Internal Management Directive

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TECHNICAL ANALYSIS TOOLS AND GUIDANCE FOR IMPLEMENTATION OF THE OREGON AIR TOXICS PROGRAM		AQ.00.013	
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Intent / Purpose / Statement of Need:

This Internal Management Directive describes the technical tools DEQ will use in implementing the Oregon Air Toxics Program, including guidance on

- Determining and Using Background Air Toxics Concentrations
- Calculating Annual Average Concentrations of Air Toxics
- Monitoring Ambient Air Toxics
- Using Toxicity Equivalency Factors
- Assessing Exposure to Air Toxics.

Authority:

OAR 340-246-0010 through 0230

Applicability:

1) This Directive applies to communities and sources of air toxics emissions throughout Oregon.
2) This Directive is intended solely as guidance for Department staff.
3) This Directive does not create any rights, duties, obligations, or defenses, implied or otherwise, in any third parties. It is not intended for use in pleading, at hearing, or at trial.
4) This Directive does not constitute rulemaking by the Environmental Quality Commission and may not be relied upon to create a right or benefit, substantive or procedural, enforceable by law or in equity, by any person.

Definitions:

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Policy:

BACKGROUND ON THE OREGON AIR TOXICS PROGRAM

The objective of Oregon's Air Toxics Program is to protect public health and the environment. To accomplish this task, the Oregon Environmental Quality Commission (EQC) adopted rules in October 2003 that established the Oregon Air Toxics Program. In August 2006, working with the Air Toxics Science Advisory Committee, DEQ determined Ambient Benchmark Concentrations (ABCs) for fifty-one air toxics based on levels protective of human health that consider sensitive populations. The ABCs represent concentrations in air that people can be exposed to over a lifetime without increasing their cancer risk by more than one in a million, or experiencing other harmful health effects. The Department must use these ABCs as planning goals, providing a means to identify and prioritize places in Oregon where public health is endangered.

The Oregon Air Toxics Program uses three complementary approaches to reduce the release of toxics air pollutants: geographic, source category and safety net. The geographic approach relies on affected stakeholders and community members, working with DEQ, to identify toxic air contaminants of concern in a specific geographic area, determine their sources, and develop strategies that will reduce people's exposure to those chemicals. The source category approach addresses reductions for categories of pollutants statewide. The safety net approach is for rare industrial "hot spot" problems where a particular facility may not be adequately addressed by federal air toxics regulations or a geographic approach, and emissions cause elevated risk to people nearby.

GUIDANCE FOR DETERMINING AND USING BACKGROUND AIR TOXICS CONCENTRATIONS

1. Background on Background Concentrations

In order to address policy questions about the contribution of local air toxic sources and the opportunities for local action it is critical to understand background concentrations. The maximum potential reductions in air toxics concentrations in both urban and rural areas are limited by the background concentrations transported into the area. This guidance explains how background concentrations are to be determined and used. The principles described are to be used in making comparisons between reported air toxics concentrations in ambient air and the ABCs found in OAR 340-246-0090(3). Although the discussion focuses on monitored data the same principles should be applied to modeled data.

Geographic Area emissions reduction planning must consider the contribution of regional, or even remote, sources to local air pollution conditions. Safety Net determinations also require knowledge about upwind source contributions. In both cases it must be clear what is considered to be background ambient concentrations for any air toxics concentrations that approach or are higher than the ABCs.

2. Definitions

Remote Background is the annual mean concentration of a compound measured at a surface site that is not impacted by local or regional emissions sources.
Regional Background is the annual mean concentration of a compound measured at a surface site that is not impacted by local emissions sources and is representative of the region or airshed.
Operational Background is the annual mean concentration of a compound measured at a surface site that is representative of the area in the predominant upwind direction from the area being assessed.

3. Geographic Area analysis (OAR 340-246-0130 through 0170)
The preferred background concentration to be used in geographic area analyses is the ***monitored regional*** background. In cases where monitored data are not available the second choice is modeled ambient concentration data available from the latest U.S. Environmental Protection Agency National-scale Air Toxics Assessment. Modeled background in that analysis includes transport from sources located between 50 and 300 km from the area as well as global background. If neither of these data sources is available then remote background may be used. Currently available remote background concentrations are provided in Table 1. These should be verified at the time of analysis. If no background data are available at all a value of zero may be used on a case-by-case basis.

4. Safety Net analysis (OAR 340-246-0190 through 0230)
The preferred background concentration to be used in safety net analyses is the ***monitored operational*** background. This should be determined by monitoring at the same time that downwind monitoring is done. In cases where these data are not available monitored regional background data may be used. If no monitored regional data are available then remote background data (Table 1) may be used. If no monitored background data are available at all then modeling may be considered on a case-by-case basis. In general it is difficult to determine all of the sources (especially area and mobile) near a potential safety net source that may be contributing to the background concentration. The latest U.S. Environmental Protection Agency National-scale Air Toxics Assessment ambient concentration results account for these sources and are preferred for establishing background concentrations.

5. Use of Background Monitoring Results
Background monitoring results should **not** be subtracted from assessment area monitoring results. Instead, a comparison of the contemporaneous concentrations can provide a better sense of the potential influence of the background concentrations on the assessment area.

6. Global or Remote Background Concentrations
Remote background concentrations of some air toxics, especially chlorinated compounds no longer in production, have been shown to change over time. If an analyst relies on a remote background concentration the most recent data available should be used and the reference for the value selected must be documented.

Table 1

Pollutant	Remote Concentration (micrograms per cubic meter)
Acetaldehyde	0.16
Acrolein	< 0. 02
Arsenic ($PM_{2.5}$)	$< 1.3 \times 10^{-4}$
Benzene	0.142
Beryllium compounds	$< 4.1 \times 10^{-5}$
1,3-Butadiene	< 0.02
Cadmium compounds	$< 4.1 \times 10^{-5}$
Carbon tetrachloride	0.63
Chloroform	0.046
Chromium ($PM_{2.5}$)	$< 4.1 \times 10^{-5}$
Formaldehyde	0.20

Lead ($PM_{2.5}$)	4.9×10^{-4}
Manganese ($PM_{2.5}$)	5.8×10^{-4}
Methylene chloride	0.086
Nickel ($PM_{2.5}$)	6.5×10^{-5}
Propylene dichloride	< 0.02
Tetrachloroethylene	0.022
Trichloroethylene	< 0.02
Vinyl chloride	< 0.02

Reference: "Background Concentrations of 18 Air Toxics for North America", McCarthy, Hafner, and Montzka, JAWMA, Vol. 56, pp.3-11 (January 2006)

GUIDANCE FOR CALCULATING ANNUAL AVERAGE CONCENTRATIONS OF AIR TOXICS

1. Background on Calculating Annual Average Concentrations

This guidance explains the data handling conventions and computations necessary for determining the annual average ambient concentration of a toxic air pollutant. The procedures described are to be used in making comparisons between reported air toxics concentrations in ambient air and the ABCs found in OAR 340-246-0090.

The Department uses the ABCs as planning goals, providing a means to identify and prioritize places in Oregon where public health is endangered. Since the ABCs are intended to protect people from chronic long-term exposure to air toxics, they are equivalent to annual average values. Measurements, or model predictions, of air toxics concentrations must therefore also be annual averages for comparison purposes.

This guidance focuses on monitored data because the Oregon Air Toxics Program rules require monitored values to be used to identify geographic areas and safety net sources. However, the same calculation procedures should be applied to modeled data that may be used in certain tiers of analysis (See Guidance on Tiered Analysis).

2. Definitions

Average and Mean refer to the arithmetic mean.
Daily Value means a 24-hour average concentration calculated or measured from midnight to midnight (local standard time).
Quarter refers to the calendar quarters, three month periods beginning with January.
Year can be any consecutive 12 month period.

3. Annual Average Calculation

Air toxics samples are generally collected on a one in six day schedule (corresponding to the US EPA schedule for particulate matter measurements). Alternative sampling schedules may be accepted if justified in the Quality Assurance Project Plan (See References below). Since these are usually integrated 24-hour samples analysis will yield a daily average value. Some air toxics measurements may be made, or reported, as hourly values. In such cases at least 18 hours of valid data are needed to yield a daily value. Calculations are done for each pollutant measured at each monitoring location (or model receptor or grid area).

3.1. Summary of Calculation

To calculate the annual average the steps are:
(a) Average the daily values to obtain the quarterly mean at each monitor.
(b) Average the quarterly means to obtain the annual mean at each monitor.

3.2. Determining the Completeness of a Year

A year meets data completeness requirements when at least three of the quarters are complete. A complete quarter should have valid data on 75 percent of the scheduled sampling days in the quarter. When computing annual means, quarters with at least 11 samples but less than 75 percent data completeness can be included in the computation if the resulting annual mean concentration (rounded according to the conventions below) is greater than the level of the ABC. To compute an annual mean when completeness is less than 75 percent, the median of the measured daily values should be substituted for any missing days and the calculation of a quarterly mean proceeds.

3.3. Incomplete Data Sets

Situations may arise in which there are compelling reasons to sample for less than a year, or retain years containing quarters which do not meet the data completeness requirement of 75% or the minimum of 11 samples. A pre-approved Quality Assurance Project Plan should contain justification for an abbreviated sampling frequency.

3.4. Minimum Detection Limits (MDL)

Ambient air concentrations of many air toxics can be very low, oftentimes at or below the minimum detection limit of the analytical method being used. Valid samples may have concentration values reported as less than the MDL. This is still valuable information as it may indicate that ambient concentrations are below the ABC. In order to retain this information:

a. If some samples have concentrations greater than the MDL then all values reported as <MDL should be converted to concentration values one-half of the MDL. These adjusted values are then included in the calculation as valid sample concentrations and an annual average can be reported. If the resulting annual average concentration is below the MDL it should be reported as <MDL.

b. If there are no sample values greater than the MDL no conversion is made and the annual average should be reported as <MDL.

c. If dioxins/furans, PCB, or polycyclic aromatic hydrocarbons (PAH) are the air toxics being considered consult the Toxicity Equivalency Factor Guidance.

3.5. Rounding Conventions

For the purposes of comparing calculated values to the ABC it is necessary to round the final results of the calculations. The annual mean shall be rounded to the appropriate number of significant figures (if the next digit is 5 or greater the value is rounded up, if it is lower it is rounded down).

4. Equations

The following equations are to be used with monitoring data only. An annual mean value is determined by first averaging the daily values in a calendar quarter using Equation 1.

<u>Equation 1</u>

$$QA_1 = (DV_1 + DV_2 + \dots + DV_n) / n$$

where **QA** is the quarterly average
$\mathbf{DV_n}$ is the daily value on the n^{th} day
n is the number of valid daily values.

The annual average is determined by averaging the valid quarterly averages using Equation 2.

<u>Equation 2</u>

$$AAC = (QA_1 + QA_2 + QA_3 + QA_4) / 4$$

where **AAC** is the annual average concentration
$\mathbf{QA_{1\text{-}4}}$ are the valid quarterly averages

5. Measurement Considerations

5.1. Requirement for Quality Assurance Plan

According to Section 2.4.2 of the Department's Quality Assurance Management Plan (DEQ03-LAB-0006-QMP) all data used by DEQ must be obtained in conformance with a Quality Assurance Project Plan. When data collection is planned by an outside group this Project Plan should be reviewed by the Department and approved prior to beginning the data gathering process.

5.2. Siting Monitors

Sample collection or monitoring systems must be sited according to US EPA guidelines for either gaseous or particulate pollutants with respect to obstructions, inlet location, and other factors to achieve representative samples (See References below).

5.3. Sample Analysis

Analyses of samples must follow US EPA approved methods when such methods exist (See References below) unless alternative methods are pre-approved by the Department.

MONITORING AMBIENT AIR TOXICS

1. Background on Monitoring Air Toxics

Both the Geographic and Safety Net regulations in Oregon's Air Toxics Program require an ambient monitoring step to provide certainty that estimated concentrations are representative of real world circumstances. It is critical that ambient air toxics concentrations are measured with sufficient data quality to meet the objectives of the Program approach being used. This guidance details the steps the Department will take to assure that ambient measurements can be appropriately compared to the ABCs.

2. Quality Assurance Plan

The Department has a long-standing policy, described in the Quality Assurance Management Plan, of only accepting data for decision making that has been collected according to an approved Quality Assurance Project Plan (QAPP). Regardless of whether ambient air measurements are to be made by the Department or any other entity, the Air Quality Division in consultation with the Laboratory Division should approve an air toxics monitoring QAPP prior to the start of measurements. In some cases historical data may be acceptable as long as it can be demonstrated that the data was gathered according to some plan that contained acceptable requisite elements of a Quality Assurance Project Plan, and the data are screened using modern QA/QC procedures.

This guidance only provides an overview of the elements of such a QAPP. Details for constructing a project-specific Plan can be found in the U.S. EPA Air Toxics Risk Assessment Reference Library, Volume 1. The Department's air toxics monitoring QAPP, available from the Laboratory Division, can provide an example to anyone interested in developing one for their own project.

3. Measurements Allowing Calculation of Annual Averages

It is important to remember that ambient air monitoring is being done to provide air toxics concentration data that will ultimately be used in assessing the health risk to people in an urban area, a neighborhood, or in close proximity to a specific source of air pollution. The monitoring program's sampling and analysis approach must provide meaningful input to that process. In order to compare measured concentrations to the ABCs, the measurements must allow calculation of an annual average. See the Guidance for Annual Averages (Section VI) for an explanation of what is required to obtain valid annual average concentrations.

4. Scoping and Planning Air Toxics Monitoring

Because sampling and analysis are relatively expensive and time consuming, a carefully thought out and well-designed monitoring program will ensure the efficient use of resources. As a simple example, the monitoring program designed for a geographic area analysis will be much different than one designed for a safety net source analysis. The EPA Guidance provides a number of other examples and important issues to consider when developing a monitoring plan.

Monitoring programs must not only give concentration data but must also provide associated data uncertainties. A key aspect, then, of the QAPP will be to specify data quality objectives appropriate for the eventual risk assessment. EPA has identified four questions that the QAPP should answer:

1. What risk management decision is to be made and how will the monitoring data be used to make it?
2. How sensitive, complete, accurate, and precise must the results be to be useful?

3. What sampling and analysis methods are available to meet that level of data quality?
4. What resources (time, money) are available to meet the data quality objectives?

Scoping and planning the monitoring program is the hard part. Once that has been done a complete QAPP will have the following elements:

- Project Plan Identification and Approvals
- Plan distribution
- Project Organization, including a Project Description, Data Quality Objectives, and Roles and Responsibilities
- Sampling rationale and design, methods, and locations
- Analytical methods
- Instruments and Equipment
- Calibration methods and Standards
- Data Management
- Quality Control in Sampling, Analysis, and Data handling
- Assessments and Response Measures
- Reporting
- References

5. Air Toxics Monitoring Locations

Determining monitoring locations, and providing a rationale, is an especially important aspect of developing a monitoring QAPP. Obviously, sampling locations will greatly determine the ambient concentrations measured, but perhaps more importantly, they will significantly impact the perception by the public of the adequacy of the whole monitoring effort. EPA has a number of guidance documents that will help to identify good monitoring locations.

Since background pollutant concentrations will be considered when comparing measured values to the ABCs, an upwind or background monitoring site is desirable. However, the Background Concentration guidance describes how background can be determined if monitoring is not possible.

In general, ambient air monitoring data collected by the Department is entered into the EPA Air Quality Data System (AQS) for archiving. With appropriate metadata attached, these measurement data can be used by the Department or other researchers studying air pollution issues across the country.

GUIDANCE FOR USING TOXICITY EQUIVALENCY FACTORS IN THE AIR TOXICS PROGRAM

1. Background on Toxicity Equivalency Factors

This guidance describes the use of toxic equivalency factors (TEFs) in the air toxics program. The concept of TEFs was introduced to facilitate risk assessment and regulatory control of persistent environmental compounds that exist in environmental samples as complex mixtures, such as polychlorinated dibenzo-*p*-dioxins (PCDDs), dibenzofurans (PCDFs), and biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs). For the polychlorinated compounds, TEFs indicate an order of magnitude estimate of the toxicity relative to 2,3,7,8-TCDD (dioxin); while for the PAHs, it indicates toxicity relative to benzo(a)pyrene. TEF values, in combination with chemical residue data, can be used to calculate toxic equivalent (TEQ) concentrations of these compounds in various environmental samples. The Department uses ABCs as planning goals, providing a means to identify and prioritize places in Oregon where public health is endangered. For PCDDS, PCDFs, PCBs, and PAHs, the ABC is compared to a TEQ derived from measurement of individual congeners or chemicals.

2. Polycyclic Aromatic Hydrocarbons (PAHs)

The current ambient benchmark for total PAHs is 9 x 10^{-4} μg m^{-3} (340-246-0090(3)(pp)). Although they share the same benchmark, the twenty-four (24) carcinogenic and the eight (8) non-carcinogenic PAHs are separated to make it easier to see how much each group contributes to total PAH risk. "Total PAH concentration" means the TEQ (with respect to benzo(a)pyrene) for the thirty-two (32) PAHs (other than naphthalene), calculated using the measured concentration of each PAH and their associated TEF values, listed in Table 1. These thirty-two PAHs are also specified in the rule. The TEQ for total PAHs is calculated as:

$$TEQ_{PAH} = \sum_{i=1}^{24C} \left(PAH_i \cdot TEF_i \right) + \sum_{i=1}^{8NC} \left(PAH_i \cdot TEF_i \right)$$

It is recommended that the detection limit for PAHs be approximately 1 x 10^{-3} μg m^{-3} (1 ng m^{-3}) in order to capture those individual compounds typically present in ambient air at extremely low concentrations.

2. Polychlorinated Biphenyls (PCBs)

The current ambient benchmark for total polychlorinated biphenyls is 0.01 μg m^{-3} (340-246-0090(3)(oo)). The rule states that "total" is "...as the sum of congeners...", which means the TEQ (with respect to 2,3,7,8-TCDD) for the twelve (12) congeners, calculated using the measured concentration of each PCB and their associated TEF values, listed in Table 2. These congeners are not specified in rule. The TEQ for PCBs is calculated as:

$$TEQ_{PCB} = \sum_{i=1}^{12} \left(PCB_i \cdot TEF_i \right)$$

It is recommended that the detection limit for PCBs be approximately 0.2 fg m^{-3} (2×10^{-10} μg m^{-3}) in order to capture those congeners typically present in ambient air at extremely low concentrations.

3. Polychlorinated dibenzo-*p*-dioxins (PCDDs) & dibenzofurans (PCDFs)
The ambient benchmark for total dioxins and furans is 3 x 10^{-8} μg m^{-3} (340-246-0090(3)(s)). Total is the TEQ (with respect to 2,3,7,8-TCDD) for the six (6) dioxins and ten (10) furans, and their associated TEF values, listed in Table 2. These dioxins and furans are not specified in the rule. The TEQ for PCDDs and PCDFs is calculated as:

$$TEQ_{dioxin} = \sum_{i=1}^{6} \left(PCDD_i \cdot TEF_i \right) + \sum_{j=1}^{10} \left(PCDF_j \cdot TEF_j \right)$$

The measured mean total TCDD ambient concentration in Oregon is about 50 fg m^{-3} (5 × 10^{-8} μg m^{-3}). It is recommended that the detection limit for PCDDs and PCDFs be approximately 0.2 fg m^{-3} (2 × 10^{-10} μg m^{-3}) in order to capture those congeners typically present in ambient air at extremely low concentrations.

Table 1. Ambient benchmark concentration (ABC) values for carcinogenic and non-carcinogenic PAHs (as benzo(a)pyrene equivalents) and volatile PAHs (as naphthalene).

CAS #	Chemical Name	WOE [a]	TEF [b]	ABC ($\mu g\ m^{-3}$)
CARCINOGENIC PAHs				**0.0009** [g]
56-55-3	Benzo(a)anthracene	B2 † §	0.005 [c]	
50-32-8	Benzo(a)pyrene	B2 † §	1.0 [c]	
205-99-2	Benzo(b)fluoranthene	B2 † §	0.1 [c]	
207-08-9	Benzo(k)fluoranthene	B2 † §	0.05 [c]	
86-74-8	Carbazole	B2 † §	0.005 [d]	
218-01-9	Chrysene	B2 † §	0.03 [c]	
226-36-8	Dibenz(a,h)acridine	2B ‡	0.1 [e]	
53-70-3	Dibenz(a,h)anthracene	B2 † §	1.1 [c]	
224-42-0	Dibenz(a,j)acridine	2B ‡	0.1 [e]	
194-59-2	7H-Dibenzo(c,g)carbazole	2B ‡	1.0 [e]	
192-65-4	Dibenzo(a,e)pyrene	2B ‡	0.02 [c]	
189-55-9	Dibenzo(a,i)pyrene	2B ‡	0.1 [c]	
191-30-0	Dibenzo(a,l)pyrene	2B ‡	1.0 [c]	
57-97-6	7,12-Dimethylbenz(a)anthracene	n/v ‡	64.0 [e]	
42397-64-8	1,6-Dinitropyrene	2B ‡	10.0 [e]	
42397-65-9	1,8-Dinitropyrene	2B ‡	1.0 [e]	
193-39-5	Indeno(1,2,3-c,d)pyrene	B2 ‡	0.1 [c]	
56-49-5	3-Methylcholanthrene	n/v ‡	5.7 [e]	
3697-24-3	5-Methylchrysene	2B ‡	1.0 [e]	
5522-43-0	1-Nitropyrene	2B ‡	0.1 [e]	
607-57-8	2-Nitrofluorene	2B ‡	0.01 [e]	
59865-13-3	4-Nitropyrene	2B ‡	0.1 [e]	
607-87-9	5-Nitroacenaphthene	2B ‡	0.03 [e]	
7496-02-8	6-Nitrochrysene	2B ‡	10.0 [e]	
NON-CARCINOGENIC PAHs				**0.0009** [g]
83-32-9	Acenaphthene	D §	0.001 [f]	
208-96-8	Acenaphthylene	D §	0.001 [f]	
120-12-7	Anthracene	D §	0.0005 [c]	
191-24-2	Benzo(g,h,i)perylene	D §	0.02 [c]	
206-44-0	Fluoranthene	D §	0.05 [c]	
86-73-7	Fluorene	D §	0.001 [f]	
85-01-8	Phenanthrene	D §	0.0005 [c]	
129-00-0	Pyrene	D §	0.001 [c]	
VOLATILE PAHs				**0.03** [h]

Table 1. Ambient benchmark concentration (ABC) values for carcinogenic and non-carcinogenic PAHs (as benzo(a)pyrene equivalents) and volatile PAHs (as naphthalene).

CAS #	Chemical Name	WOE [a]	TEF [b]	ABC ($\mu g\ m^{-3}$)
91-20-3	Naphthalene	SE §	n/a	

NOTES FOR TABLE 1

(a) Weight-of-evidence for carcinogenicity. USEPA (1986 Guidelines): B2 - Probable carcinogen; D - Not classifiable; USEPA (1999 Guidelines): SE - suggestive evidence for carcinogenicity; International Agency for Research on Cancer (IARC) Guidelines: 2B - possibly carcinogenic.

(b) Toxicity equivalency factors [with respect to benzo(a)pyrene].

(c) From Larsen and Larsen (1998) cited in Boström et al. (2002).

(d) Derived by back-calculation from URE for carbazole (URE from USEPA OAQPS).

(e) Based on California cancer potency factors, cited in *Rhode Island Air Toxics Guideline* (Revised, April 2004), Table F.

(f) USEPA (1993) cited in ATSDR (1995).

(g) Proposed benchmark for PAHs as B(a)P equivalents. Value from CalEPA OEEHA; also used by USEPA OAQPS. Derived for benzo(a)pyrene using oral-to-inhalation route extrapolation, with an oral dose from USEPA IRIS.

(h) Proposed benchmark for naphthalene. Derived from the adopted (03 Aug 04) California unit risk factor of 3.4×10^{-5} (μg m^{-3})$^{-1}$. [www.oehha.ca.gov/air/hot_spots/pdf/naphth080304.pdf]

† Member of U.S. EPA's list of 7 carcinogenic PAHs.

‡ A POM constituent with known toxicological properties.

§ Member of U.S. EPA's list of 16 PAHs.

n/a Not applicable

n/v Not available

Table 2. World Health Organization toxicity equivalency factors (TEF) for dioxins and furans (2005).

COMPOUND	TEF_{WHO98}
PCDDs	
2,3,7,8-TetraCDD	1
1,2,3,7,8-PentaCDD	1
1,2,3,4,7,8-HexaCDD	0.1
1,2,3,6,7,8-HexaCDD	0.1
1,2,3,7,8,9-HexaCDD	0.1
1,2,3,4,6,7,8-HeptaCDD	0.01
1,2,3,4,6,7,8,9-OctaCDD	0.0003
PCDFs	
2,3,7,8-TetraCDF	0.1
1,2,3,7,8-PentaCDF	0.03
2,3,4,7,8-PentaCDF	0.3
1,2,3,4,7,8-HexaCDF	0.1
1,2,3,6,7,8-HexaCDF	0.1
2,3,4,6,7,8-HexaCDF	0.1
1,2,3,7,8,9-HexaCDF	0.1
1,2,3,4,6,7,8-HeptaCDF	0.01
1,2,3,4,7,8,9-HeptaCDF	0.01
1,2,3,4,6,7,8,9-OctaCDF	0.0003
PCBs	
3,3′,4,4′-TetraCB (PCB 77)	0.0001
3,4,4′,5-TetraCB (PCB 81)	0.0003
3,3′,4,4′,5-PentaCB (PCB 126)	0.1
3,3′,4,4′,5,5′-HexaCB (PCB 169)	0.03
2,3,3′,4,4′-PentaCB (PCB 105)	0.00003
2,3,4,4′,5-PentaCB (PCB 114)	0.00003
2,3′,4,4′,5-PentaCB (PCB 118)	0.00003
2′,3,4,4′,5-PentaCB (PCB 123)	0.00003
2,3,3′,4,4′,5-HexaCB (PCB 156)	0.00003
2,3,3′,4,4′,5′-HexaCB (PCB 157)	0.00003
2,3′,4,4′,5,5′-HexaCB (PCB 167)	0.00003
2,3,3′,4,4′,5,5′-HeptaCB (PCB 189)	0.00003

GUIDANCE FOR ASSESSMENT OF EXPOSURE TO AIR TOXICS

1. Background on Assessment of Exposure to Air Toxics

Using the Geographic, Source Category and Safety Net approaches, Oregon's air toxics program provides the framework for a process to determine the occurrence of health hazards from air toxics and to identify and prioritize pollution sources for reduction efforts. All of these approaches require an ambient monitoring step to provide certainty that estimated concentrations are representative of real world circumstances. However, exposure concentrations are not necessarily the same as ambient concentrations because people rarely remain in one outdoor location for a full day, and certainly not for a lifetime. This section details the steps the Department will take to assure that exposure concentrations can be appropriately compared to the ABCs.

2. Different Types of Exposure Assessments

It is important to remember that exposure assessment is done within the context of a health risk assessment for people living in an urban area, a specific neighborhood, or in close proximity to a specific source of air pollution. How exposures are determined must be meaningful to that process. In order to compare exposure concentrations to the ABCs, they must allow calculation of an annual average exposure. They must also represent the exposures attributable to the source(s) that can be addressed within the area of interest. This means that background, or upwind, pollutant concentrations must be considered. Guidance for determining background concentrations is available.

While there may be many different approaches to determining the exposure of people to air toxics, ranging from personal monitors to measuring respiratory impact to county- scale model estimates, it is most likely that DEQ and others will rely on models to estimate ambient air concentrations and then exposures. It is important to understand the uncertainties in the ambient concentration predictions (model 1) before using them to estimate exposure concentrations (model 2). Since ambient monitoring will always be done, some evaluation of the models' ability to predict ambient concentrations, and ultimately exposures, will make this possible.

2. Role of Monitoring

Ambient air monitoring has uncertainties that must be recognized. Monitoring can play a useful role in validating model estimates but should not be used by itself to attack the conclusions drawn from the models. In some cases modeled ambient concentrations coupled with evidence from monitoring may clearly demonstrate that there are no exposures of concern in an area or from a source, making further exposure assessment unnecessary. However, generally an exposure assessment will require two modeling steps.

3. Choice of Exposure Models

Because each exposure assessment will be unique, this guidance only attempts to give the broad outlines of the necessary elements. More detailed discussion and guidance can be found in the EPA Risk Assessment Library, Volumes 1 – 3. Specific details about the models used and the input and output requirements for ambient air concentration modeling are already available from the Air Quality Technical Services section. Modeling plans for both ambient concentrations and exposure concentrations must be reviewed and approved by this section. EPA or DEQ approved models are the presumptive choice in all cases.

As in developing an ambient monitoring plan, it is important to spend some time considering the data quality objectives of the modeling analysis. There will be differences in the exposure assessment depending whether the analysis is for a large urban area, i.e. for geographic area planning, or for a smaller, perhaps neighborhood sized area, for safety net concerns. In addition to the spatial scale, key factors to consider are the time scale, population activity factors, and whether the analytical framework will be probabilistic or deterministic.

In the past DEQ has used the CALPUFF model to predict area-wide ambient air concentrations, while EPA has used ASPEN. Neither of these models includes reactivity, an important factor for secondary formation of some pollutants like formaldehyde, or the destruction of others like 1,3-butadiene. Point source related ambient air modeling has been done with AERMOD and other EPA approved models. AQ Technical Services should be consulted about the preferred model to use based on the air toxics of concern in each specific case.

The specific pollutants and unique domain characteristics will guide AQ Technical Services in determining what is appropriate. Key inputs include: meteorological data, land use characteristics; topographic elevation data; emissions and "stack" parameter data; emissions sources (permitted point sources, on-road mobile sources, non-road mobile sources, area sources); and receptor locations. The primary output being a spatial distribution of modeled concentrations in micrograms per cubic meter.

The HAPEM series exposure models, developed and used by EPA, have also been employed by DEQ to convert ambient concentrations to exposure concentrations. Other means of determining exposure may be possible but this model is the presumptive choice unless AQ Technical Services approves an alternative. As an example, in California OEHHA has provided guidance that allows a simpler, conservative, screening level assessment of exposure to off-site workers and to nearby residents.

Details of the HAPEM model and specific instructions on its use can be obtained from AQ Technical Services. Key inputs will be: air quality data (modeled concentrations from a dispersion model; population data; activity data; commuting patterns; microenvironments; and stochastic processes to characterize distribution of exposure. Here the output will be a distribution of adjusted exposure concentrations in micrograms per cubic meter.

A critical consideration in any exposure estimation is the population at risk. The ABCs have been selected to be protective of the group most sensitive to that pollutant and therefore the exposure estimate must also be reflective of that group. To accomplish that goal, the Department will begin by comparing exposures at the 95th percentile level to the ABCs, but will use the range that makes sense considering uncertainties and confidence.

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X. EFFECTIVE DATE

This Directive is effective on July 2, 2008.

6/17/2008
Date

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6/30/08
Date

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Pursuant to OAR 340-200-0020(66)(d)(B)