REINHOLD ENVIRONMENTAL Ltd.

2015 APC Round Table & Expo Presentation

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REDKOH
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Guiding & Keeping Your Technicians Current Regarding Fault Finding / Performance of ESP Controls

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REDKOH INDUSTRIES

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The Basics of a Precip

Charge, Collect, Remove

- Dust laden gas enters the precipitator.
- The dust particles become charged by free electrons from the discharge electrodes.
- The charged particles are attracted to, and collect on, the collecting electrode plates.
- Like charges repel, unlike charges attract.
- The collected particles are knocked off the collecting plates for removal from the precipitator.

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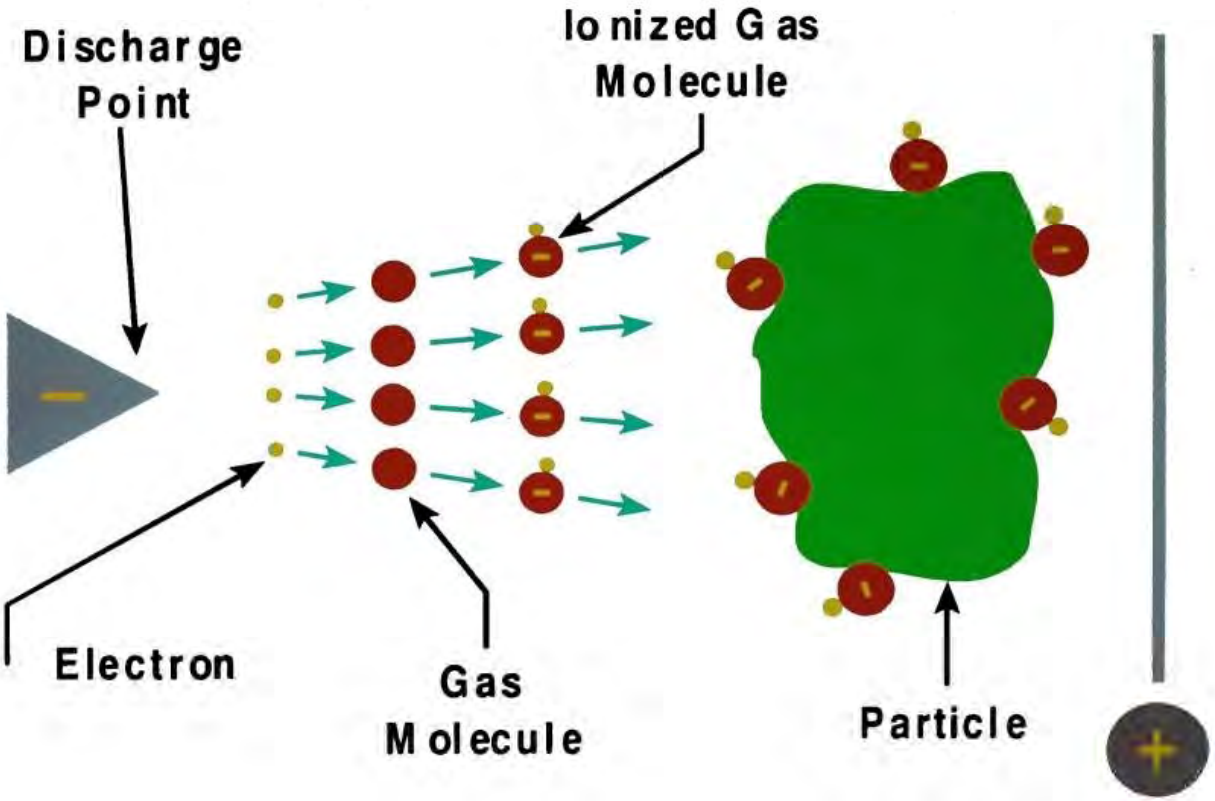
Particle Charging



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Key Components

Power Supply and Controls

- Supplies the highest possible level of voltage to an electrical field
- Controls arcing and sparking between the electrodes and the collecting plates
- Protects system components
- Reduces stress on the TR

Feedback Signals

- Primary Voltage – The voltage that appears across the T/R
- Primary Current – The current that is drawn from the supply
- Secondary Current – The current that is drawn from the ESP
- Secondary Voltage – The Voltage that appears on the ESP

Discharge Electrodes

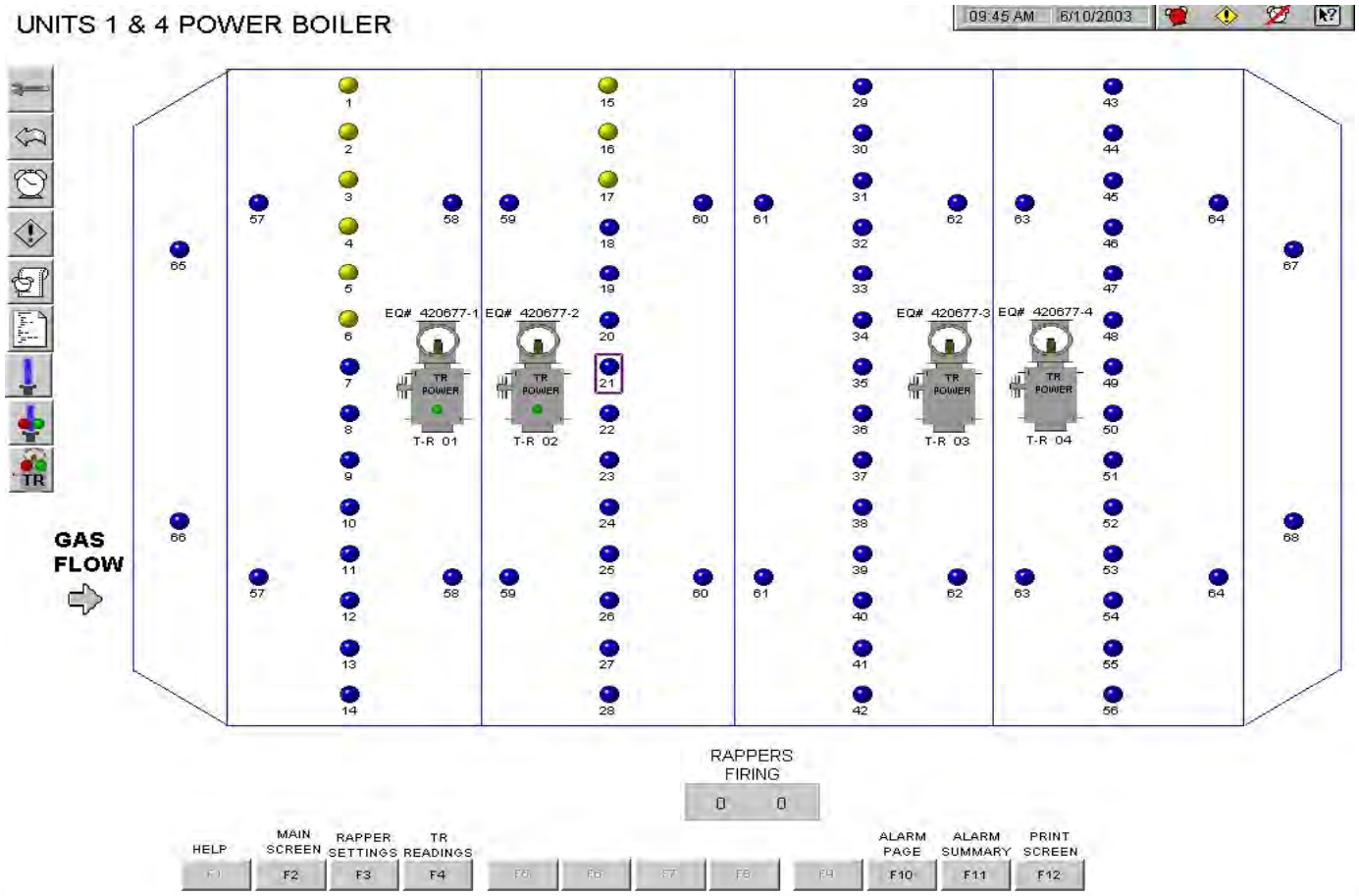
- Deliver the voltage that creates an electrical field between the electrode and the collecting plate
- The force causes particulate to attract and stick to the collecting plates
- Types of discharge electrodes could include: Rigid Spiked Pipes, Barbed Discharge Wires, Spiral Wires and Straight Round Wires

Typical Rapper Control

Rapper Control System

- Energize rappers, electric vibrators, and air solenoids.
- Permit adjustment of the frequency and duration of energization.
- Permit adjustment of the energization intensity.
- Identify faulty devices and type of fault

Rapper Roof Layout



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RECOVERY PRECIPITATOR

CHAMBER 1 NORTH 02:10 PM 4/16/2003

Clock #	Cycle Clock Time	Wait Clock Time	Enable/ Disable	Devices
1	00:00:01	00:00:00	✓	1 - 11
2	00:00:01	00:00:00	✓	12 - 22
3	00:00:01	00:00:00	✓	23 - 33
4	00:00:01	00:00:00	✓	34 - 44
5	00:00:01	00:00:00	✓	45 - 46
6	00:00:01	00:00:00	✓	47 - 48
7	00:00:01	00:00:00	✓	49 - 50
8	00:00:01	00:00:00	✓	51 - 52
9	00:00:01	00:00:00	✓	53 - 54
10	00:00:01	00:00:00	✓	55 - 58
11	00:00:01	00:00:00	✓	59 - 59

Devices Firing

2 1

Multi Program # 1 1 - 6

Status
NORMAL RAPPER MODE STOPPED
SEQUENCE ALL MODE

Alarms

MRC POWER ON | MRC POWER OFF | SEQUENCE ALL ON | SEQUENCE ALL OFF

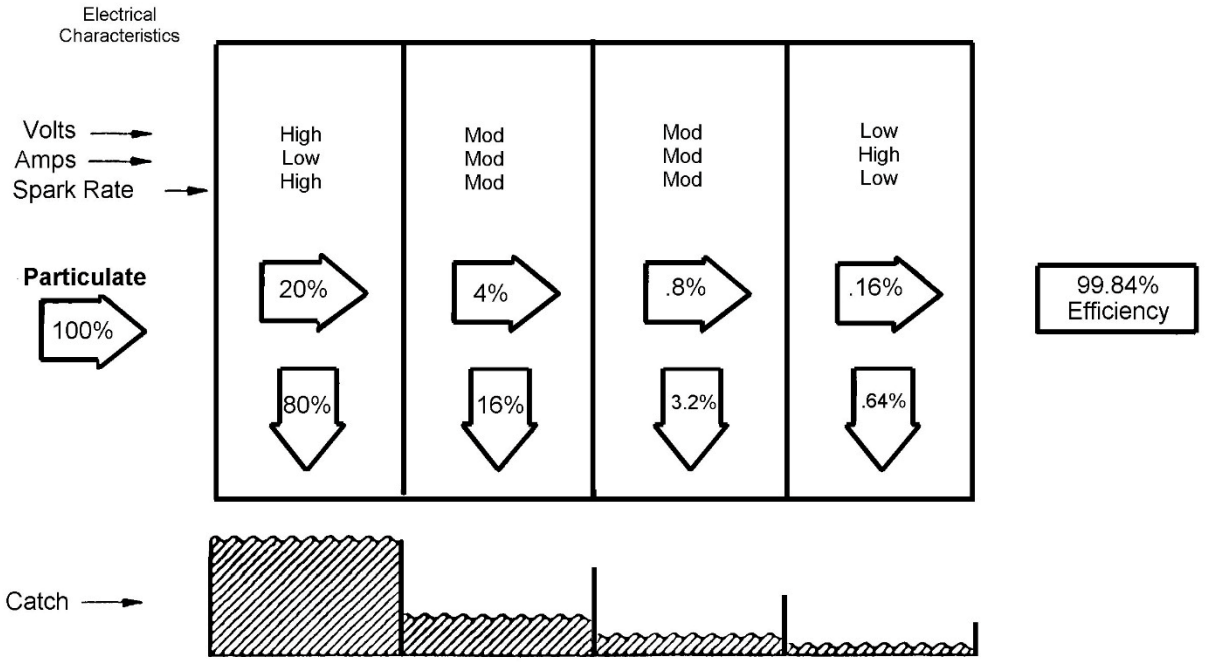
HELP F1 | MAIN SCREEN F2 | CHAMBER 1(NORTH) F3 | CHAMBER 2(SOUTH) F4 | FP CHM 1 F5 | FP CHM 2 F6 | FP TEMP. F7 | FP SLCT F8 | F9 | ALARM PAGE F10 | ALARM SUMMARY F11 | PRINT SCREEN F12

Understanding Sparks

- When voltage applied to an electrical field is too high for the dynamic conditions a spark-over occurs.
- A short term collapse of the electrical field.
- When a spark is detected, power may be interrupted while the spark extinguishes, power will ramp up after.
- Don’t be afraid of sparks!

Particulate Collection

TYPICAL RELATIONSHIP BETWEEN ELECTRICAL READINGS AND PARTICULATE
CATCH NUMBERS ARE ONLY APPROXIMATIONS FOR ILLUSTRATION



Remember…

- Small problems have a high chance of becoming big problems.
- Changes that produce desired short term results may not last, or even worse, will become detrimental in the long run (Don’t fix one problem while creating another)
- Plants are integrated systems where every piece of equipment will eventually impact another.
- Start troubleshooting from inside the precipitator and work your way out by isolating components.

Remember…

- When adjusting operating parameters allow from a few hours to a few days to see noticeable changes.
- Important to have steady boiler and process conditions during optimization.
- Begin recording electrical readings, at least daily, to begin a history of data to be used for future comparison.
- When electrical levels change on all controls, this is usually associated or attributed to the process.

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What Electrical Readings Can Tell Us

What Electrical Readings Can Tell Us

- When Discharge Electrodes are Built-up
- When Plates are Built-up
- When ESP is overloaded with Particulate
- When a TR is Grounded
- Excessive Sparking
- Defective Control Components
- Broken or Swinging Discharge Electrodes

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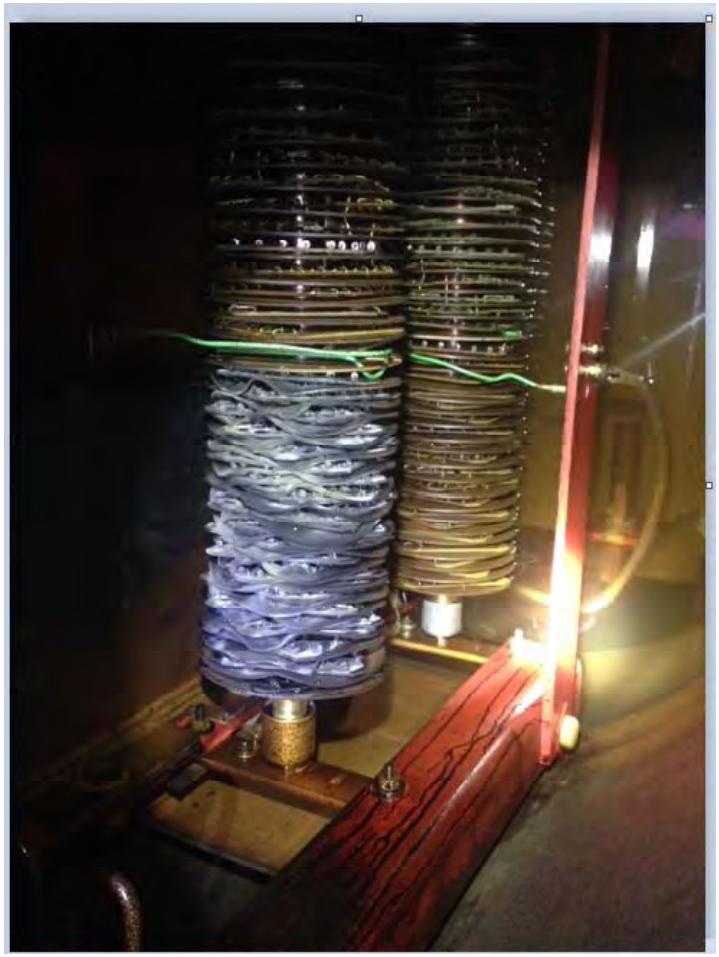
Where To Start

Process Changes

Control Problems

Electrical Problems

Ash Removal Problems



Process Changes

- Process changes will come and go
- Will affect chambers or the entire precipitator
  - Air Flow
  - Temperature
  - Moisture
  - Chemistry

Control Problems

Controller, Transformer, and The ESP Field

1. Take a full set of readings
2. Go through all connections in the control cabinet, pay special attention to the 480V and 120V AC signals
3. Disconnect the high voltage from the ESP and perform an open circuit test
4. Hook up a lamp load, verify 480V with smooth control on the output

Control Problems

5. Verify control is detecting arcs and sparks using an oscilloscope
6. Capture waveforms of sparks and arcs
7. Call an expert

Electrical Problems

- Loss of Feed Power
- Broken or Shorted Electrical Wires
- Close Clearances Inside ESP
- Broken Discharge Electrodes

Ash Removal Problems

- Equipment Failure Resulting in Ash Build-up
  - Shorts
  - Damaged Field Components

Other Possible Problems…

- In-leakage
- Condensation/moisture build-up in high voltage bus
- Dirt/dust inside control cabinets
- Age-related erosion

In Conclusion

- Although the precipitator is a rather simple device in terms of the basis of operation, there are numerous factors that can both positively and negatively effect the day to day efficiency.
- Stay aware of what these factors are, understand their effect, and optimize them for best performance.
- A preventative maintenance program should be implemented to monitor conditions inside the ESP to prevent unscheduled outages.
- There are consultants who have spent their lifetime solving precipitator problems on a daily basis. Don't be shy about asking for help. In the long run it will save you time and money.