

STAR Program Implementation Workshops

Workshop 103
September 7, 2006

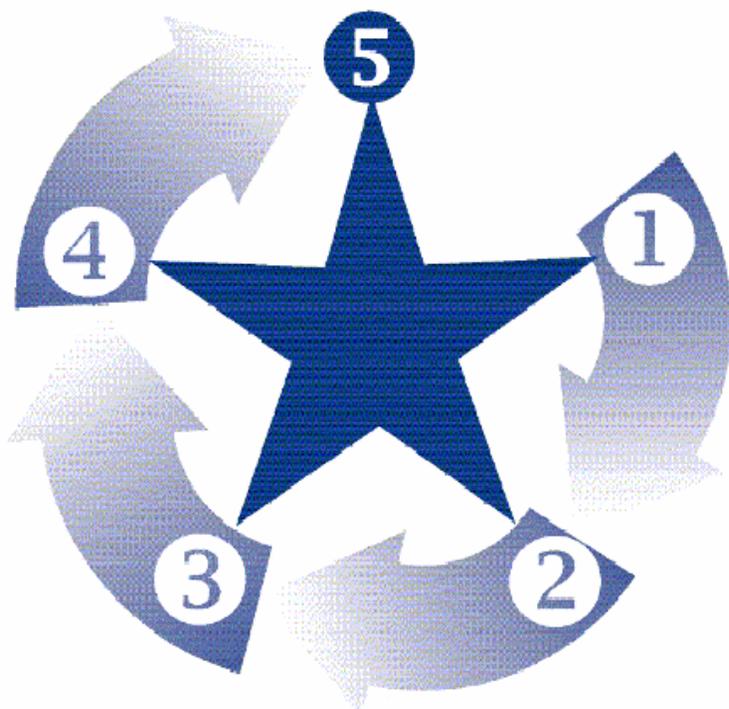
Agenda

- STAR Workshops 101 and 102
- Conversion factors and some basics
- Regulation 5.21 ... 12-31-06 Requirements
- Documentation to be submitted
- Summary of Results
- Changes
- Miscellaneous Frequently Asked Questions
- Questions
- STAR Workshop 104 – T-BAT



STAR Program

Strategic Toxic Air Reduction



- 1 Emissions levels**
- 2 Release points**
- 3 Modeling**
- 4 Reduction plan**
- 5 Compliance**

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STAR Workshop 101

Applicable Information

- Deriving Benchmark Ambient Concentration (BAC)
- Toxicity-based de minimis (uses Tier 1)
- Categories of Toxic Air Contaminants (TACs)
- De minimis – 6 different ways
- Using the Tier 1 table to calculate risk
- Using the Tier 2 table to calculate risk

STAR Workshop 102

Applicable Information

- Tier 3 Modeling
- Information needed for Tier 4 modeling
- Demonstrating environmental acceptability
- Determining cumulative risk
 - **Dwain Kincaid**, Kentuckiana Engineering Co.
 - **Todd Royer**, URS Corp.

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Useful Conversion Factors

Lb/hr and $\mu\text{g}/\text{m}^3$

- $\text{___ Lb/hr} \times 2.67 \times 10^8 / \text{SCFM} = \text{___} \mu\text{g}/\text{m}^3$
- $\text{___} \mu\text{g}/\text{m}^3 \times \text{SCFM} / 2.67 \times 10^8 = \text{___ Lb/hr}$

ppm & ppb and mg/m³ & μg/m³

- ___ppm x 0.04088 x mol. wt. = ___mg/m³
- ___mg/m³ x 24.4638 / mol. wt. = ___ppm
- ___mg/m³ x 1000 = ___μg/m³
- ___μg/m³ / 1000 = ___mg/m³
- ___ppb x 0.04088 x mol wt. = ___μg/m³
- ___μg/m³ x 24.4638 / mol. wt. = ___ppb

(ppm & ppb equations @ 77 °F)

Lb/hr and g/sec

- $\text{___ Lb/hr} \times 0.126 = \text{___ g/sec}$
- $\text{___ g/sec} \times 7.93 = \text{___ Lb/hr}$

Thus, $1 \text{ g/sec} = 7.93 \text{ Lb/hr}$

Feet, Inches, and Meters

- ___feet x 0.3048 = ___meters
- ___inches x 0.0254 = ___meters
- ___meters x 3.281 = ___feet
- ___meters x 39.37 = ___inches

Lb/hr and T/yr

Potential @ “24-7” full operation

- ___ Lb/hr x 4.38 = ___ T/yr

- ___ Lb/hr x 8760 = ___ Lb/yr

Temperature

- $[(\text{---}^{\circ}\text{F} + 40) \times 5/9] - 40 = \text{---}^{\circ}\text{C}$
- $[(\text{---}^{\circ}\text{C} + 40) \times 9/5] - 40 = \text{---}^{\circ}\text{F}$
- $(\text{---}^{\circ}\text{F} + 460) \times 5/9 = \text{---}^{\circ}\text{K}$
- $\text{---}^{\circ}\text{C} + 273 = \text{---}^{\circ}\text{K}$



A Quick Refresher on Some Basics

How is Risk Determined?

Maximum Concentration ($\mu\text{g}/\text{m}^3$)

■ Risk = $\frac{\text{Maximum Concentration } (\mu\text{g}/\text{m}^3)}{\text{BAC } (\mu\text{g}/\text{m}^3)}$

What is Environmental Acceptability?

- **Environmental Acceptability (EA) means the risk meets the established goals**
- **Risk can be:**
 - **Cancer risk – how many in one million
e.g., 1×10^{-6} or 10×10^{-6}**
 - **Noncancer risk – Hazard Quotient
e.g., 1.0 HQ**

Consideration of Multiple Pollutants

- **Carcinogens** – Accumulate risk from all “applicable” carcinogens
- **Noncancer risk** – Does NOT accumulate HQ from similar adverse-effect TACs

Categories of TACs

- Regulation 5.23
 - **Category 1 TACs – Section 1 – 18**
 - Category 2 TACs – Section 2 – 19
 - Category 3 TACs – Section 3 – 17
 - Category 4 TACs – Section 4 – **136**

De Minimis – 6 Ways

Regulation 5.01 section 1.6

- MSDS
 - 0.1% carcinogen
 - 1.0% noncarcinogen
- Trivial activity
- Insignificant activity
- BAC-based lb/hr, lb/averaging period
- Surface coating process, new/modified, <5.0 tpy, 18 months
- Motor vehicle fueling/refueling

De Minimis #1

Regulation 5.01 section 1.6.1

- **IF** information of a **purchased** material is from an **MSDS** (Material Safety Data Sheet)
 - Carcinogen: <0.1% by weight
 - Noncarcinogen: <1.0% by weight
- Does NOT apply to mixture of several purchased materials
- Does NOT apply to purchased materials w/o MSDS that are independently analyzed
- **Does NOT apply to materials manufactured by the process or process equipment**

De Minimis #2

Regulation 5.01 section 1.6.2

- Process or process equipment or activity is on District's **Trivial Activity** list
- <http://www.louisvilleky.gov/APCD/STAR/STARLinks.htm>



De Minimis #3

Regulation 5.01 section 1.6.3

- Process or process equipment or activity is on District's **Insignificant Activity** list
- <http://www.louisvilleky.gov/APCD/STAR/STARLinks.htm>



De Minimis #4

Regulation 5.01 section 1.6.4

- Toxicity-based amounts, developed from BACs
 - Pounds per hour
 - AND**
 - Pounds per averaging period
-
- <http://www.louisvilleky.gov/APCD/STAR/STARLinks.htm>



De Minimis #5

Regulation 5.01 section 1.6.5

- New or modified surface coating process or process equipment, including coating change
- Potential volatile organic compound (VOC) emissions are < 5.0 tons per year
- **No longer de minimis 18 months after** beginning operation or process/coating change
- **Does not apply to existing P/PE**

De Minimis #6

Regulation 5.01 section 1.6.6

- Motor vehicle fueling or refueling process and process equipment for gasoline and other liquid fuels

E. A. Goals for Stationary Sources

	Applicable Source Sector	Applicable Process or Process Equipment ¹	Applicable TACs	EAG_C^{2,3} Risk ($\otimes 10^{-6}$)⁶	EAG_{NC}^{4,5} HQ
2.5.1	Point source	Individual stationary source, individual existing P/PE	Individual TAC	1.0	1.0
2.5.2	Point source	Individual stationary source, all P/PE, including new or modified P/PE	Individual TAC		1.0
2.5.3	Point source	Individual stationary source, all P/PE, including new or modified P/PE	Total for all applicable TACs	7.5	

- For the 12-31-06 Submittal ...
 - **Only Category 1 TACs from existing and new/modified P/PE are required to be included**
 - **Excludes de minimis emissions**

- For the 3-31-08 Submittal ...
 - Category 2 TACs ... and ...
 - All applicable TACs are required to be included (R 5.21 S 2.4)

Modeling

- Tier 1 – Simple look-up table
 - SCREEN3
 - 25' building, 1.25 SH/BH, 100' distance
- Tier 2 – Look-up table
 - SCREEN3
 - Actual Building height, Stack height, Distance
- Tier 3 – SCREEN3 or TSCREEN
- Tier 4 – ISC3ST, AERMOD, or other EPA Model

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Regulation 5.21

Section 4.1

- Determine whether the allowed emissions comply with the EA goals in section 2.5
- For each process or process equipment submit the results and supporting documentation

Regulation 5.21

Section 4.3

- If EA goal is not met based on allowed/potential emissions but actual emissions don't exceed EA goal, you may request new or revised emission limit
- Request must be in writing and clearly identify the P/PE involved and specify the requested new or revised emission limit
- New or revised emission limit shall become a condition of the applicable permit

Determining Risk

Maximum Concentration ($\mu\text{g}/\text{m}^3$)

■ Risk = $\frac{\text{Maximum Concentration } (\mu\text{g}/\text{m}^3)}{\text{BAC } (\mu\text{g}/\text{m}^3)}$



It looks simple,
but, as “they” always say ...

The devil is in the details!



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Documentation for De Minimis BAC-based only (R 5.01 S 1.6.4)

- Identify Process/Process Equipment
- Identify TAC
- **Allowed/Potential** pounds per hour
- **Allowed/Potential** pounds per averaging period
- Calculations showing potential, or
Identify enforceable condition for allowed

Documentation for Tier 1 Modeling

- Identify Process/Process Equipment
- Identify TAC
- Allowed/Potential pounds per hour
- Allowed/Potential pounds per averaging period
- Calculations showing potential, or
Identify enforceable condition for allowed
- Calculations showing maximum concentration
(R 5.22 S 2)
- Calculations showing risk (R 5.21 S 2)

Documentation for Tier 2 Modeling

- Identify Process/Process Equipment
- Identify TAC
- Allowed/Potential pounds per hour
- Allowed/Potential pounds per averaging period
- Calculations showing potential, or
Identify enforceable condition for allowed
- Stack height, influential building height, distance to
closest property line
- Identify Table 2 factor, showing calculations if
interpolated
- Calculations showing maximum concentration
(R 5.22 S 3)
- Calculations showing risk (R 5.21 S 2)

Documentation for Tier 3 Modeling

- Identify Process/Process Equipment
- Identify TAC
- Allowed/Potential pounds per hour
- Allowed/Potential pounds per averaging period
- Calculations showing potential, or
Identify enforceable condition for allowed
- **Printout from SCREEN3 model**
- Calculations showing risk (R 5.21 S 2)

*** SCREEN3 MODEL RUN ***

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT
EMISSION RATE (G/S) = .100000E-01
STACK HEIGHT (M) = 15.2400
STK INSIDE DIAM (M) = 1.1582
STK EXIT VELOCITY (M/S)= 8.9595
STK GAS EXIT TEMP (K) = 294.3000
AMBIENT AIR TEMP (K) = 293.0000
RECEPTOR HEIGHT (M) = .0000
URBAN/RURAL OPTION = URBAN
BUILDING HEIGHT (M) = 10.6700
MIN HORIZ BLDG DIM (M) = 30.4800
MAX HORIZ BLDG DIM (M) = 30.4800

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS
WAS ENTERED.

... etc. ... See handout

Documentation for Tier 4 Modeling

- Identify Process/Process Equipment
- Identify TAC
- Allowed/Potential pounds per hour
- Allowed/Potential pounds per averaging period
- Calculations showing potential, or
Identify enforceable condition for allowed
- See “Reports for Tier 4 Modeling” handout
- Calculations showing risk (R 5.21 S 2)

Reports for Tier 4 Modeling

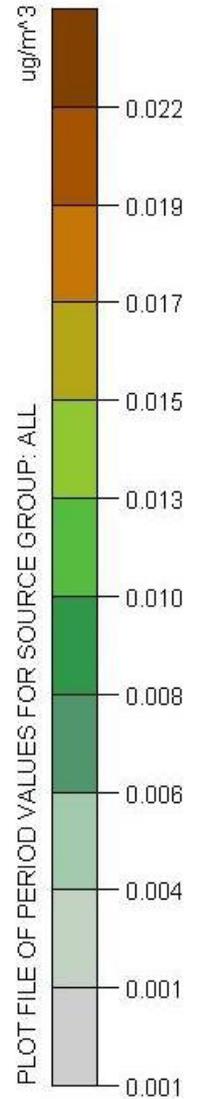
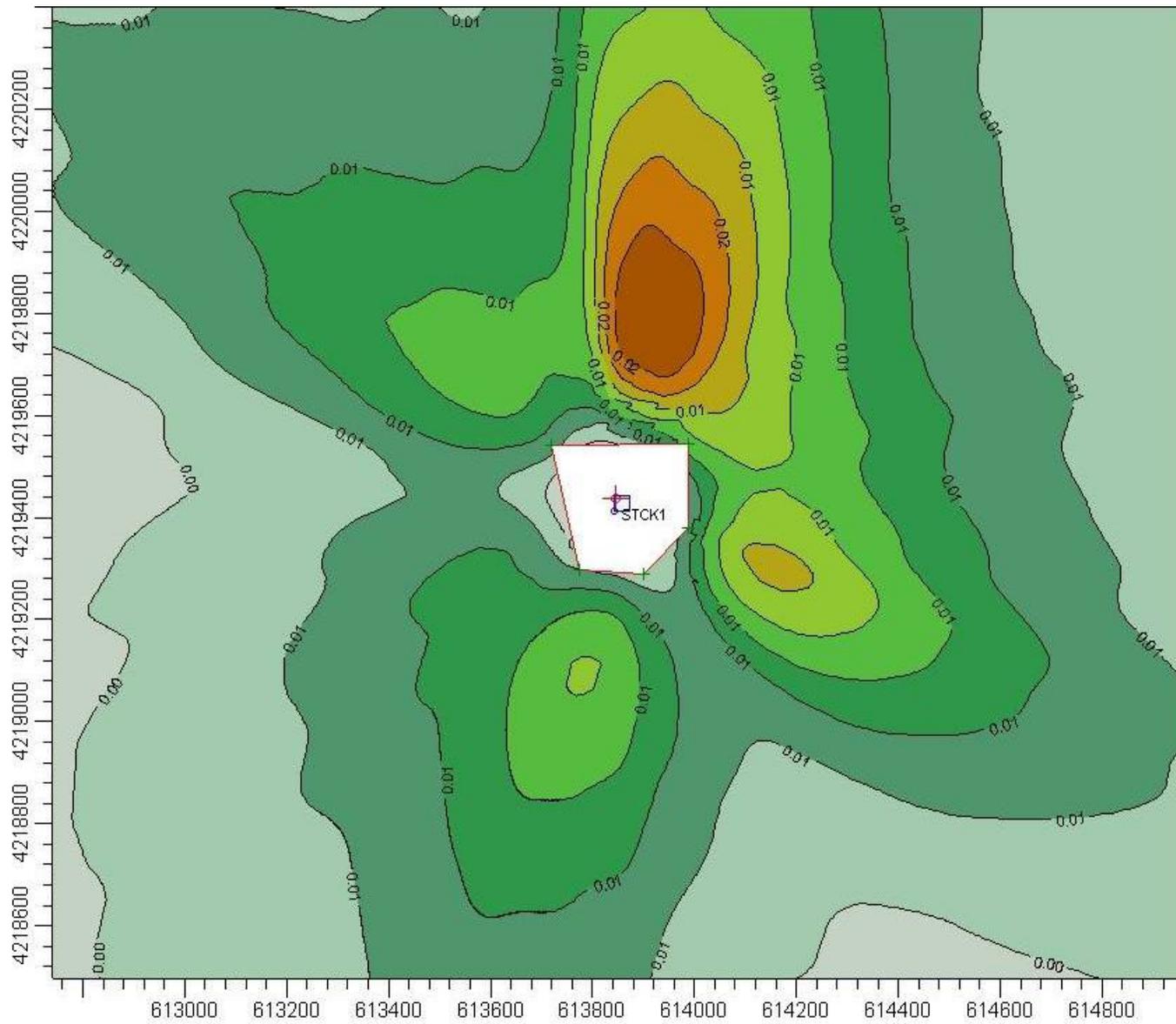
■ I. Paper Format

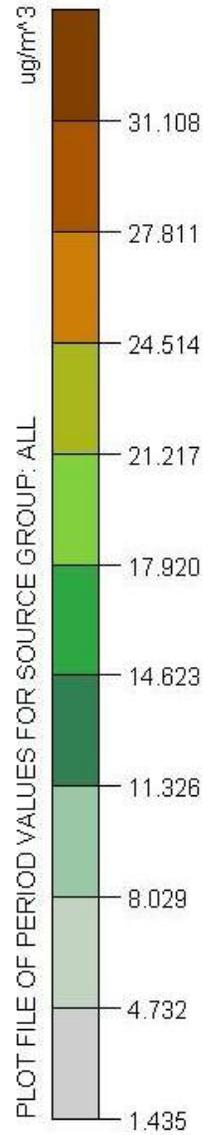
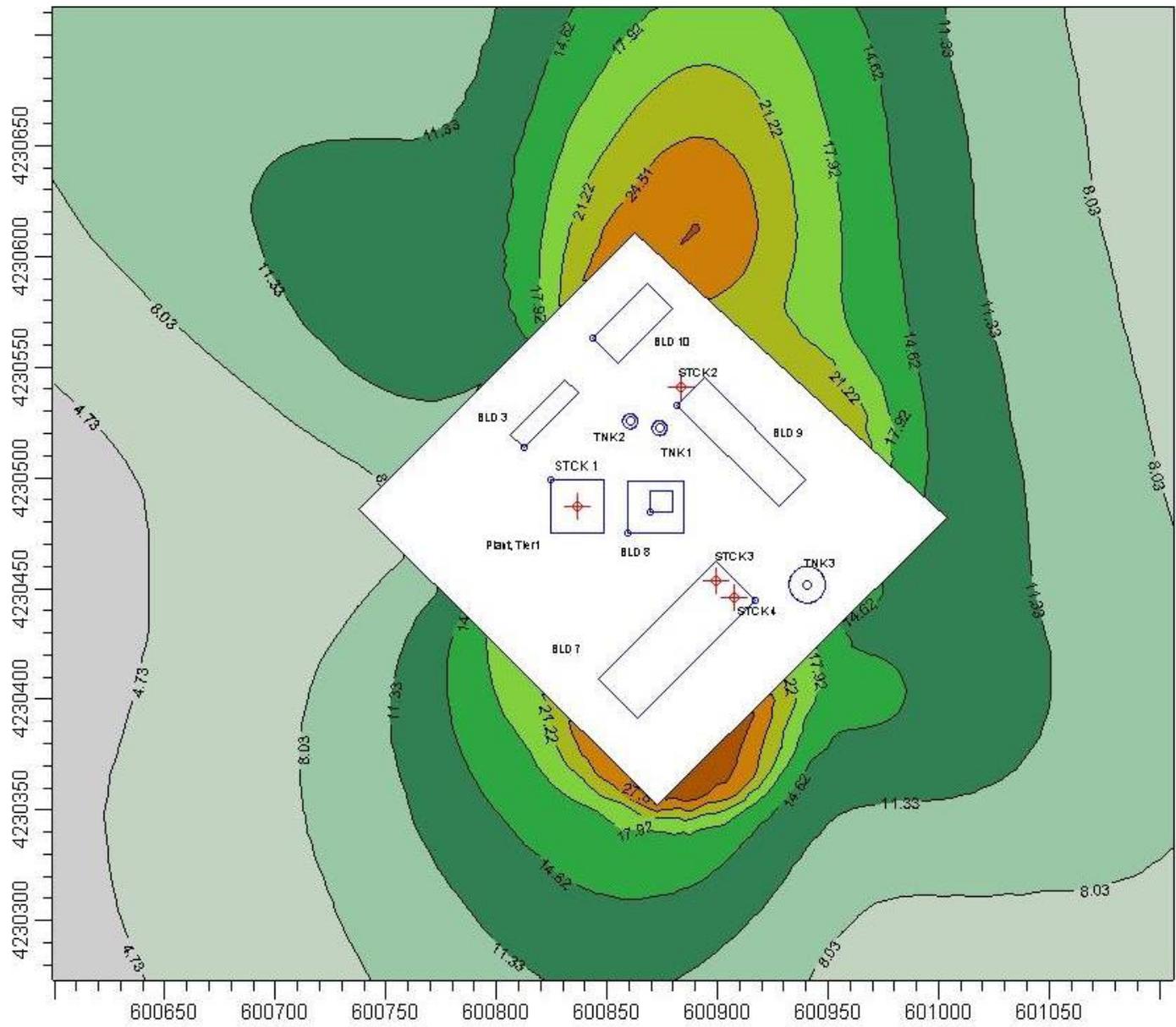
- See handout

■ II. Electronic Files

6. Model Files

- BPIP Output File
- ISC, ISC-Prime, or AERMOD Input and Output Files
- Optional but helpful if a software interface is available:
ISC, ISC-Prime, or AERMOD Plot Files (A paper copy is also helpful, but optional)
- All files on disk or CD





LMAPCD

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Environmental Acceptability Results Table

- See Excel Spreadsheet handout

Environmental Acceptability Results Table

	TAC	BACc	BACnc	BACnc A.P.
1	Acrylonitrile	0.015	2	Annual
2	Benzene	0.13	30	Annual
3	1,3-Butadiene	0.03	2	Annual
4	Chromium hexavalent	0.000083	0.008	Annual
5	Chromium trivalent		5	8-Hr
6	Formaldehyde	0.077	3	Annual
7	Methylene chloride	2.1	400	Annual
8	Vinyl chloride	0.23	100	Annual

Environmental Acceptability Results Table

Process #1					
Allowed		Max Conc		Risk c	HQ
Lb/Hr	Lb/A.P.	ug/m ³			
x	x	x		a1	m1
x	x	x		b1	n1
x	x	x		c1	o1
x	x	x		d1	p1
x	x	x			q1
x	x	x		f1	r1
x	x	x		g1	s1
x	x	x		h1	t1

Environmental Acceptability Results Table

Process #3							
Allowed		Max Conc	Risk c		Total		
Lb/Hr	Lb/A.P.	ug/m ³		HQ	Risk c	HQ	
x	x	x	a3	m3	a1+a2+a3	m1+m2+m3	
x	x	x	b3	n3	b1+b2+b3	n1+n2+n3	
x	x	x	c3	o3	c1+c2+c3	o1+o2+o3	
x	x	x	d3	p3	d1+d2+d3	p1+p2+p3	
x	x	x		q3		q1+q2+q3	
x	x	x	f3	r3	f1+f2+f3	r1+r2+r3	
x	x	x	g3	s3	g1+g2+g3	s1+s2+s3	
x	x	x	h3	t3	h1+h2+h3	t1+t2+t3	
				Cumulative risk	a1+ ... h3		

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Proposed Changes from STAR IAG Review Process



- **R 5.01 S 1.6.7 De Minimis** – Emissions resulting from natural gas combustion
 - **Current** – EA demonstration required if allowed/
potential emission of TAC is greater than de minimis
 - **Proposed** – Add de minimis definition – all emissions resulting from combustion of natural gas
 - All emissions of process if only natural gas combustion emissions, e.g, boiler, N.G. turbine
 - De minimis does not include other emissions from process, e.g., paint oven



Proposed Changes from STAR IAG Review Process



- R 5.22 S 5.1.2 ISC/AERMOD Tier 4
 - **Current** – arithmetic mean of maximum conc.
From 5 individual years of met data
 - **Proposed** – model 5-year period, maximum
5-year concentration
- Group 1 Category 1 TACs – Either
- Group 1 Category 2 TACs – New, but option to
use current
- Group 2 – New
- Construction permits – Phase in for new

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What is the maximum allowed receptor grid spacing for ISC3/AERMOD modeling?

- Overriding requirement is that result is reasonably close to the max. conc.
- Initial receptor grid spacing flexible, may be used to locate approximate location of max. conc.; then use finer grid spacing for second run
- District recommendation:
 - 20 meters at fenceline, especially if downwash situation
 - No greater than 100 meters away from fenceline; the closer the max. conc. is to the fenceline, the smaller the grid spacing should be

How do the 4.2 and 10 factors for industrial property and public roadways, respectively, affect the environmental acceptability demonstration for other areas?

- The presence of industrial property or public roadways does not affect the EA goals applicable to the ambient air over any other property.
- For example, if a public roadway is next to the emitting source, the single chemical, single process risk goal is 10×10^{-6} , but the EA risk goal for the far side of the road is still 1×10^{-6}

If a company modifies only a part of a process or process equipment, how much of the total process or process equipment is subject to STAR review pursuant to R 5.21 S 3?

- Like new source review regarding the same issue, **the determination is made on a case-by-case basis**
- Similarly, the factors considered include:
 - How much is included in the process
 - How much of the P/PE is being modified
 - The relationship between the modified P/PE and other parts of the P/PE
 - The effect of the modification on other parts of the P/PE, such as whether the modification will cause/allow an increase in emissions from other parts of the P/PE (debottlenecking)



For a metal compound, how much of the molecule is used for determining EA, the whole molecule or just the metal component?

- Use only the metallic fraction of the metal compound when demonstrating EA.

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