# LESSON 8

## PSD Netting

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## Netting

- Netting is a process of looking back over a specified period and summing all the applicable increases and decreases in emissions of a pollutant and comparing that to the major modification threshold
- Netting concept applies only to existing major sources
- Minor sources not eligible to “net” emissions changes

231

## Determination of Significant Emissions Increase - Netting

- Determine if a "net emissions increase" will result
- Considers previous and prospective emissions changes
- If so, PSD applies to each pollutant's emissions for which the net increase is "significant

232

## Netting

- Required only if proposed project - by itself, or with "related projects" – has significant emissions, or a significant emissions increase
- Process also used in NA- NSR
  - Affects amount of offsets required

233

233

## Netting (Cont'd)

- Net Emissions Change
- **EQUALS**
- Emissions increases associated with the proposed modification
- **MINUS**
- Source-wide creditable contemporaneous emissions decreases
- **PLUS**
- Source-wide creditable contemporaneous emissions increases

234

234

## Creditable Contemporaneous Emissions

- Emission increases and decreases are credible if:
  - They have occurred within 5 years of modification
  - Have not been relied upon for permits

235

235

## Netting (Cont'd)

- Netting analysis uses projected new emissions rather than potential
- *Projected actual emissions* means the maximum annual rate, in tons per year, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the 5 years (12-month period) following the date the unit resumes regular operation after the project, or in any one of the 10 years following that date, if the project involves increasing the emissions unit's design capacity or its potential to emit that regulated NSR pollutant and full utilization of the unit would result in a significant emissions increase or a significant net emissions increase at the major stationary source.

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## PSD NETTING EXERCISES (*Optional*)

- Use handouts
- Perform the netting calculations for each of the three exercises
- A class discussion will follow

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## PRACTICAL EXERCISES – NETTING

- **EXERCISE 1**
- An existing minor source (subject to the 100 ton per year threshold for the list of 28) proposes a modification. The modification involves the shutdown and removal of an old emissions unit (providing an actual contemporaneous reduction in NOx emissions of 75 tpy) and the construction of two new units with a total projected actual NOx emissions of 110 tpy.
- **Does PSD apply to the new units?**
- **Why or Why not?**

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## PRACTICAL EXERCISES – NETTING

- **EXERCISE 2**
- An existing major source is located in an area which is attainment for all criteria pollutants. The source had less-than-significant increases of NOx (30 tpy) and SO2 (15 tpy) two years ago, and a 50 tpy decrease of SO2 three years ago. The source now proposes to add a new process unit with an associated projected increase in emissions of NOx (35 tpy) and SO2 (80 tpy). The 80 tpy increase in SO2 is significant before netting. The 35 tpy increase in NOx is not significant.
- **Would either the NOx or SO2 emission increase trigger PSD after netting?**
- **Why or why not?**

239

239

## PRACTICAL EXERCISES – NETTING

- **EXERCISE 3**
- A plant which manufactures automobile and truck tires – an existing major source – proposes to increase its production of both types of tires. For its automobile tire line, the source applies for – and is granted – a minor modification permit for a new extruder that will increase projected VOC emissions by 39 tons per year. A few months later, the source applies for another minor modification permit to construct a new tread end cementer on the same line. This will increase projected actual VOC emissions by 12 tons per year.
- **Should the extruder modification have been subject to PSD?**
- **Why or why not?**
- **Should the tread-end cementer modification cause the plant to be subject to PSD?**
- **Why or why not?**

240

240

## QUESTIONS?

241

# LESSON 9
## Emission Limitations

242

## Lesson Objectives

- Understand types and pros/cons of emission limitations
- Understand basics of converting technical/legal emission limit language of regulations into understandable language in permit

243

## Emission Limits

- Performance-based
  - Most common
  - Requires meeting an emission standard
- Technology-based
  - Requires using a specified technology
- Other
  - Work Practices

244

## Performance-based Limits

- Numerical limit is directly stated
- Averaging times specified
- Flexibility in how to meet limit
- May be based on statute or rule

245

## Establishing a Performance-based limit

- Can be established using dispersion modeling level set safely below an emissions rate at which adverse impact will occur
- May reflect Best Available Control Technology (BACT) or Lowest Achievable Emission Rate (LAER) determinations

246

## Performance-based Limits Issues

**Pro**

- Flexibility
- Expectations clear
- Encourages advanced technology

**Con**

- Compliance may be difficult or expensive to determine
- Selection of averaging times is crucial

247

## Technology-based Limits

- Require specified technology
  - Actual control device specified
  - Fuel throughput/composition
  - Raw materials throughput/composition
  - Must at a minimum reflect applicable
    - BACT/LAER determinations
    - NSPS/NESHAP
    - MACT

248

## Technology-based Limits Issues

| Pro | Con |
| --- | --- |
| • Compliance may be easy to determine<br>• Precedents exist<br>• Expectations clear | • Minimizes flexibility<br>• May inhibit technical innovation |

249

## Emission Limits – Other

- Neither technology nor performance-based
- Parametric/surrogate measures
- Design parameters that limit uncontrolled emissions
- Caps on production or operating hours
- Applicability limits

250

## Should emission limits be included in permit?

- Required for "Title V Operating Permits"
- Other permits?

251

## How should emission limits be included in permit?

- Copy verbatim?
- By reference?*
- Redundant requirements?
- Paraphrase?*
  - *Use with caution!

252

## Documentation

- The basis for the emission limitation must be specified
- Determine applicable requirements
- Explain determination in support document

253

## Emission limitations vs. Permit conditions

- Line may be blurry
- Some permit conditions are surrogate for emission limitations
- Emission limitations a subset of permit conditions

254

## Discussion Question

- Why is it important to specify the effective date of any regulations on which emission limits in a permit are based?

255

## QUESTIONS?

256

# LESSON 10

## Averaging Time

257

## Lesson Objectives

- Understand the reason for averaging times
- Review the connection between emission limits and averaging times
- Examine the effects of shorter vs. longer averaging times

258

## Averaging Time - Purpose

- Establishes compliance parameter for emission limit
- Allows emission limitation to match effect needed to be protected against

259

## Averaging Times (Cont'd)

- Instantaneous
- Short-term (24 hours or less)
- Long-term (more than 24 hours, i.e. monthly, annually, or May 1 through September 30)

260

## Averaging Times (Cont'd)

- Must be specified for performance-based limits
- May appear:
  - In or near same condition as the limit
  - In general section of permit on monitoring or testing
  - In test method

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## Averaging Time – Stringency

- Affects stringency of limit
- For a given level of emissions, a longer averaging time is less stringent than a shorter averaging time
- Too long an averaging time would not protect against adverse effects of short term exposure

262

## Short Averaging Times

- If not explicitly stated, source will argue for longest reasonable time
- If explicitly stated, but very short term, source may resist
- Agency needs to impose averaging times commensurate with effect

263

## Averaging Times Technology-based Emission Limits

- Irrelevant for some limits
  - Work practices
  - Solvent content, etc.
- Others do need averaging time
  - Specific control equipment

264

## Sample Permit Condition Rolling 12-month Average

To comply with this Permit and to avoid applicability of 15A NCAC 2D .0530, "Prevention of Significant Deterioration", as requested by the permittee, volatile organic compound (VOC) emissions from the modified nylon 6,6 manufacturing process (ID No. SRC-BCI) must be less than 40 tons in any consecutive twelve (12) month period. [15A NCAC 2D .0530]

265

## Class Discussion

Results for three 2-hour tests conducted over 3 consecutive days are 3.1, 2.6, and 4.9 lbs/hour. The average is 3.5 lbs/hour. Assuming the results are representative, what limits do the data support?

(3.1 + 2.6 +4.9) / 3 = 3.5

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## Response to Class Discussion

- Assuming the results are representative, the data support:
  - A limit near 3.5 lbs/hour with a 72 hour averaging time
  - A limit somewhere around 5 lbs/hour with a 2-hour averaging time or 6-hour averaging time
- The data does not support an averaging time of less than 2 hours

267

## Class Exercise

An applicant requests that an emissions unit be limited to 6000 hours per year of operation to keep emissions below the major source threshold of 100 tons per year. Operation for 6000 hours at the estimated emissions rate and maximum capacity would result in emissions of 99 tons per year.

Can this be done? If so, how? If so, what conditions should be imposed?

268

## Class Exercise (Cont'd)

- Yes, it can be done
- However must ensure accuracy of ±1%
- May be less costly for source to reduce it's request to 95 tpy
- Agree on an emission factor
- Permit condition limiting Hours
- Select appropriate averaging time

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## Class Exercise (Cont'd)

- An agreed upon factor (such as 0.1 lb emissions per unit produced) is consistent and can represent average emissions. It provides the most certainty to the source, which only has to stay below 6000 hours per year to comply with that limit

270

## Class Discussion

- What are the three classifications used to describe averaging times?

271

## Averaging Times

- Instantaneous
- Short-term (24 hours or less)
- Long-term (more than 24 hours, i.e. monthly, annually, or May 1 through September 30)

272

## Group Exercise Averaging Time (1 of 2)

- 5 new 4000 HP EGU peaking engines at an existing major source in an attainment area:
  - NSPS PM limit – 0.40 g/HP-hr
  - PTE of each engine is 15 T/yr $PM_{10}$
  - 24 hr $PM_{10}$ SIL is 5 ug/m$^3$
  - 24 hr $PM_{10}$ impact on $PM_{10}$ NA area is 7 ug/m$^3$

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## Group Exercise Averaging Time (2 of 2)

- What is the averaging time for the NSPS PM limit?
- Write an "hours of operation" limit that makes the project a $PM_{10}$ synthetic minor (<15 T/yr).
- What is the maximum averaging time a $PM_{10}$ limit could be given to assure $PM_{10}$ emissions do not cause or contribute to a $PM_{10}$ NAAQS violation?

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## Discussion of Exercise

- Points to discuss
  - "Speed limits" vs. average limits
  - Referencing test methods
  - Using CEMS for compliance monitoring
  - Block average vs. rolling average (or sums)
  - Operational flexibility vs. regulatory conditions

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Questions?

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# LESSON 11

## Best Available Control Technology (BACT)

277

## Best Available Control Technology (BACT)

Best Available Control Technology (BACT) means an emission limitation (including opacity limits) based on the maximum degree of reduction which is achievable for each pollutant, taking into account energy, environmental, and economic impacts, and other costs.

278

## PSD Top Down BACT

- Step 1 – Identify all control technologies
- Step 2 – Eliminate technically infeasible options
- Step 3 – Rank remaining control technologies by control effectiveness
- Step 4 – Evaluate cost effectiveness of controls and document results
- Step 5 – Select BACT

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## BACT Limitations

- BACT Determination is site specific
- BACT does not redefine project
  - BACT does not mandate changes in process or fuel (i.e. a coal fired power plant does not have to be gas fired)
- BACT for GHG for "Anyway PSD Sources" will be addressed separately

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## BACT TYPES

- ***Inherently Lower-Emitting Processes/Practices***, including the use of materials and production processes and work practices that prevent emissions and result in lower "production-specific" emissions; and
- ***Add-on Controls***, such as scrubbers, fabric filters, thermal oxidizers and other devices that control and reduce emissions after they are produced.
- ***Combinations of Inherently Lower Emitting Processes and Add-on Controls***. For example, the application of combustion and post-combustion controls to reduce NOx emissions at a gas-fired Combined Cycle Gas Turbine

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## BACT Sources

- Data sources for Determining Feasible control technology include:
  - EPA's BACT/LAER Clearinghouse and Control Technology Center;
  - Best Available Control Technology Guideline - South Coast Air Quality Management District;
  - Control technology vendors;
  - Federal/State/Local new source review permits and associated inspection/performance test reports;
  - Environmental consultants;
  - Technical journals, reports and newsletters air pollution control seminars

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## BACT/LAER Clearinghouse

- Data on:
  - Source Type (i.e. boiler, turbine etc)
  - Type of Permit (NSR or PSD)
  - Allowed Emission Rate in various units
  - Basis for emission rate

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## BACT/LAER Clearinghouse (Cont'd)

- Control Levels will vary by Locality
- Control Levels will vary by process and manufacturer
- https://cfpub.epa.gov/RBLC/
- Other agencies have clearinghouse documents
- CARB, SCAQMD, BAAQMD, SJVAPCD

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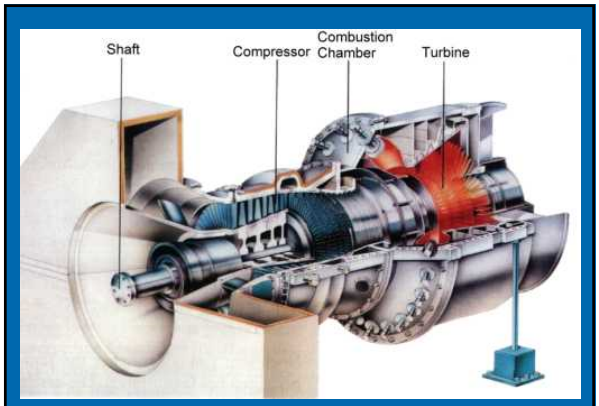
## BACT Determination

- Example:
  - Simple cycle gas turbine for peaking power Added to existing major source
  - Existing plant has potential to emit (PTE) more than 250 tpy of NOx
  - New peaking gas turbine has PTE > 40 tpy, but < 100 tpy CO
  - New turbine is subject to PSD BACT for NOx

285




286

# NACT 334 - INTRODUCTION

287

## BACT Determination For Simple Cycle Gas Turbine

- Step 1 Identify All control technologies
  - Water or Steam Injection
  - Combustion control i.e. low NOx Combustor
  - Combination of above
  - Add on controls like Selective Catalytic Reduction (SCR)
- Step 2 Eliminate Infeasible technologies
  - Steam Injection not feasible

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## BACT Determination For Simple Cycle Gas Turbine (Cont'd)

- Step 3 - Rank Remaining Controls
  - SCR add on controls most effective
  - Combustion Controls are higher emitting than SCR
  - Water Injection least effective on controlling emissions

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## BACT Determination For Simple Cycle Gas Turbine (Cont'd)

- According to BACT/LAER Clearinghouse;
  - 7 Installations build simple cycle gas turbines between 2001 and 2014
  - BACT determinations ranged from 9ppm (3 cases) to 42 ppm (1 case)
  - 42 ppm was special case where limited water was available
  - Range in BACT results shows that BACT is case by case

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## BACT Determination For Simple Cycle Gas Turbine (Cont'd)

- Best Available Control Technology Guidelines - South Coast Air Quality Management District
- Gas Turbines, Simple Cycle
- Gas Turbine, A/N 406065, El Colton, LLC 2/17/04
- Gas Turbine, A/N 383044, Indigo 9/18/01
- Gas Turbine, A/N 374502, LADWP Valley 9/18/01

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## BACT Determination For Simple Cycle Gas Turbine (Cont'd)

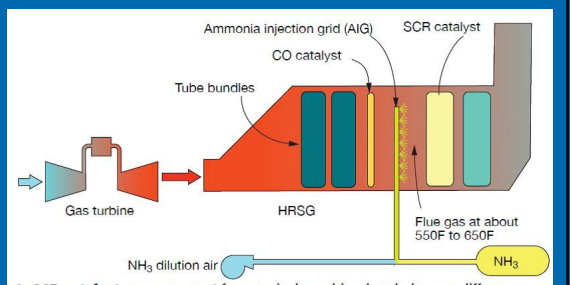
- Step 4 - Evaluate Cost/Rank Controls
- Cost of SCR for Peaking Turbine ~$18 K/t of NOx
- Cost of Combustion modification ~ $1K/t of NOx
- Cost of water injection ~ $1.5K/t of NOx
- Step 5 – Select BACT
  - Water injection and combustion control

292

## Another Example

- Combined Cycle Power Plant with heat recovery steam generator

293




**1. SCR catalyst arrangement** for a typical combined cycle has no diffuser vanes, perforated plates, or tempering air downstream of the gas turbine. A uniform $NH_3/NO_x$ profile at the catalyst inlet is critical to achieving desired SCR performance in terms of $NO_x$ reduction and ammonia slip

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## BACT Options

- Step 1 - Options Similar to Simple Cycle Gas Turbine
  - Add on control i.e. SCR and NSCR
  - Water injection
  - Steam Injection
  - Dry NOx Control
- Step 2 - Eliminate Infeasible Options
  - All options are technically feasible

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## BACT Determination

- Step 3 – Rank Controls
  - Combined (dry + Add on) highest control
  - Add on controls
  - Dry NOx Control
  - Steam injection next
  - Water Injection the Next
- Step 4 – Evaluate Cost/Rank Controls
  - Add on $30,000 per ton of NOx
  - Others less than $4,000 per ton of NOx

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## BACT Determination (Cont'd)

- Step 5 – Select BACT ????
- Review of BACT Documents
- According to BACT/LAER Clearinghouse
  - 36 sources since 2000
  - Since 2010 all less than 5 ppm with add on control (SCR)
  - 2000-2010 most = dry control from 15-25 ppm

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## BACT Determination (Cont'd)

- Differences based on:
  - technology demonstration – use of technology leads to more use
  - Definitions of cost effectiveness vary from state to state

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## Examples of Cost Effectiveness

- What is your agency's threshold?
- Examples

| Summary of BACT Cost Effectiveness Thresholds ($/ton) | | | | | |
|---|---|---|---|---|---|
| | SCAQMD | BAAQMD | SJVAPCD | YSAQMD | SDAPCD |
| NOx | 19,100 | 17,500 | 24,500 | 24,500 | 18,000 |
| CO | 400 | | 300 | 300 | |
| VOC | 20,000 | 17,500 | 17,500 | 3,900 | |
| SOx | 10,100 | 18,300 | 18,300 | 3,900 | |
| PM10 | 4,500 | 5,300 | 11,400 | 5,700 | |

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## Summary Top Down BACT Review

- Step 1 – Identify all control technologies
- Step 2 – Eliminate technically infeasible options
- Step 3 – Rank remaining control technologies by control effectiveness
- Step 4 – Evaluate most effective controls and document results
- Step 5 – Select BACT

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## QUESTIONS?

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# LESSON 12

## Emission Offsets Banking and Trading

302

## Lesson Objectives

- Explain the emission offset requirements
- Define the offset ratios
- Discuss criteria for emission offsets
- Examine emissions trading vs emissions banking

303

## Emission Offsets
### Pre-Construction Permits NA-NSR

- Offsets:
  - Emission reductions that:
    - Offset the emissions increases resulting from the new source or modification, and
    - Provide a net air quality benefit
  - Offset ratio can be from 1:1 up to 1.5:1, depending on:
    - the criteria pollutant of concern; and
    - the nonattainment classification

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## Federal Offset ratios

| | Area Classification | Ratio |
|---|---|---|
| Ozone | Marginal | 1.1:1 |
| Ozone | Moderate | 1.15:1 |
| Ozone | Serious | 1.2:1 |
| Ozone | Severe | 1.3:1* |
| Ozone | Extreme | 1.5:1* |

*1.2:1 if SIP requires all existing major sources in Non-attainment Area to use BACT

CAA § 182

305

## Federal Offset Ratios

| | Area Classification | Offset Ratio |
|---|---|---|
| CO | Moderate | 1:1 |
| CO | Serious | 1:1 |
| PM10 | Moderate | 1:1 |
| PM10 | Serious | 1:1 |
| NO2, SO2 | All | 1:1 |

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## Offsets Exercise

- Maximum emission rate of new source is 100 pounds per hour
- LAER reduces emissions 80%
- Offset required is 1.2:1

- What is the uncontrolled PTE of the source in tons per year?
- What are the offsets required in pounds per hour?
- From what geographical area are the offsets required?
- How is the source going to obtain the offsets?

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## Offsets Exercise (Cont'd)

- Offsets:
  - Calculating offsets is more involved than the example
    - The example looked only at offsetting direct emissions from the project
    - In practice, offsets must assure "reasonable further progress"
      - Reasonable further progress is a planning term

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## Emission Offsets

- How are offsets obtained?
  - Enforceable emission reductions in the non-attainment area
  - Banking
  - Other?

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## Emission Allowances & Emission Offsets

Emissions trading

versus

Emissions banking

310

## Emissions Trading

- Emissions Trading (Market Based program):
  - Also called a "cap and trade" program
  - Emissions are limited on a geographic basis
  - Emissions are tracked through allowances
  - Sources must hold enough allowances to cover actual emissions (usually on an annual basis)
  - Sources can buy or sell allowances
    - Sources that can economically reduce emissions can sell excess allowances to sources that cannot economically reduce emissions
  - Title IV Acid rain SOx trading program is an example of an emissions trading program
  - Requires comprehensive and transparent method of tracking emissions

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## Emissions Banking

- Emissions Banking:
  - Primarily a nonattainment area program
  - Allows sources who have gone out of business or reduced nonattainment pollutants to below regulatory requirements to "bank" those emissions
  - New or modified sources may purchase banked emissions when needed for offsets
  - Requires comprehensive and transparent method of tracking emissions

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## Emissions Banking (Cont'd)

Emissions Banking:

- For purposes of banking, trading, or immediate use, emissions reductions must be:
  1. Real
  2. Surplus
  3. Permanent
  4. Quantifiable
  5. Enforceable

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## Emissions Banking (Cont'd)

Emissions Banking:

- A state or local agency operating a registration program must ensure that the banked emissions meet these five criteria

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## Emissions Banking (Cont'd)

Emissions Banking:

- Offsets must generally be of same pollutant
  - Some consideration of inter-pollutant offsetting between ozone precursors (VOC/NOx)
- The use of emission reduction credits to offset other criteria pollutants may be restricted geographically

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## Questions?

316

# LESSON 13

## Role of Modeling & Inventories in Permitting

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## AIR SHED MODELING EXAMPLE

- Air Quality Modeling to Support the Georgia SIPs for $O_3$
- Courtesy of Georgia Department of Natural Resources
- Special thanks to Jim Boylan of the Protection Branch

318

## Lesson Objectives

- Learn how permits fit within the SIP planning process
- Provide an overview of Modeling & Inventories
  - Uses and Reasons
  - Benefits
  - Limitations
  - Factors Affecting Models
  - Types of Models

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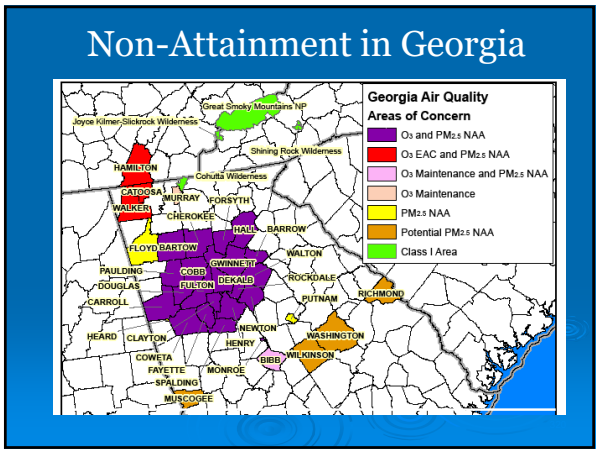
# NACT 334 - INTRODUCTION

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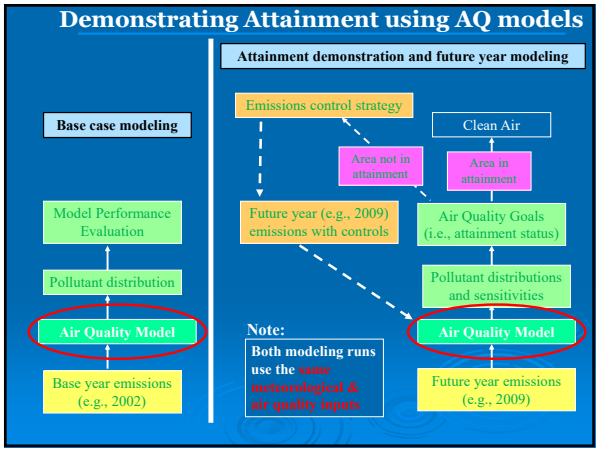


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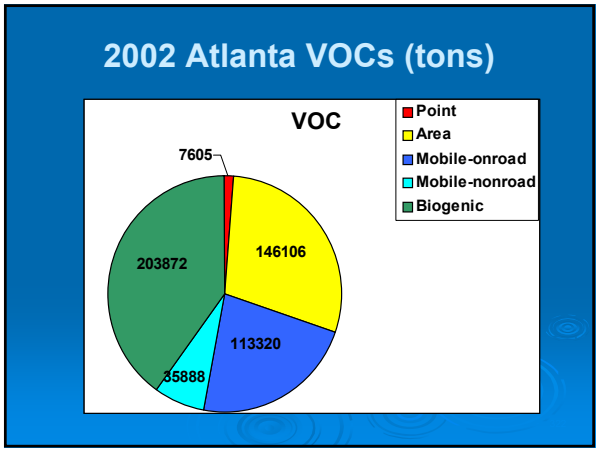


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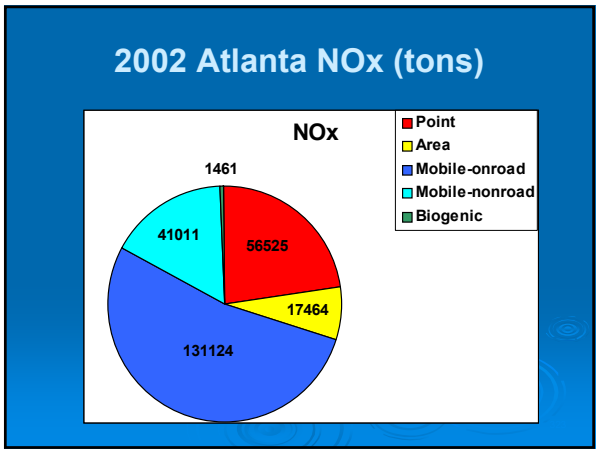
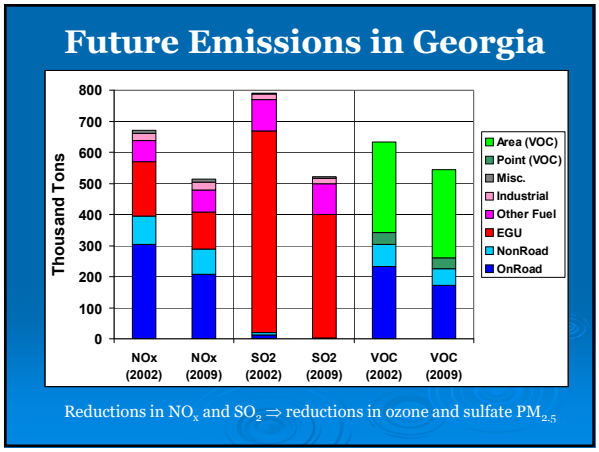
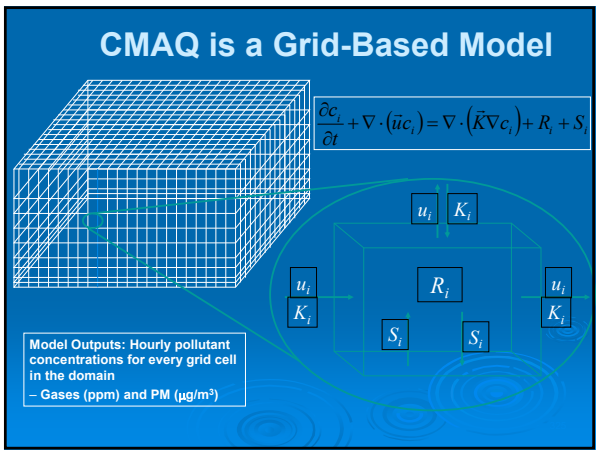

2002 Atlanta NOx (tons)
NOx
Point
Area
Mobile-onroad
Mobile-nonroad
Biogenic
1461
41011
56525
17464
131124

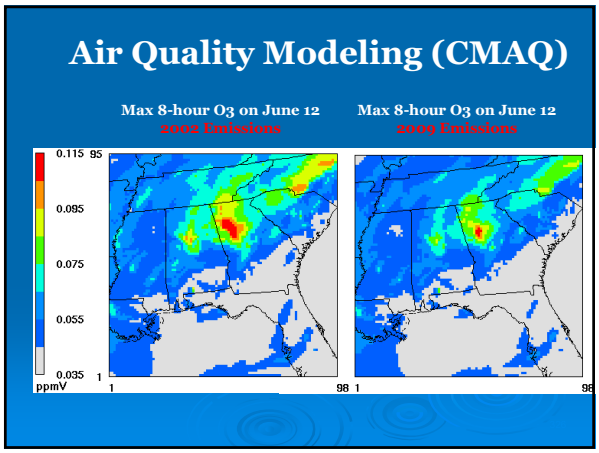
323


Future Emissions in Georgia
Thousand Tons
800
700
600
500
400
300
200
100
0
NOx (2002)
NOx (2009)
SO2 (2002)
SO2 (2009)
VOC (2002)
VOC (2009)
Area (VOC)
Point (VOC)
Misc.
Industrial
Other Fuel
EGU
NonRoad
OnRoad
Reductions in $NO_x$ and $SO_2$ ⇒ reductions in ozone and sulfate $PM_{2.5}$

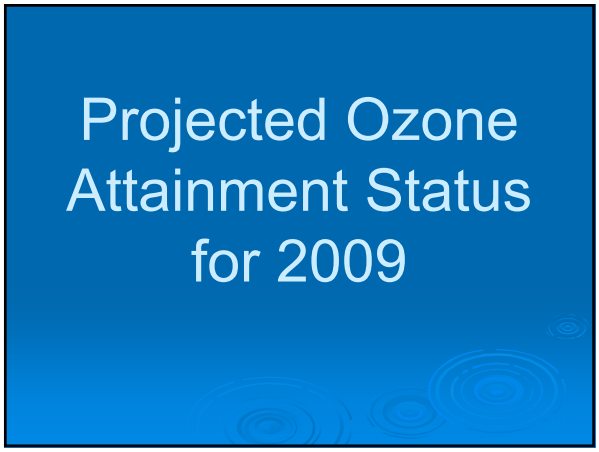
324


CMAQ is a Grid-Based Model
$\frac{\partial c_i}{\partial t} + \nabla \cdot (\vec{u} c_i) = \nabla \cdot (\vec{K} \nabla c_i) + R_i + S_i$
$u_i$ $K_i$
$R_i$
$S_i$
Model Outputs: Hourly pollutant concentrations for every grid cell in the domain
– Gases (ppm) and PM (μg/m³)

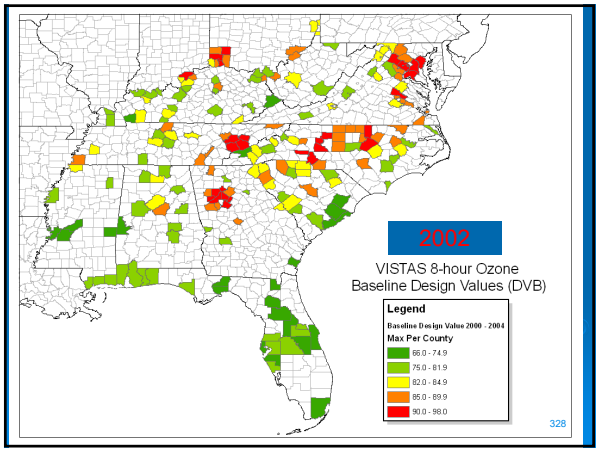
325


Air Quality Modeling (CMAQ)
Max 8-hour O3 on June 12
2002 Emissions
Max 8-hour O3 on June 12
2009 Emissions
0.115
0.095
0.075
0.055
0.035
ppmV
95
1
98

326


Projected Ozone Attainment Status for 2009

327


2002
VISTAS 8-hour Ozone
Baseline Design Values (DVB)
Legend
Baseline Design Value 2000 - 2004
Max Per County
66.0 - 74.9
75.0 - 81.9
82.0 - 84.9
85.0 - 89.9
90.0 - 98.0
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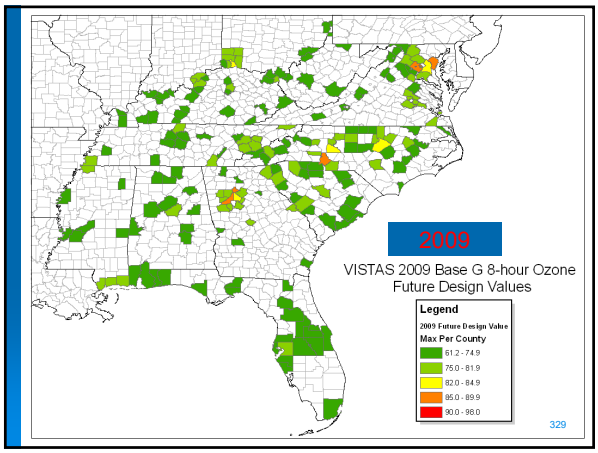
# NACT 334 - INTRODUCTION

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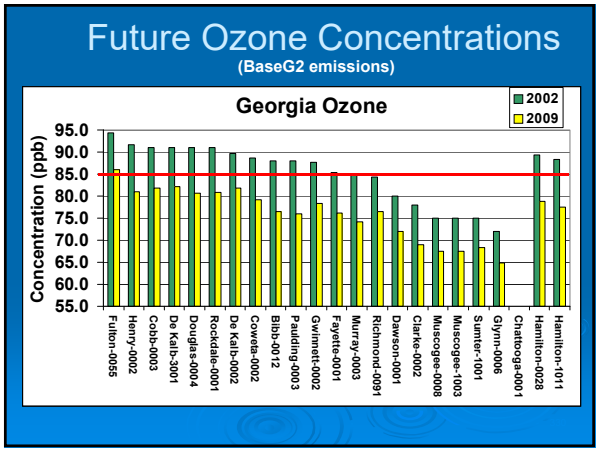


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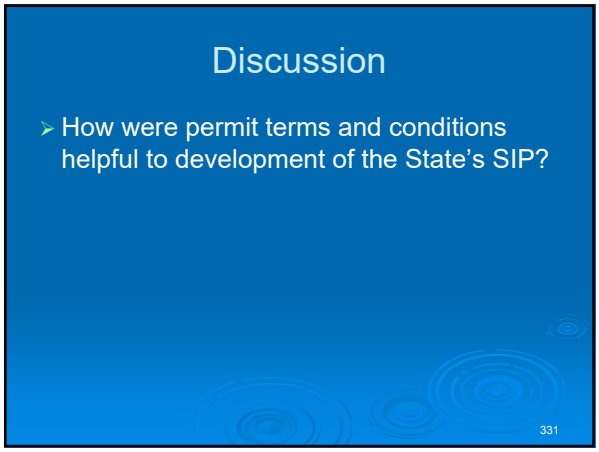


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