



Covanta

Low NOx Technology

WTERT Conference
October 2008



Covanta Low-NOx Technology

**Announced in March 2007
New, cost-effective technology that
changes how we look at NOx**

- **Able to meet Federal requirements without SNCR**
- **With SNCR able to achieve previously unachievable NOx levels**



Why Focus on NO_x

- Criteria pollutant, acid gas, ozone precursor
- Contributes to acid rain and SMOG
- Non-attainment areas require LAER and off-sets
 - Impacts development of new EfW plants
- Only emission EfW industry is not significantly below MACT
- **WE NEED TO DO BETTER**



EfW NO_x Control

- **Uncontrolled NO_x in EfW mass-burn units typically in 300 ppm range**
- **SNCR typically controls NO_x to 150-200 ppm**
 - MACT standard for large EfW = 205 ppm
 - NH₃ slip increases with lower NO_x
- **Flue Gas Recycle with SNCR further reduces NO_x to ~ 100 ppm (new Covanta unit at Lee)**
- **SCR used in Europe – but high cost & energy**
- **GOAL: SIGNIFICANTLY LOWER NO_x WITHOUT HIGH COST OF SCR**



Covanta Low NOx Technology

Very Low NOx – VLNTM

Low NOx – LNTM

- ❖ **Developed in cooperation with our partners Martin GmbH**
- ❖ **Both patent pending**



Covanta VLN™

- **Internal circulation gas used as tertiary gas**
- **Air distribution based on MSW HHV and boiler fouling**
- **Integrated SNCR and combustion control**
- **Reduced total air flow – lower excess O₂**
- **Increased boiler efficiency and energy recovery**
- **Best for new units**



Covanta LN™

- **Simplification on VLN™ for retrofit applications**
- **No internal circulation gas**
- **Total air flow unchanged – minimal impact on boiler performance**
- **Remainder of plant unaffected**
- **Comparable performance to VLN™**
- **Best for retrofit applications**



Where it All Started



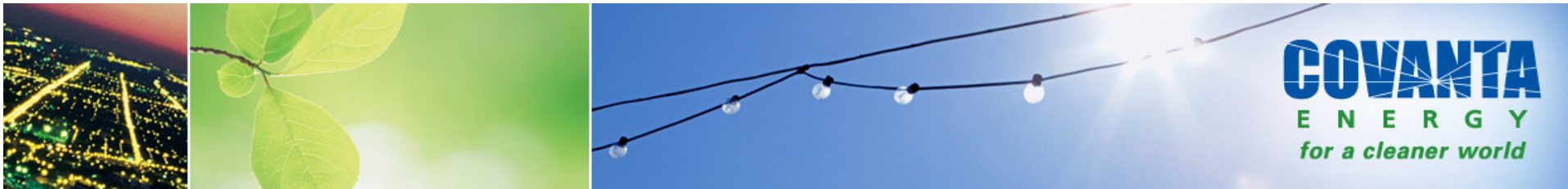
- **325 TPD Mass Burn Martin Grate**
- **Low NOx installed in April 2006**
- **Extended testing in both LNTM and VLNTM modes**



COVANTA
ENERGY
for a cleaner world

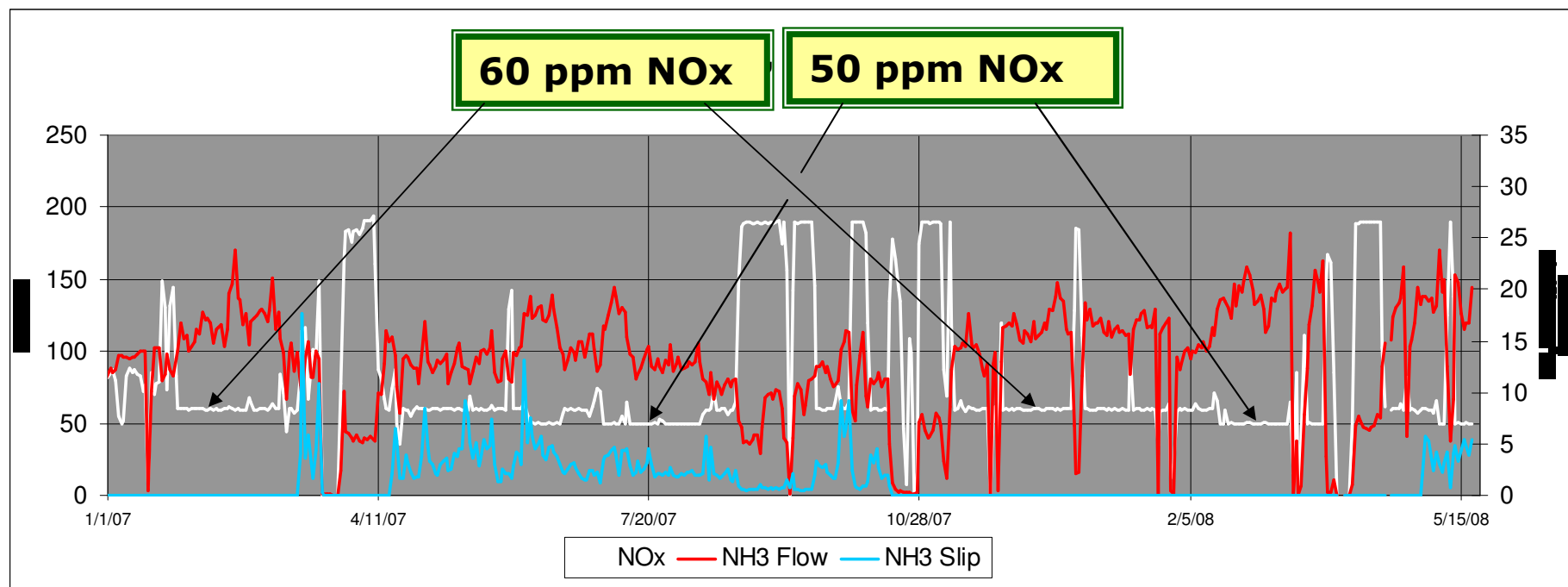
Low NO_x Performance

- Over 2 years of operation
- Without SNCR NO_x reduced ~ 50%
 - NO_x = 130 – 180 ppm
 - Meets current MACT w/o SNCR
- Covanta LNTM with SNCR:
 - **NO_x = 70 - 90 ppm** (function of boiler)
 - NH₃ slip < 10 ppm
- Covanta VLNTM with SNCR:
 - **NO_x < 60 ppm**
 - NH₃ slip < 10 ppm



VLN™ Extended Performance

January 2007 - May 2008





Design / Operating Considerations

- **Increased furnace temperature**
- **Reduced furnace gas velocity**
 - Reduced particulate carry-over
- **SNCR design & integration of combustion and SNCR control**
- **Tertiary nozzle design to ensure complete mixing**
 - CFD modeling



Other Operating LN™ Systems

- **Hempstead, NY (1 unit)**
 - 900 TPD DBA roller grate and boiler
 - Start-up in December 2006
- **Hennepin, MN (2 units)**
 - 600 TPD W&E grate and boiler
 - Start-up in August 2007 and March 2008
- **Haverhill, MA (2 units)**
 - 825 TPD Martin grate and boiler
 - Start-up in October 2007 and April 2008
- **Essex, NJ (1 unit)**
 - 900 TPD DBA roller grate and boiler
 - Start-up in May 2008



Conclusions

- **Covanta Low NOx technologies have been commercially demonstrated**
 - Years of operating experience in multiple plants
- **LNTM System for Retrofit Applications**
 - 60 – 90 ppm NOx with SNCR
 - Six installations operating
 - More installations planned
- **VLNTM System for New Units**
 - 60 ppm NOx with SNCR
 - < 10 ppm NH3 slip
- **FURTHER NOx REDUCTIONS TO COME**