

ICI Boiler Control Recommendations

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ICI Boiler Population

- **Heat input range :10 mm btu/hr and above**
- **~46,000 units > 10 mm btu/hr (USA); another 120,000 units less than 10 mm btu/hr**
- **~2.3 trillion Btu/hr total capacity (> 10 mm btu/hr); 2.7 TBtu/hr (total); for comparison coal-fired EGUs at 3 TBtu/hr (!)**
- **Largest use in paper and pulp industry (other industries: food, chemical, refining, primary metals) ; 71% of units, 82% of capacity**
- **Natural Gas : most common fuel (78% of units, 56% of capacity); paper, refining, and primary metals industry use large amount of by-product fuels (40 to 50% of capacity)**
- **Coal, oil, wood : important for certain regions and certain industries**
- **Median age (based on capacity) : about 40 years, very little new capacity (about 7% less than 10 years old); affects retrofit difficulty**

Background Documents

- Numerous background documents were reviewed (EPA, DOE, OTAG, NACAA*, NESCAUM, LADCO, Federal & State regulations, etc.)
- OTC Methodology derived mainly from:
 - “Midwest RPO BART Engineering Analysis” MACTEC, March 30, 2005
 - “ACT Document – NO_x Emissions from ICI Boilers”, EPA 453/R-94-022, March 1994

***NACAA formerly STAPPA & ALAPCO**

ICI Boiler Uncontrolled NOx Emission Ranges

- Pulverized Coal 0.36-1.65 lb NOx/mmBtu
- Residual Oil 0.13-0.79 lb NOx/mmBtu
- Distillate Oil 0.08-0.30 lb NOx/mmBtu
- Natural Gas 0.06-0.45 lb NOx/mmBtu

Actual emission rates will vary based on: NOx control type, fuel type, boiler type, boiler firing type, age of boiler, current regulatory requirements, etc.

Types of NO_x Control Equipment Analyzed

- Low NO_x Burners (LNB)
- Ultra Low NO_x Burners (ULNB)
- Low NO_x Burners plus Flue Gas Recirculation (LNB+FGR)
- Low NO_x Burners plus Selective Non-Catalytic Reduction (LNB+SNCR)
- Selective Catalytic Reduction (SCR)

ICI Boiler Controlled NOx Emission Ranges

- Pulverized Coal 0.0675-0.93 lb NOx/mmBtu
- Residual Oil 0.025-0.25 lb NOx/mmBtu
- Distillate Oil 0.011-0.33 lb NOx/mmBtu
- Natural Gas 0.01-0.24 lb NOx/mmBtu

Actual emission rates will vary based on: NOx control type, fuel type, boiler type, boiler firing type, age of boiler, current regulatory requirements, etc.

NOx Recommendations

- < 25 mmBtu/hr
 - Annual Tune-up

NOx Recommendations

- 25 – 100 mmBtu/hr (Annual Tune-up +)
 - Option 1
 - Natural Gas - 0.05 lbs NOx/mmBtu
 - # 2 Oil - 0.08 lbs NOx/mmBtu
 - # 4 or 6 Oil – 0.20 lbs NOx/mmBtu
 - Coal – 0.30 lbs NOx/mmBtu
 - Option 2
 - 50 % reduction from uncontrolled
 - Option 3
 - Purchase Current Year NOx allowances to achieve emissions rates

NOx Recommendations

- 100 – 250 mmBtu/hr
 - Option 1
 - Natural Gas – 0.10 lbs/mmBtu
 - # 2, 4 or 6 Oil – 0.20 lbs/mmBtu
 - Natural Gas & Oil Combined – 0.20 lbs/mmBtu
 - Coal
 - Wall-fired – 0.14 lbs/mmBtu
 - Tangential-fired – 0.12 lbs/mmBtu
 - Stoker – 0.22 lbs/mmBtu
 - CFB – 0.08 lbs/mmBtu

NOx Recommendations

- 100 – 250 mmBtu/hr (Continued)
 - Option 2
 - LNB/SNCR, LNB/FGR, SCR or some combination of these controls in conjunction with LNB technology
 - Option 3
 - 60 % reduction from uncontrolled
 - Option 4
 - Purchase Current Year NOx allowances to achieve emissions rates

NOx Recommendations

- > 250 mmBtu/hr
 - Option 1
 - Purchase Current Year NOx allowances to achieve emissions rates
 - Option 2
 - Phase I (2009) – Emission rate equal to EGUs of similar size
 - Phase II (2013) - Emission rate equal to EGUs of similar size

SO₂ Recommendations

- < 250 mmBtu/hr (Fuel Sulfur Limits)
 - # 2 Oil – 0.05 % S by weight by 2012
 - # 4 Oil – 0.25 % S by weight by 2012
 - # 6 Oil – 0.50 % S by weight by 2012

SO₂ Recommendations

- > 250 mmBtu/hr
 - Option 1
 - Purchase Current Year SO₂ allowances to achieve emissions rates
 - Option 2
 - Phase I (2009) - Emission rate equal to EGUs of similar size
 - Phase II (2013) - Emission rate equal to EGUs of similar size