



Buy Quiet Workshop

National Institute for Occupational Safety and Health

PNR: A Simplified Product Noise Rating for the General Public

Matthew A. Nobile



Hudson Valley Acoustics Laboratory

Poughkeepsie, New York, USA

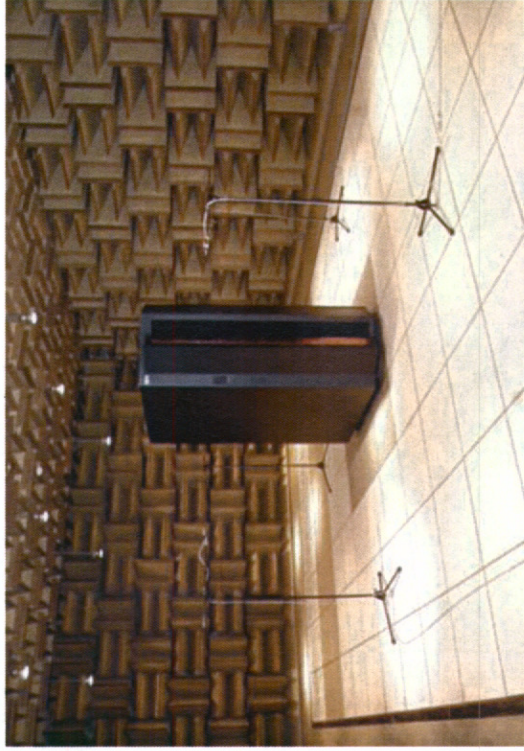
email: nobile@us.ibm.com





**Poughkeepsie,
New York**

**An IBM High-End
server being tested at
the IBM Acoustics Lab**



2011 Nov 09-10

2

Matthew A. Nobile



Outline of Talk

- Background
 - Terminology
 - Information
- Elements of the PNR Method
 - The *Scale*
 - The *PNR value*, itself
 - The *Range-of-Levels*
 - The *Visual Icon*
- A Look Ahead

- **What is the problem?**
 - How do we provide meaningful product noise level information to the general public in order to help them make informed purchasing decisions?

- Types of labels and declarations (most existing ones are for Energy)
 - *Informative* Labels and Declarations
 - *Comparative* Labels and Declarations
 - *Endorsement* Labels and Declarations

Informative Declaration

Declared Noise Emissions in Accordance with ISO 9296				
Product Description	Declared A-Weighted Sound Power Level, L_{WAd} (B)		Declared A-Weighted Sound Pressure Level, L_{pAm} (dB)	
	Operating	Idling	Operating	Idling
Server Model XYZ configured with one processor cage (FC 555), one I/O cage (FC 666), 4 hard drives (FC 777), and bulk power module (FC 888)	6.9	6.7	49	47


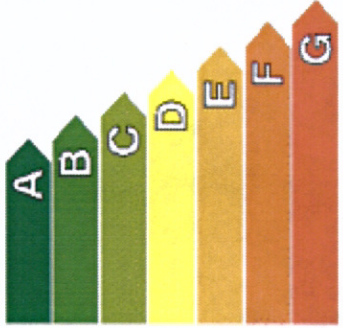

Notes:

- L_{WAd} is the statistical upper-limit A-weighted sound power level in bels;
- L_{pAm} is the mean A-weighted emission sound pressure level measured at the 1-meter bystander positions;
- 1 B = 10 dB.
- All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296

Background: Types of Declarations

Comparative Declaration

ENERGY SCALE

Energy	Washing machine
Manufacturer Model	
More efficient	
Less efficient	
Energy consumption kWh/cycle (based on standard test results for 60 C cotton cycle) <small>Actual energy consumption will depend on how the appliance is used.</small>	1.05
Washing performance <small>A: higher G: lower</small>	A B C D E F G
Spin drying performance <small>A: higher G: lower</small>	A B C D E F G
Spin speed (rpm)	1400
Capacity (cotton) kg	5.0
Water consumption l	55
Noise (dB(A) re 1 pW)	52 70
<small>Further information is contained in product brochures</small>	
	
<small>Not in EU 20026 Washing Machine Label Directive No. 94/21/EC</small>	

Specific Product Information



Background: Types of Declarations

Endorsement Declarations



Information...

- Relevant for a particular task at hand
 - *Task* = to make informed purchasing decisions
- Tailored to a particular group or audience
 - *Group* = members of the general public

Result: The PNR proposal will target this task and be suitable for this group.

What if, instead...

- *Task* = to predict sound pressure levels in a room containing noise-emitting equipment
- *Group* = Acoustical consultants or engineers

Result: The information needed here would be very different.

There are different *product groups* and different *purchasing groups*

Product Groups

Consumer Products

Business/ Professional Products

Industrial Products

Outdoor Equipment Products

Entertainment/ Transportation Products

Purchasing Groups

Consumers

Corporate Procurement

Municipalities and Government

Schools

Construction Firms

Factories/ Workplaces

The PNR scheme applies primarily to the following:

Product Groups



Purchasing Groups



What do engineers want to know?

- Sound power level
- Sound pressure level
- 1/3-octave band levels
- Discrete tone ratings
- Sound Quality metrics
- Directivity
- Plots, curves, charts, and more!

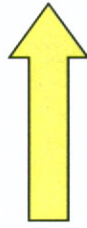
What do consumers want to know?

1. How loud is this product?
2. How loud is this product compared to similar products?

- “How loud is this refrigerator?”
 - Will it be intrusive and annoying, or will I even be able to hear it?
- “How loud is this refrigerator compared to that refrigerator?”
 - Knowing the answer to this question is key to the purchasing decision

Outline of Talk

- Background
 - Terminology
 - Information
- Elements of the PNR Method
 - The Scale
 - The PNR value, itself
 - The Range-of-Levels
 - The visual icon
- A Look Ahead



First, an acknowledgement:

- The Product Noise Rating method is a proposal being developed by the INCE-USA Technical Committee on Product Noise Emissions (TC/PNE)

How can we answer the following
fundamental question in a simple,
understandable way?

“How loud is this product?”

SOLUTION:

- We need a simple "Noise Scale" that shows the overall range of noise levels

Elements of the PNR Method: Richter Scale

Richter Scale

Richter Magnitudes	Description	Earthquake Effects	Frequency of Occurrence
Less than 2.0	Micro	Microearthquakes, not felt.	About 8,000 per day
2.0-2.9	Minor	Generally not felt, but recorded.	About 1,000 per day
3.0-3.9		Often felt, but rarely causes damage.	49,000 per year (est.)
4.0-4.9	Light	Noticeable shaking of indoor items, rattling noises. Significant damage unlikely.	6,200 per year (est.)
5.0-5.9	Moderate	Can cause major damage to poorly constructed buildings over small regions. At most slight damage to well-designed buildings.	800 per year
6.0-6.9	Strong	Can be destructive in areas up to about 160 kilometres (100 mi) across in populated areas.	120 per year
7.0-7.9	Major	Can cause serious damage over larger areas.	18 per year
8.0-8.9	Great	Can cause serious damage in areas several hundred miles across.	1 per year
9.0-9.9		Devastating in areas several thousand miles across.	1 per 20 years
10.0 and above	Epic	Never recorded.	Extremely rare (Unknown)

- Of course, ground vibrations are very complicated and seismologists want to know a lot more about tremors and earthquakes, but the simple Richter scale is fine for the general public

- And there are many other scales:
 - Beaufort Wind scale for rating wind speeds
 - Saffir-Simpson scale for rating hurricanes
 - Fujita-Pearson scale for rating tornados
 - Astronomical brightness scale for rating the brightness of celestial objects
 - Scoville heat scale for rating the hotness or piquancy of chili peppers and hot sauces

Elements of the PNR Method: 1. The PNR Scale

Product Noise Rating (PNR) Scale

PNR	Subjective Impression at Typical Distance from Product	Typical Products
0-20	Inaudible - Barely Audible	
20	Extremely quiet	Ticking Wristwatch
25		Small electric clock
30	Very Quiet	Tablet Computer (with miniature fan)
35		Laptop Computer
40	Quiet	Desktop Computer
45		Workstation Computer, Humidifier - Low Speed
50	Quiet to Moderate	Small Household Fan on Low Speed
55	Moderate	Dishwasher, Small LCD Projector
60		Refrigerator, Electric Toothbrush
65	Moderate to Loud	Small Household Fan on High Speed
70		Hair Dryer - Low Speed, Electric Razor
75	Loud	Hair Dryer - High Speed
80		Vacuum Cleaner
85	Very Loud	Kitchen Blender, Garbage Disposal
90		Orbital Sander
95		Belt Sander
100	Extremely Loud	Circular Saw
105		Impact Wrench
110		
115		Jackhammer, Pneumatic Riveter
120	Painfully Loud	

Not Final!

- **Thus, First Element = The PNR Scale**
 - 0-120 Scale
 - No decibels (or bels, or sones, or aspers, or...)

- **What does the PNR value mean?**
- **It describes noise emission from the product**
 - *the amount of noise energy radiated from the product*
 - *characteristic of the product, itself, not the environment in which it is located*
- **It does not describe noise immission**
 - *not the amount of noise energy received by a person or microphone*
 - *not the noise level in a workplace*
 - *not the noise exposure to employees*

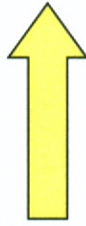
- **How do we determine the PNR for a product?**
 - **Rely on existing ISO sound power level standards**
 - *perhaps with some simplifications*
 - *different test codes for different product types*
 - **PNR will simply be the measured A-weighted sound power level in decibels but without the decibels**
 - *Simplicity is the goal*
 - *The general public has never really accepted the decibel (or bel)*
 - *But, there is an objective metric behind it*

■ **Thus, Second Element = The PNR Value, itself**

- A-weighted sound power level in decibels, but without the decibels (no units)
- Take advantage of 40-year experience and fine-tuning of ISO sound power level standards and test codes

What do consumers want to know?

1. How loud is this product?
2. How loud is this product compared to similar products?

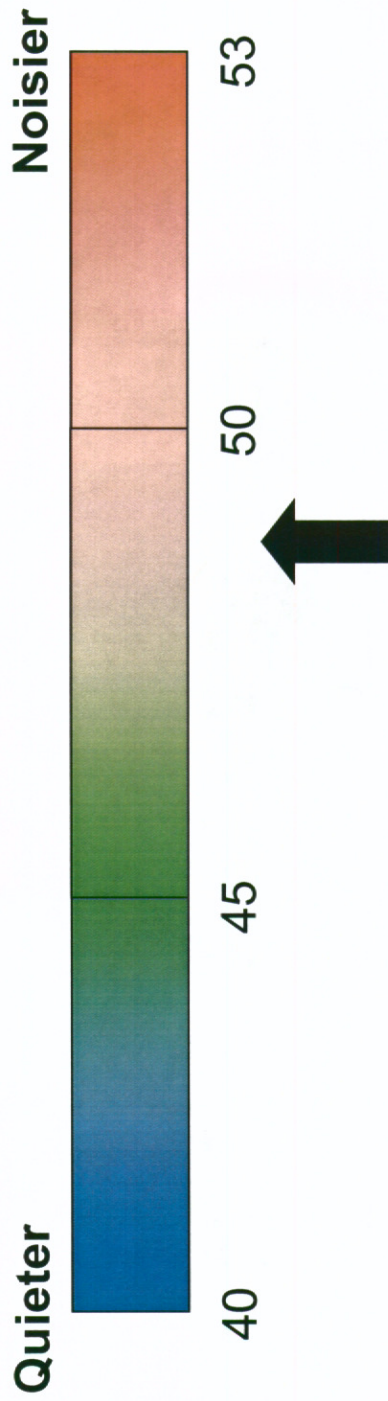


SOLUTION:

- We need a comparative element, a “range-of-levels” indicator

Include Information on “Range of Levels” for Product Noise

Typical Range of A-Weighted Sound Power Levels for Similar Products

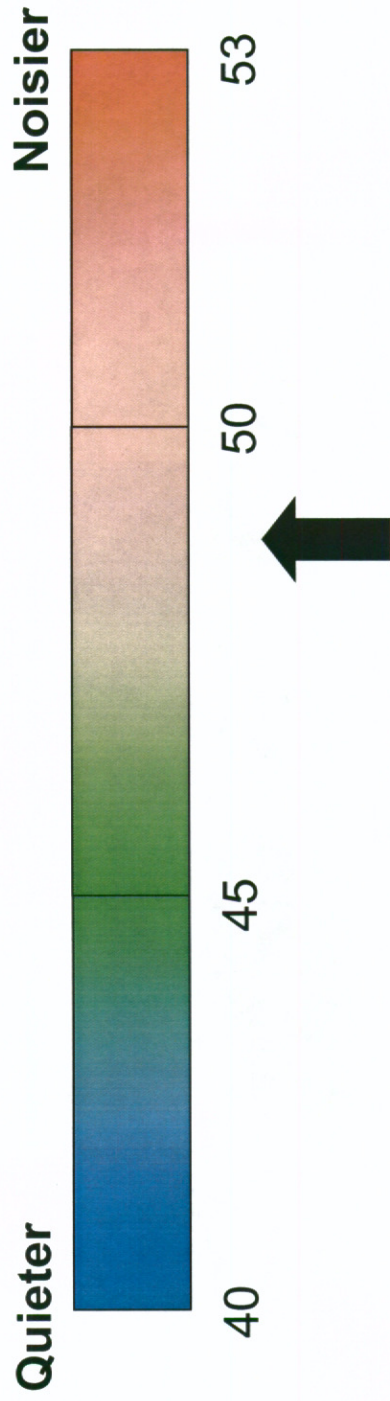


This Product: 48 dB



Include Information on “Range of Levels” for Product Noise (PNR version)

Typical Range of PNRs for Similar Products



■ Thus, Third Element = A “Range-of-Levels” Indication

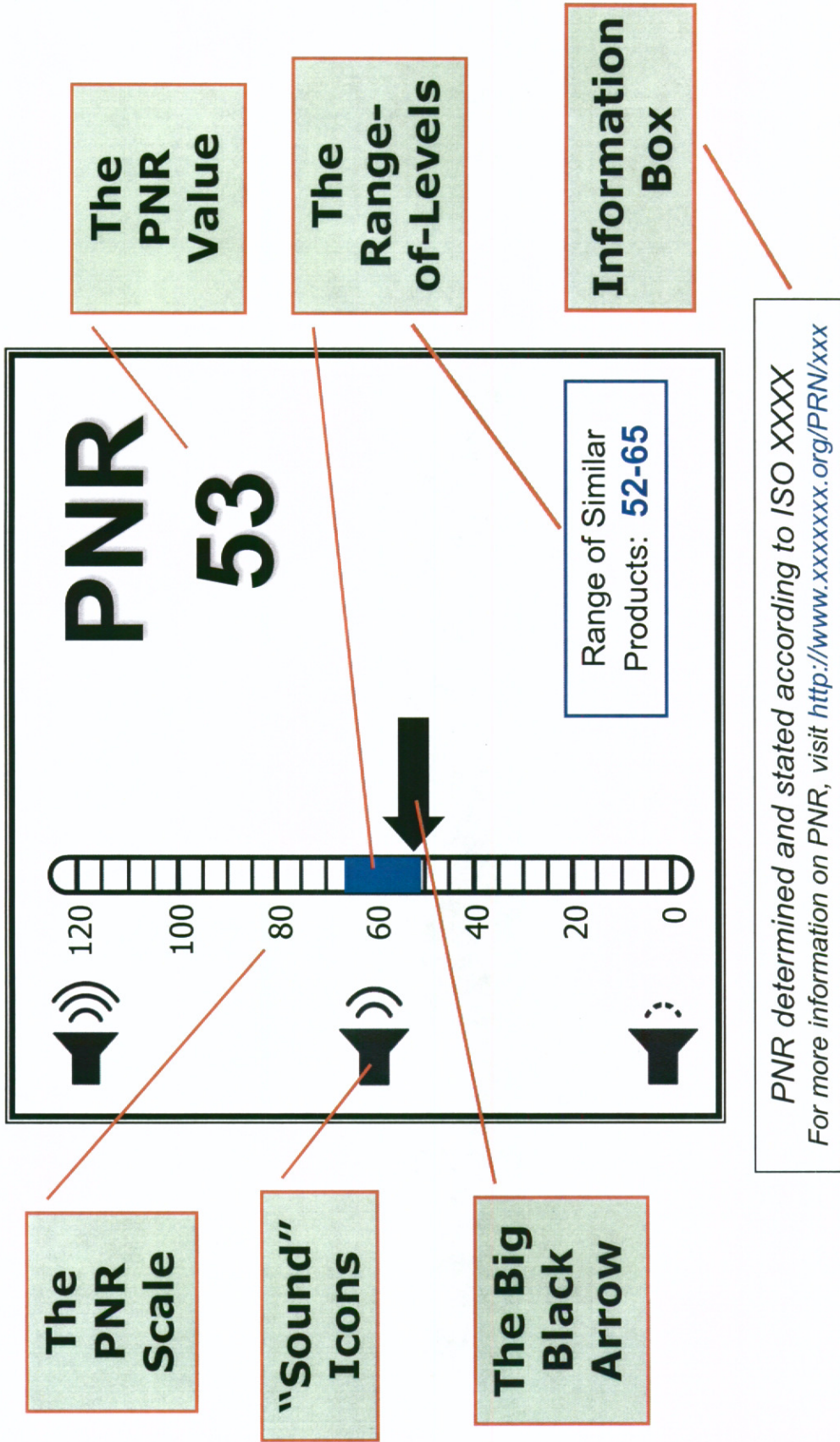
- Provide the range of PNRs for similar products
- Include the “big black arrow” showing where the product falls along that range
- This will provide incentive to manufacturers to “move their arrow” lower
- This might provide some justification for consumers paying a little extra for a low-noise product
- Big arrow and range-of-levels renders actual units less important

How can we present the PNR to the public in a simple, uniform manner?

- We need a visual icon
 - should be instantly recognizable
 - should present the needed information in as simple a manner as possible

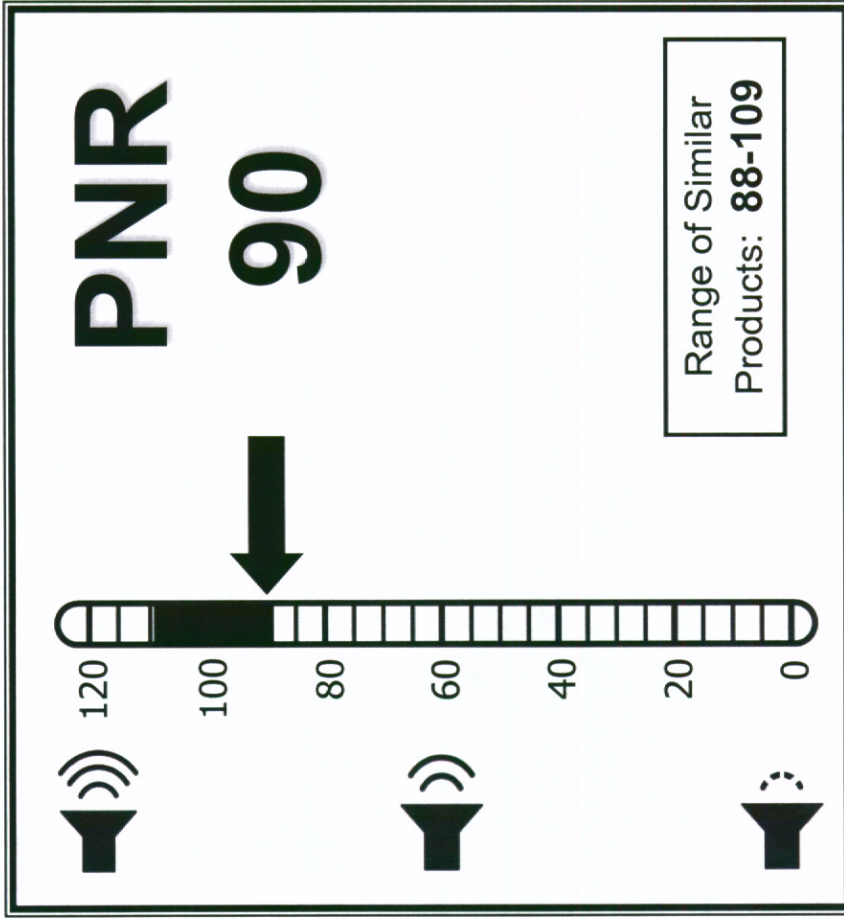
Elements of the PNR Method: 4. The Visual Icon

The PNR Icon



Elements of the PNR Method: 4. The Visual Icon

The PNR Icon: Loud product, but a “good” one

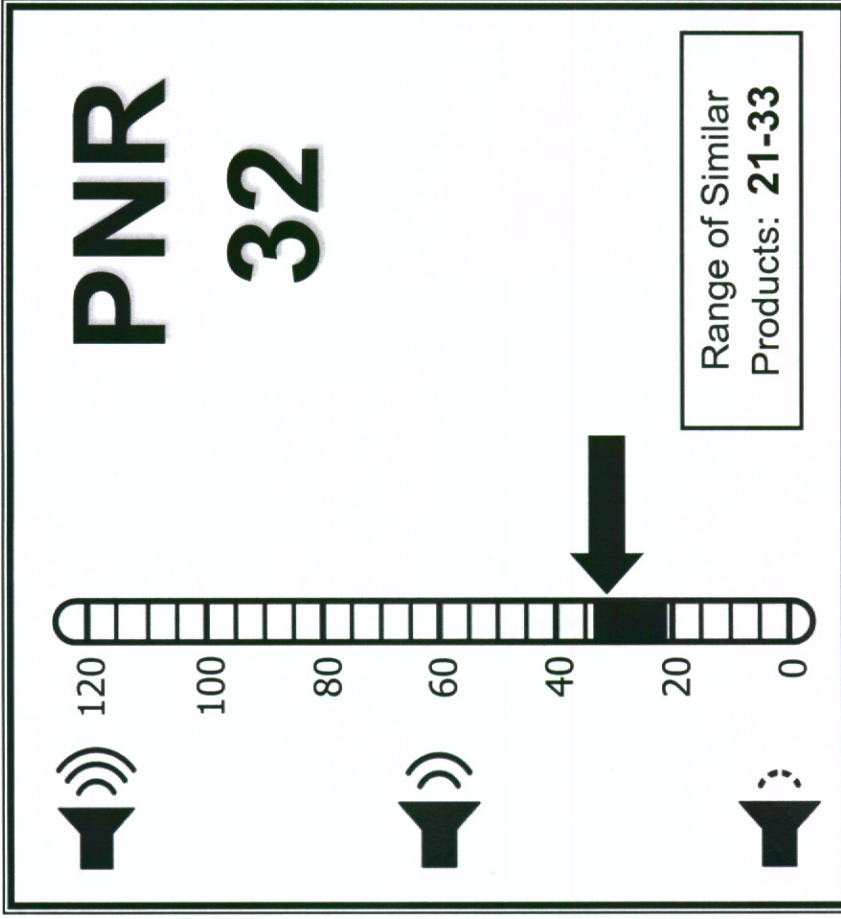


*PNR determined and stated according to ISO XXXX
For more information on PNR, visit <http://www.xxxxxxx.org/PRN/xxx>*



Elements of the PNR Method: 4. The Visual Icon

The PNR Icon: Quiet product, but a “bad” one



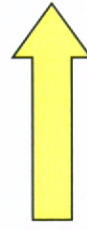
*PNR determined and stated according to ISO XXXX
For more information on PNR, visit <http://www.xxxxxxx.org/PRN/xxx>*



- **Thus, Fourth Element = A Visual Icon**
 - Instantly recognizable as a Product Noise Rating
 - Includes overall scale for noise
 - Shows range-of-levels for similar products
 - Includes “big black arrow” to show where this product falls on range-of-levels
 - May include an “information box” for references or other information

Outline of Talk

- Background
 - Terminology
 - Information
- Elements of the PNR Method
 - The Scale
 - The *Range-of-Levels*
 - The *PNR value*, itself
 - The *visual icon*



■ A Look Ahead

■ A hopeful vision of the future:

- Consumers will add "low noise level" to their buying decisions.
- People will be asking "What is the PNR for this product?"
- Consumers might be more willing to pay higher prices for quieter products once they can see that these products are "better" than others in terms of noise.
- Consumers will start *demanding* quieter products once they know they are out there.
- Manufacturers will want to "move their arrow" towards lower noise.
- Manufacturers will begin developing lower-noise product lines and noise-reducing options when they see consumers making decisions based on noise.

■ A hopeful vision of the future (cont.):

- Consumer advocate groups looking into "certification" or "Buy Quiet" programs will have data at their fingertips, and will publicize "low PNR" products.
- Consumer publications will include PNRs in their product ratings.
- Products will *routinely* be measured for noise.
- Support for noise testing, instrumentation, education, and standards will increase dramatically.
- As the general public becomes familiar with PNR ratings and product noise in general, interest in the field of acoustics and noise control, itself, will increase.
- **The world will become a quieter place!**



Buy Quiet Workshop

National Institute for Occupational Safety and Health

Thank You for your Attention

Matthew A. Nobile



Hudson Valley Acoustics Laboratory
Poughkeepsie, New York, USA
email: nobile@us.ibm.com

