Memo

To: Technical Workgroup
From: DEQ and OHA
Date: June 13, 2016
Subject: Screening and Risk Assessment (UPDATED 7/28/16)

Introduction

The Cleaner Air Oregon rulemaking is a partnership between Oregon Health Authority and Oregon Department of Environmental Quality to develop a new regulatory system for managing air toxics emissions from industrial sources. The new rules will be based on the potential risk to human health so DEQ can carry out its mission of cleaner air and a healthier Oregon. In developing this new regulatory approach, the two agencies will begin looking at individual sources of industrial emissions across the state in relation to public health benchmarks.

DEQ and OHA have evaluated other state air toxics permitting programs and narrowed the field to six programs for further assessment: Louisville, Kentucky; New Jersey, New York, Rhode Island, South Coast Air Quality Management District (California), and Washington. Key elements of these air toxics programs will be summarized and presented to the Technical Workgroup and the resulting policy issues will be discussed at Policy Forums around the state and with the Advisory Committee. After receiving input on the different aspects of a risk-based air toxics permitting program from the Technical Workgroup, the Policy Forums, and the Advisory Committee, DEQ/OHA will draft proposed rules and all interested parties will have a chance to comment on the proposed rules during the public notice period in 2017.

DEQ and OHA will be updating this issue paper throughout the rulemaking process based on input from the Technical Workgroup, Policy Forums around the state and the Advisory Committee.

A glossary of terms can be found at this link:
https://www.oregon.gov/deq/RulesandRegulations/Advisory/8Glossary.pdf

Purpose

This issue paper addresses screening and risk assessment. How have other states approached screening sources? How are risk-based concentrations or modeling used in a screening approach?

Screening and Risk Assessment

How are risk-based concentrations and modeling used in a screening approach?

The programs included in this review developed a range of screening levels to compare to estimated pollutant concentrations and to determine requirements for modeling, risk analysis, or permit conditions. Three main approaches are used: 1) spreadsheets and tables, 2) modeling of estimated impacts, or 3) a combination of the two.

Some programs developed significant emission rates to exempt smaller sources from the requirements of a risk-based analysis. If potential emissions were greater than the significant emission rate, the programs required further analysis, often a series of steps with more involved analysis at each level. When

modeling was required, the models used progressed in degrees of refinement from screening applications such as AERSCREEN to a refined model like AERMOD. At each step, modeled concentrations are compared to state-developed significant impact levels. In this approach, the final modeled concentrations would be used in a risk analysis for cancer risk and for short-term and chronic non-cancer hazard.

The following information was gathered at the June 30, 2016 Technical Workgroup meeting:

Pros and Cons of SERs and SILs:

- Shouldn't be so conservative so that everything falls through. Needs to be conservative enough so that any sources that pose a public health risk are evaluated.
- Keeping the information up to date is critical. This will be a major factor.
- In the Washington program if only ASILs were used, there would be some pretty small criteria pollutant sources that wind up doing modeling for very small emissions.
- The goal of SERs is to screen out sources that pose low risk.
- Ensure that the SERs are clear, transparent, etc. Using risk numbers is more difficult. Recommend spreadsheets that calculate emissions.
- The SQER concept is good because it helps to streamline process and eliminates need for work that doesn't lead to a particular value. The conservative nature of how the values were derived becomes important and useful. Many facilities emit above the SER and have to go on to show concentrations less than the Acceptable Source Impact Levels. Consultants usually work with larger sources so the concept of screening out has been useful.
- Industry likes the SQERs better than a concentration in units of ug/m3. One downside that occasionally happens is that the SQERs represent one facility's emissions only. If you have many similar facilities in one area, the overlap doesn't get reflected so maybe the SQERs aren't sufficiently conservative.

Other states opted to rely on spreadsheets and tables for the initial screening steps and in some cases for the complete analysis. Although reference or look-up tables can be easy to use, they can also be very complex, such as those developed by South Coast Air Quality Management District and can require some effort to use correctly.

The following information was gathered at the June 30, 2016 Technical Workgroup meeting:

Pros/Cons of lookup tables:

- Any type of successful program needs a tiered analysis. Having the analysis screen out sources that are less risky is important. Design the spreadsheet that has the latest benchmarks and plug in different parameters. The spreadsheet can do a lot of lookups. Use the latest technology and web based tools.
- SCAQMD uses an optional web-based risk calculation spreadsheet with protected underlying assumptions and calculations for different types of sources. The online spreadsheet tool has multiple categories for different types of sources. There are simple tables for any kind of facility. Some of the tabs in the spreadsheet are tailored to spray booths, boilers, etc. The different tabs have been helpful on a screening level approach because you can't do one thing for all types of sources. The spreadsheet is changed every time the guidance is changed with major revisions every 5-10 years.

- Applicants can use lookup tables as a control method to find out what limits can be taken without going on to next tier of review and also take unnecessarily high permit limits if allowed without further review.
- South Coast's spreadsheet requires entries for all pollutants, non-cancer (by target organ) and cancer with default emission factors so it's easier.

The use of modeling for much of the analysis has advantages now that the duo of AERSCREEN and AERMOD are in common use. When coupled with significant emission rates and significant impact levels, use of the AERSCREEN-AERMOD modeling system makes the process of estimating screening concentrations more transparent than a reference to a look-up table. Also, the use of AERSCREEN at the initial level of the analysis paves the way for refined modeling using AERMOD if it is required.

The following information was gathered at the June 30, 2016 Technical Workgroup meeting:

Pros/Cons of screening/refined models:

- AERSCREEN can be run pretty easily after it's coded into a spreadsheet but AERMOD requires professional help.
- SCAQMD sources can use both AERSCREEN (Tier 3) and AERMOD (Tier 4) to do a risk assessment.
- Emissions and building/stack data are needed to run the models. Building downwash could cause an order of magnitude difference in emissions and occurs if receptor is within 10 building heights.

The table below describes program screening approaches for the six selected programs. Where possible, the use of risk based concentrations and modeling in their approach is identified in the program description.

Program	Program Description
Louisville, Kentucky	For new, modified, and existing sources, a four tier set of screening steps ranging from simple to complex, is used. All results from the four tiers are compared to Benchmark Ambient Concentrations. • Tier 1: Emissions from a process or equipment are divided by a factor from Table 1: Simple Factor for Determining Maximum Ambient Concentration for each of four averaging times to derive a concentration. • Tier 2: The annual factor from Tier 1 is adjusted with another factor from a table that incorporates the distance to property line, stack height, and height of influential buildings to give the maximum ambient concentration. • Tier 3: The maximum concentration is estimated using a screening model, such as SCREEN3 and Toxics Screening Model (TSCREEN), now replaced with AERSCREEN. • Tier 4: Uses the refined model AERMOD.

Program	Program Description
New Jersey	For new and modified sources, a two level process is defined for individual equipment. • Step 1: Uses an Excel spreadsheet that requires stack information, annual and hourly emission rates, and stack distance to property line. The spreadsheet calculates concentrations and incremental cancer risk and non-carcinogenic impacts. The Level 1 assessment can be performed by the New Jersey Department of Environmental Protection or the applicant. If a source fails the first-level risk screening by exceeding the cancer risk guidelines for new and modified sources, a second-level risk screening will be conducted. • Step 2: Uses AERMOD as the dispersion model to do a refined analysis to more accurately estimate ambient air concentrations by using stack and source specific data and representative meteorological data. If the second-level risk screening analysis predicts air concentrations where risk falls into the "negligible" category, no further risk assessment or modification is needed. If the risk predicted by a second-level risk screening for a specific source is still not "negligible," the New Jersey Department of Air Quality Risk Management Committee may recommend that the applicant apply better air pollution controls or change stack characteristics for better dispersion before the permit is approved. The applicant can also submit a risk minimization strategy. The Level 2 analysis can be performed by New Jersey Department of Environmental Protection or the applicant. Facilities required to conduct a facility wide risk assessment must develop a protocol which is submitted for review and approval.
New York	New York Department of Environmental Conservation established an Environmental Rating system that classifies air contaminants (A-D) according to the severity of their adverse impact on the environment, with A being worst. In addition, New York established two other tables: a table of High Toxicity Air Contaminants with corresponding Mass Emission Limits, and a Degree of Air Cleaning Required that determines the percent of emissions reductions based on the Environmental Rating and emissions levels. • Step 1: For process emissions less than the High Toxicity Air Contaminant Mass Emission Limits, no further analysis is required. The source can take an enforceable permit limit to meet this emissions requirement. If not, further analysis is necessary. • Step 2: DEC will assign an Environmental Rating to the toxic contaminant from the process emission source based on the following: o Toxicity, other properties and the emission rate potential of the air contaminant; o Location of the source with respect to residences or other sensitive environmental receptors; o Emission dispersion characteristics at or near the source; and

Program	Program Description
	○ The projected maximum cumulative impact of taking into account emissions from all sources in the facility under review and the pre-existing ambient concentration of the air contaminant under review. • Step 3: If an Environmental Rating of A is assigned and the uncontrolled emissions are less than 0.1 pound/hour, or if an Environmental Rating of B or C is assigned and emissions are less than 10 pounds/hour, a dispersion model (AERSCREEN, AERMOD) is used to estimate maximum offsite concentrations. These should be less than the Annual Guideline Concentrations and Short-term Guideline Concentrations. • Step 4: If an Environmental Rating of A is assigned and emissions are equal to or greater than 0.1 pounds/hour, or if and Environmental Rating of B or C is assigned and emissions are equal to or greater than 10 pounds/hour, then the level of control is determined by a Degree of Air Cleaning table.
Rhode Island	Rhode Island Department of Environmental Management established a significant emission rate, Minimum Quantities, and Acceptable Ambient Levels. DEM requires the use of California Air Resources Board's Risk Assessment Standalone Tool to determine risk. Modeling receptors are located in residential and other sensitive areas where people gather or work. The analysis steps are: • Step 1: Sources with emissions less than the Minimum Quantities are exempt from further analysis. Facilities which emit the listed substances in quantities at or above the MQ levels are subject to the Air Toxics Operating Permit requirements in the regulation unless specifically exempted. • Step 2: AERSCREEN is used as the screening model. If model concentrations for short-term and annual emissions are equal to or less than the Acceptable Ambient Levels, the cancer risk does not exceed 100 in one million, and the chronic and acute Hazard Index does not exceed 1, then the project is approved, otherwise Step 3. • Step 3: AERMOD is used as the refined model. If the concentration and risk criteria described in Step 2 are met, then the project is approved.
South Coast Air Quality Management District (CA)	A four-tier set of screening steps are used, ranging from screening emissions level to a detailed risk assessment. • Tier 1: Uses a look up table by Toxic Air Contaminant for hourly and annual emissions from new/modified equipment for distances of 25, 50, and 100 meters to the nearest receptor locations (residential, worker, sensitive receptor). The Tier 1 screening emissions are based on one in one million additional cancer risk. • Tier 2: Is a screening risk assessment that incorporates look up tables for calculating dispersion factors (x/Q). The variables used in the tables include hourly and annual emissions, stack height, building dimensions, operating schedule, geographic location (meteorology), and distance to receptors. For chronic/carcinogenic

Program	Program Description
	Toxic Air Contaminants, distance is to residential and sensitive receptors; for acute Toxic Air Contaminants distance is to fenceline. A risk assessment using the estimated concentrations from the tables is made with data from additional tables that include adjustments for cancer potency, and exposure variables. • Tier 3: Uses the AERSCREEN model together with modified risk estimation equations used in Tier 2. • Tier 4: Requires a detailed risk assessment be performed using the California Air Resources Board Hotspots Analysis Reporting Program model that incorporates AERMOD, which requires actual meteorological data and modeled concentrations.
Washington	Washington Ecology established Acceptable Source Impact Levels as ambient benchmark concentrations for Toxic Air Pollutants, de minimus emission thresholds, and Small Quantity Emission Rates as screening emission rates. New and modified emission units are subject to the program. If potential emissions exceed the de minimis emission levels, then a Tier 1 review is required. Receptors are placed at the fenceline and beyond. Ecology uses a structured tier review: • Tier 1 review: o Step 1: Compares increase in Toxic Air Pollutant emissions after T-BACT is installed with the Small Quantity Emission Rate thresholds. If emissions are greater than the thresholds, then next step is required. o Step 2: Uses AERSCREEN as a screening model and compares concentrations to the Acceptable Source Impact Level. If concentrations are greater than the Acceptable Source Impact Levels, then next step is required. o Step 3: Uses AERMOD or other refined model. The analysis can account for Toxic Air Pollutant emissions reductions from another emission unit at the same facility being analyzed. If concentrations greater than Acceptable Source Impact Levels, then Tier 2 is required. • Tier 2 review considers the model results from Tier 1 and requires: o A health impact assessment, o The inclusion of background concentrations from National Air Toxics Assessment or monitored values and modeled emissions from other sources within 1.5 kilometers, o Emission reductions of the Toxic Air Pollutant from other existing sources. Ecology may also consider a risk level of 10 in one million in its determination. o Ecology may recommend approval of a project that is likely to cause an exceedance of acceptable source impact levels for one or more Toxic Air Pollutants only if it determines that the emission controls for the new and modified emission units represent T-BACT and the applicant demonstrates that the increase in emissions of Toxic Air Pollutants is not likely to result in an increased cancer risk of more than one in one hundred thousand and ecology determines that the non-

Program	Program Description
	cancer hazard is found to be acceptable. If Tier 2 review thresholds are exceeded, then Tier 3 review is required. • Tier 3 review includes a risk management analysis and considers other offsetting benefits that provide greater environmental benefit than the adverse impacts from the new project. The offsetting benefits could include reductions in Toxic Air Pollutants other than from the project.

The following information was gathered at the June 30, 2016 Technical Workgroup meeting:

Pros and Cons of tiered screening steps:

- SCAQMD uses screening steps and multiple tiers (four) with increasing levels of refinement. The vast majority of sources don't get to Tier 4. The online spreadsheet tool has multiple categories for different types of sources. There are simple tables for any kind of facility. Some of the tabs in the spreadsheet are tailored to spray booths, boilers, etc. The different tabs have been helpful on a screening level approach because you can't do one thing for all types of sources.
- Two factors should be kept in mind. Tier 1 vs Tier 3 and acute/chronic vs carcinogenic. DEQ and OHA should develop system that is simple to use and workable but takes in to account gradations with different kinds of compounds with exposures and with levels of emissions at different tiers. One size doesn't fit all and the analysis gets complicated quickly.
- Because of Washington's tiered process, the first tier is meant to be relatively conservative and look at fenceline as ambient air. The second tier is more realistic on where people are exposed. Land use issues come up because some areas aren't developed yet but could be in the future. If the area is zoned residential, one must assume someone is living there now for risk assessment.

What do we need to consider for types and location of modeling receptors? What have other states done?

Other state and local agencies use air toxics emission modeling to determine the impact of air emissions at a distance from the facility emitting the pollutants. Where programs look at impacts varies. Some use the property boundary of the facility (fenceline). Others use the nearest residential or sensitive population. Modelers call the location where they are looking for impacts a "receptor."

Program	Program Description
Louisville, Kentucky	Ambient Air (Environmental Acceptability Goals are adjusted for roadways and industrial properties)
New Jersey	Fenceline (or location of highest impact not on the facility's property), nearest sensitive receptor
New York	Residential and sensitive receptor
Rhode Island	Residential and sensitive receptor

Program	Program Description
South Coast Air Quality Management District (CA)	Nearest long-term human exposure (aka "residential and sensitive")
Washington	Fenceline or highest off-site impact for Tier 1, use of receptor-specific exposure factors for Tier 2

What are the advantages and disadvantages of these approaches?

Note: *this is each state's/local's evaluation of their own program.*

Both fenceline and residential/sensitive receptors are used by the programs in this review. There may be advantages to both. Criteria pollutant modeling considers ambient air to begin at the fenceline. If the source undertaking a toxics analysis has already conducted criteria pollutant modeling, the receptor grid starting at the fenceline is already established. However, use of residential and sensitive receptors reinforces the concept of human exposure and risk, especially for carcinogenic and chronic risk.

The following information was gathered at the June 30, 2016 Technical Workgroup meeting:

Pros/Cons of fenceline or residential/sensitive receptors:

- You can find homes on National Air Toxics Assessment (NATA) maps for chronic impacts, where people live for up to 70 years. They use residential receptors for chronic impacts and offsite/fenceline receptors for acute impacts. At community meetings, people requested that office buildings be considered nearby receptors.
- SCAQMD looks at commercial buildings and sensitive receptors. Children are not found at commercial receptors so the exposure scenario is different. There are odd cases where policy decisions have to be made like what do you do with a permitted source at college campus? They don't usually do onsite receptors but are college students receptors? Some work in other areas consider anywhere on campus as a sensitive receptor at ground level. These days there are so many sensitive receptors; people with chronic diseases. Anybody could be sensitive receptors. DEQ and OHA should use both fenceline, residential commercial, and commercial receptors when modeling risk.

The following information was gathered at the July 27, 2016 Technical Workgroup meeting:

Pros and Cons of developing Significant Emission Rates/Screening Steps

- Washington has 1-hour and 24-hour emissions rates in addition to annual. Small Quantity Emission Rates have been useful in screening those projects most likely to not cause problems. When required to do a more refined analysis, the refined analysis usually produces a lower concentration than if you looked at ratio of emission rate proposed divided by SQER. The SQER is pretty conservative compared to the actual scenario.
- The initial WA screening analysis uses the Small Quantity Emission rates. These rates are based on the Screen3 uses a 1-hour concentrations, and EPA factors that convert the 1-hour to 24-hour and annual concentrations. From experience, larger sources cannot get out of doing the analysis because the SQERs are pretty conservative. When you get to that point for larger sources, there is

an incentive to reduce emissions so sources don't have to do a full risk assessment to meet an ASIL.WA SQERs don't screen out very many sources (just very small ones) but ASILs are reasonable.

- Sometimes for very complex facilities, with large numbers of emission points, SQERs are helpful to do a quick analysis. One recent company had 150 compounds and all of them are below SQER. Very simple sources can screen out of risk analysis along with some complex ones.
- At some facilities, individual pollutants may be just under the SQER but when the contribution from many release points are added up, the total is over the SQERs. EPA has a tool called T-REX that has health benchmarks built in, and you can set a threshold value. You could use this spreadsheet to add up all pollutants to see if they are below a combined threshold. There was a recommendation to take advantage of technology, like spreadsheets, rather than to use static lookup tables.
- A screening model as a first step is a wise approach. You can get very different levels depending on assumptions.

Pros and Cons to modifying results to account for background and locations of receptors

- Take advantage of spreadsheets to account for the locations of receptors and background. However, background could be built into the generalized criteria for all sources and locations.
- A tool that is simple enough to apply in all cases will be difficult. It depends on how conservative the first step is and whether you need to add background.
- What role does background play in the regulatory scheme? If it is included, then you need to always estimate background, which can be difficult to obtain with very sparse monitoring data. Some annual average concentrations could be used to scale emission rates that are based on 8 hours/day and 5 days/week. If it's a one-hour concentration, then you wouldn't scale.
- The downside to models and tools is they become outdated. What happens when the EJ tool changes? What if sensitive receptors change? Like a new hospital? Models give good information but how do you move them forward in time? It becomes an implementation issue. If you know what is going to happen in future, you can account for that but may need to rerun model in future to account for changes.
- Some states use annual average SERs for the initial screening level analysis.
- It's more common to have different averaging times for carcinogenic versus acute, long and short-term respectively. Just an annual SER is too simple.
- From the non-cancer perspective, when you compare chronic to acute values, that ratio varies and depends on the pollutant. It's difficult to take an annual number and compare it to a one-hour number.
- Having multiple averaging periods for SERs is good and hasn't posed a problem in Washington. It's not that cumbersome to look at multiple averaging times.
- For a quick and dirty check, an annual averaging period is good. There might be some value to look at different averaging periods.
- How often do you run into situations where a facility fails chronic but not acute and vice versa? It depends on the pollutant and the source of data. EPA has derived 8-hour and acute for acrolein. It can happen in both situations.

- When looking at acute numbers, EPA uses California's RELs. For shorter time periods, the exposure is different. For chronic exposures, you look at households where people live. The exposure scenario is different.
- The way the Washington rule is structured, the de minimis is the SQER /20. There is no rhyme or reason for this calculation, they just wanted a very low level. If you are emitting pollutants below the de minimis levels, then you don't have to do anything else.
- WA needs de minimis levels or else there would be lots of permit applications. You need a threshold to define what is too small. SWCAA must make de minimis threshold determination, not the source.
- De minimis is tied to T-BACT in WA. If your emissions are greater than De Minimis, then T-BACT is required even if your emissions are less than the SQER. You need to determine what Oregon will do.

Pros and cons of using exposure concentrations versus ambient concentrations

- In NATA, they calculate exposure concentrations based on census tracts. Exposure to ambient air is different for people that stay in their homes as to people who spend most time outside. Exposure concentrations and risk are lower than modeled ambient concentrations and risk. Using exposure concentrations made the analysis less conservative. Don't include exposure and keep the analysis conservative.
- Homeless people who live largely outside have 24 hour exposure. People who leave windows open 24 hours/day also have higher exposure to ambient air. You can't count on people being in buildings during the day.
- When the SER used, it assumes continuous exposure, wherever it occurs. In the second step of the analysis, concentration and risk can be adjusted based on exposure frequency and duration. Risk assessment guidance from EPA and CA can be used to derive exposure scenarios and exposure frequency.
- Taking exposure into account for more refined analyses can be appropriate, as for example as addressed in CA and WA.
- Does the use of SERs and other screening tools assure that the risk based benchmarks and public health are protected while not placing an undue burden on permitted sources? The progression of steps is the right framework to ensure this.
- You need a balance between staff and how many permits you can handle. You want a tool to keep the workload appropriate and yet protect public health. You can't tell industry that it will take 6 years to get a permit. To check the balance, take sources from the existing inventory and test the proposed system of screening tools to see how many source fall through and pass the test, and how many fail and have to do refined analysis.
- If you have a whole new set of permittees of sources that are similar, it makes sense to come up with a general order or permit to implement consistent types of controls across these sources.

High quality data from permittee?

- Under the permitting scheme, when a facility is being built, the engineer must use professional judgment and discretion to see if emissions estimates make sense. If a facility proposes emission factors that are in the middle of the range of published EFs, then a source test might be required.

If the source proposes an EF that is conservative, then the permitting authority may elect to not require a source test. Also, if a source is willing to take an emission limit, then a source test may not be necessary. You need a quality assurance (QA) step in this process to verify emissions comprehensively.

- For the National Emissions Inventory (NEI), a compendium of all state toxics inventories, you can do a check by industry type or SIC or SCC codes to compare emissions. You can see outliers. To estimate emissions for the risk screening analysis, use emission factors and production data, material balance data, source test results, engineering judgment, and informed guesses when other information is not available. You can compare Oregon's emissions inventory to other states.
- The more unusual the source, the more unreliable the emission factors will be. Surrogates may not be accurate. Chamber testing may be worthwhile method to estimate emissions. Initial cost may be expensive, but cheaper than stack test.
- SCAQMD found that when looking at all tools in the kit, source testing is very critical component. Not all source tests are equal. A source test for PM doesn't get at air toxics. For fugitive emissions, you can never get emission factors or source test results, so monitoring can be a very important way to estimate emissions. For EPA NEI, emissions are all self-reported in CA. South Coast does some auditing but there are too many to do all facilities. You can spot check for outliers. Monitors can find unexpected information. Use the same agency approach for consistency across sources.
- Don't confuse precision and accuracy in emissions inventories. Something can be repeatable but may still not be accurate. That's why we build conservatism into models.
- Continuous Emissions Monitors would be great but are very expensive. Source test data is next on the hierarchy but only one source test isn't enough, especially under variable conditions. Is the test repeatable? Use industry-wide emission factors. AP-42 provides conservative EFs.
- South Coast uses AP-42 too but there is CAT Emission Factors database on CARB's website with source test information for a whole variety of sources. There are also default toxic emission factors.
- Include ambient monitoring as another tool to develop emissions inventory.

TECHNICAL WORKGROUP QUESTION: Are there other technical issues which would inform the advantages and disadvantages of this issue?

The following are policy questions related to screening and risk assessment.

Do DEQ and OHA have the technical information assembled in this issue paper to inform these policy choices? Are there unique aspects of air toxics permitting programs not described in this paper that DEQ and OHA should consider? Is there technical information or considerations missing from this issue paper?

- How should sources be screened out of the program?
- Should the screening process be based on emission rates or acceptable ambient concentrations using screening modeling?
- What types of modeling or lookup tables should DEQ use?

- Where should DEQ model for impacts from air toxics? At the fenceline of a permitted facility? At the nearest residence? Where a sensitive population lives, works, or plays?