

***Canadian Process  
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Delta, BC, Canada***



# Improving Efficiency in Gold Leaching Circuits



# Cyanidation of Gold



**Gold dissolution by cyanide requires oxygen**

**Ores containing “oxygen consumers” affect leaching by depleting dissolved oxygen levels**

**Slurry Oxygen Demand must be satisfied to guarantee complete gold dissolution**



# Cyanidation of Gold

**Under normal cyanidation conditions, the rate of gold dissolution is directly proportional to DO level of pulp**



# Advantages of increasing DO

- ▶▶ reduce the amount of cyanide soluble gold going out in the tailings and so improve recovery
- ▶▶ oxidize species in the ore which consume oxygen and reduce the amount of cyanide being used by destroying cyanocides
- ▶▶ reduce of the amount of additives such as “lead “ required



# Cyanidation of Gold

## Common Methods of Increasing DO levels

Hydrogen / Calcium Peroxide addition

Air injection

Tonnage oxygen injection



# Peroxide

- ▶▶ Hydrogen or Calcium Peroxide added as an oxidant
- ▶▶ Very effective at increasing DO level of slurry
- ▶▶ High operating cost



# Tonnage Oxygen Use

- ▶▶ Ability to achieve DO levels of 30 ppm
- ▶▶ Can achieve higher DO levels for plants operating in hot climates
- ▶▶ Requires on-site oxygen plant or liquid oxygen storage facilities
- ▶▶ Expensive



# Cyanidation of Gold

## Typical Oxygen Consumption Rates

**Low Sulfur Feed – (2 -3 % S)**

**1 – 1.5 kg O<sub>2</sub> / T**

**High Sulfur Feed - (10 – 15% S)**

**200 – 500 kg O<sub>2</sub> /T**



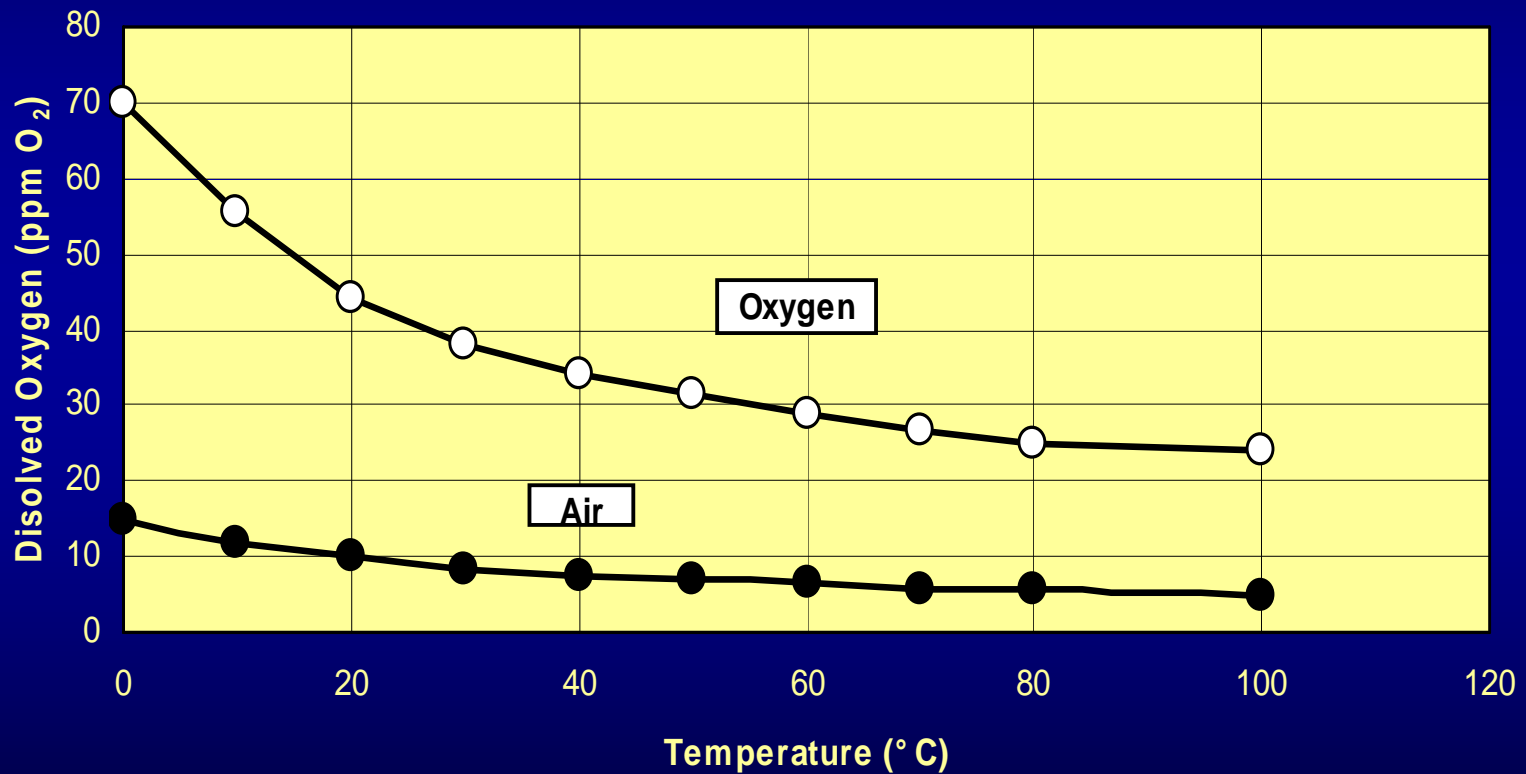
# Air / O<sub>2</sub> Addition

- ▶▶ **Compressed air or oxygen is most common method to increase DO levels**
- ▶▶ **Choosing correct sparging device is important to ensure proper performance**



# Cyanidation of Gold

Maximum Dissolved Air / Oxygen in Water  
as a Function of Temperature at Sea Level



# Gas Sparging Systems

Sparging is key to efficient utilization of air or oxygen

$$\frac{dC}{dt} = k_L a (C^* - C)$$

$dC/dt$  = mass transfer rate,  $g/m^3 \cdot h$

$K_L$  = Overall liquid phase mass transfer coefficient,  $m/h$

$a$  = interfacial area,  $m^2/m^3$

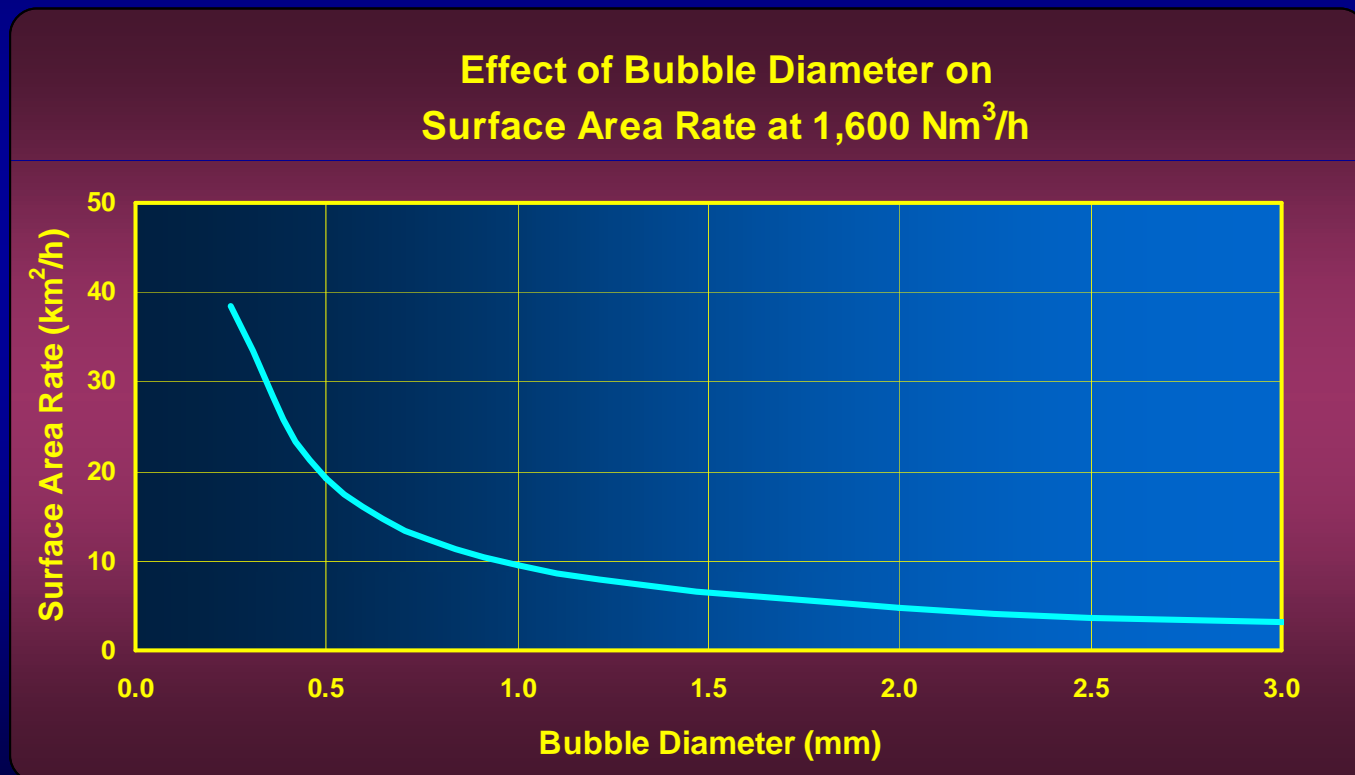
$C^*$  = Equilibrium liquid Phase DO concentration,  $g/m^3$

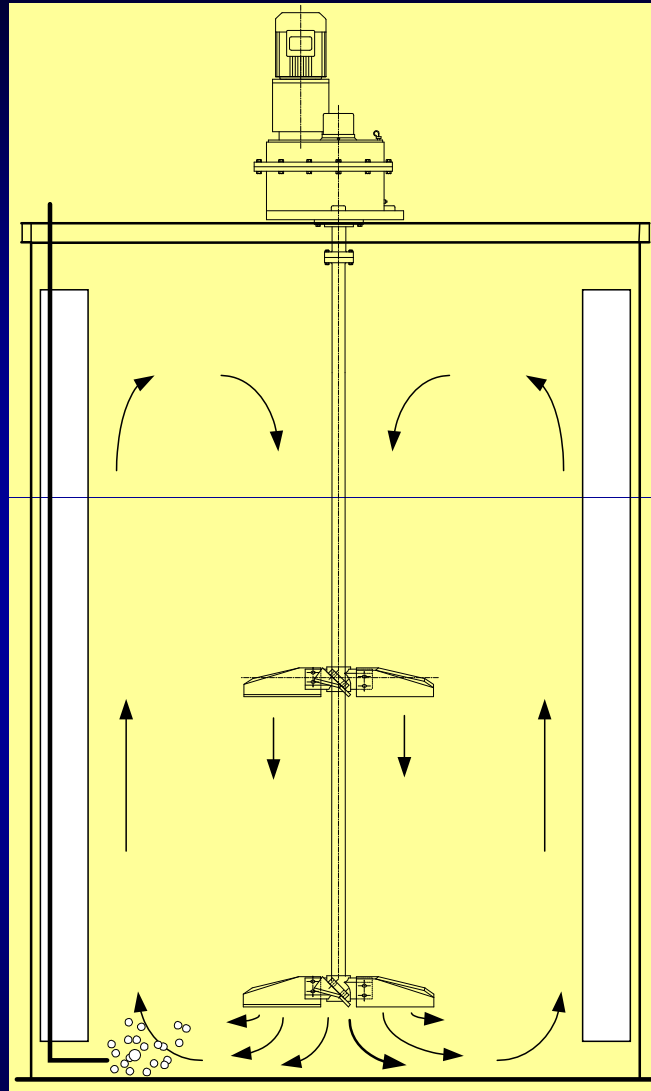
$C$  = Bulk liquid phase DO concentration,  $g/m^3$



# Bubble Size – Surface Area

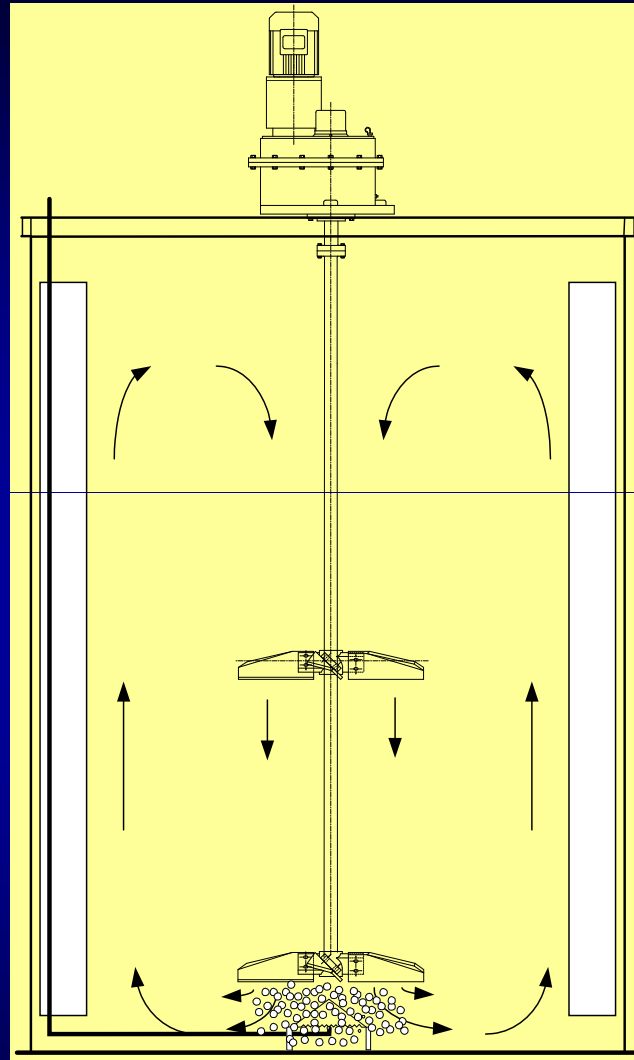
Oxygen mass transfer depends largely upon the total surface area rate and agitation intensity



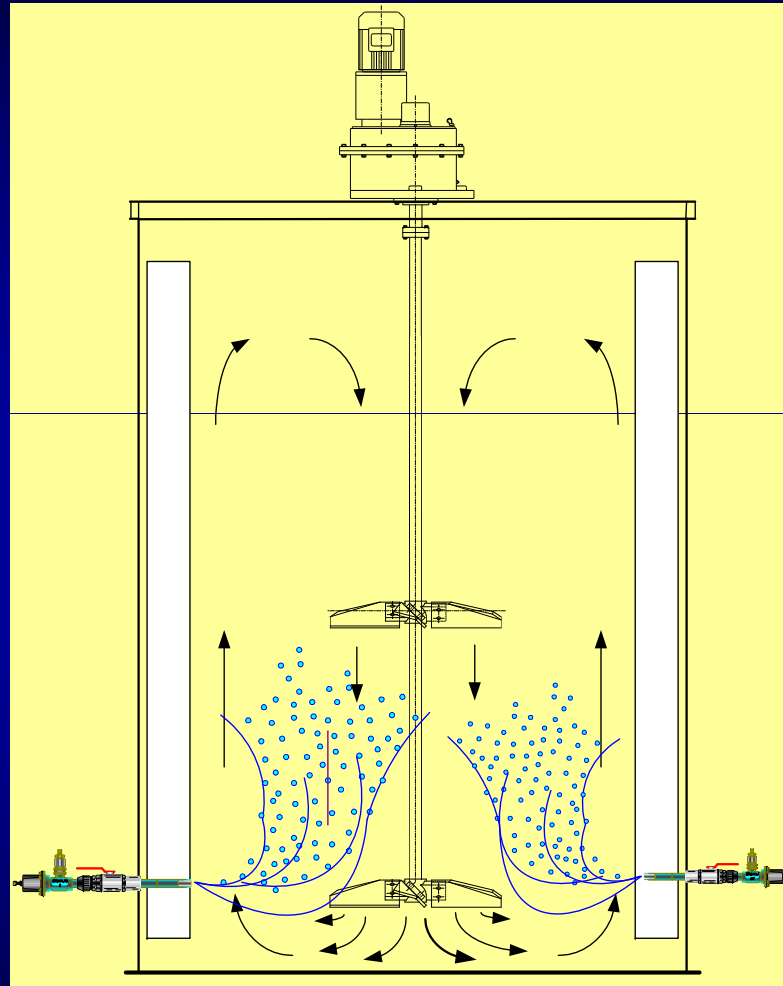


**Pipe Sparger**





**Bubble Cone**



## Slamjet Spargers



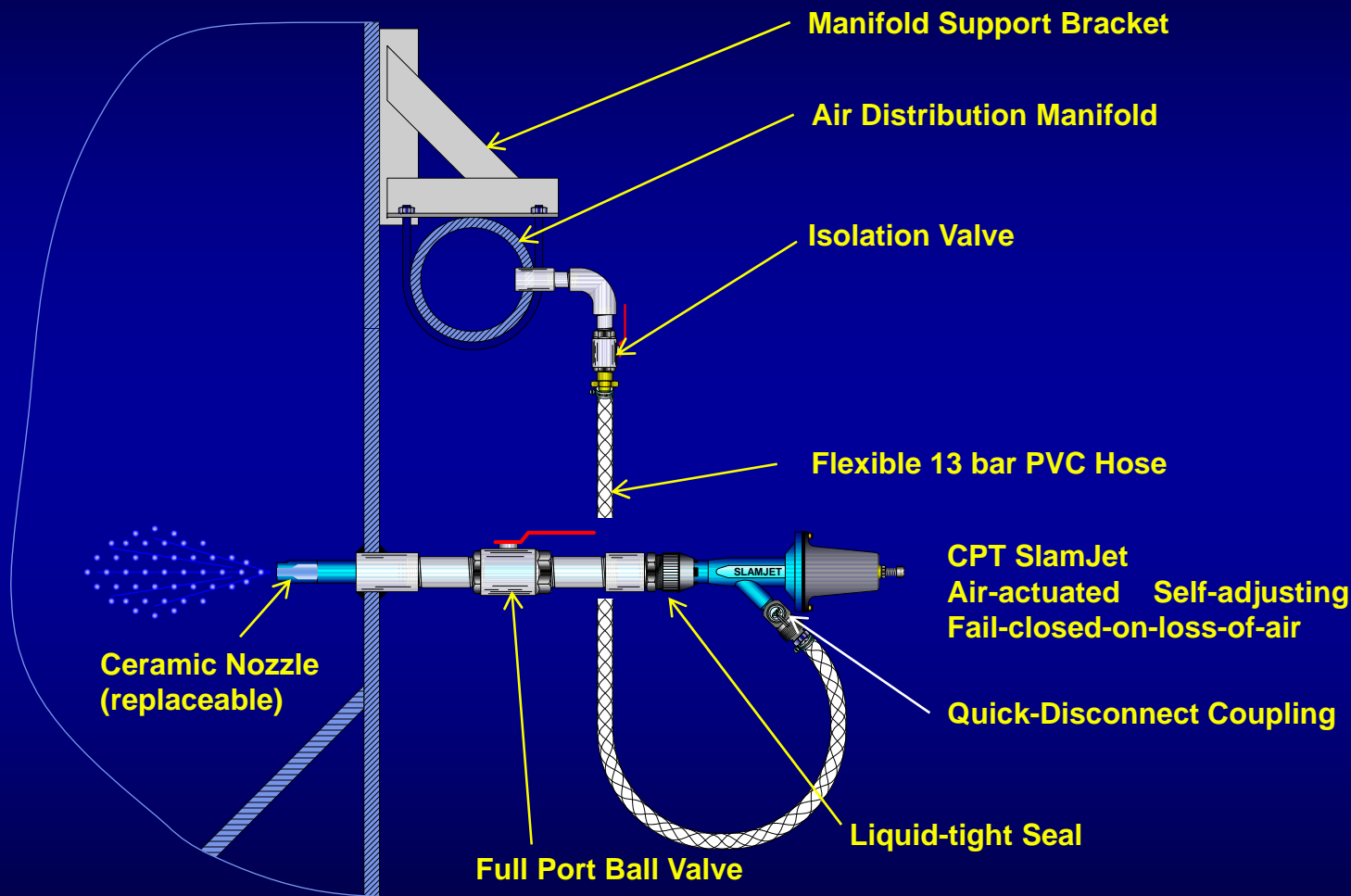
# ***CPT SlamJet***

## ***The New Standard***

- ▶▶ **Self Adjusting**
- ▶▶ **Positive Seal**
- ▶▶ **Fail Closed on Loss of Air**
  - ▶ **Needle valve actuated by diaphragm system, factory preset to remain closed until manifold pressure is high enough**
  - ▶ **Loss of pressure causes needle valve to “slam” shut – backflow is prevented**

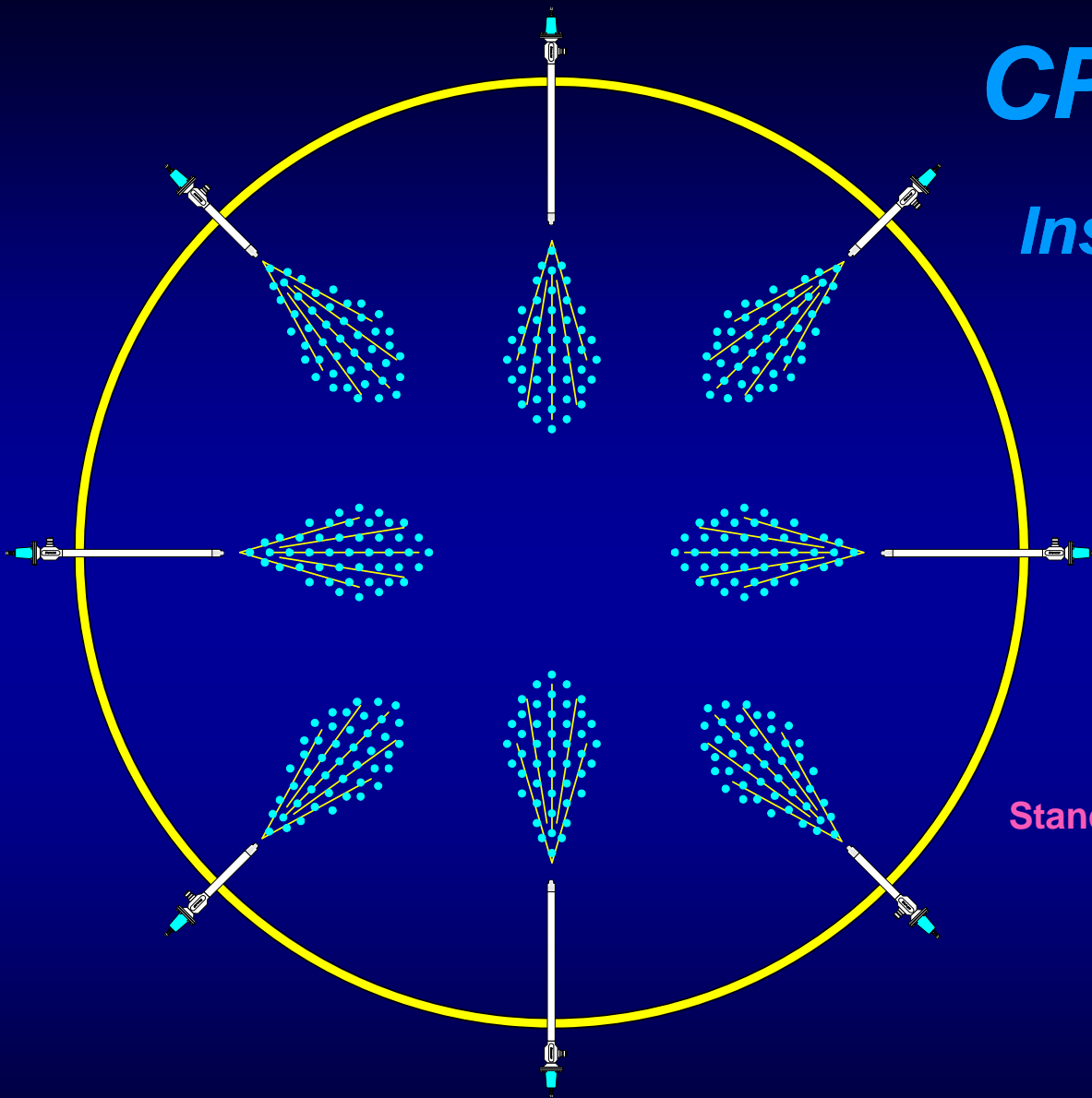


# Typical Installation



# CPT SlamJet

## Insertion Pattern



Standard Radial Pattern



# Benefits Of CPT Sparger

- ▶▶ Improved DO levels
- ▶▶ Non-Plugging
- ▶▶ Improved Agitation
- ▶▶ Reduced Maintenance of agitator shafts & gear boxes resulting from uneven air addition under agitator

