



Humidity Control in Storage- and Processing Spaces: A Brief Overview

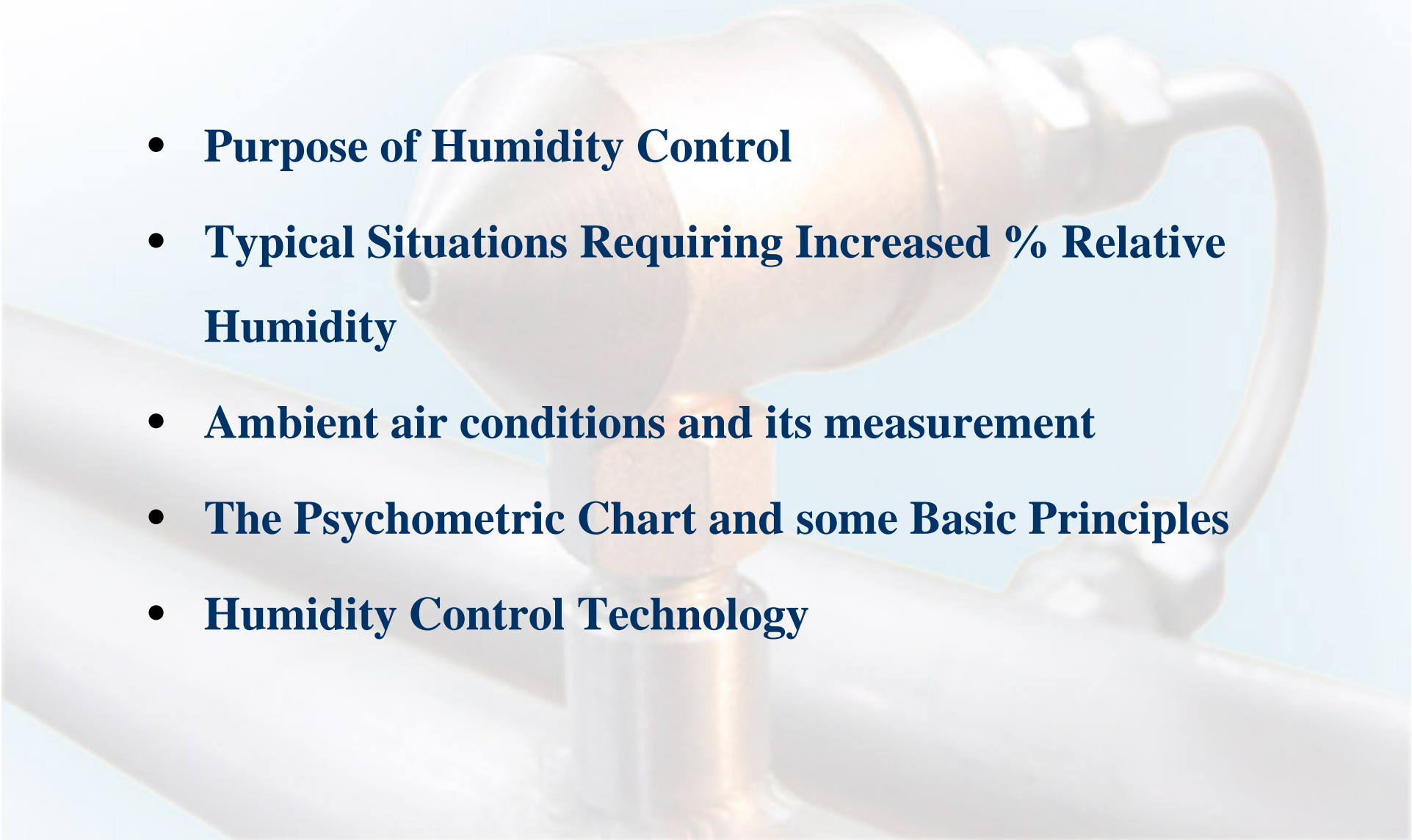
by

Johann Murray Pr Eng

Ultimate Air Solutions (Pty) Ltd

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Presentation Content

- **Purpose of Humidity Control**
 - **Typical Situations Requiring Increased % Relative Humidity**
 - **Ambient air conditions and its measurement**
 - **The Psychometric Chart and some Basic Principles**
 - **Humidity Control Technology**
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Purpose of Humidity Control

To modify (increase or decrease) and control at a set point the Humidity Ratio or % Relative Humidity of air in a space, to suit conditions required for specific activities taking place in that space.

The Humidity Ratio (HR) = Kg Moisture per Kg Dry Air

and

% Relative Humidity (%RH) = Current Humidity Ratio expressed as % of maximum Humidity Ratio of air at the same °C.

In this presentation we will only discuss cases where an increase in HR or %RH is required.

Typical Situations Requiring Increased % Relative Humidity

- **Wineries and Distilleries**
- **Cold Storage (Including land and sea transport)**
- **Ripening of Bananas and Citrus**
- **Mushroom growing**
- **Gas Turbines**
- **Industry (Clean Rooms, Cotton & Textile, Paper & Printing, Tobacco etc)**

Wineries and Distilleries

- **A barrel can lose up to 4-8% wine or brandy in one year due to evaporation through the barrel**
- **Humidity and temperature control can reduce the losses to 1-2% per annum**
- **Most red wine is matured in barrels for 1 to 2 years, while Distilleries store barrels generally for 3 to 10 years**
- **Typical regime = 80-85% RH**

Wineries



Cold Storage

- **Reduces loss of weight of the product due to evaporation, from 5%-10% to 1%-2%**
- **Increases product value by maintaining its firmness, appearance, and quality**
- **Extends shelf life**
- **Use of Atomizers as a delivery mechanism for anti-sprouting treatment, against Fungi, Bacteria, and Insects**
- **Typical regime = 85-98% RH**

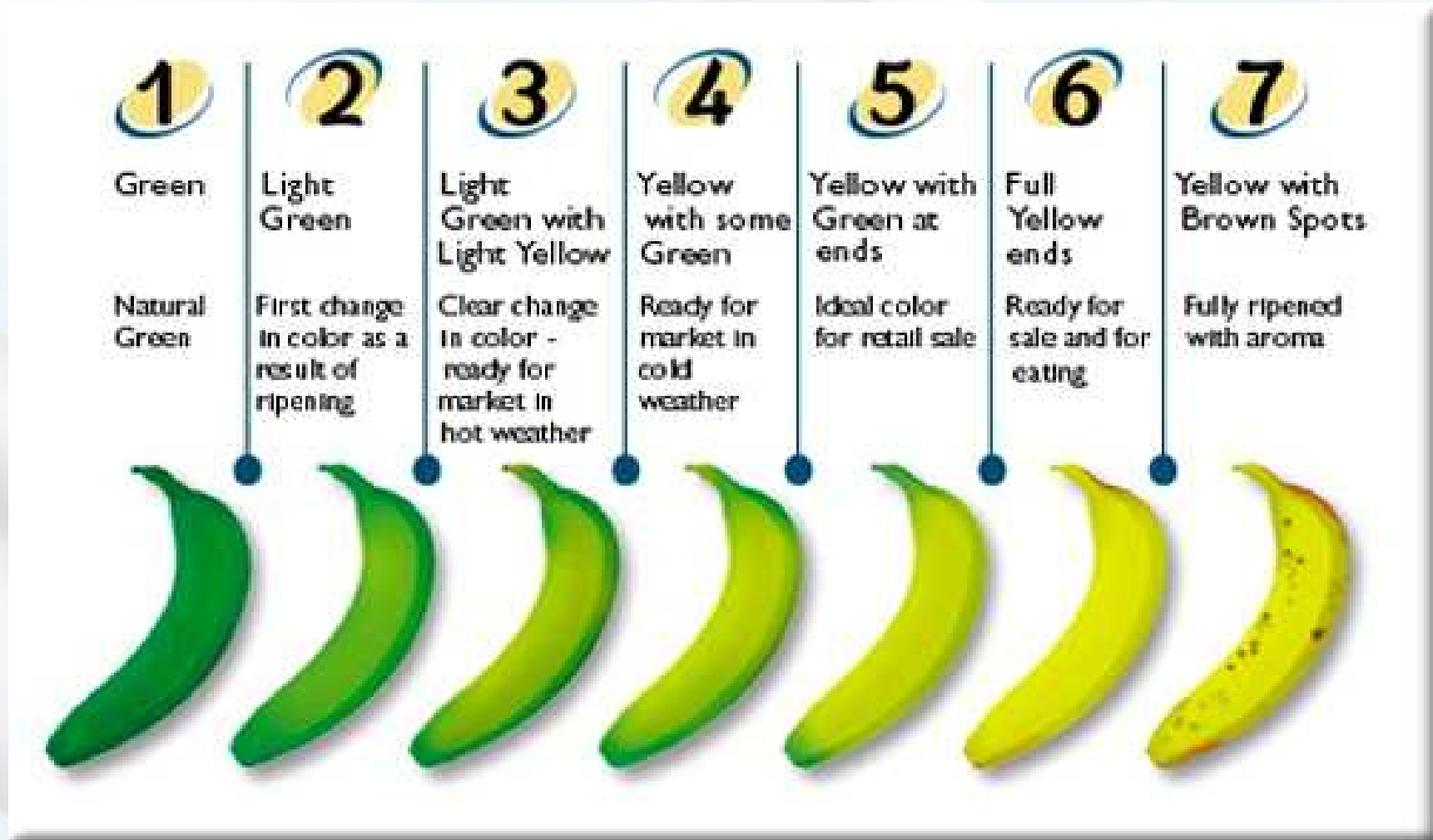
Cold Storage



Banana and Citrus Ripening

- **High 95% RH slows and improves ripening.**
- **Extends shelf life.**
- **Reduces damage from bruising.**
- **Maintains firmness.**
- **Prevents spotting.**

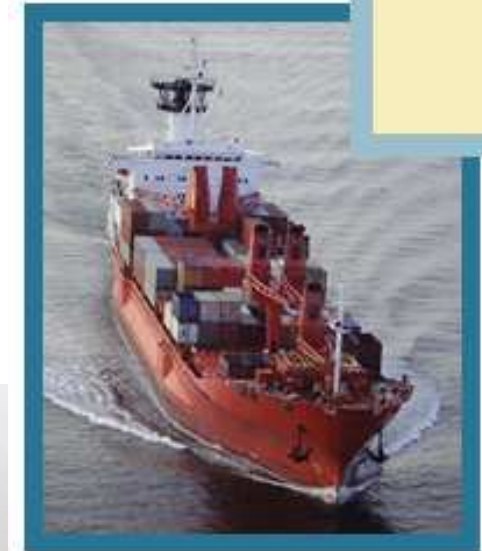
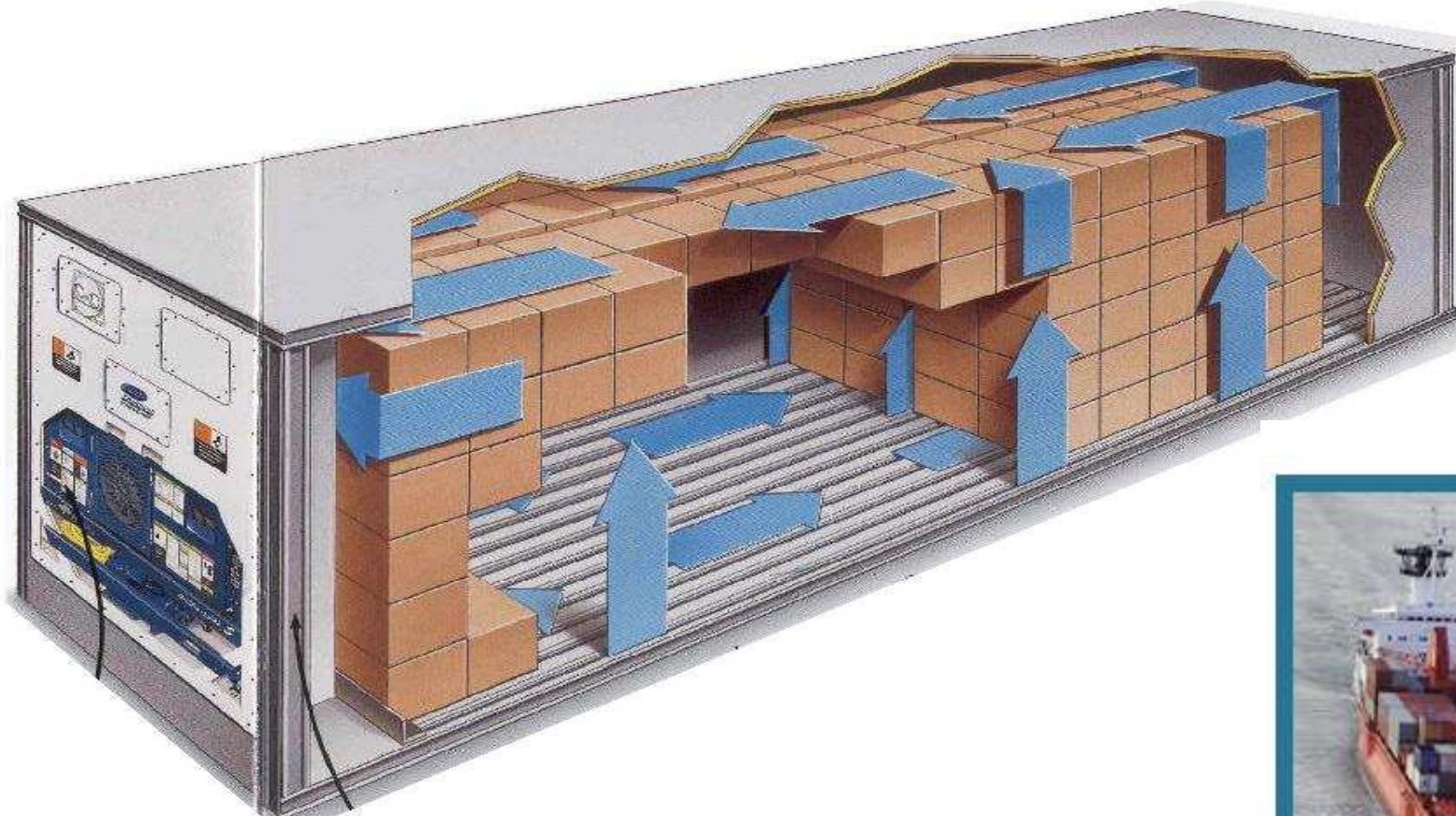
Banana and Citrus Ripening



Reefers and Containers

- **Long-distance Refrigerated Sea Transport Refrigerated Containers (for road/rail/sea transport) Plus dedicated refrigerated cargo ships**
- **Integrated solution with the container's systems (electricity, air, water and control).**
- **A close loop solution, which provides long range dependably and reliability.**
- **Maintains stable humidity at a range from 76% to 95%.**

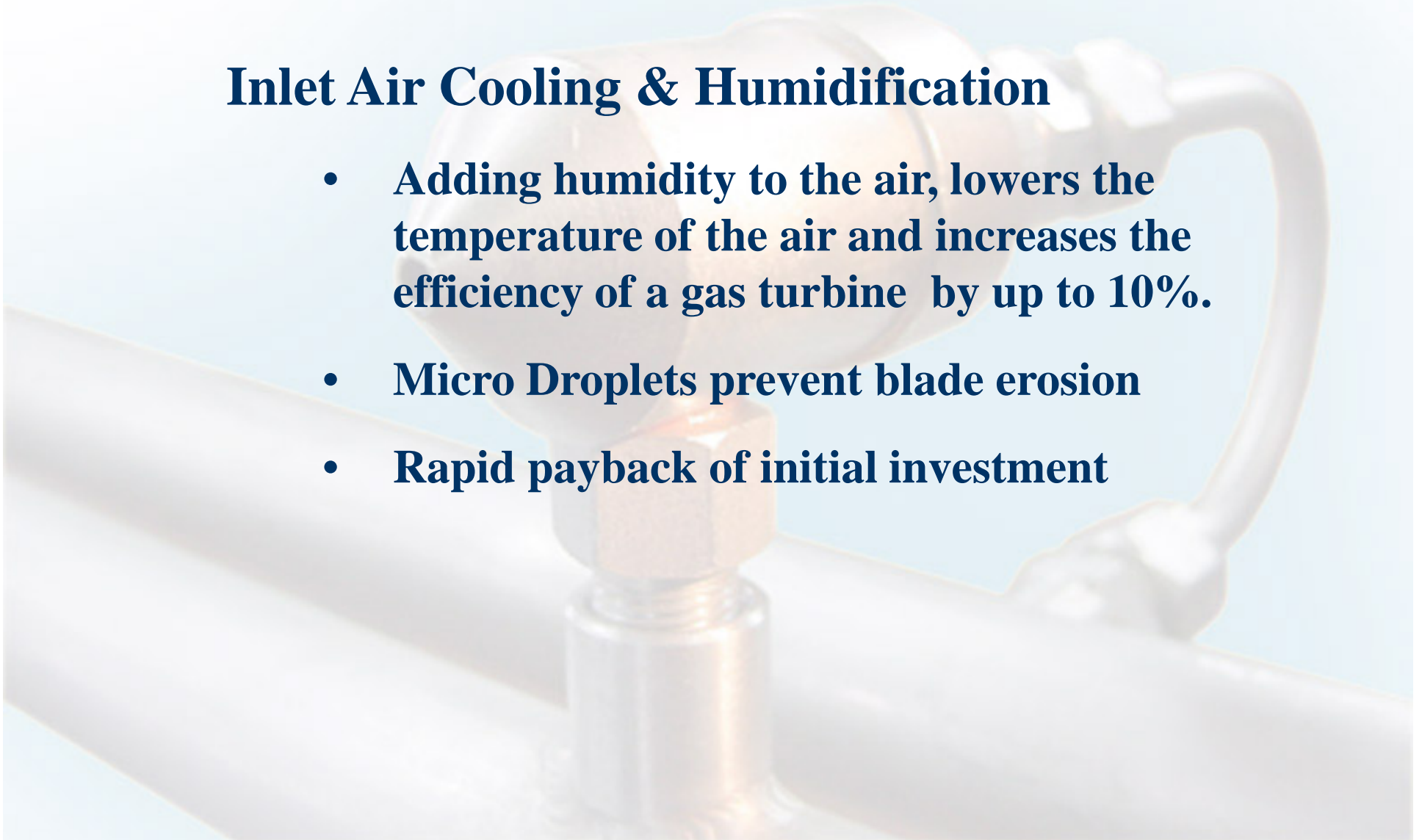
Reefers And Containers



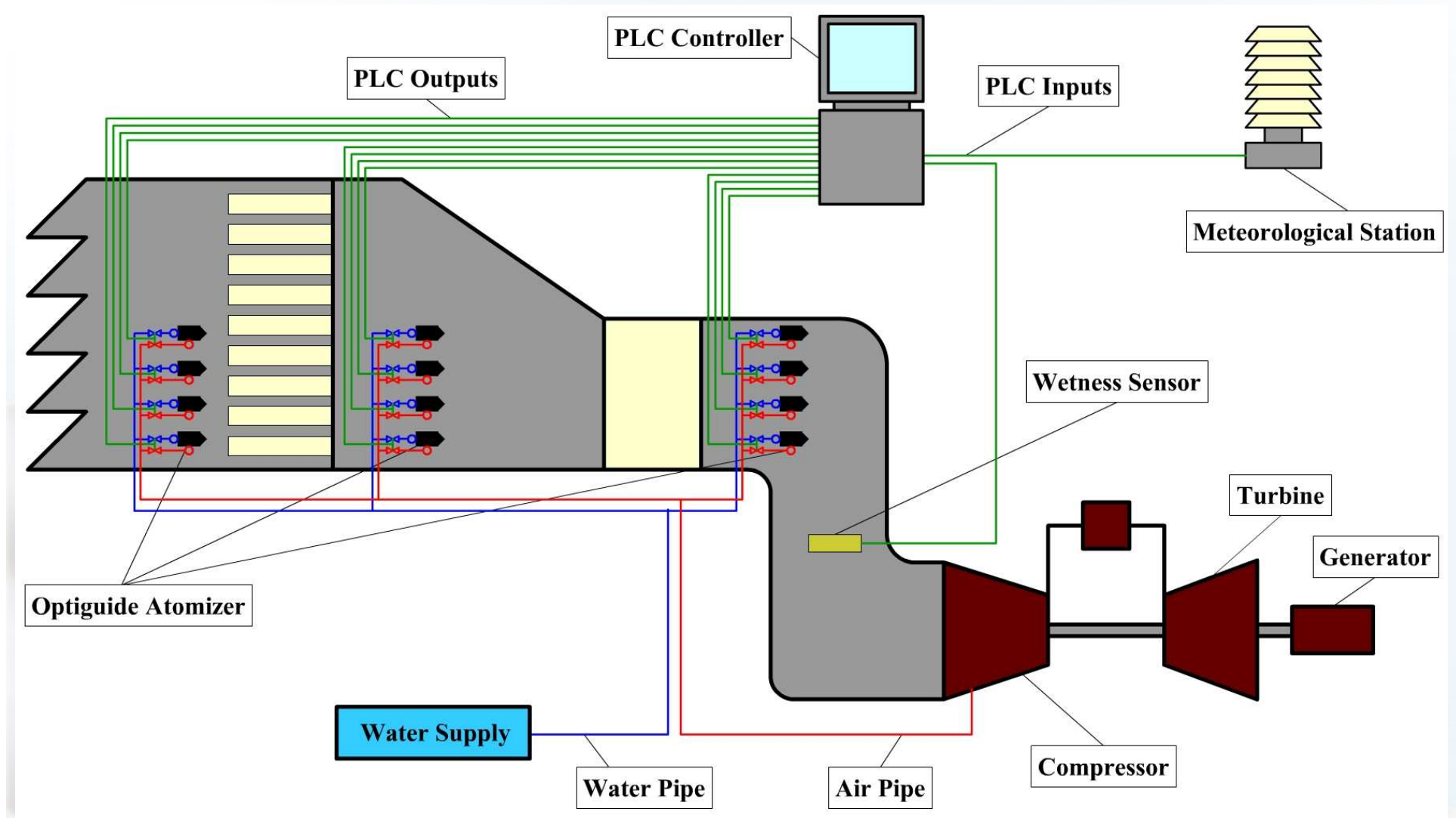
Gas Turbines

Inlet Air Cooling & Humidification

- **Adding humidity to the air, lowers the temperature of the air and increases the efficiency of a gas turbine by up to 10%.**
- **Micro Droplets prevent blade erosion**
- **Rapid payback of initial investment**



Optiguide Air Cooling System Typical Layout Scheme



Clean Rooms

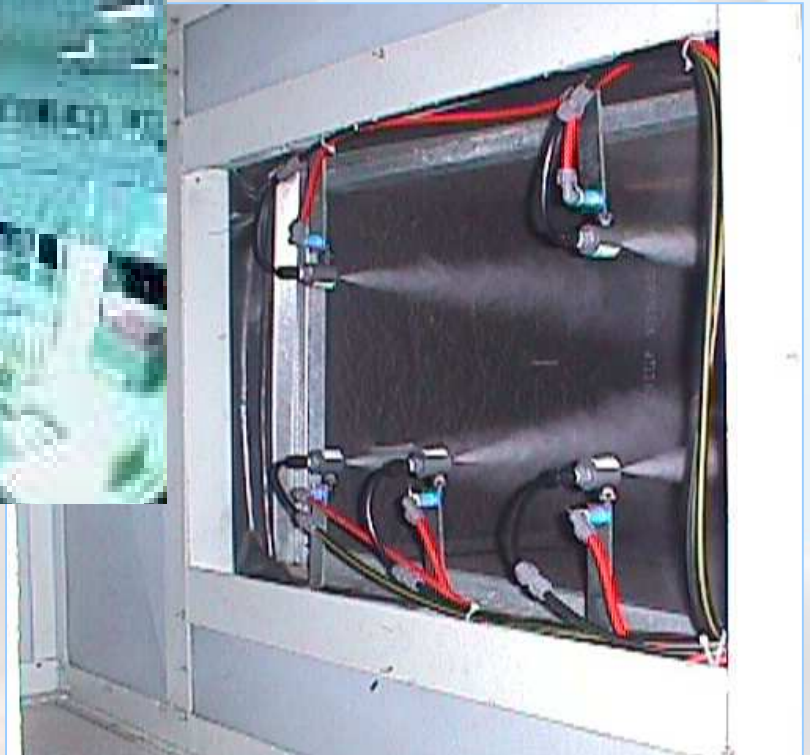
Applications:

- **Reduction of static electricity in Clean Rooms in semiconductor wafer fabrication, the micro-electronics industry and pharmaceutical production**
- **Reduction of static electricity in explosives manufacturing facilities**
- **Counteracting dryness in industrial and commercial air conditioning (Comfort AC)**

The Need: Steady, controlled Relative Humidity (40-60% RH)

The Competition = Steam

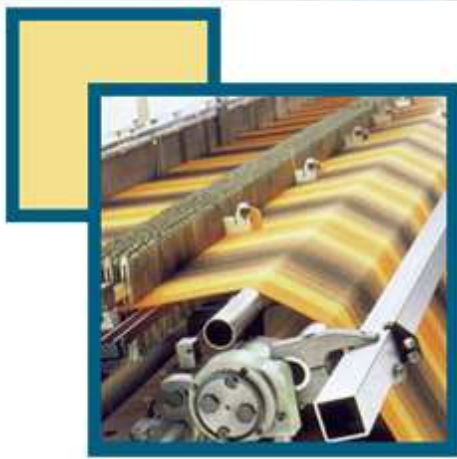
Clean Rooms



Cotton and Textile

- **Adding moisture to stored Cotton Bales can increase the sale value of the cotton by about 4%.**
- **Thread and fibers remain flexible and easily worked, for higher efficiency.**
- **Humidity reduces static electricity in the air to prevent clinging materials.**
- **Dust and fiber in the air are reduced as water droplets increase their weight and bring them to the floor.**

Cotton and Textile



Paper and Printing

- **Adding humidity to 50-60% R.H. maintains flexibility of the paper, and improves efficiency.**
- **Increases the running time of the paper printing machines.**
- **Enables homogenous ink spread and drying.**
- **Dust and fibers suppression in work area .**
- **Reduces static electricity in the air to prevent sparks and fire hazards.**
- **All year constant conditions for label storage.**

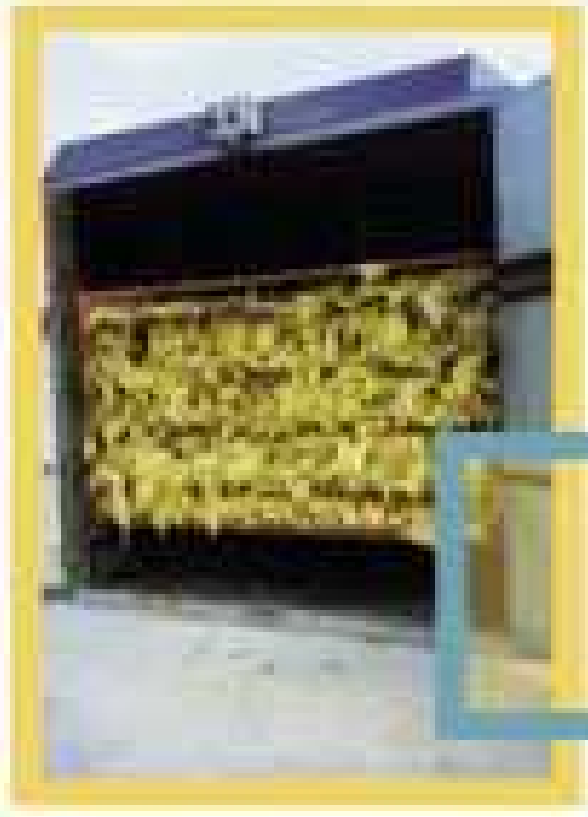
Paper and Printing



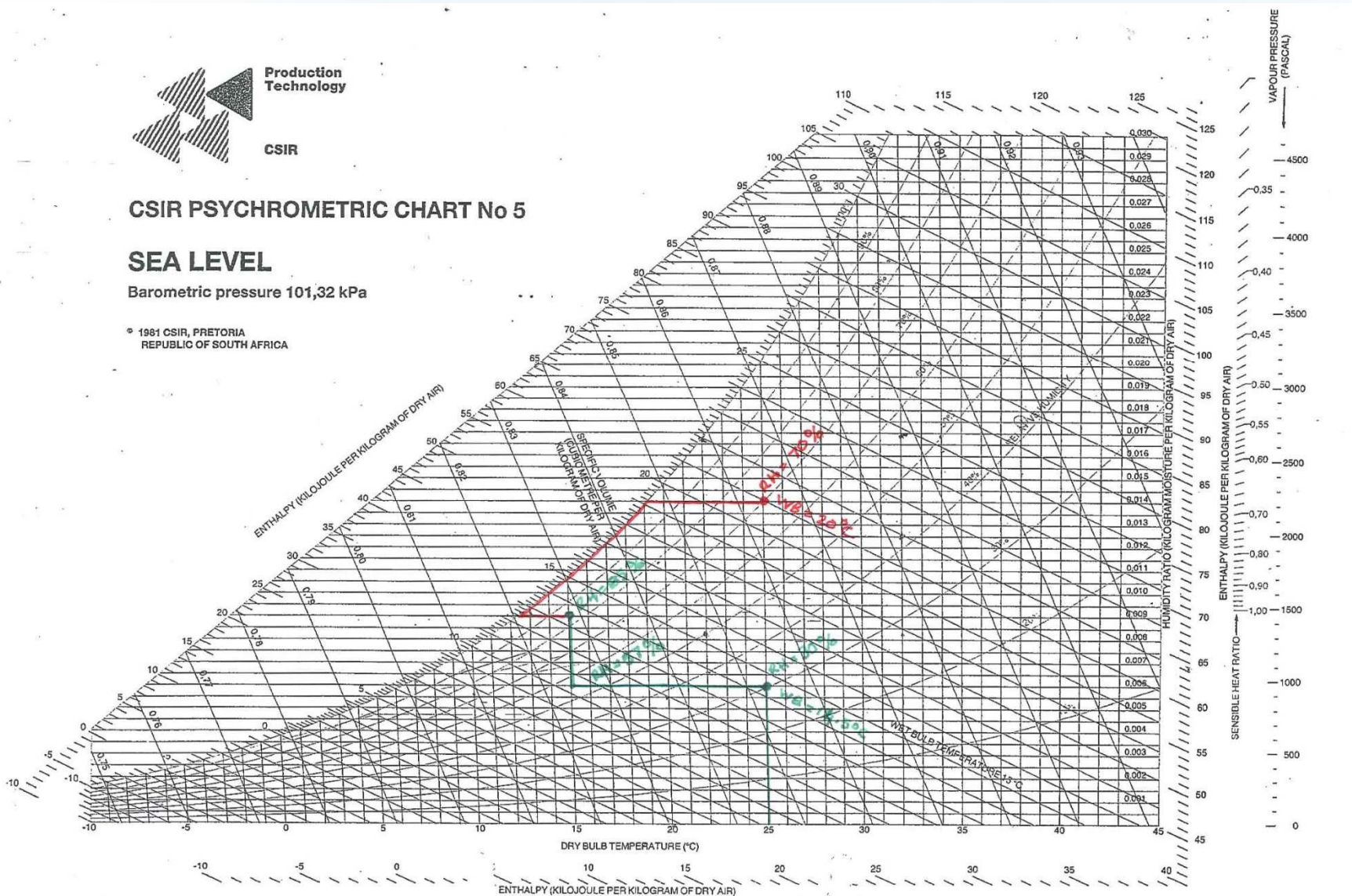
Tobacco Storage and Curing

- **Tobacco must be kept at high humidity to keep leaf moisture at 16-18%.**
- **Adding humidity to air, up to 70%RH, in large storage rooms allows the tobacco leaf to breathe in water vapor, without the wetness that blackens leaves and causes mold.**
- **Tobacco leaves absorb the humidity, adding moisture and flexibility to the leaf, preventing crumbling.**
- **Tobacco Leaf spines remain dry and brittle.**

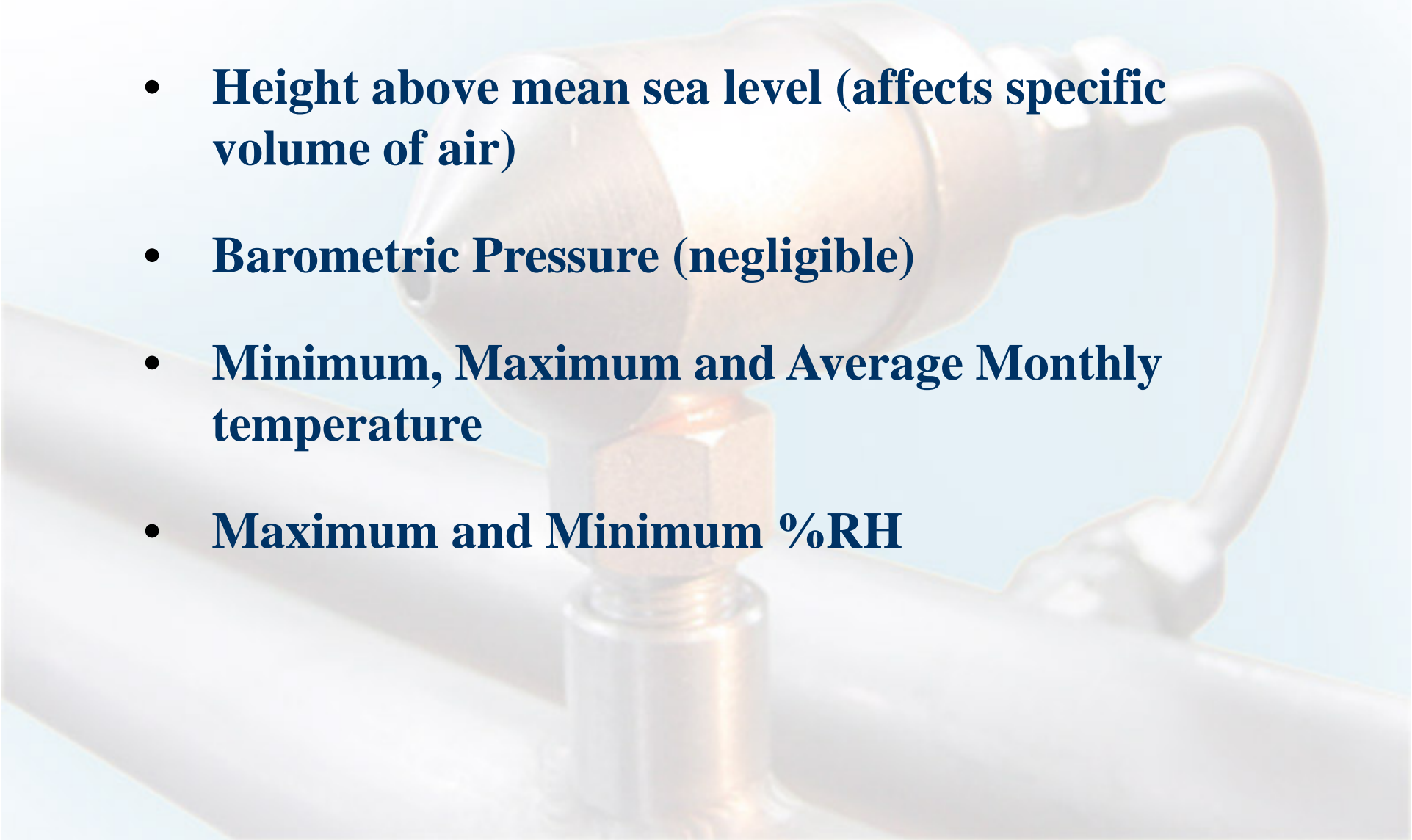
Tobacco Storage and Curing



The Psychrometric Chart and Some Basic Principles



Ambient Air Conditions and its Measurements

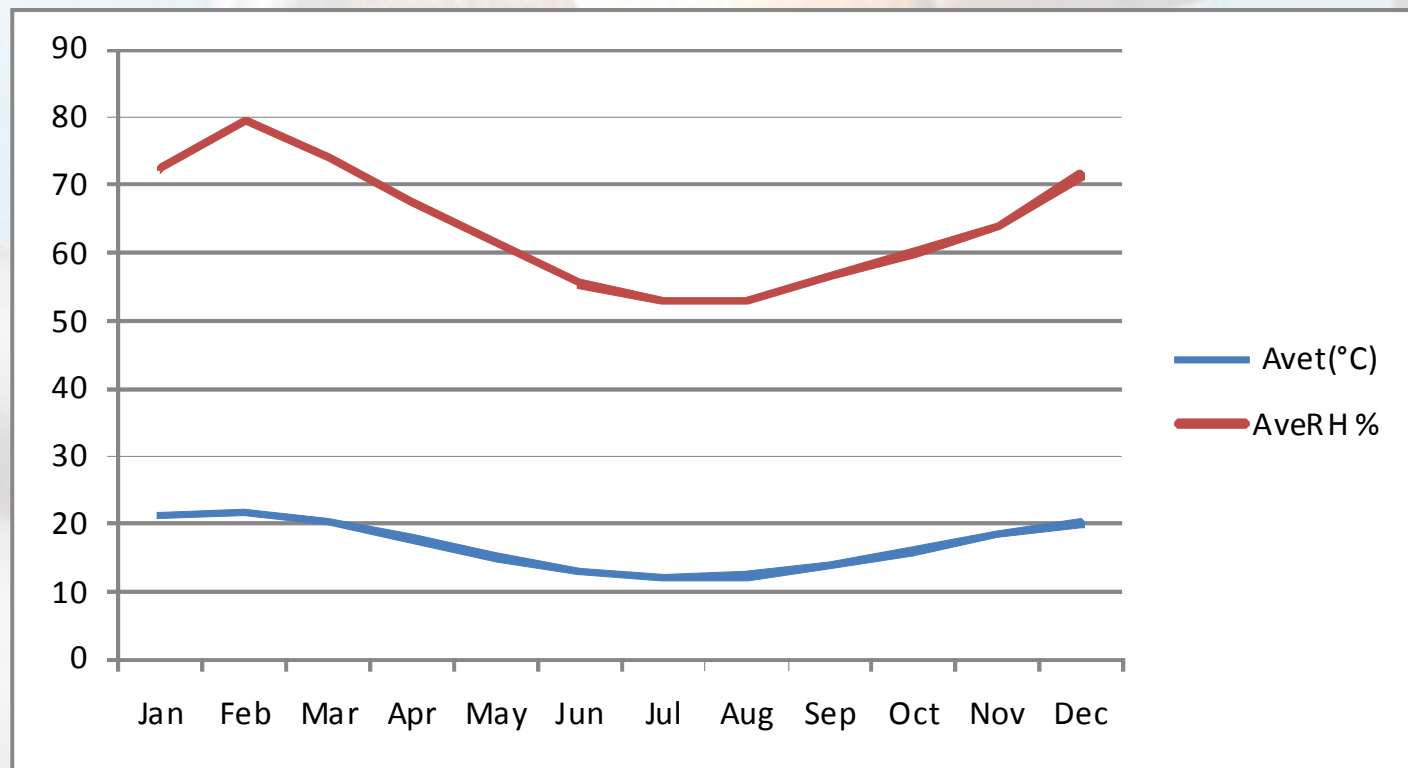
- **Height above mean sea level (affects specific volume of air)**
 - **Barometric Pressure (negligible)**
 - **Minimum, Maximum and Average Monthly temperature**
 - **Maximum and Minimum %RH**
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Ambient Air Conditions and its Measurements

Ambient Air = Source of air varies through the year

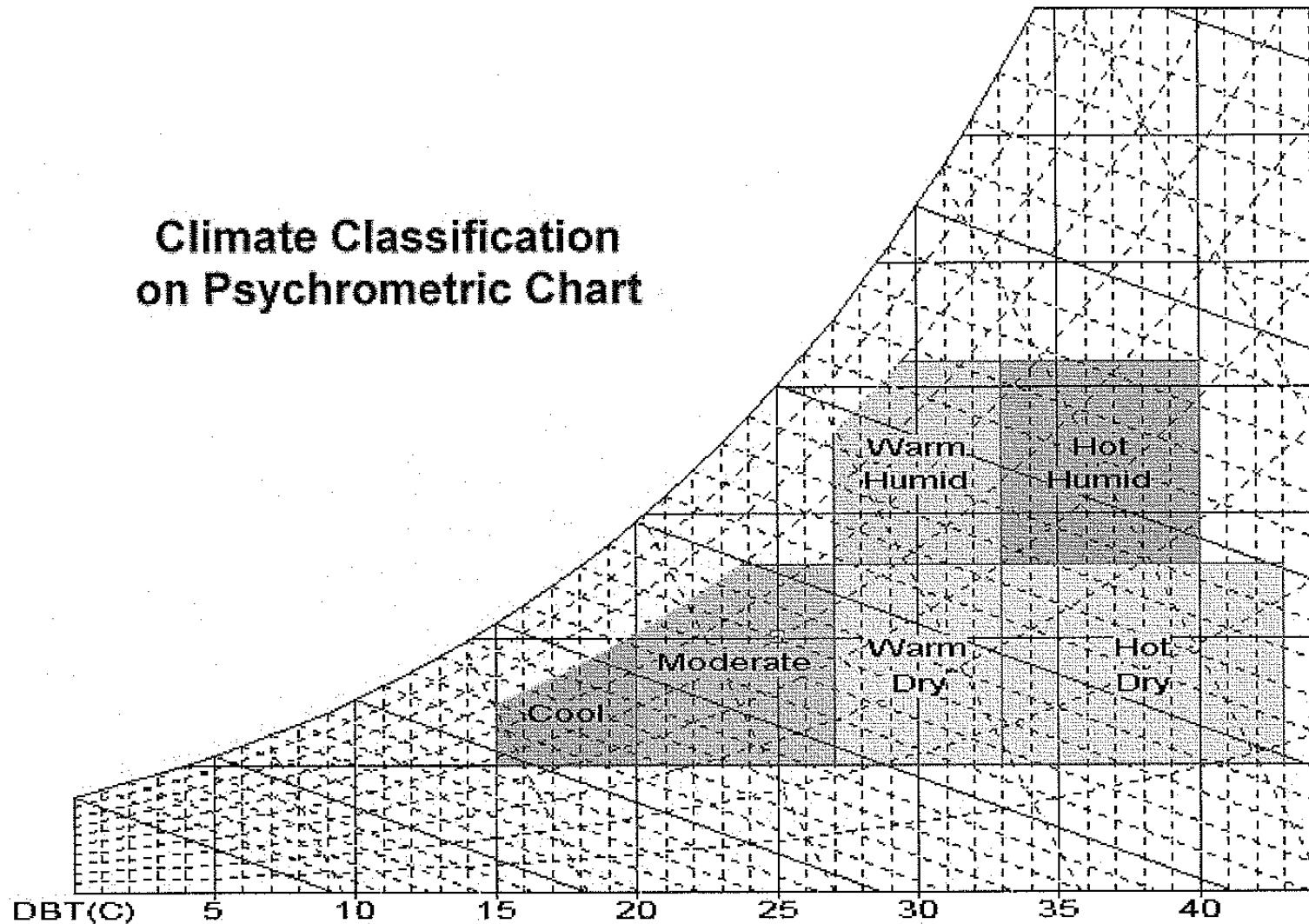
ELSENBURG: Long term summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avet(°C)	21.25	21.78	20.37	17.9	15.01	12.91	12.01	12.35	13.76	15.92	18.45	20.14
AveRH %at 16°C	72.5	79.5	74.0	67.5	61.5	55.5	53.0	53.0	56.5	60.0	64.0	71.5



Ambient Air Conditions and its Measurement

Ambient Air Conditions typical of geographical region



Humidity Enhancement Technology

TYPICAL INSTALLATION:

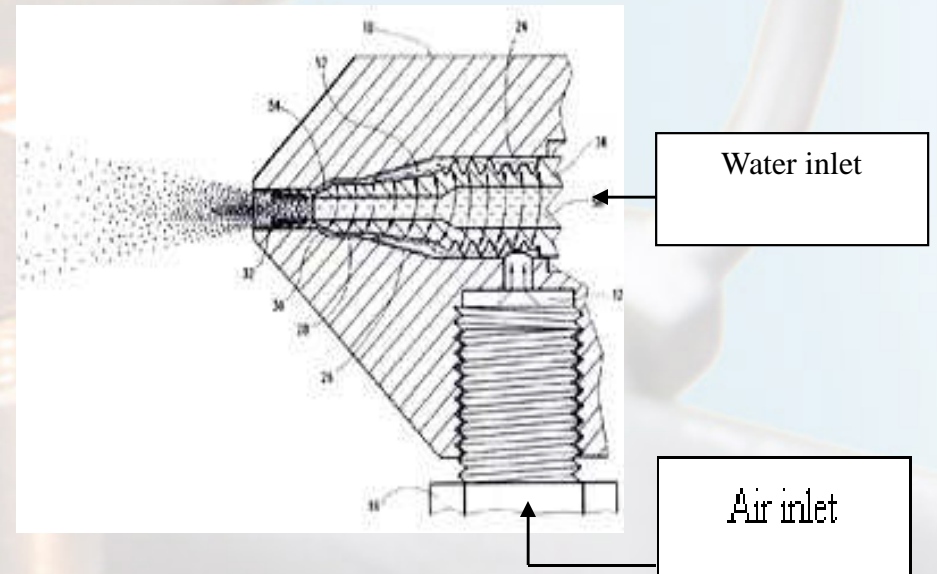
- **Sensor reading %RH or Wet – and Dry Bulb thermometer**
- **Water Vapour applicator with valve**
- **PLC controller reads sensor and open or close valve to regulate %RH**

TYPES OF APPLICATORS:

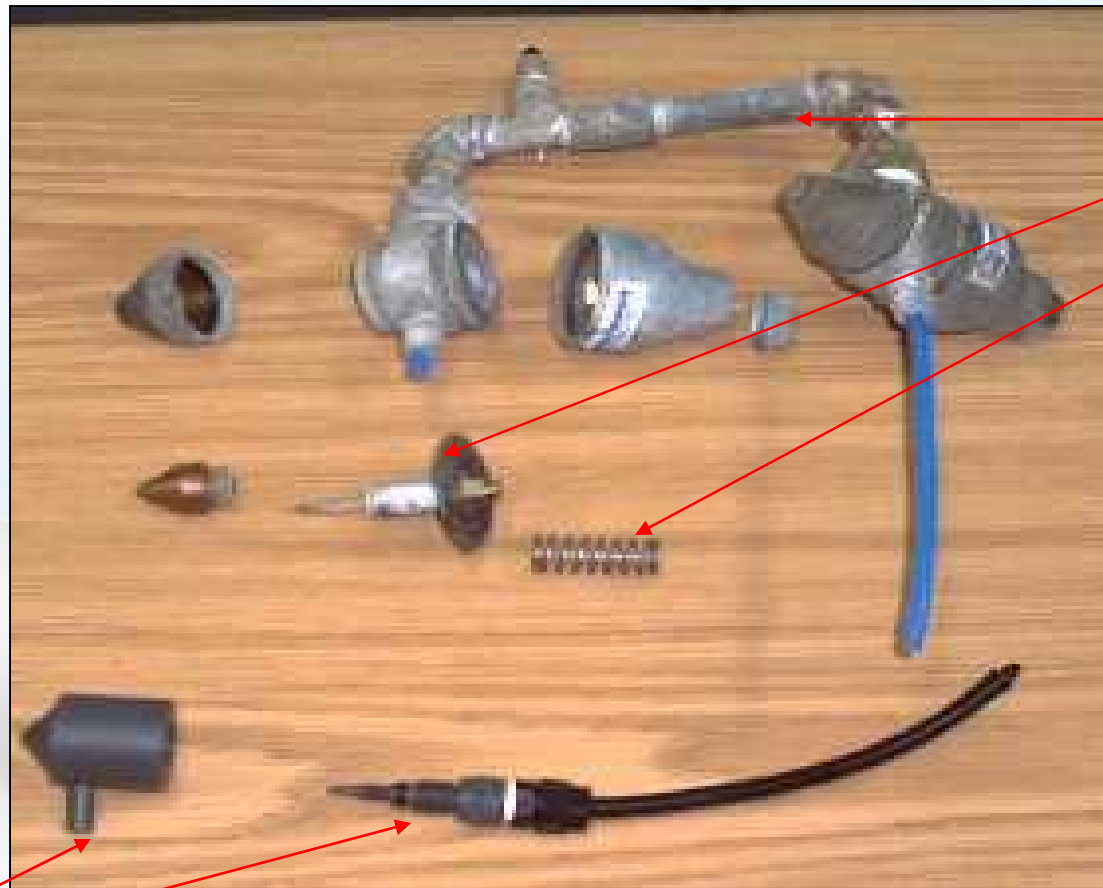
- **Whet wall (Not suitable for most high %RH and other applications)**
- **Steam (High energy cost, adding heat)**
- **Spinning disc (Low capacity, large droplets)**
- **High (>100 Bar) water pressure misters (small (0.3mm) orifice, clogging, high energy cost, wetness)**
- **Compressed air/vacuum water atomizers (large 1.4mm orifice, 2-10 micron droplets, dry mist, no moving parts, low maintenance Tabor patent)**

The vacuum atomizer advantages

- **Wide scale of Humidity Control - up to 98%**
- **Unique “Dry Fog” technology (a registered Optiguide Patent) which provides micro droplets (size 2-10 Microns).**



Optiguide Atomizer versus Others



Herrmidifier
fogger

Optiguide Atomizer



**Thank you for your
attention**

Contact Details

Ultimate Air Solutions (Pty) Ltd

Fax 021 883 8514 Phone 083 628 7820

Web: www.optiguide.co.il **e-mail:** jmurray@mbbsouth.co.za