

Reinhold Environmental Ltd.



2007 NOx Round Table & Expo
Presentation

February 5-6, 2007 in Cincinnati, OH

STEAG



steag

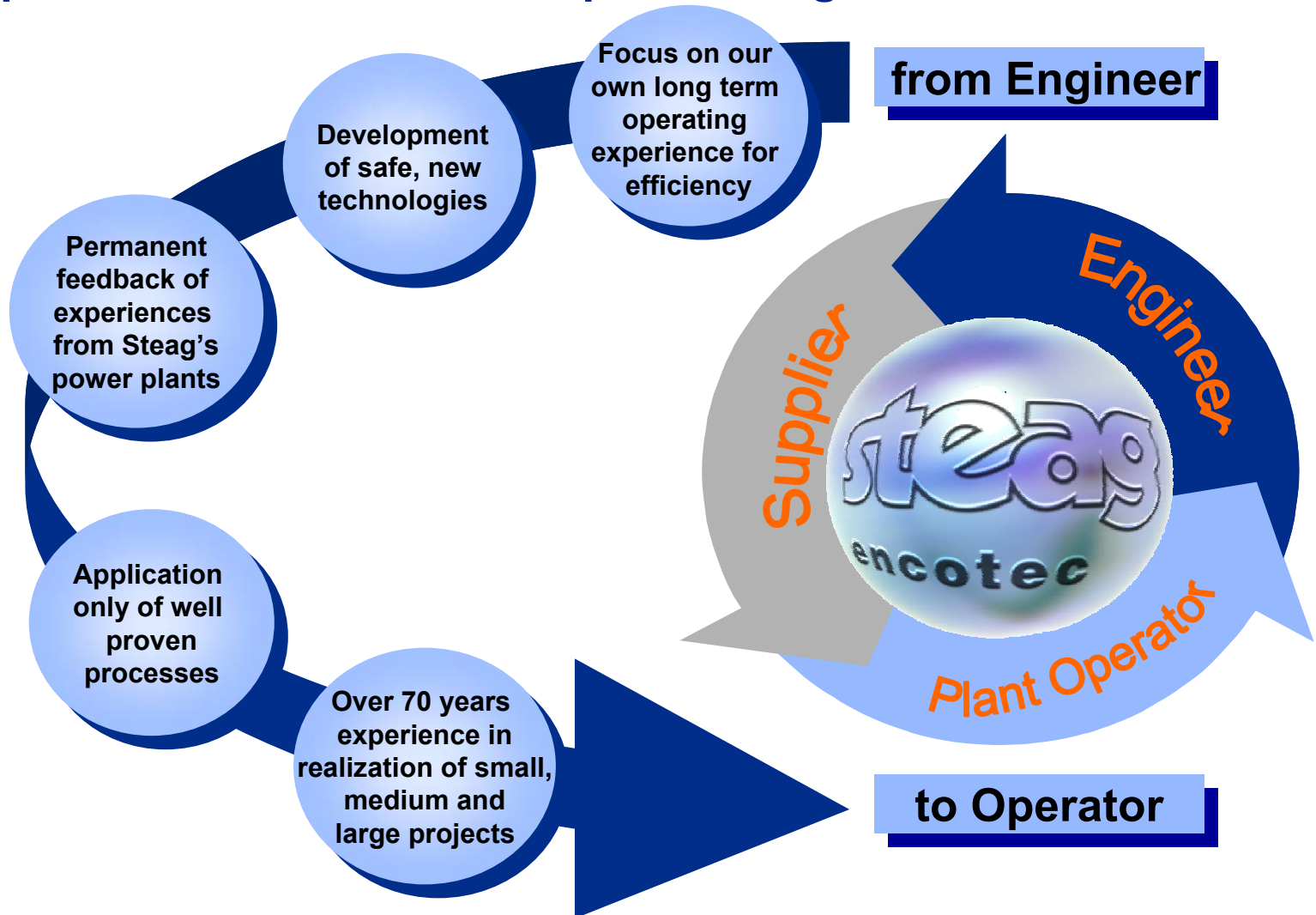
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STEAG AIG Tuning Do's and Don'ts

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STEAG LLC

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Steag encotec – We always go the full circle and provide our services as “Operator Engineers”



AIG Tuning – Part of SCR Management Program

- **STEAG's 20 years of experience operating 24 SCRs has proved the necessity of annual AIG system tuning:**
 - **Maximizes NO_x removal efficiency**
 - **Optimizes SCR operation**
 - **Optimizes AIG system operation**
 - **Reduces NH₃ consumption**
 - **Minimizes ammonia (NH₃) slip**
 - **Reduces O & M costs**
 - **Compare catalyst sampling results with expected results / deactivation**



**ECOS AIG
Testing Truck**

Keys To Successful AIG Tuning – Do's and Don'ts

- **Pre-tuning Preparation**

- **On-site inspection of the AIG system**
- **Review system information (drawings, diagrams, etc.)**
 - **SCR layout**
 - **Ammonia injection grid design**
 - **Sampling grid design**
- **Confirm there is a fixed installed sampling grid after the last catalyst layer**
- **Review AIG equipment availability**
 - **Are there differential pressure transmitters or gauges on the tuning valves (indicator of changes being made)?**
 - **Are the tuning valves frozen closed or locked?**



**Review System
Documentation**

Keys To Successful AIG Tuning - Do's and Don'ts

- **Pre-tuning Preparation**

- **Confirm all test ports are free of air in-leakage and correctly labeled to correspond with points inside the reactor**
- **Evaluate test site access and need for hoist/and or crane to move equipment to test location**
- **Inquire on availability of plant personnel to assist in moving testing equipment to test locating**
- **Determine what safety training / equipment / precautions plant requires and include additional time in schedule**



**Multi-point NO_x/O₂
Instrumentation Set-up**

Keys To Successful AIG Tuning - Do's and Don'ts

- **Good Communication Between Plant And Testing Crew**
 - **Communicate directly with plant manager, SCR / AIG system operator and control room operator**
 - **Confirm tuning schedule with plant personnel**
 - **Moving equipment to test location (1 day)**
 - **Calibrating instrumentation (1 day)**
 - **Tuning (2 days if unit is stable and reactor is close to optimum)**
 - **Removing equipment from test location (1 day)**
 - **Can reduce time if two units are side by side and tuned at the same time; set-up equipment between the two units and run longer lines**



**Ammonia Header And
Take-Off Trunks**

Keys To Successful AIG Tuning - Do's and Don'ts

- **Good Communication Between Plant And Testing Crew**
 - **Outline what is required of the plant during the tuning**
 - **Unit must be operated at full load on a continuous basis during the entire scheduled testing period**
 - **Assure there is maximum flue gas volume flow rate and maximum NOx mass flow rate through the SCR**



AIG Tuning Grid

Keys To Successful AIG Tuning - Do's and Don'ts

- **Tuning: Procedure**
 - **Calibrate equipment upon set-up**
 - **Run test quality gas through system for reference point**
 - **Perform actual AIG tuning**
 - **Coordinate computer results after each run**
 - **At completion of test, mark final valve positions**
 - **Lock valves in position so they cannot be accidentally moved**

A photograph showing a complex industrial piping system with numerous valves and gauges, likely used for AIG tuning.

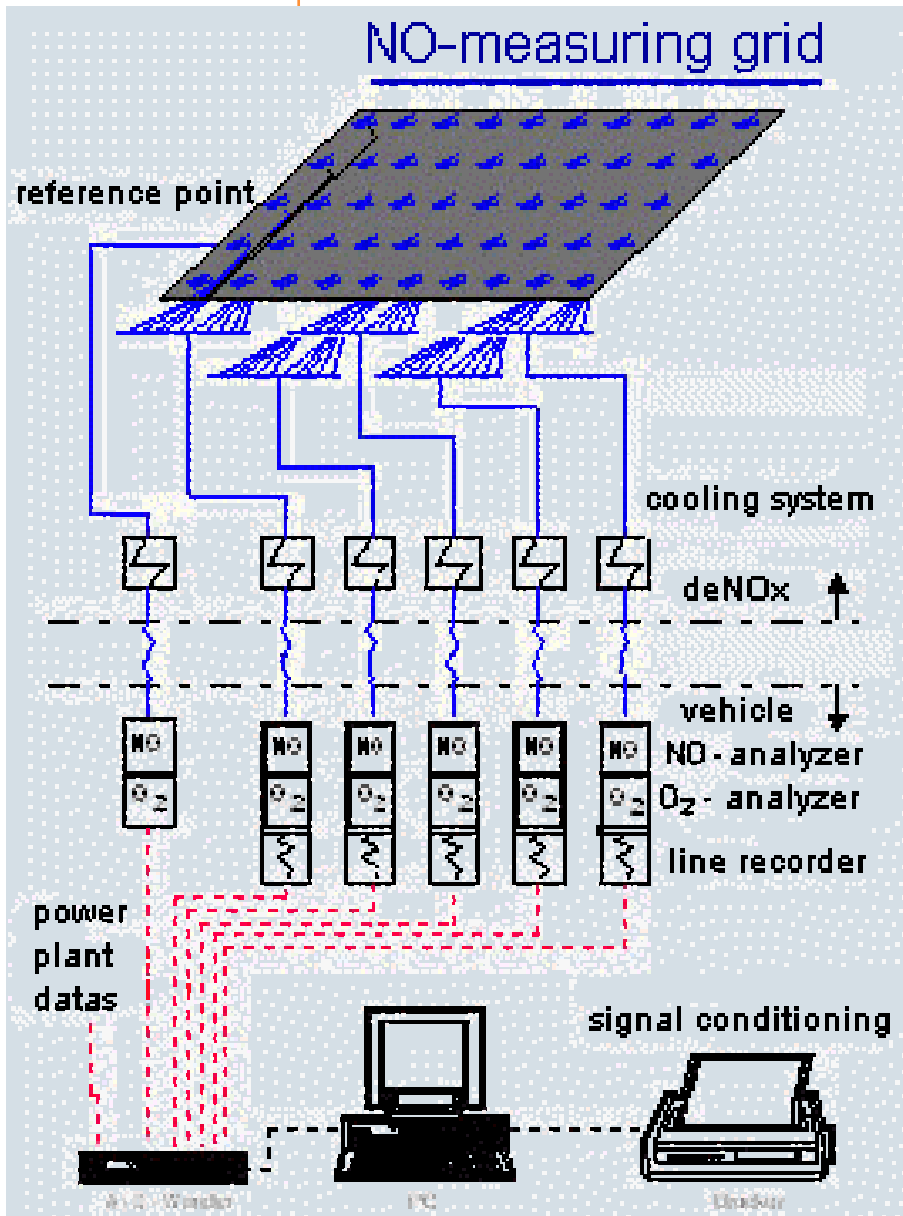
**AIG Tuning
Valves**

Keys To Successful AIG Tuning - Do's and Don'ts

- **Tuning: Compare Before and After Conditions**
 - Chart for the “as found” condition that gives each point value along with the average for the entire grid with a minimum value indication given for that data chart and a maximum value given for the data chart.
 - Provide information for the initial starting point of each AIG reactor tuned enabling the operator to know just where the starting point is for each point on the grid and how off from the average the reactor is at the various points.
 - Chart that gives the same data for the “as left” condition so that when unit is tuned next year, comparison of the data can be made to determine how much the unit has drifted from the last tuning.



AIG Tuning
Valves



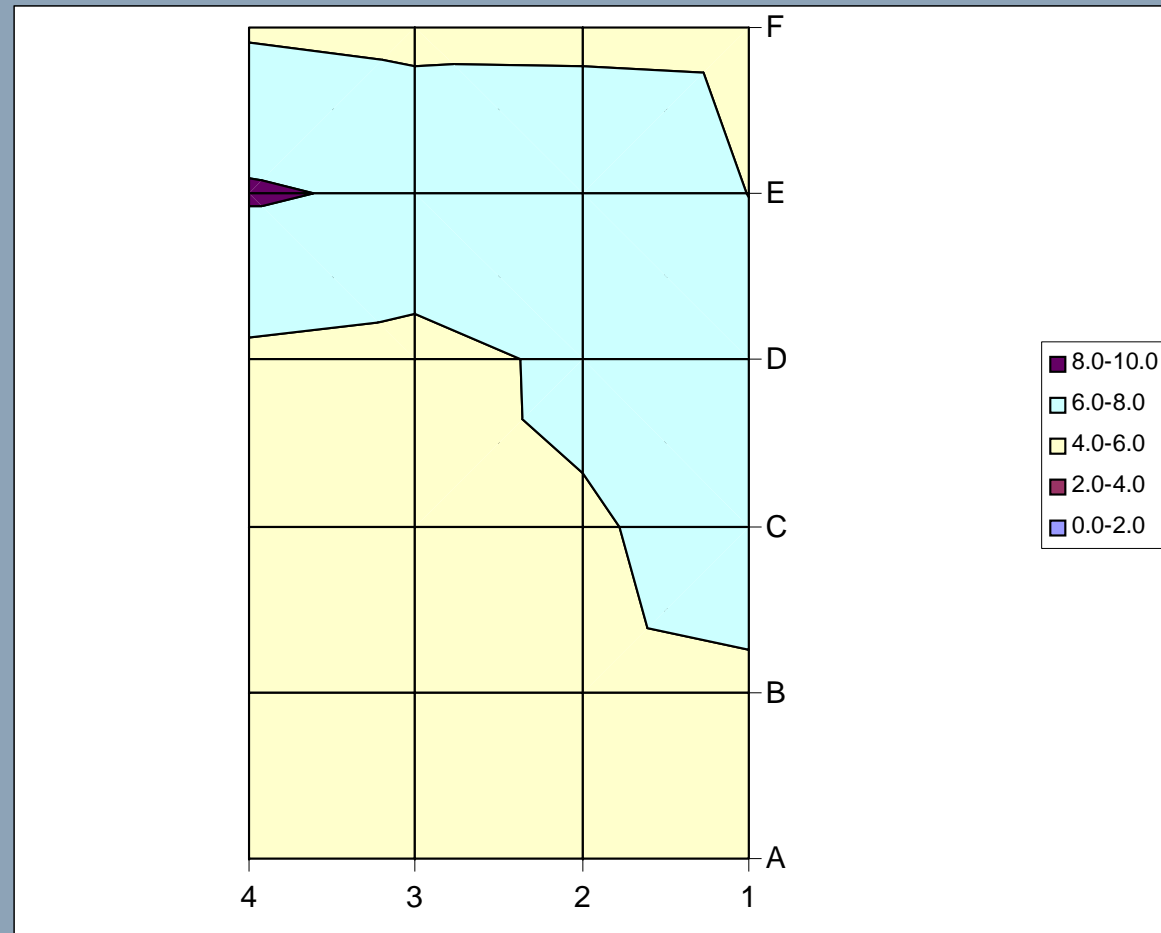
AIG tuning with Steag's ECOS (Emissions Control and Optimization System) allows for:

- Using up to 7 NO/O₂ analyzers in parallel
- Building a fully O₂-corrected 3D NO profile after the last catalyst layer for up to 100 points in about 3 minutes
- Tuning quality within about +/- 10 ppm NO

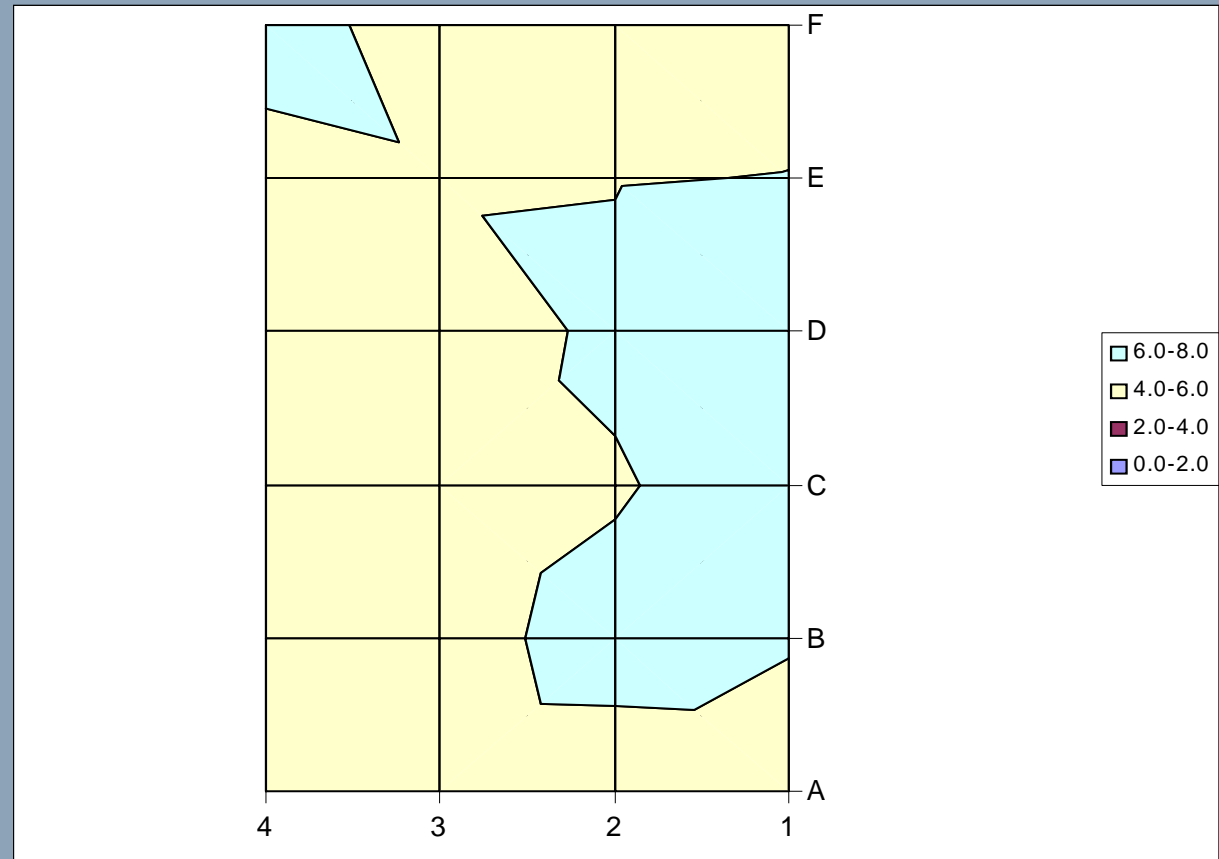
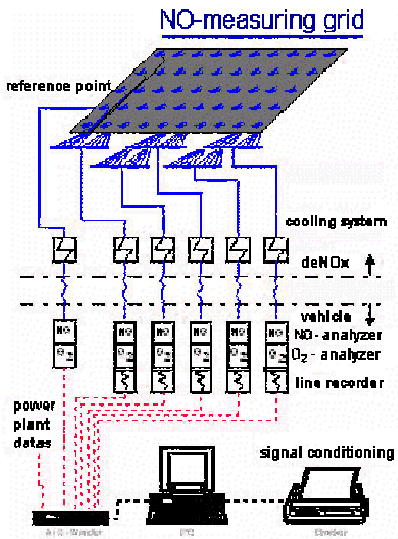
AIG Tuning: SCR Performance Monitoring – US Utility Before AIG Tuning



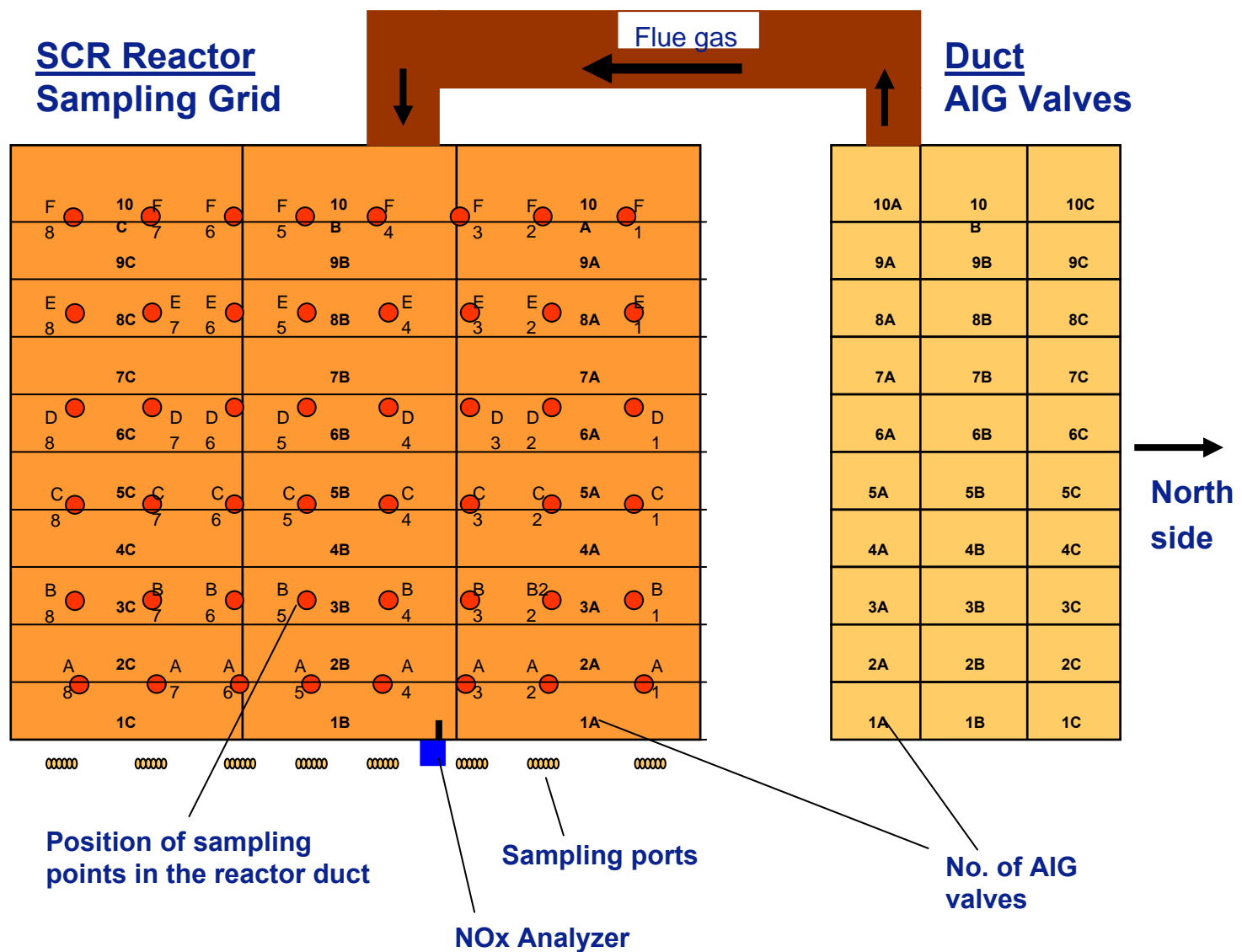
AIG Tuning Analyzers



AIG Tuning: SCR Performance Monitoring – US Utility After AIG Tuning



AIG Tuning: Template of what areas in the reactor are influenced by each valve



**AIG Tuning:
Measurement 1
Showing the
differences
from the
average for
each point
measured,
each value
range color
coded**

1	2	3	4	5	6	7	8	AV	
41	37	42	44	41	38	41	43	41	
46	43	45	46	45	40	45	47	45	
52	50	50	49	50	45	48	50	49	
52	51	52	53	52	46	48	49	50	
53	49	51	52	52	45	49	49	50	
52	49	50	51	50	45	48	49	49	47
-6	-10	-5	-3	-6	-9	-6	-4		
-1	-4	-2	-1	-2	-7	-2	0		
5	3	3	2	3	-2	1	3		
5	4	5	6	5	-1	1	2		
6	2	4	5	5	-2	2	2		
5	2	3	4	3	-2	1	2		
2	-1	1	2	1	-4	-1	0		

Measurement 1

green	20	0 - 2
yellow	12	3 - 4
orange	13	5 - 6
red	1	7 - 8
violet	2	>9

Measurement 2

1	2	3	4	5	6	7	8	AV
42	43	47	50	48	49	43	41	45
45	45	45	48	48	47	42	41	45
52	52	53	54	53	51	47	45	51
50	51	52	54	53	51	46	43	50
51	50	53	53	53	51	46	45	50
50	50	53	52	52	50	46	44	50
-7	-6	-2	1	-1	0	-6	-8	
-4	-4	-4	-1	-1	-2	-7	-8	
3	3	4	5	4	2	-2	-4	
1	2	3	5	4	2	-3	-6	
2	1	4	4	4	2	-3	-4	
1	1	4	3	3	1	-3	-5	
0	0	2	3	3	1	-4	-5	

green	18	0 - 2
yellow	20	3 - 4
orange	6	5 - 6
red	4	7 - 8
violet	0	>9

**AIG Tuning:
Measurement 2
Showing the
differences
from the
average for
each point
measured,
each value
range color
coded**

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AIG Tuning: Data Sampling Example Before O₂ Correction

System Section: Unit #1

Experts: V. Bobon, M. Martin, P. Diehl

Date: 9 May/ 06

Beginning the net measurement: 10:25:00 AM

Ending the net measurement: 10:39:00 AM

Oxygen concentration at point of grid (Vol.-%)											Mean value	Mean value working plane
South												
		A	B	C	D	E	F					
East (testing pots)	8	3.9	3.8	4.2	3.9	4.5	4.1					4.1
	7	3.8	3.7	4.1	3.8	4.1	4.0					3.9
	6	3.8	3.7	4.1	3.9	4.1	4.0					3.9
	5	3.8	3.7	4.2	3.9	4.0	3.9					3.9
	4	3.9	3.7	4.9	4.0	4.2	4.1					4.1
	3	3.8	3.8	4.2	3.9	4.1	3.9					3.9
	2	3.9	3.9	4.2	3.8	4.1	3.9					4.0
	1	3.9	3.8	4.3	4.0	4.1	4.1					4.0
Mean value		3.9	3.7	4.3	3.9	4.2	4.0					

4.0

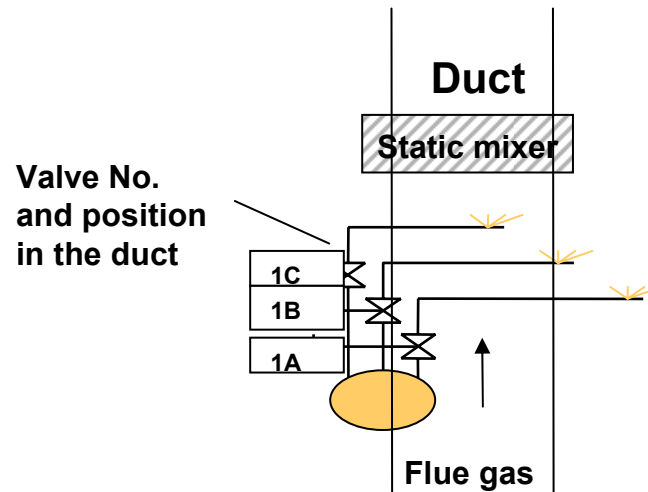
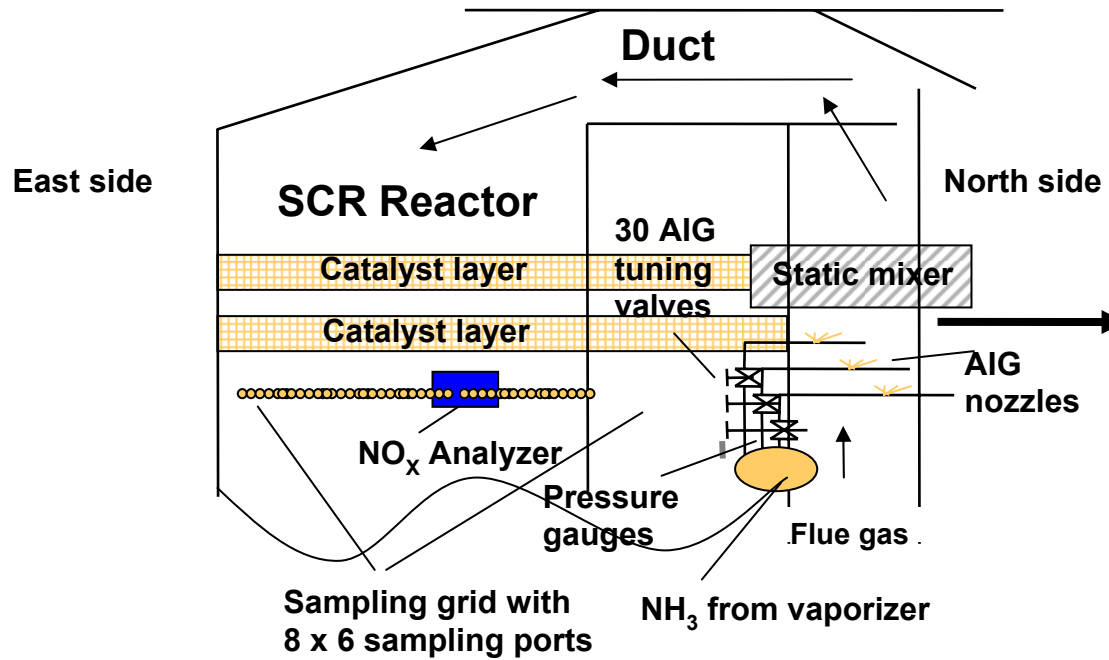
Minimum value

3.7

Maximum value

4.9

**AIG Tuning:
Side view
example of
where valves
are located
with respect
to the reactor**



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?Questions?

STEAG's 20 years
of SCR operation

