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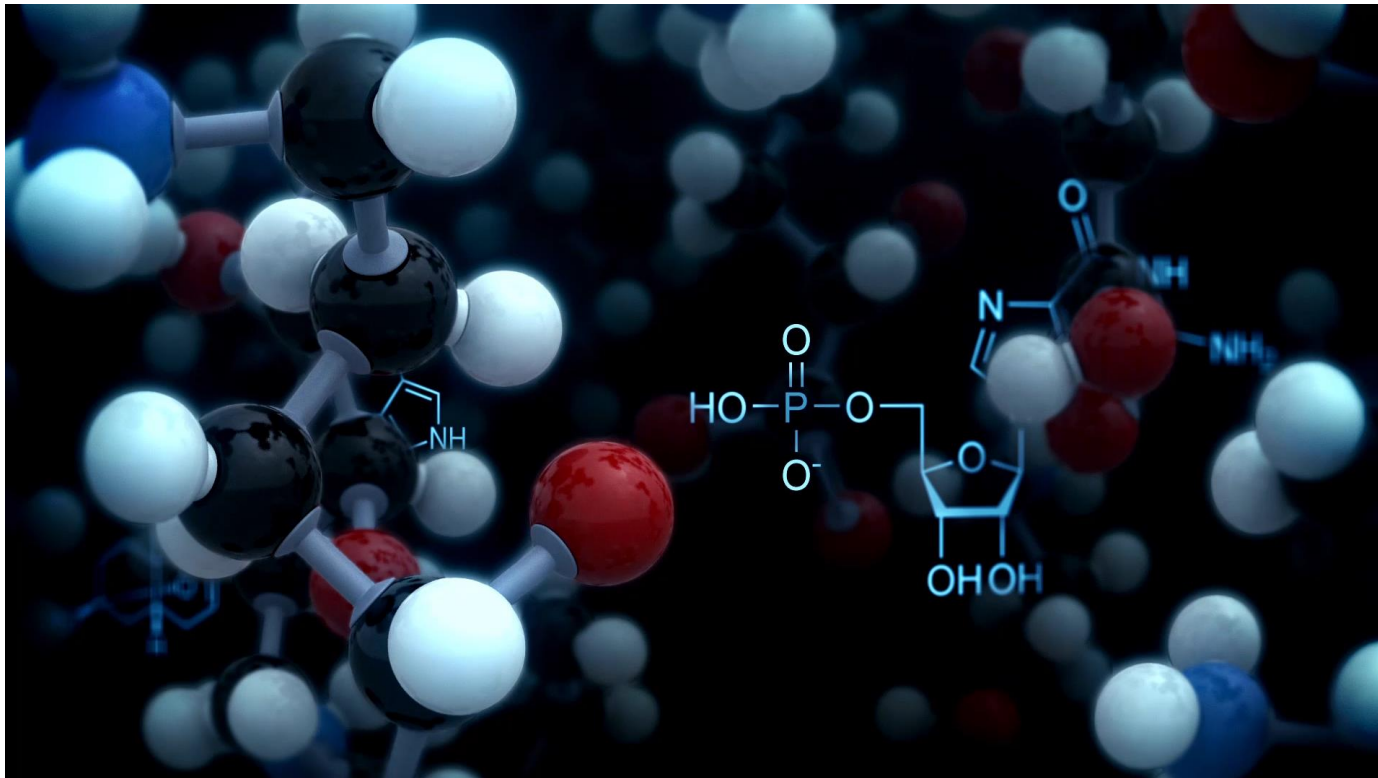
2024 Reinhold/PCUG Round Table Presentation

Hosted by LG&E/KU and Co-hosted by Southern Co. and TVA
in The Marriott Resort Lexington Griffin Gate Hotel, Lexington,
KY on June 24-25, 2024

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2024 REINHOLD Round Table

June 24-25, 2024, The Marriott Resort Lexington Griffin Gate Hotel



WHY CATALYST

BUILDS UP

**It Is Time for Power
Plants to Follow the
Science!**

Presented by Jeff Shelton

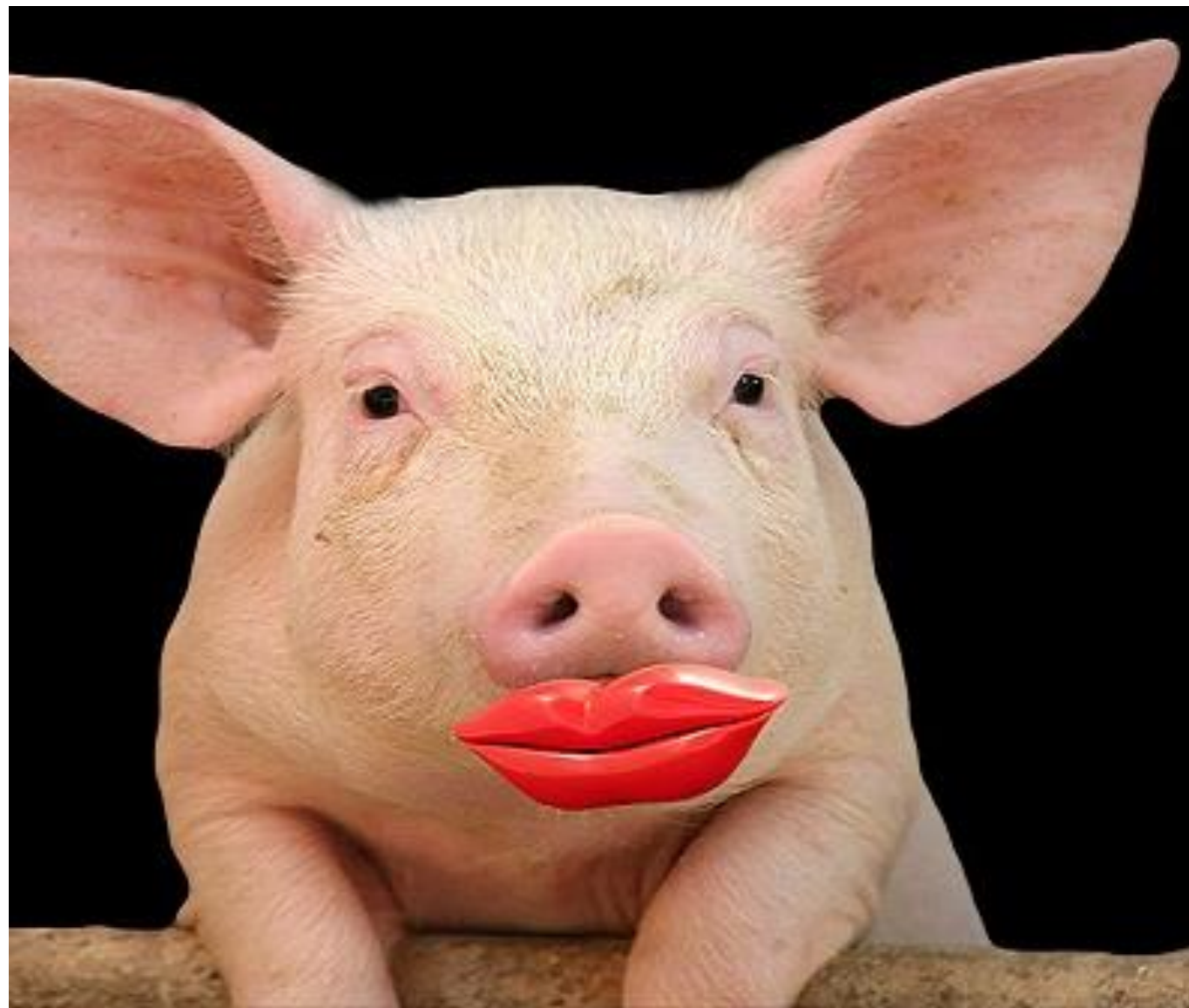
& Connor Shelton

Dracyon Corp



WHY DOES CATALYSTS BUILDUP?

- The answer is simple: a heavy load of sticky fly ash overwhelms the system.
- The most common answer we hear is, “because our catalyst pitch is too small. Simply not true!
- When plants increase catalyst pitch to combat buildup, they:
 - Fail to eliminate buildup
 - Sacrifice surface area and reactivity
 - Replace catalyst regularlyAll catalyst will build up!
- It is time to follow the science regarding the cause of catalyst buildup.



EXTENDING CATALYST LIFE

- Increasing catalyst pitch without addressing why your catalyst is building up is like putting lip stick on a hog
- No matter what you think, it is still a hog.
- Understand what really is happening. Don't kiss the hog!
- Follow the Science!

STATING THE FACTS

- Plants are often told that increasing pitch size will alleviate buildup. This seldom works.
- Meanwhile, plants have eliminated buildup while maintaining pitch size.
- Plants have spent as much as \$500,000 vacuuming catalyst.
- How did they do that? With online and offline cleaning designed to eliminate buildup.

COMBAT BUILDUP

The key is to proactively combat buildup with online cleaning devices.

Increasing pitch size does not solve buildup, but it does increase revenue for catalyst manufacturers.

Catalyst OEMs have no incentive to solve buildup. The more surface area and greater the pressure drop the quicker new catalyst is purchased

- Follow the Science by:
 - Eliminating buildup with online cleaning devices.
 - Replacing catalyst based on reactivity, not buildup.

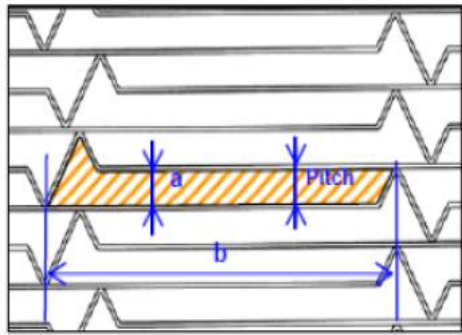
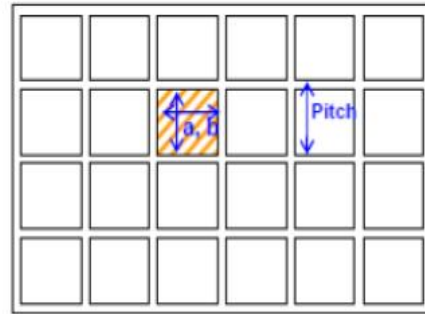


Plate type

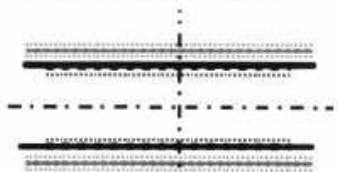
Typical Pitch: 5.7 – 7.0 mm



Honeycomb type

Typical Pitch: 6.9 – 9.2 mm

PARALLEL PLATE



SQUARE HONEYCOMB

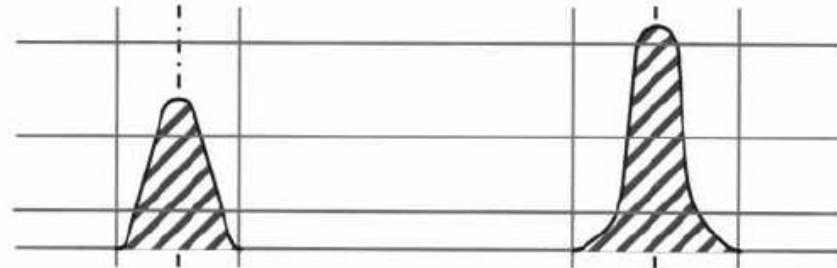
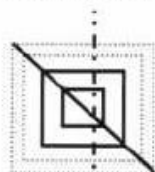
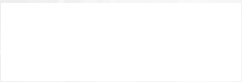
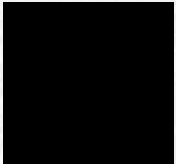
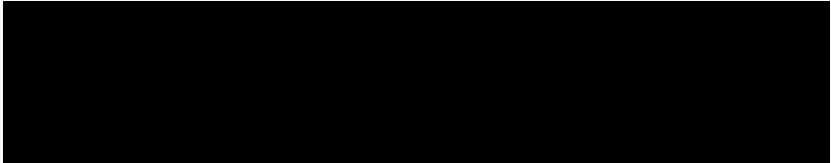
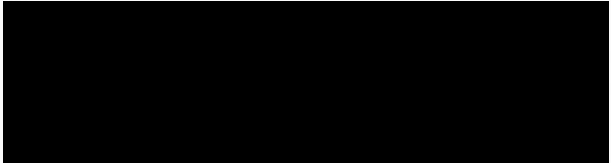
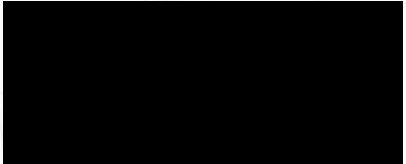
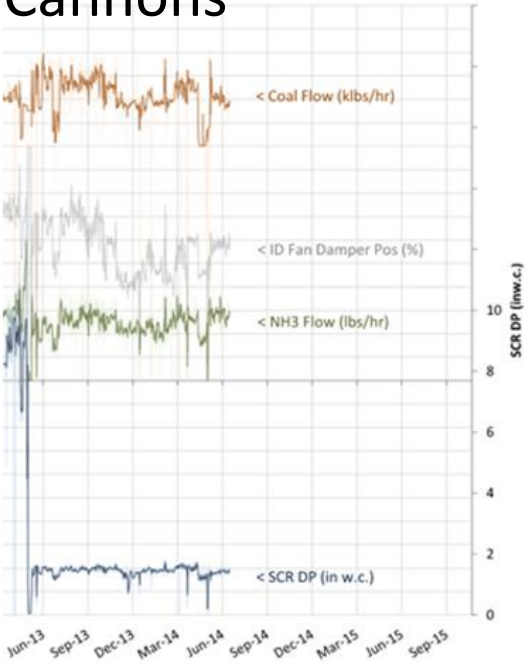


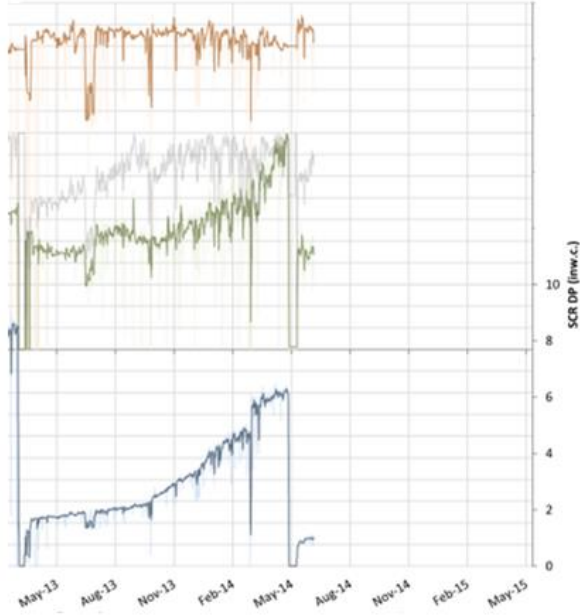
Figure 2: Gas Velocity Distributions



With Air Cannons



Without Air Cannons





**IF YOUR FLOW
RECTIFIER BUILDUP
SO WILL YOUR
CATALYST**

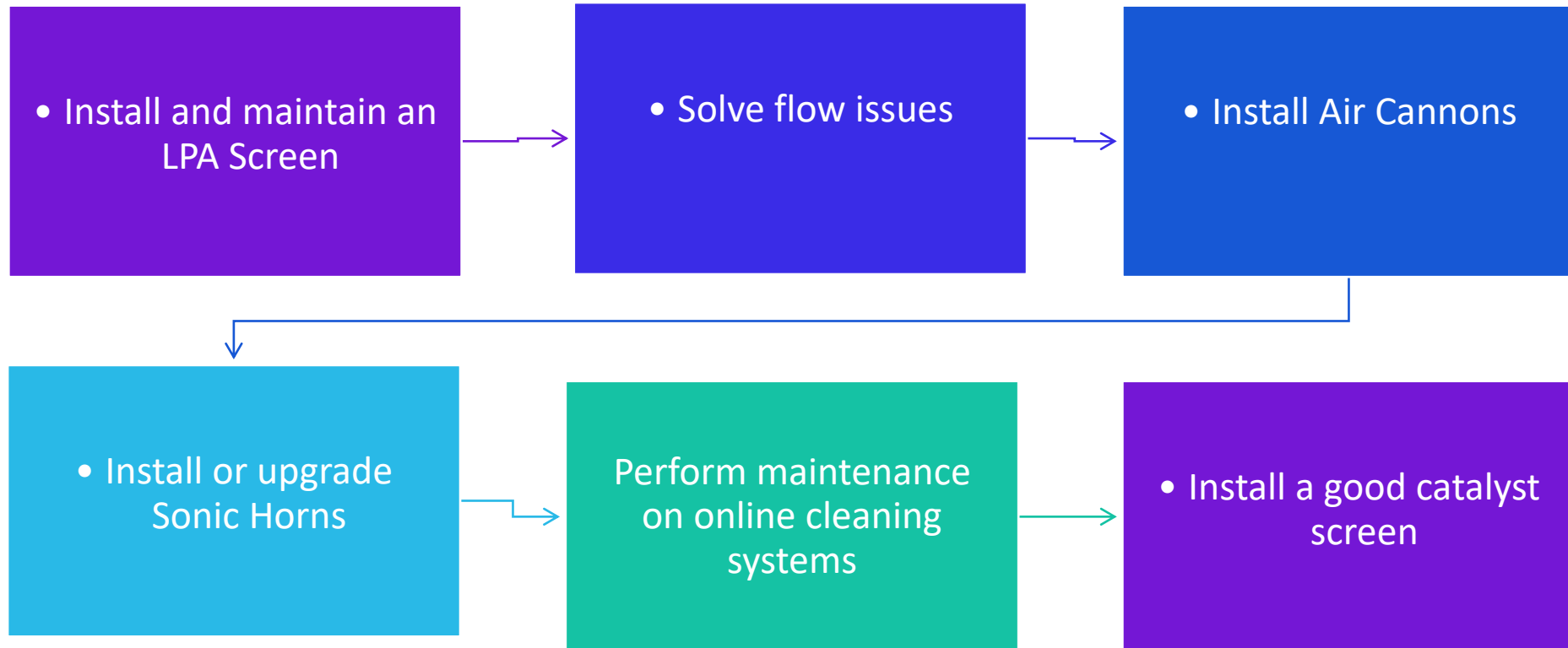
All Catalyst will build up. This is a much wider pitch.

CATALYST AND MONEY



- All catalyst will buildup. The key is to Follow the Science! Properly applied Online and Offline cleaning will prevent buildup.
- Sacrificing surface area by increasing pitch size will not solve the problem. May slow the problem down but is not the solution!
- Work with people you trust, people that will spend your money as if it were their own.
- Do not work with people who promote solutions that benefits them at your expense.

FOLLOW THE SCIENCE AND EXTEND CATALYST LIFE



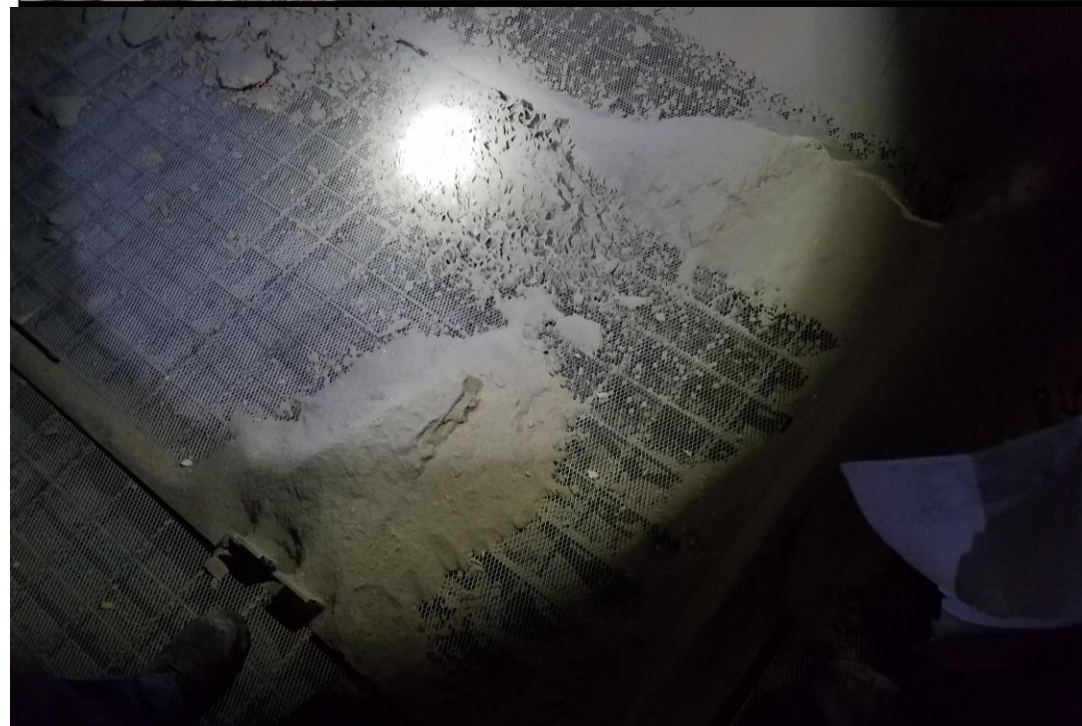
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When SCR's were introduced in coal Power market LPA screens were not included in the original scope.

This was because the issue was not fully understood.

LPA is #1 cause for buildup in SCR's!

In 2019 virtual all new SCR's in the US included LPA screen as part of the original supply. Nearly 80% in Europe. Why because the cost of buildup is so high!!



FOLLOW THE SCIENCE WITH AIR CANNONS



- Surprisingly, air cannons have went decades with little to no technological development.
- Many plants continue to employ air cannons and nozzles designed near the turn of the century.
- Advances in technology which is a single reservoir tank to discharge through multiple nozzles designed to remove tough buildup.
- Countless field and lab testing have proven the superiority of this system.
- If you Follow the Science, modern air cannons improve operational efficiency and prolong catalyst life.



INSTALLATION PRACTICES

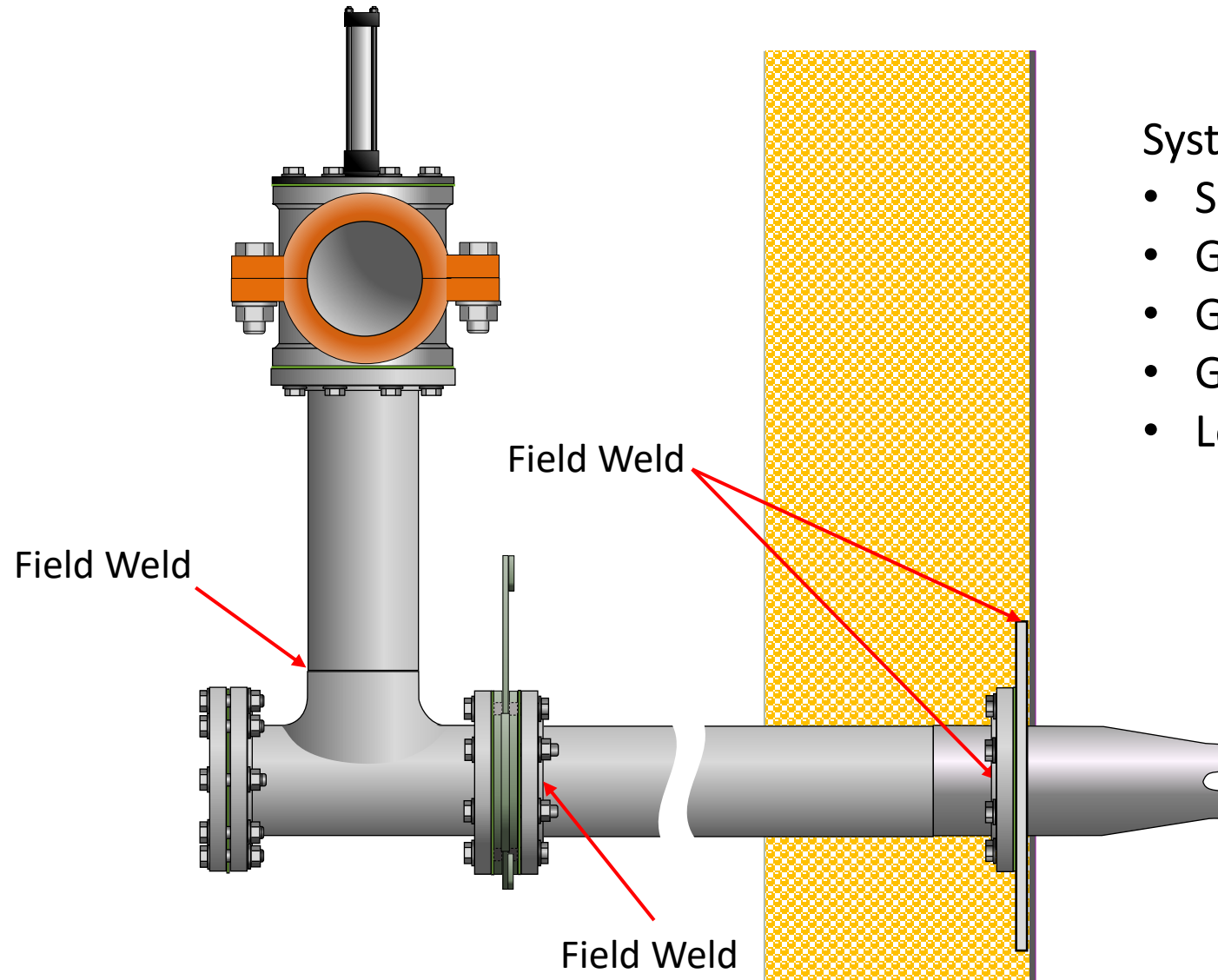
- Air Cannons are an important part of the solution, but only when installed properly.
- Common examples of improper installation practices include:
 - Installing in an inaccessible location.
 - Installing too close to the process.
 - Installing with the air cannon facing upward.



MODERN AIR CANNON SYSTEM DESIGNED FOR SCRS



Good Air Cannon Installation



System advantages:

- Superior nozzle
- Greater cleaning force
- Greater reliability
- Greater cleaning area
- Lower cost



INSTALLATION LOCATION

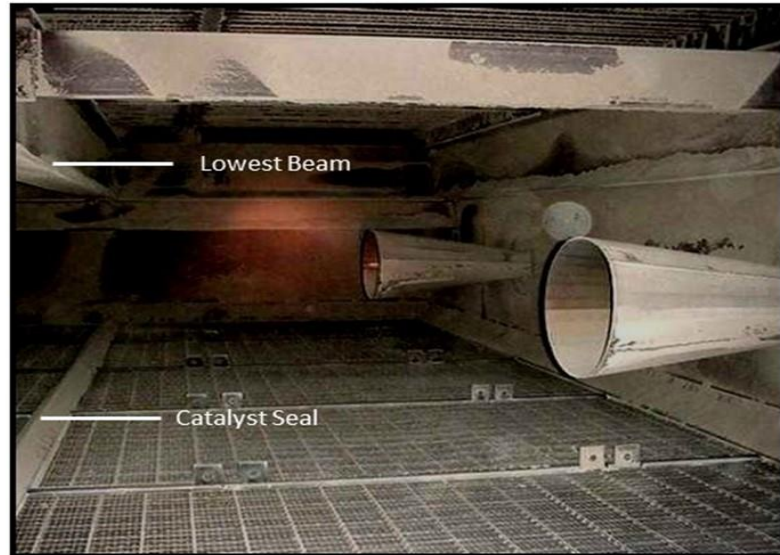
- Extended pipe runs enable you to install the air cannons away from the application.
- This, combined with the specially designed protector valve, has the following advantages:
 - Protects air cannon from the process
 - Prevents material from entering air cannon
 - Ensures ease of accessibility



CLEANING POWER?

- Some may think the extended pipe runs sacrifice cleaning power.
- The larger tank and superior nozzle ensure that is not the case.
- Some may remain skeptical. Seeing is believing!

SONIC HORNS



- It is important to select the right sonic horn.
- Large sound generators produce greater cleaning action.
- It is also important to maintain sonic horn installations.
- Due to shortfalls in O&M budgets, sonic horn maintenance is often overlooked.
- Most plants require improvements to their current installation.



CATALYST SCREEN

- All catalyst screens are not equal.
- For many years, the only purpose catalyst screens served was to enable personnel to walk on catalyst during outages.
- Modern catalyst screens have the following advantages:
 - Reduced vacuuming time
 - Reduced buildup
 - Improved flow
- Follow the science by installing a screen designed for SCR cleanliness.

BEFORE CLEANING



AFTER CLEANING





FLASHLIGHT TEST

- If you can see the flashlight then all the buildup has been removed. Once a layer passes this test then the top is vacuumed again.
- Low pressure plus high volume catalyst cleaning has proven to be effective. This system has cleaned catalyst that was buildup up in the center.



COMPRESSED AIR CLEANING

- In one reactor the buildup precleaning
- 1st Layer—70% blocked
- 2nd layer-40% blocked
- 3rd Layer-80% blocked
- 4th layer—25% blocked
- Post Cleaning—95% open
- Difference in % buildup is related to many factors including age. The longer the periods between cleaning combined with the catalyst age leads to a high % of buildup

WHY PLANTS KEEP THEIR CATALYST



- In some plants, it is easier to use capital money than O&M money.
- This means many plants do not perform maintenance necessary to reduce buildup.
- Meanwhile, replacing catalyst every 2 years has become industry standard.
- So many plants use capital money to buy new catalyst.
- Fact if your air cannons are not working then they offer no benefits

CONCLUSION



- New regulations means coal fired power plants are held to a high standard of DeNOx.
- When the catalyst is kept clean, the SCR can meet the new DeNOx requirements.
- The technology exists to keep the catalyst clean and meet all regulations.
- Follow the Science by hiring the right SCR maintenance contractor.

Follow the Science



EXTENDING CATALYST LIFE

- Increasing catalyst pitch without addressing why your catalyst is building up is not a blast or successful.
- Follow the Science and understand why and how your catalyst builds up and when it needs to be replaced!