Start here

NOx Control Issue Tree Diagram
(top of the tree)

Note:
"Wip?" = What is the Problem?
"Wis?" = What is the Solution?
"" = New this month.

Generators need to reduce NOx emissions from coal-fired power plants

- Why?
  - New Regulations
    - Which regs?
      - Section 126 petition reduction rules
      - EPA requirements for State Implementation Plans for ozone transport
        - Which states?
          - Alabama, Connecticut, Delaware, District of Columbia, Illinois, Indiana, Kentucky, Massachusetts, Maryland, Michigan, North Carolina, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, and West Virginia
            - What are the plans?
              - Yet to be developed
        - What is required?
          - Plans for meeting prescribed NOx emission budgets
            - When are plans due?
              - October 28, 2000
            - How meet budgets?
              - Reduce emissions or buy out of state allowances
                - Which emissions?
                  - Probably coal-fired power plants
                    - Why?
                      - EPA budgets are based on power plant reductions
            - When meet budgets?
              - Summer ozone season of 2003
                - Wip?
                  - May hurt the reliability of the grid
                    - Why?
                      - Too many outages at once
                  - Possible shortages of supply
- How?
  - Modify the Fuel
    - Such as?
      - Switch to Gas
        - Wip?
          - Limited Availability
          - Gas Price Risk
      - Co-fire Coal and Gas
        - Wip?
  - Modify the Combustion Process
    - How?
      - Reduce NOx Formation
        - How?
          - Reduce Temperature
            - Wip?
              - Derates Capacity
            - Such as?
              - Low NOx Burners
                - Who builds?
                  - Various vendors
                    - Such as?
                      - Mitsui Babcock Low NOx Axial Swirl Burners www.mitsuibabcock.com
                      - Energy & Environmental Research Corp. www.eercorp.com
                      - Babcock & Wilcox Co. DRB-4Z low-NOx burner www.babcock.com
                      - Advanced Burner Technologies Corp. Opti-Flow system
                - Wip?
          - Control Combustion
            - Who designs?
              - Various vendors
                - Such as?
                  - Phenix Limited, LLC Clean Combustion System 805-985-1543
                    - How does CCS work?
                      - Rocket Science
                        - Meaning what?
                          - Based on combustion research by rocket motor engineers
                    - Wip?
                      - Experimental
      - Remove NOx
        - Such as?
          - Fuel Reburn
            - Wip?
    - How analyze?
      - Computer simulation
        - Such as?
          - Westinghouse Process Control, Inc. SmartProcess www.westinghousepc.com
          - NeuCo LLC ProcessLink www.neuco.net
          - Pavilion Technologies www.seedco.com/pav.htm
  - Remove Postcombustion NOx
    - How analyze?
      - Computer simulation
        - Such as?
          - NGB Technologies Compliance Advisor www.ngbtech.com
          - Alden Research Lab www.aldenlab.com
          - Environex www.environex.com
    - How?
      - Selective Non-Catalytic Reduction
        - Who designs?
          - Various vendors
            - Such as?
              - Coal Tech Low cost NOx control 610-667-0442
        - Who builds?
          - Various vendors
            - Such as?
              - Mobotec USA ROFA - Rotamix www.mobotec.com
              - Fuel Tech NV NOxOUT www.fueltechnv.com
        - Wip?
          - Chemical Problems
          - Hard to Control
      - Selective Catalytic Reduction
        - How does SCR work?
          - Inject ammonia into the flue gas then pass the gas through a catalytic converter
        - Who builds?
          - Various vendors
            - Such as?
              - Ishikawajima-Hirima Heavy Industries Co. Tokyo (03) 3534-4405
              - Babcock & Wilcox Co. www.babcock.com
              - Black & Veatch www.bv.com
        - Wip?
          - Hard to Retrofit
            - Why?
              - May have to reroute the flue gas
          - Expensive
            - How much?
              - SIP cost estimated at $25 billion
          - Chemical Problems
            - Such as?
              - Ammonia slip
                - Wis?
                  - Chemical treatment
                    - Such as?
                      - Treat with lime
                        - Wip?
                          - Plugging
                          - Corrosion
                      - Treat with magnesia
                        - Who designs?
                          - Various vendors
                            - Such as?
                              - Martin Marietta Magnesia Specialists 410-780-5500
                  - Extra catalyst layers
                  - Flow modeling
                    - A series reactor
                      - Meaning what?
                        - Add an additional ammonia injection grid
                          - Such as?
                            - Two 60% reactors may be better than one 80% reactor
                  - To do what?
                    - Match the ammonia concentration profile to the NOx profile across the catalyst surface
              - Chemical spills
      - Electro-Catalytic Oxidation
        - How does ECO work?
          - A plasma reactor oxidizes NOx and other pollutants into acids
          - Acids are removed by a wet electrostatic precipitator
        - Who builds?
          - Powerspan (formerly Zero Emissions Technology) www.powerspancorp.com
        - Wip?
          - Experimental
            - Status?
              - 2 MW flue gas pilot tests successful
                - Where?
                  - FirstEnergy's R.E. Burger plant
              - 50 MW flue gas commercial tests planned
                - Where?
                  - FirstEnergy's Eastlake plant
- How much?
  - Up to 90%
  - Down to 0.15 pounds per million Btu
  - Reduction required is site specific
    - Why?
      - Different boilers have different emissions
        - Such as?
          - TVA's Paradise emits 1.8 lbs/mmBtu
          - Cinergy's Zimmer emits 0.46 lbs/mmBtu

Issue analysis by Daniel Pashley-Romero, Ph.D.
Technical Services Manager