

Framework Examples

Cleaner Air Oregon

REFORMING OREGON'S INDUSTRIAL AIR QUALITY REGULATIONS

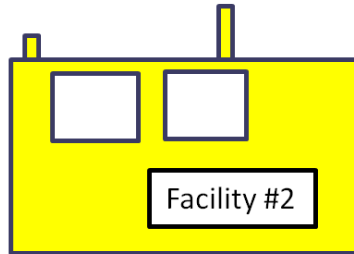
Inviting Oregonians to help create new regulations that protect what we all care about: the health of our people and our planet, and the economic vitality of our communities.

Example Facilities

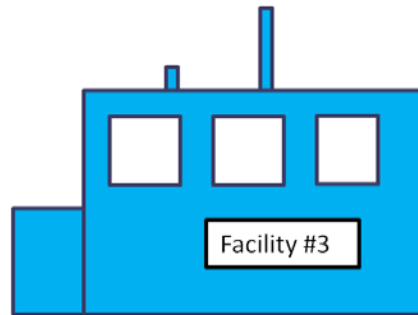
We'll walk through 5 hypothetical existing facilities, to illustrate how the analysis could work.



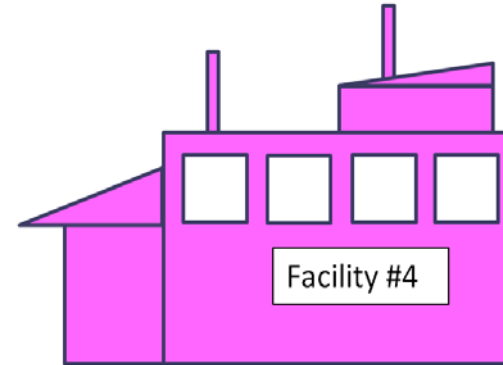
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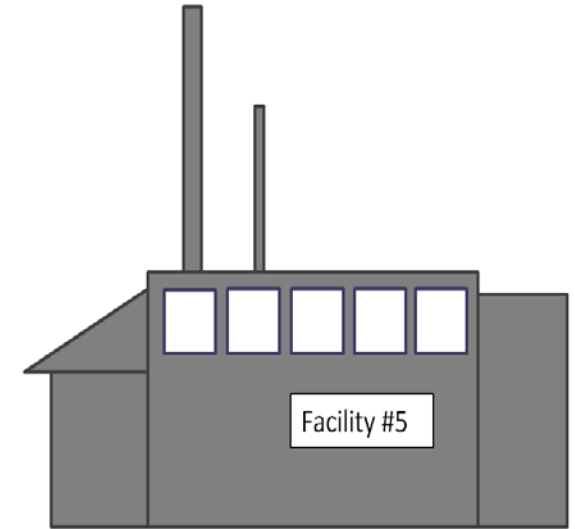
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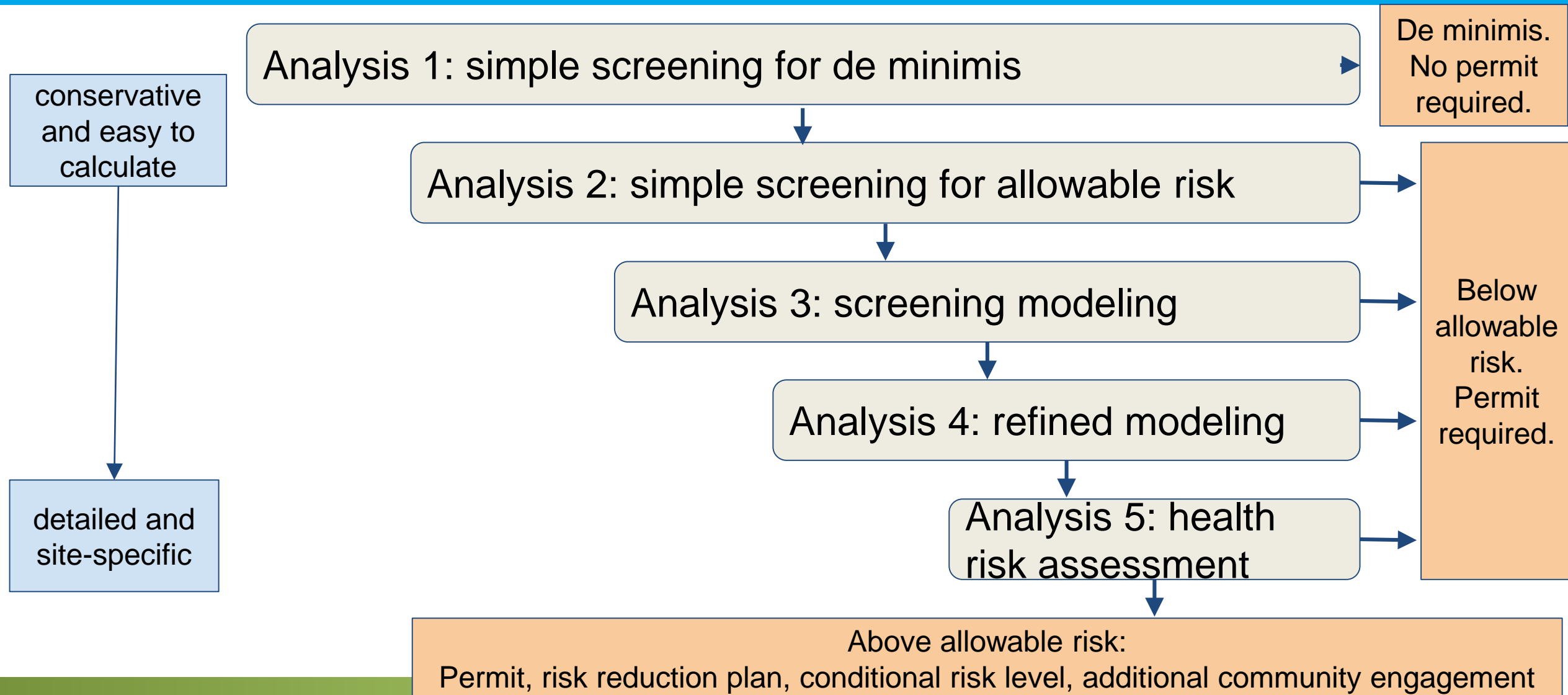


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5

Progressively refined risk assessment steps



Reference Emission Rates (RERs)

- Initial screening tool - no modeling required
- Agencies back-calculate RERs using Risk-Based Concentrations (RBCs) and conservative default modeling parameters (short stack height, short squat building, low wind speed).
- Would be listed in a table in the rule, could be changed through rulemaking as new science becomes available

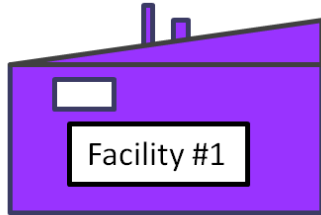
How to use RERs

- One chemical can have up to 3 RERs, for different risk types
 - chronic cancer
 - chronic noncancer
 - acute noncancer

- Risk estimate for one chemical = $\frac{\textit{emissions}}{\textit{RER}}$

- Risk estimate for all chemicals emitted by a facility = $\sum_{\textit{chemicals}} \frac{\textit{emissions}}{\textit{RER}}$

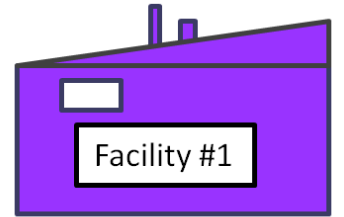
Facility #1



Max Annual Emission Rate (pounds/year)			
Toxic Air Pollutant	Emissions Unit #1	Emissions Unit #2	Total
Chemical A	1	1	2
Chemical B	0	1	1
Chemical C	10	10	20

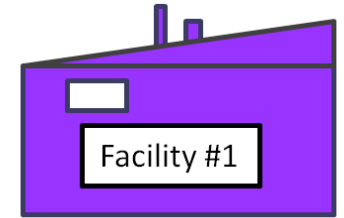
Max Daily Emission Rate (pounds/day)			
Toxic Air Pollutant	Emissions Unit #1	Emissions Unit #2	Total
Chemical A	0.003	0.003	0.006
Chemical B	0	0.05	0.05
Chemical C	0.1	0.3	0.4

Reference Emission Rates (RERs)



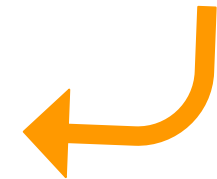
Toxic Air Pollutant	Chronic Cancer RER	Chronic Noncancer RER	Acute Noncancer RER
	(pounds/year)		(pounds/day)
Chemical A	10	120	2
Chemical B	20	N/A	4
Chemical C	100	2,000	5

Facility #1: analysis 1

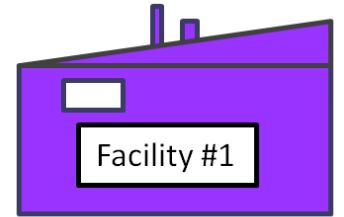


Toxic Air Pollutant	Emission Rate (pounds/year)	Chronic Cancer RERs	Ratio ER/RER
Chemical A	2	/ 10	= 0.2
Chemical B	1	/ 20	= 0.05
Chemical C	20	/ 100	= 0.2
		TOTAL	0.45

Sum of Ratios



Facility #1: analysis 1



Toxic Air Pollutant	Emission Rate	Chronic Noncancer RERs		Ratio ER/RER
	(pounds/year)			
Chemical A	2	/	120	= 0.02
Chemical B	1	/	N/A	= N/A
Chemical C	20	/	2,000	= 0.01
			TOTAL	0.03

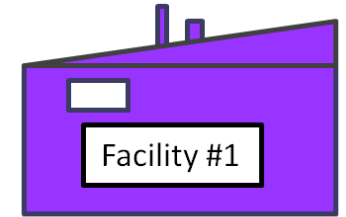
Sum of Ratios

Toxic Air Pollutant	Emission Rate	Acute Noncancer RERs		Ratio ER/RER
	(pounds/day)			
Chemical A	0.006	/	2	= 0.003
Chemical B	0.05	/	4	= 0.01
Chemical C	0.4	/	5	= 0.08
			TOTAL	0.10

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Facility #1: analysis 1 results

Risk Type	Sum of Ratios	De Minimis Level	Is Below?
chronic cancer	0.45	0.5	Y
chronic noncancer	0.03	0.5	Y
acute noncancer	0.10	0.5	Y



All three are below 0.5, so facility would screen out as de minimis.

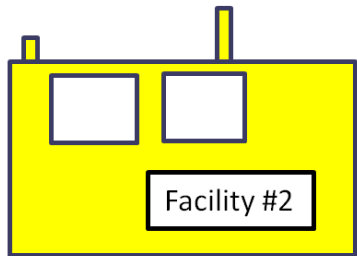
No permit or annual reporting required. Facility data would be kept in a database and available for records requests.

De minimis risk levels:

≤ 0.5 in 1 million cancer risk

≤ 0.5 hazard index for chronic and acute noncancer

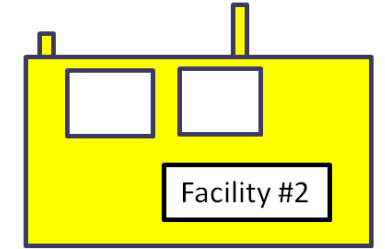
Facility #2



Facility #2 is like facility #1, but has higher emissions of chemical A.

Toxic Air Pollutant	Max Annual Emission Rate (pounds/year)	Max Daily Emission Rate (pounds/day)
Chemical A	2 5	0.006 0.03
Chemical B	1	0.05
Chemical C	20	0.4

Facility #2: analysis 1

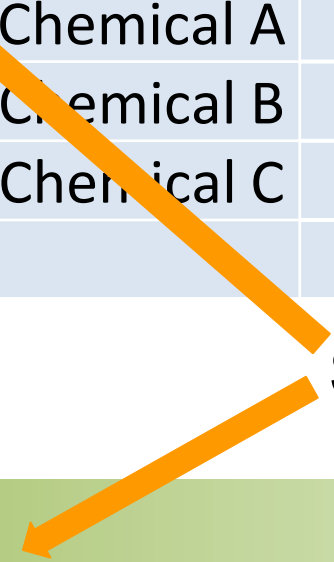


Toxic Air Pollutant	Emission Rate (pounds/year)	Chronic Cancer RERs	Ratio ER/RER
Chemical A	5 /	10 =	0.5
Chemical B	1 /	20 =	0.05
Chemical C	20 /	100 =	0.2
		TOTAL	0.75

Toxic Air Pollutant	Emission Rate (pounds/year)	Chronic Noncancer RERs	Ratio ER/RER
Chemical A	5 /	120 =	0.04
Chemical B	1 /	N/A =	N/A
Chemical C	20 /	2,000 =	0.01
		TOTAL	0.05

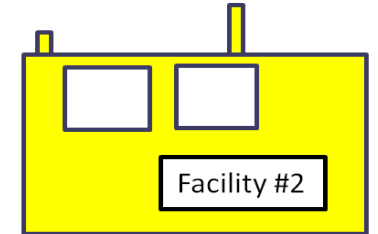
Toxic Air Pollutant	Emission Rate (pounds/day)	Acute Noncancer RERs	Ratio ER/RER
Chemical A	0.03 /	2 =	0.02
Chemical B	0.05 /	4 =	0.01
Chemical C	0.4 /	5 =	0.08
		TOTAL	0.11

Sum of Ratios



Facility #2: analysis 1 results

Risk Type	Sum of Ratios	De Minimis Level	Is Below?
chronic cancer	0.75	0.5	N
chronic noncancer	0.05	0.5	Y
acute noncancer	0.11	0.5	Y



Chronic cancer is above 0.5, so facility would not screen out as de minimis.

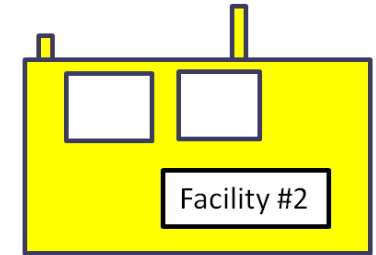
De minimis risk levels:

<= 0.5 in 1 million cancer risk

<= 0.5 hazard index for chronic and acute noncancer

Facility #2: analysis 2

Risk Type	Ratio ER/RER	Allowable Risk	Is Below?
chronic cancer	0.75	10	Y
chronic noncancer	0.05	1	Y
acute noncancer	0.11	1	Y



All three are under the facility allowable risk, so facility would comply with allowable risk levels at the analysis 2 level.

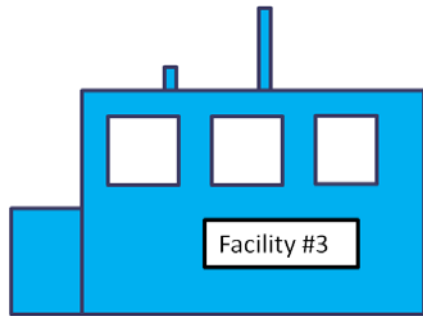
Permit and annual reporting required. Opportunity for public comment as part of permitting process.

Individual facility allowable risk:

<= 10 in 1 million cancer risk

<= 1 hazard index for chronic and acute noncancer

Facility #3



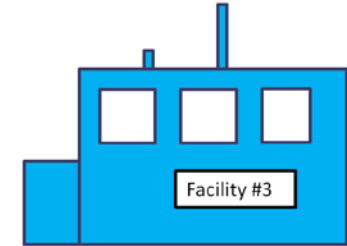
A bigger facility, with higher emissions

Toxic Air Pollutant	Max Annual Emission Rate (pounds/year)	Max Daily Emission Rate (pounds/day)
Chemical A	100	1
Chemical B	30	1
Chemical C	50	1

Do the same RER calculation as in previous example

Facility #3: analyses 1 and 2

Risk Type	Sum of Ratios	Allowable Risk Level	Is Below?
chronic cancer	12	10	N
chronic noncancer	0.86	1	Y
acute noncancer	0.95	1	Y



All are above 0.5, so facility would not screen out as de minimis.

Chronic cancer is above facility allowable risk, so facility would not comply with allowable risk levels at the analysis 2 level.

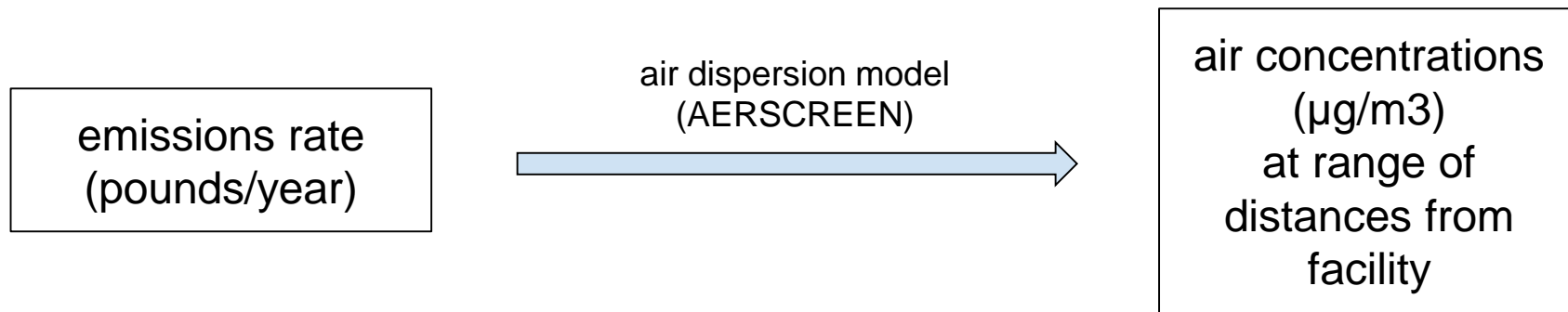
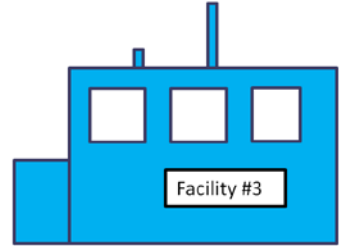
Individual facility allowable risk:

≤ 10 in 1 million cancer risk

≤ 1 hazard index for chronic and acute noncancer

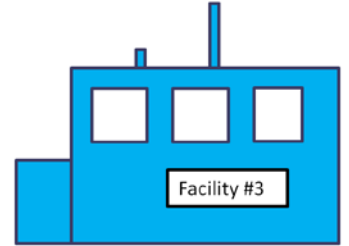
Analysis 3: AERSCREEN modeling

- Facilities that don't screen out in analyses 1 and 2 can do more site-specific analysis 3 using the AERSCREEN model.
- AERSCREEN uses conservative defaults for some parameters like weather, but uses some site-specific parameters like stack height and distance to where people could be exposed.



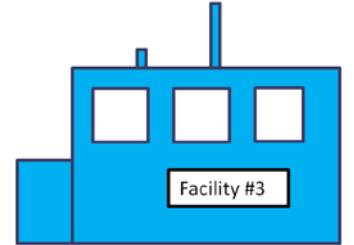
Risk-Based Concentrations (RBCs)

- Calculated by DEQ and OHA
- Air concentration that would pose a 1 in 1 million cancer risk or a hazard quotient of 1.
- Would be available for lookup in the rule, could be changed through rulemaking as new science becomes available

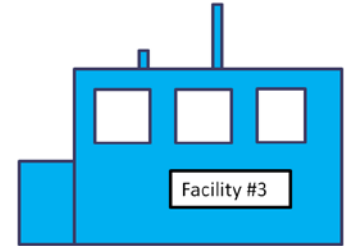


Estimating Risk

- Risk estimate for one chemical = $\frac{\text{model output concentration}}{RBC}$
- Risk estimate for all chemicals emitted by a facility = $\sum_{\text{chemicals}} \frac{\text{model output concentration}}{RBC}$



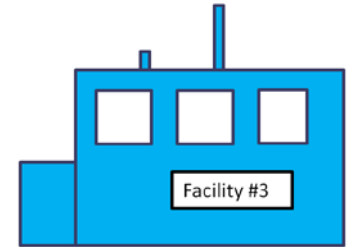
Risk-Based Concentrations (RBCs)



Toxic Air Pollutant	Chronic Cancer RBC	Chronic Noncancer RBC	Acute Noncancer RBC
	(µg/m ³)		
Chemical A	0.01	0.12	0.2
Chemical B	0.02	N/A	0.4
Chemical C	0.1	2	0.5

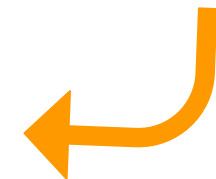
Facility #3: analysis 3, AERSCREEN modeling

Risk estimate calculation using AERSCREEN model results

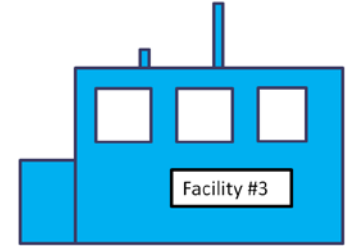


Toxic Air Pollutant	Emission Rate (pounds/year)	Modeled Concentration ($\mu\text{g}/\text{m}^3$)	Chronic Cancer RBC ($\mu\text{g}/\text{m}^3$)	Ratio modeled conc/RBC
Chemical A	100	0.075	0.01	7.5
Chemical B	30	0.023	0.02	1.1
Chemical C	50	0.038	0.1	0.4
			TOTAL	9

Sum of Ratios



Facility #3: AERSCREEN modeling



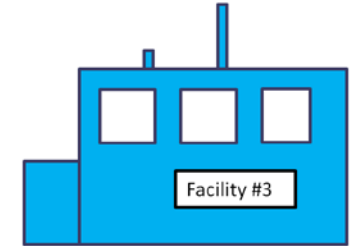
Toxic Air Pollutant	Emission Rate (pounds/year)	Modeled Concentration (µg/m ³)	Chronic Noncancer RBC (µg/m ³)	Ratio modeled conc/RBC
Chemical A	100 →	0.075	/ 0.12	= 0.63
Chemical B	30 →	0.023	/ N/A	= N/A
Chemical C	50 →	0.038	/ 2	= 0.02
			TOTAL	0.64

Toxic Air Pollutant	Emission Rate (pounds/day)	Modeled Concentration (µg/m ³)	Acute Noncancer RBC (µg/m ³)	Ratio modeled conc/RBC
Chemical A	1 →	0.075	/ 0.2	= 0.38
Chemical B	1 →	0.075	/ 0.4	= 0.19
Chemical C	1 →	0.075	/ 0.5	= 0.15
			TOTAL	0.71

Sum of Ratios

Facility #3: analysis 3

Risk Type	Sum of Ratios of modeled concentration/RBC	Allowable Risk Limit	Is Below?
chronic cancer	9	10	Y
chronic noncancer	0.64	1	Y
acute noncancer	0.71	1	Y



All three are under the facility allowable risk, so facility complies with allowable risk levels at the analysis 3 level.

Permit and annual reporting required. Opportunity for public comment as part of permitting process.

Individual facility allowable risk:

<= 10 in 1 million cancer risk

<= 1 hazard index for chronic and acute noncancer

Facility #3 Analysis 2 and 3 Comparison

Note in this example:

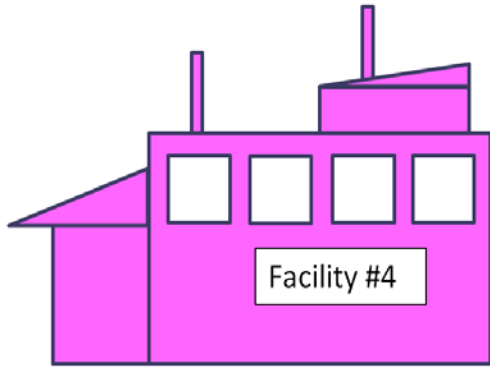
Risk Type	Analysis Level 2 Sum of Ratios of emissions/RER	Analysis Level 3 Sum of Ratios of modeled concentration/RBC
chronic cancer	12	9
chronic noncancer	0.86	0.64
acute noncancer	0.95	0.71

Results at Level 3 are lower than results at Level 2. Level 3 gives a more accurate result.

All estimates are “upper-bound” estimates, i.e., actual level may be lower but will not be higher

Facility #4

A bigger facility with higher emissions:



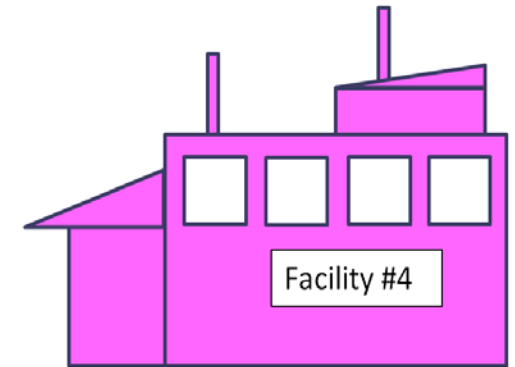
Toxic Air Pollutant	Max Annual Emission Rate (pounds/year)	Max Daily Emission Rate (pounds/day)
Chemical A	120	1
Chemical B	50	1
Chemical C	70	1

Facility #4: analyses 1-3

They have higher emissions than Facility #3, so just like #3 they don't screen out at the de minimis or RER step. When they do AERSCREEN modeling, they get a higher estimated risk, and they don't screen out.

Analysis
1 & 2

Risk Type	Ratio ER/RER	Allowable Risk Level	At or Below?
chronic cancer	15.2	10	N
chronic noncancer	1.0	1	Y
acute noncancer	1.0	1	Y

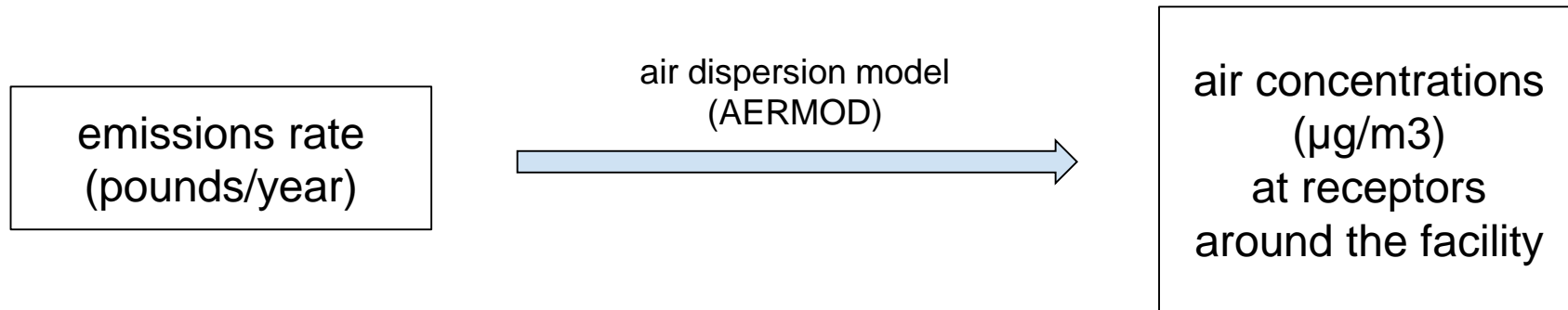
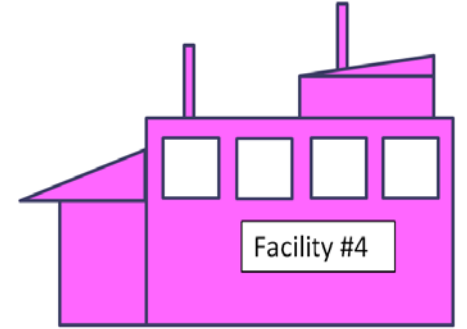


Analysis
3

Risk Type	AERSCREEN modeled concentration/RBC	Allowable Risk Limit	At or Below?
chronic cancer	11.4	10	N
chronic noncancer	0.8	1	Y
acute noncancer	0.7	1	Y

Analysis 4: AERMOD modeling

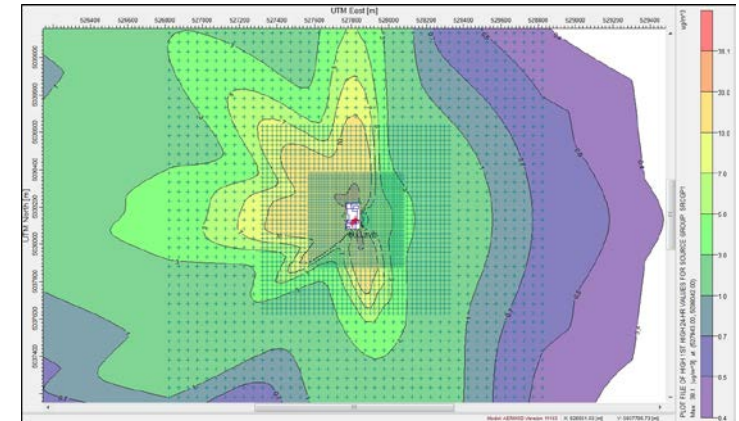
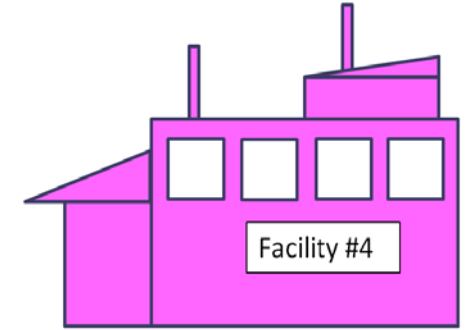
- Facilities that don't screen out using the AERSCREEN model can use AERMOD.
- AERMOD uses more accurate parameters for weather and site-specific parameters like stack height and distance to where people could be exposed.



Facility #4: AERMOD modeling

Use a more detailed model, AERMOD, to get a more accurate estimate using more site-specific data (multiple stacks, etc) and local weather.

Toxic Air Pollutant	Emission Rate (pounds/year)	AERMOD Modeled Concentration ($\mu\text{g}/\text{m}^3$)	Chronic Cancer RBC ($\mu\text{g}/\text{m}^3$)	Ratio modeled conc/RBC
Chemical A	120	0.060	0.01	6.0
Chemical B	50	0.030	0.02	1.25
Chemical C	70	0.042	0.1	0.35
			TOTAL	7.6

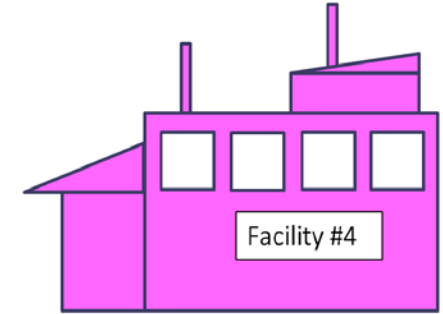


The table above is the same as for the AERSCREEN step, except the modeled concentration is now from AERMOD.

The same calculation would be done for chronic noncancer and acute noncancer.

Facility #4: analysis 4, AERMOD

Risk Type	Sum of Ratios of modeled concentration /RBC	Allowable Risk Level	Is below?
chronic cancer	7.6	10	Y
chronic noncancer	0.5	1	Y
acute noncancer	0.5	1	Y



All three are under the facility allowable risk, so facility complies with allowable risk levels at the analysis 4 level.

Permit and annual reporting required. Opportunity for public comment as part of permitting process.

Individual facility allowable risk:

<= 10 in 1 million cancer risk

<= 1 hazard index for chronic and acute noncancer

Allowable risk for new facilities

- Example: new facility with 3 emissions units
 - same screening steps for facility limit
 - in addition, limits on each new emissions unit would apply

1. New single emissions unit* (PE 14)	<ul style="list-style-type: none"> • 1 in 1 million excess cancer risk / hazard index (HI) 1
2. New single emissions unit with TBACT* (PE 14)	<ul style="list-style-type: none"> • 5 in 1 million / HI 1
3. New and existing whole facility*† (PE 14,15)	<ul style="list-style-type: none"> • 10 in 1 million / HI 1 • if >10 in 1 million / HI 1, additional community engagement and risk reduction plan required • if > 25 in 1 million / HI 3, accelerated risk reduction schedule
4. Total industrial emissions impact in an area (across one or multiple facilities)*†‡ (PE 9)	<ul style="list-style-type: none"> • could set limit between 20 and 80 in 1 million / between HI 2 and 4 <ul style="list-style-type: none"> ○ no expansion or new facilities would be allowed if they would cause impact above this limit at a receptor, or would increase impact if already above this limit • or, could handle outside CAO

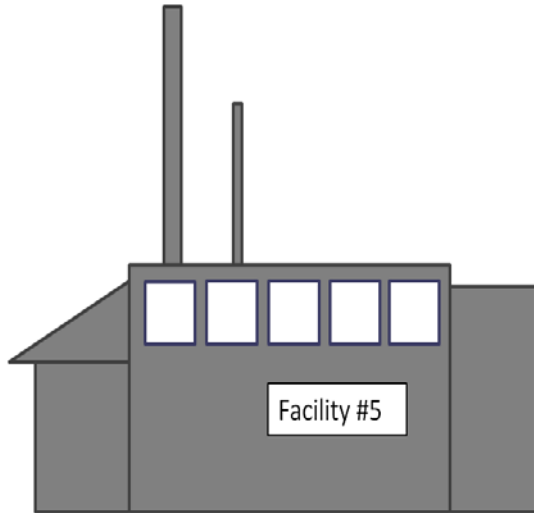
Allowable risk for new units

- Example: existing facility adds 3 new emissions units
 - same screening steps for facility limit (including proposed new units)
 - in addition, limits on each new emissions unit would apply

1. New single emissions unit* (PE 14)	<ul style="list-style-type: none"> • 1 in 1 million excess cancer risk / hazard index (HI) 1
2. New single emissions unit with TBACT* (PE 14)	<ul style="list-style-type: none"> • 5 in 1 million / HI 1
3. New and existing whole facility*† (PE 14,15)	<ul style="list-style-type: none"> • 10 in 1 million / HI 1 • if >10 in 1 million / HI 1, additional community engagement and risk reduction plan required • if > 25 in 1 million / HI 3, accelerated risk reduction schedule
4. Total industrial emissions impact in an area (across one or multiple facilities)*†‡ (PE 9)	<ul style="list-style-type: none"> • could set limit between 20 and 80 in 1 million / between HI 2 and 4 <ul style="list-style-type: none"> ○ no expansion or new facilities would be allowed if they would cause impact above this limit at a receptor, or would increase impact if already above this limit • or, could handle outside CAO

Facility #5

A bigger facility with even higher emissions:



Toxic Air Pollutant	Max Annual Emission Rate (pounds/year)	Max Daily Emission Rate (pounds/day)
Chemical A	400	2
Chemical B	400	2
Chemical C	400	2

Facility #5: analyses 1-3

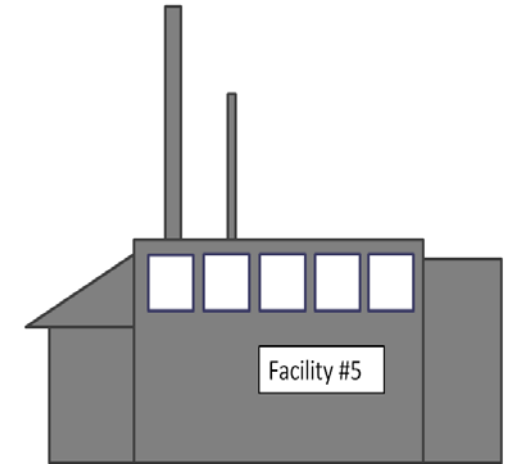
Facility #5 has higher emissions than Facility #4, so just like #4 they don't screen out at the de minimis level. At the RER and AERSCREEN modeling steps their estimated risk is higher than allowable.

Analysis 1 & 2

Risk Type	Sum of Ratios ER/RER	Allowable Risk Level	Is Below?
chronic cancer	64	10	N
chronic noncancer	3.5	1	N
acute noncancer	1.9	1	N

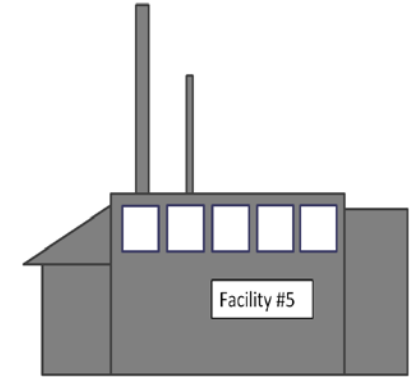
Analysis 3

Risk Type	Sum of AERSCREEN modeled concentration/RBC	Allowable Risk Limit	Is Below?
chronic cancer	48	10	N
chronic noncancer	2.7	1	N
acute noncancer	1.4	1	N



Facility #5: analysis 4

Risk Type	AERMOD modeled concentration /RBC	Allowable Risk Level	Is below?
chronic cancer	32	10	N
chronic noncancer	1.8	1	N
acute noncancer	1.0	1	Y



This facility is still above allowable risk at the analysis 4 level.

Facility could do a detailed Health Risk Assessment to get even more site specific, but let's say that after that they are still above.

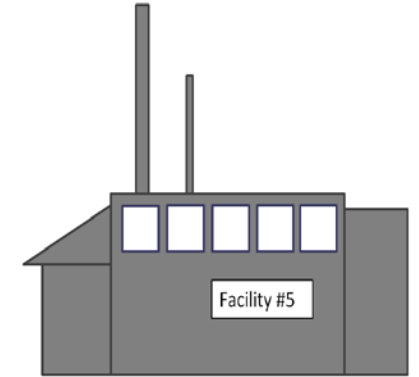
Individual facility allowable risk:

<= 10 in 1 million cancer risk

<= 1 hazard index for chronic and acute noncancer

Facility #5: analysis 5

Risk Type	Full Health Risk Assessment	Allowable Risk Level
chronic cancer	32	10
chronic noncancer	1.8	1
acute noncancer	1.0	1



If over allowable risk level after full Health Risk Assessment:

Option 1:

- Require Risk Reduction Plan
- Require Community Engagement Plan

Option 2:

- Conditional Risk Level
- Require Community Engagement Plan

Facility #5: Risk Reduction Plan

- Pollution prevention
- Product substitution
- TBACT
- Enforceable internal offsets
- Any method to get under allowable risk levels



Community Engagement Plan

Community engagement plans would do the following:

- Identify community groups and potentially sensitive populations, including nearby schools and daycare facilities, that should be routinely included in important correspondence;
- Tailor public notification and engagement efforts to ensure that potentially sensitive populations are reached;
- Establish a phone line and email address to accept complaints;
- Establish a community committee or other forum for communication between community members and the facility contact;



Community Engagement Plan

Continued:

- Provide public notification of potential health risks;
- Provide public meetings to take public input on the risk reduction plan and timelines before the plan is approved;
- Provide annual public meetings after approval of the risk reduction plan until they are in compliance; and
- Describe the results and recommendations of the public outreach efforts in annual reports to DEQ.



Conditional Risk Level - definition

If a facility:

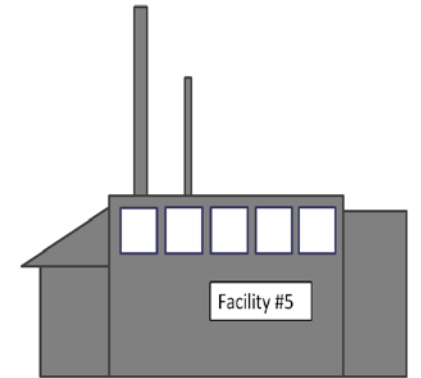
- has TBACT (or equivalent) installed on all non-exempt emissions units; and
- cannot comply with the Facility Allowable Risk Level

then facility:

- can apply for a Conditional Risk Level:
 - must review TBACT every 5 years
 - must review new technologies annually for emissions units where feasible TBACT controls do not exist

Conditional Risk Level - example

Source	Allowable Risk	Facility Cancer Risk	Risk after TBACT
Facility 5	10	32	25



- TBACT already installed on all non-exempt emissions units
- Community Engagement Plan
- 5 year review of TBACT
- Annual review of new technology for non-TBACT

Area Allowable Risk - proposed range

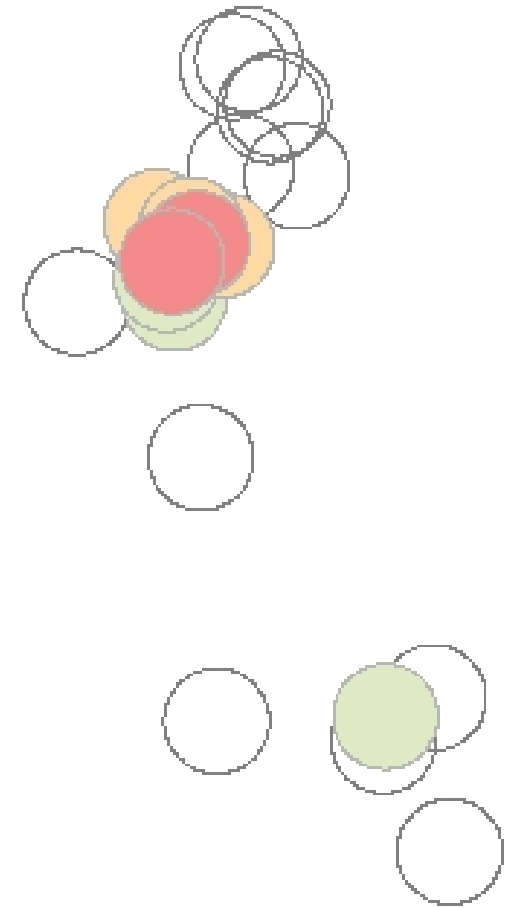
Proposed range of 20 to 80 in 1 million and HI 2-4:

- NATA statewide average risk from all emissions: 38 in 1 million
- $\sim\frac{1}{2}$ NATA statewide average risk = $40/2 = 20$
- $\sim 2 \times$ NATA statewide average risk = $2 \times 40 = 80$

Area Allowable Risk - defining areas

Steps for DEQ:

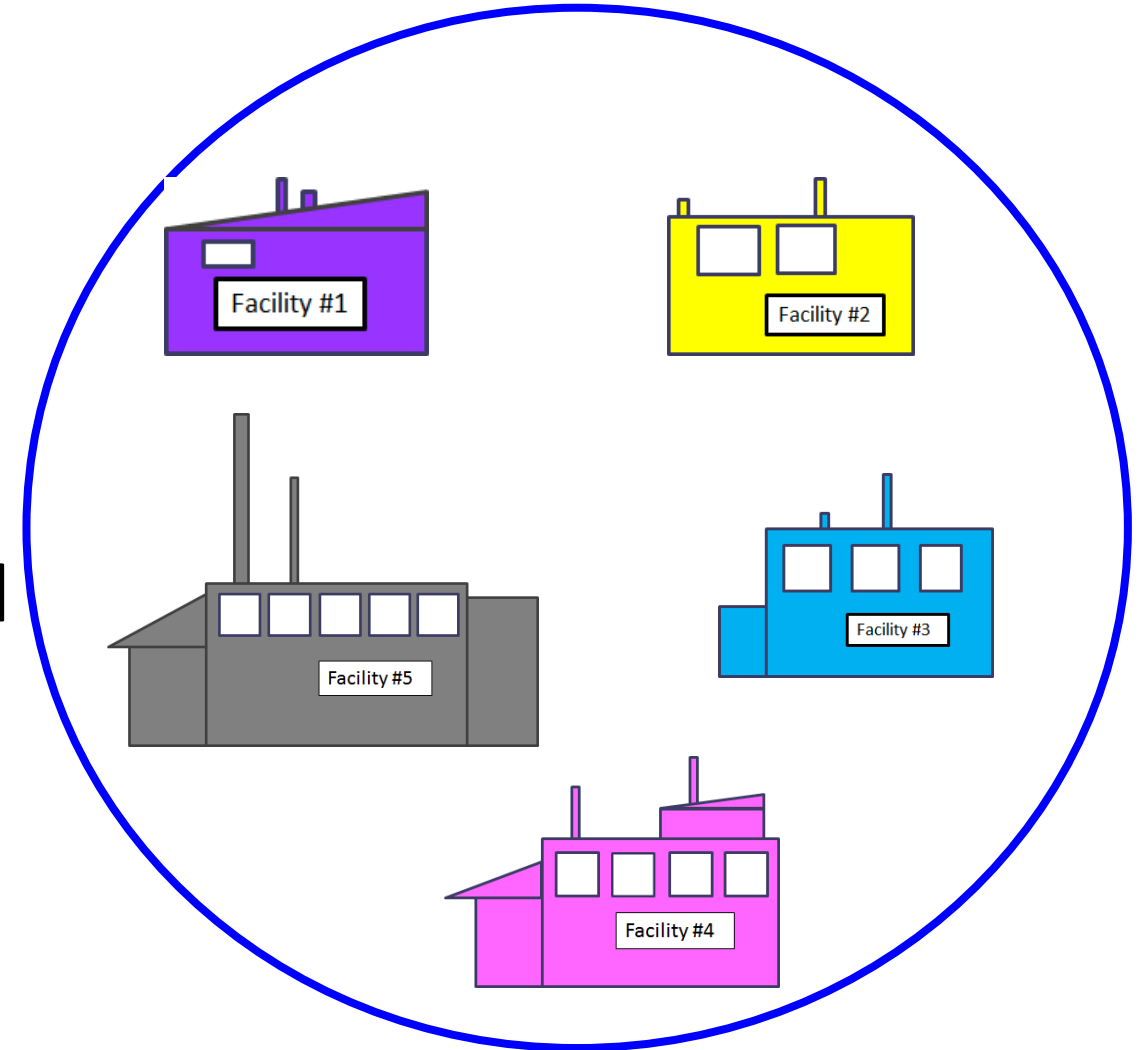
1. Define areas with multiple sources that emit Toxic Air Pollutants
2. Identify sources > de minimis risk level (permitted and unpermitted)
3. Model sources in each area using emissions, actual stack parameters and local meteorological data to estimate worst case risk impacts



Area Allowable Risk - analysis

Steps for DEQ: (continued)

4. Determine if risk in any area is $>20-80$ in 1 million or $HI > 2-4$
5. If risk below 20-80, new/modified facilities can increase impacts up to 20-80.



Area Allowable Risk - exceedance

Source	Allowable Risk Level	Actual Cancer Risk	Allowable Area Risk	Below?
Facility 1	0.5	0.45		
Facility 2	10	0.75		
Facility 3	10	9		
Facility 4	10	7.6		
Facility 5	10	32		
TOTAL		50	40	No

New Facility 6?	10	8	8	no permit issued
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Questions?