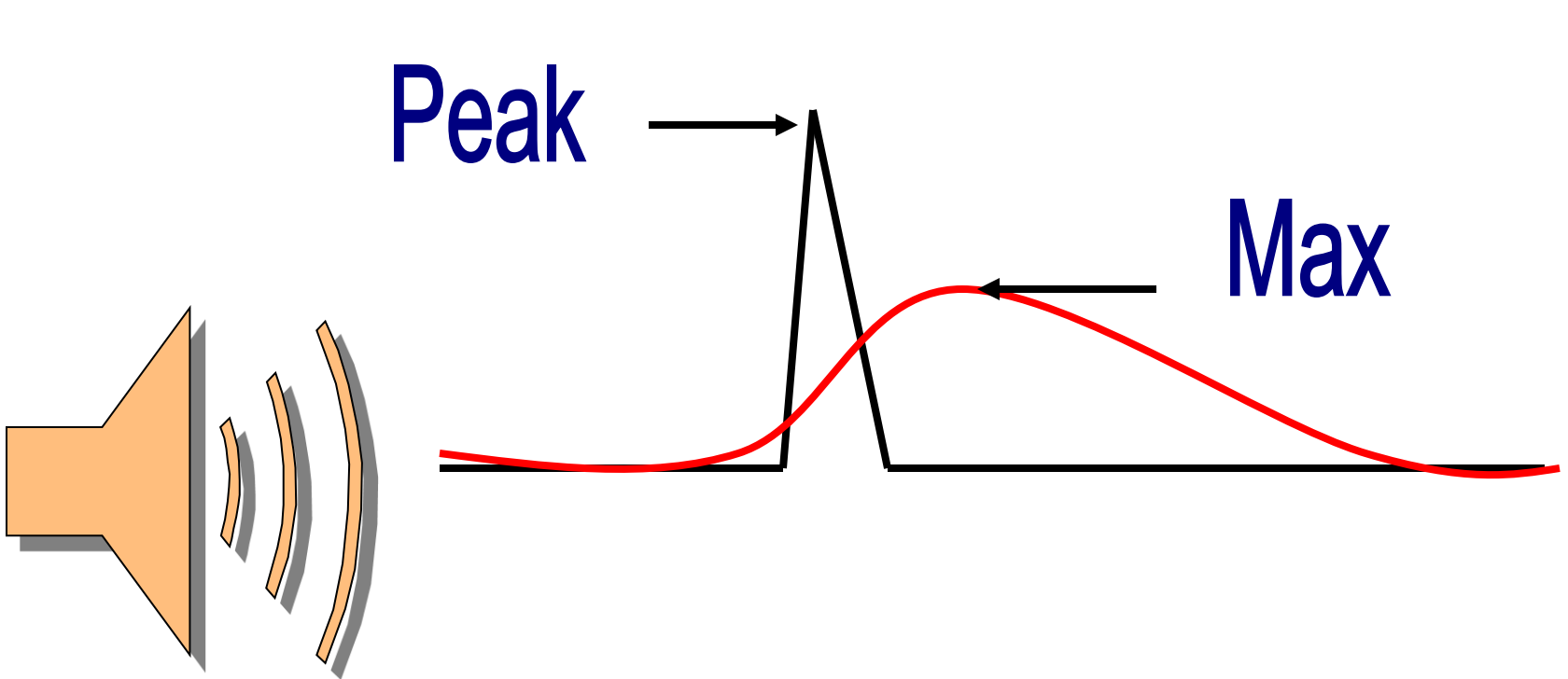
TWA

↑ 8 hours

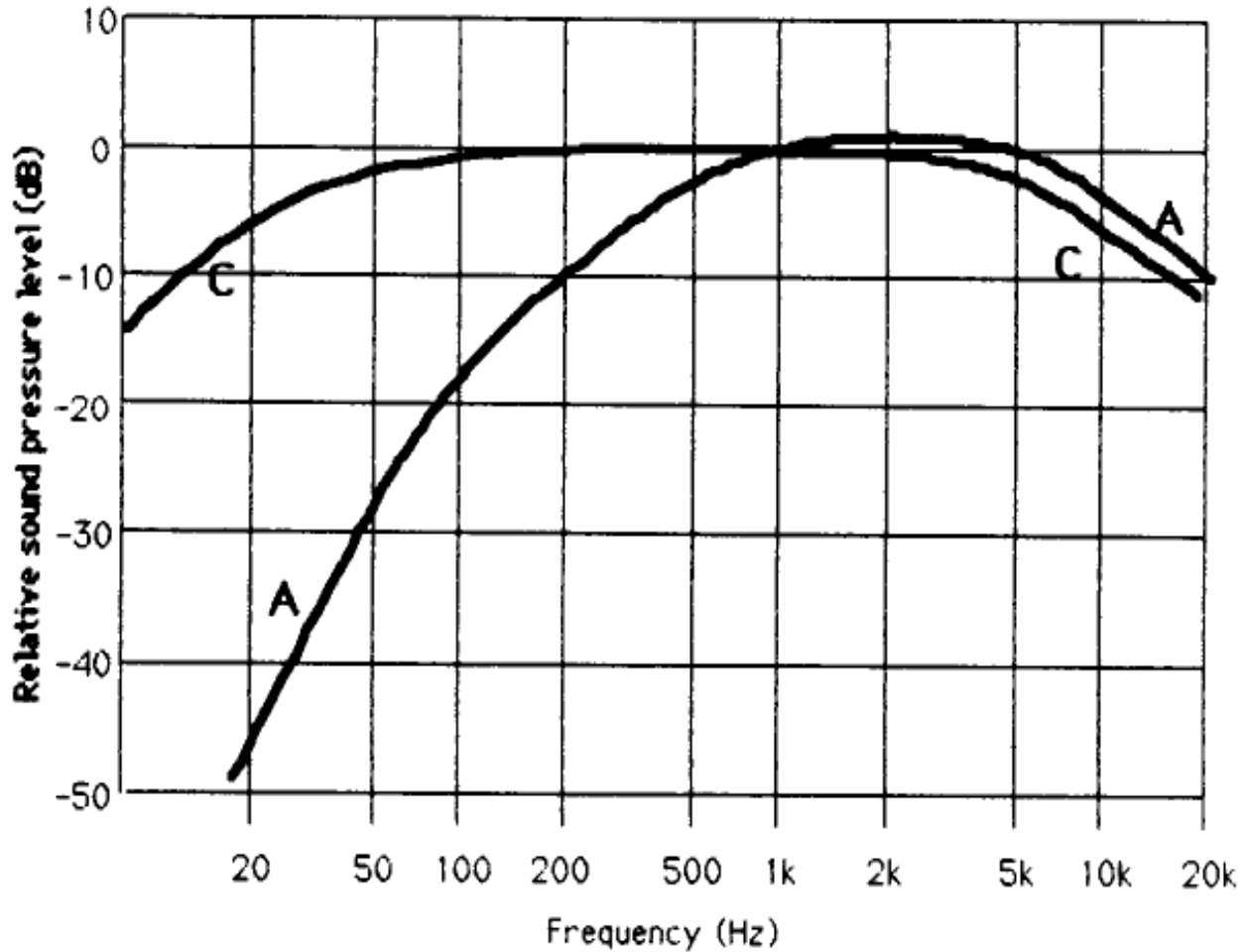
# Noise Terminology

- **Response (Fast or Slow):** Determines how quick the unit responds to fluctuating noise.
- **Maximum Level (L<sub>max</sub>):** The largest sampled sound level during the instrument's run time allowing for the **RESPONSE** that the unit is set for (fast or slow).
- **Peak Level (L<sub>pk</sub>):** The highest, **unweighted**, instantaneous sound level that the microphone detects.

# A Graphic Look

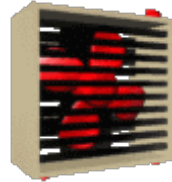


# A & C Weighting Curves

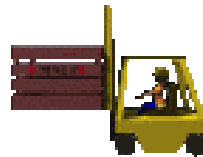


# Types of Sound

- Continuous



- Intermittent



- Impulsive



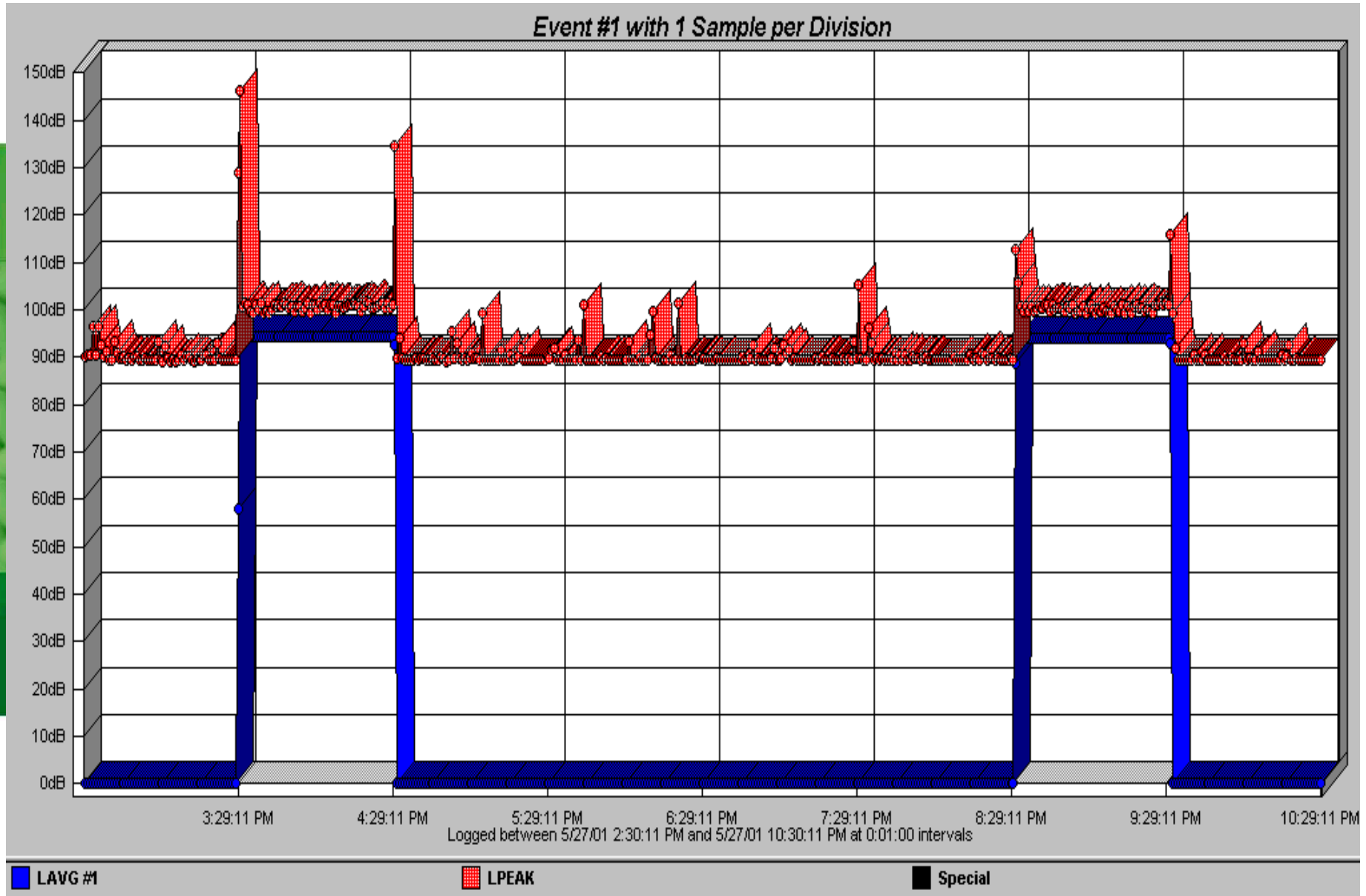
# Full Shift Study Evaluation

**Dose & Run Time**

**45.69%**

**Peak  
Level**

**146 dB**



# How To Do A Noise Survey

- Check Battery
- Reset Unit
- Calibrate Unit
- Inform Worker
- Place Unit
- Place Microphone
- Leave It Alone
- Work
- Check It
- Observe
- Remove Unit
- Record or Download Data

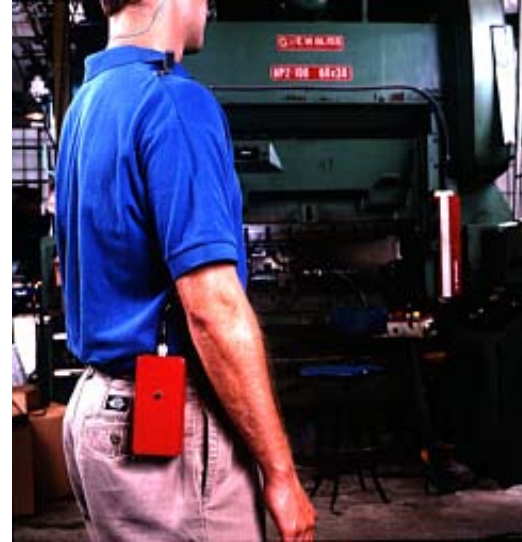
# Survey Pitfalls

- *Microphone Placement*

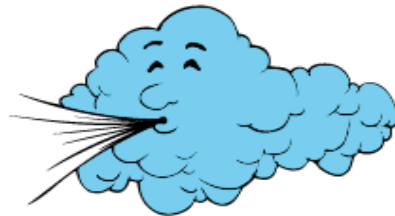
- Mic on Shoulder
- Dosimeter on Belt
- Mic Cord

- *Employee*

- *Project Assumption*



- *Wind*



- *Battery Condition*

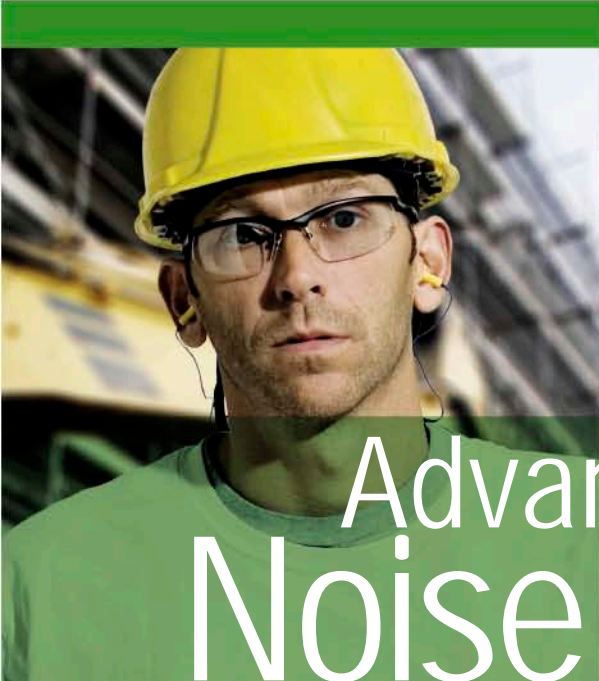
- *Radio Frequency Interference (RFI)*

# Be Sure to Read the FINE Print



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3M™ NoisePro™



# Advanced Personal Noise Monitoring

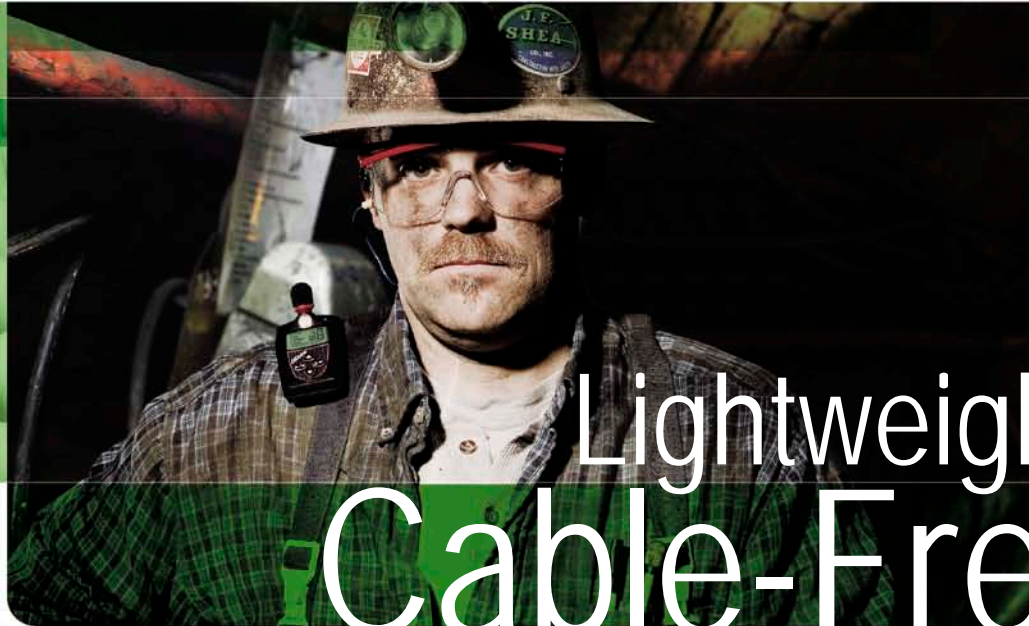
## Reporting and Analysis



# Dosimeter Features

- Easy to Use
- Rugged & Reliable
- Multiple Study Capability
- Datalogging – Time History
- Simultaneous Weightings
- Multiple Logging Intervals
- TWA Alarm – Vibrating Belt Clip
- Boom Microphone
- Recalculated Exposure Data
- Multiple Auto Run Features
- Auto Configuration
- Multilingual
- Multiple Intrinsic Safety Approvals
- Display
- IP Rated
- Pre & Post Calibration
- Multiple Download Options

# 3M™ Edge™



Lightweight,  
Cable-Free  
Noise Detection

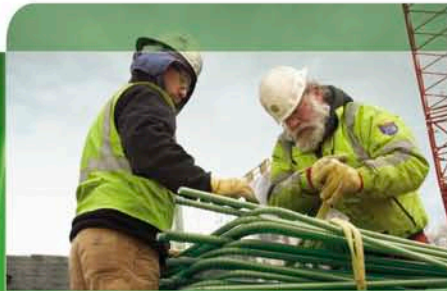


## *Cable Free Noise Dosimeters*

- Multiple virtual dosimeters in one (eg4 and eg5 models only)
- Data logging & time history
- 70 dB to 140 dB range
- Peak weighting: A, C, or Z
- RMS time response: Fast, Slow
- Programmable "Auto-On" options
- Exceptional battery life
- Communicating/Charge: Docking Stations (Recharge 2 to 4 hrs)
- Interfaces with software for quick setup, analyzing data, and reporting
- Field Replaceable microphone
- Multiple Language Display
- Small Shoulder Mount & Light-weight: 2.5 oz (71 g), less mounting device
- Intrinsic Safety Approvals

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# 3M™ Noise Indicator NI-100



Easy, Durable  
Noise Level  
Detection

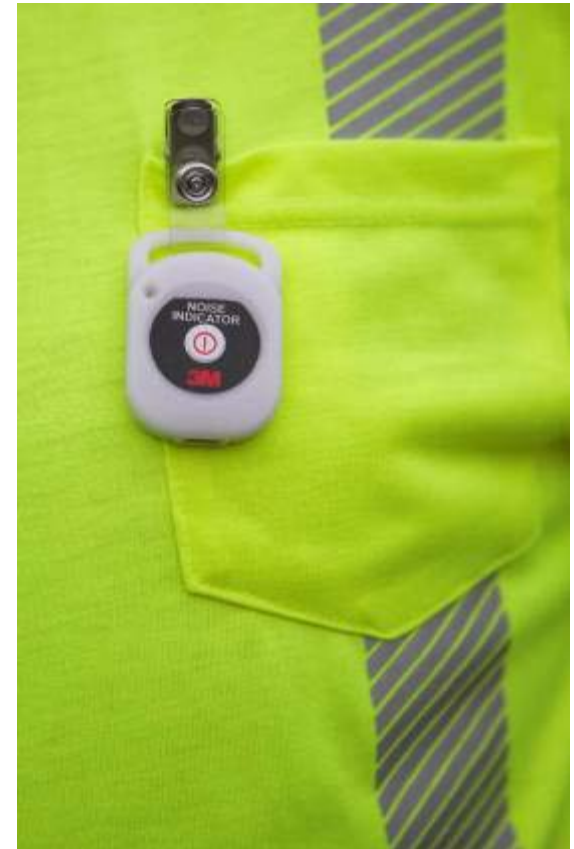


# 3M™ NI-100 Noise Indicator

- **“NOT A DOSIMETER”**
- **Key Points:**
  - *Economical, easy-to-use, lightweight, long battery life, rechargeable.*
  - *Know when noise levels increase to a hazardous level and hearing protection may be needed.*
- **Applications and Positioning:**
  - *Can be used wherever noise is variable and potentially hazardous.*
  - *An essential part of a hearing conservation program to train/remind workers of noise hazards. Answers the question “How loud is too loud?”.*



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3M™ NI-100 Noise Indicator





# Sound Level Meters



# Types of Microphones



**Random Incidence**



**Direct Incidence/  
Free Field**



**Pressure Microphone**

# Classification of Sound Level Meters

- Three types of SLM's established by ANSI & IEC Standards:
  - *Type 0*
    - *Laboratory Grade Instrument*
  - *Type 1*
    - *Precision Instrument*
  - *Type 2*
    - *General Purpose Instrument*

For most noise surveys a Type 2 or better instrument can be used.

# Entry Level: SD-200 New Product

**+95 dB**  
 (Red LED flashes (Fast pulses) when noise is above 95 dB)

**+87 dB**  
 (Red LED flashes (slow pulses) when noise is at or above 87 dB)

**+ between 87-93 dB**  
 (Red and Yellow LEDs appear when noise is between 87 - 93 dB)

**between 83-93 dB**  
 (Yellow LED appears when noise is at or between 83 - 93 dB)

**+ between 83-85 dB**  
 (Green and Yellow LEDs appear when noise is between 83 - 85 dB)

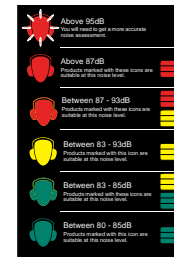
**between 80-85dB**  
 (Green LED appears when noise is at or between 80 - 83 dB)



- Unique LEQ averaging function at this price point
- Rechargeable lithium polymer batteries
- January 2011 Launch



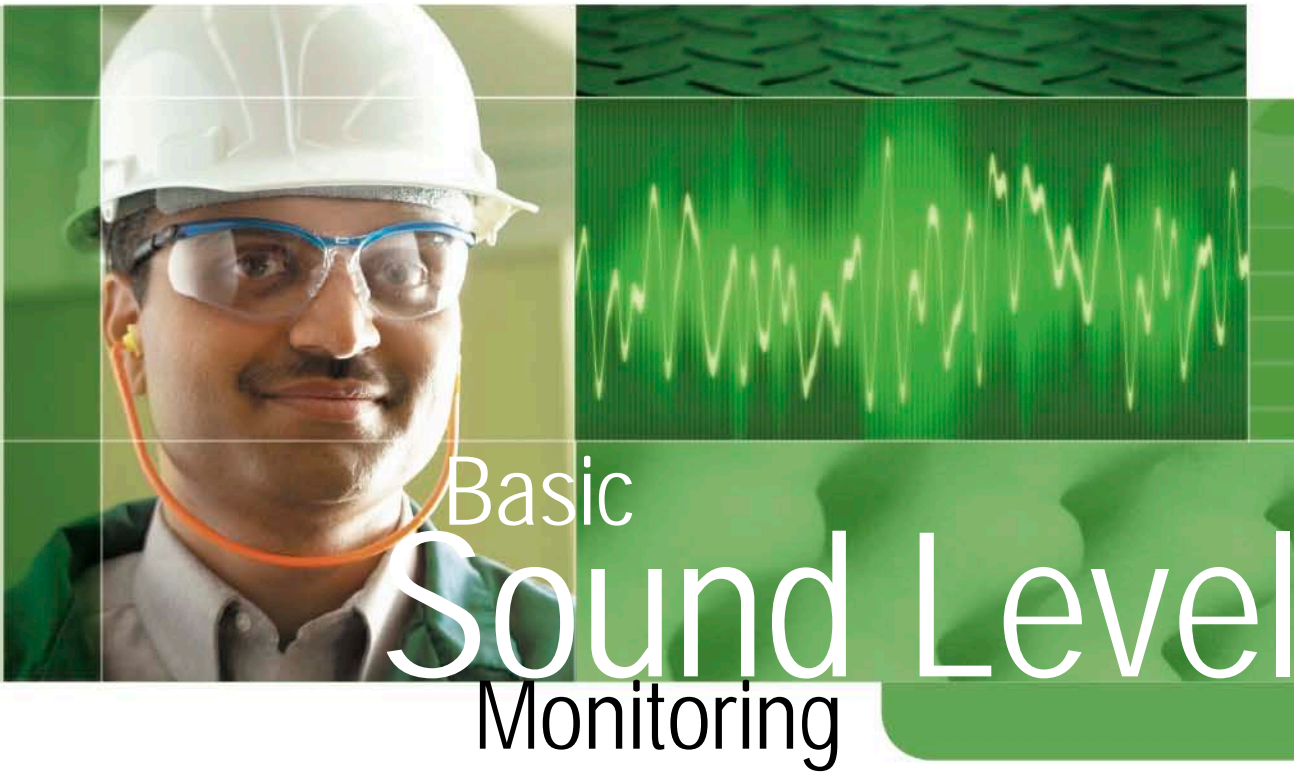
+



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# 3M™ Basic Sound Level Meters



# Basic Sound Level Meters



Integrating



Non-Integrating

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# 3M™ SoundPro™ Sound Level Meters



## Advanced Sound Level Monitoring



# Octave Band Filter Applications

An SLM with octave band filters has the capability of measuring sound levels at selected frequencies, while simultaneously excluding levels at other frequencies

- Frequency evaluation of noise sources for selecting hearing protection at the most efficient NRR (Noise Reduction Rating)

# Octave Band Filter Applications

## Engineering Studies –

- *Selection of Acoustical Absorbing or Sound Deadening Materials*
- *Evaluation of Equipment, or Machinery, to Comply with Customer Requirements*

# Octave Band Filter Applications

Background Checks In Hearing Test Booths & Rooms:

## US OSHA

500Hz – 40 dB

1000Hz – 40 dB

2000Hz – 47 dB

4000Hz – 57 dB

8000Hz – 62 dB

## ANSI S3.1

125 Hz – 35 dB

250 Hz – 25 dB

500 Hz – 21 dB

1000 Hz – 26 dB

2000 Hz – 34 dB

4000 Hz – 37 dB

8000 Hz – 37 dB



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# 3M™ QUESTemp<sup>o</sup>™ Series

Heat Stress Monitoring a “Best Practices Approach”



## Robust Construction



From the

# Market Leader



# Why Monitor for Heat Stress/Strain?

- Determine employee(s) susceptibility to heat illness
- Pairing of workers
- Maximize shift work time
- Seasonal Changes

# Program Resources

- American Conference of Governmental Industrial Hygienists (**ACGIH**)
- National Institute for Occupational Safety & Health (**NIOSH**)
- International Organization for Standardization (**ISO**)
- Electric Power Research Institute (**EPRI**)
- World Health Organization (**WHO**)
- National Athletic Trainers Association (**NATA**)
- American Academy of Pediatrics (**AAP**)



# Industrial Hygiene Model

- Identify
- Monitoring: Area & Personal
- Control:
  - *Engineering Controls*
  - *Administrative Controls*
- Protect:
  - Work/Rest*
  - PPE*
  - Training*

# Heat Stress Symptoms

- *Sweat Cessation*
- *Skin Color Change*
- *Shivering*
- *Irritability*
- *Disorientation*



# Area Heat Stress



# Area Monitoring

- Area Monitoring gives an excellent snapshot of the work environment & combined with type of work being performed and clothing type, gives a good indication of how long the employee can work safely in a particular hot environment.

# Wet Bulb Globe Temperature

- Dry Bulb: Shielded Thermometer
  - Air Temperature
- Wet Bulb: Wet Wick over Thermometer
  - Temperature, Humidity, and Airflow
- Globe: Black Copper Globe over Thermometer
  - Radiant Heat (Sunlight)

# WBGT vs. Humidex/Heat Index

- WBGT is a far better indicator of what is going on with the individual.
- Humidex/Heat Index is a “Feels Like” indicator, which does not accurately reflect how a radiant heat source may be affecting an individual.

# Area Heat Stress Monitor Features

- Rugged for Indoor & Outdoor Use – IP Rated
- Detachable Sensor Bar
- 2 Inch or 6 Inch Globe
- Multilingual
- Optional Air Velocity Probe
- Selectable Stay Times
- Relative Humidity
- Tripod Mountable
- Multiple Sensor Bars
- Shielded Dry Bulb Sensor
- Datalogging – Time History
- Multiple Intrinsic Safety Approvals
- Netlinkable
- Control Remotely
- Multiple Power Options
- **Waterless** Wetbulb Technology



# Personal Heat Stress



# Program Evaluation

- Work Evaluation
- Medical Screening
- Training
- Monitoring
- Controls
  - *Work/Rest*
  - *Hydration*
  - *Air Flow*
  - *PPE*

# Evaluation

- Classify Type of Work Load
  - *Light*
  - *Moderate*
  - *Heavy*
  - *Very Heavy*
- Correction Factors for Clothing
- WBGT is Measured and Rest Time is Determined

# Medical Screening



- Pre-existing conditions
- Overweight
- Unacclimatized
- Conditioned
- Alcohol, Drugs

# Training

- Management and Workers
  - *Heat Stress & Heat Strain*
  - *Heat Disorders*
  - *Self and Coworker Awareness*
  - *Safe Practices*
  - *First Aid*

# Personal Monitoring

Personal Monitoring Goes Beyond Ambient Measures by Considering Affects Of:

- Medications
- Dietary Supplements
- Alcohol
- Diseases
- Individual Acclimatization

# Exposure Controls

- Rest/Work Scheduling
- Re-hydration
- Cooling Vests
- Ventilation
- Humidity Reduction
- Change Process or Procedure
- Clothing



# Rest

- Rest in cool or shaded area
- Use fans or air conditioning
- Rehydrate
- Watch for ailing coworkers



# Hydration

- Drink before, during and after physical labor
- Anticipate conditions: weather, gear, dress, workload
- Drink every 15- 20 minutes
- Make fluids accessible
- Drink cool fluids
- Flavored drinks may increase use
- Replace Electrolytes in extreme conditions

