Emission Inventory and Risk Assessment Guidelines for Gasoline Dispensing Stations

Introduction

The purpose of this appendix is to document the methods used by AQMD staff to estimate cancer risks from the industry-wide source category of retail gasoline dispensing facilities. The methods are consistent with (1) AQMD's risk assessment procedures for Rule 1401 and (2) California Air Pollution Control Officer Association (CAPCOA) risk assessment guidance for gasoline service stations. The methods used to estimate emissions, pollutant concentrations, and cancer risks are covered here. Tables of maximum cancer risks at various locations in the South Coast Air Basin and at various residential and occupational distances are provided. The document concludes with an example calculation using the cancer risk tables.

Emission Inventory Methods

Emissions from gasoline transfer and dispensing mainly occur during loading, breathing, refueling, and spillage as described below:

> Loading – Emissions occur when a fuel tanker truck unloads gasoline to the storage tanks. The storage tank vapors, displaced during loading, are emitted through its vent pipe. A pressure/vacuum valve installed on the tank vent pipe significantly reduces these emissions.
>
> Breathing – Emissions occur through the storage tank vent pipe as a result of temperature and pressure changes in the tank vapor space.
>
> Refueling – Emissions occur during motor vehicle refueling when gasoline vapors escape through the vehicle/nozzle interface.
>
> Spillage – Emissions occur from evaporating gasoline that spills during vehicle refueling.

All retail service stations under AQMD jurisdiction have Phase I and II vapor recovery systems to control gasoline emissions. Phase I vapor recovery refers to the collection of gasoline vapors displaced from storage tanks when cargo tank trucks make gasoline deliveries. Phase II vapor recovery systems control the vapors displaced from the vehicle fuel tanks during refueling. In addition, all gasoline is stored underground with valves installed on the tank vent pipes to further control gasoline emissions.

The gasoline and benzene emission factors for each of the four processes are summarized in Table 1. The factors given in the table follow the CAPCOA recommended guidelines except that 95 percent control is assumed for Phase II vapor recovery, whereas CAPCOA assumes 90 percent control due to incomplete compliance.

Table 1. Gasoline and Benzene Emission Factors for Retail Service Stations

Process	Gasoline EF (lbs/1000 gal)	Benzene EF (lbs/1000 gal)	Comment
Loading	0.42	0.00126	benzene weight percent in vapor is 0.3%
Breathing	0.025	0.000075	benzene weight percent in vapor is 0.3%
Refueling	0.32	0.00096	benzene weight percent in vapor is 0.3%
Spillage	0.42	0.0042	benzene weight percent in liquid is 1.0%

Exposure Modeling Methods

Air quality modeling was performed using a U.S. EPA air quality dispersion model, called ISCST3 (Industrial Source Complex – Short Term, Version 3). ISCST3 is a Gaussian plume model capable of estimating pollutant concentrations from a wide variety of sources that are typically present in an industrial source complex. Emission sources are categorized into four basic types: point, area, volume, and open pit sources. ISCST3 estimates hourly concentrations for each source/receptor pair and calculates concentrations for user-specified averaging times, including an average concentration for the complete simulation period.

ISCST3 is executed using the urban dispersion parameters, which is AQMD policy for all permitting in its jurisdiction. The U.S. EPA regulatory defaults options are implemented except that the calm processing option is disabled. The AQMD believes that calm processing is inappropriate for its meteorological data for the following reasons:

- Calm processing was developed by the U.S. EPA to correct problems with preprocessed data in which calm winds are given the speed of 1 m/s and the direction of the last non-calm hour. This results in artificial persistence. Wind data collected by the AQMD is not preprocessed.
- Wind speeds in the AQMD stations are always 1 m/s or greater. Thus, model problems associated with lower wind speeds are not an issue.
- Wind direction is always recorded regardless of the wind speed and the direction is randomized over a 22.5 degree sector. Thus, artificial persistence is not an issue.
- AQMD data is more like on-site data and calm processing is not appropriate for on-site data.
- Given the high frequency of calms at many sites in the South Coast Air Basin and their association with high pollutant concentrations, it would be inappropriate to eliminate that portion of the data.

For these reasons, the AQMD does not require calm processing for permit modeling.

Emissions from gasoline service stations are non-buoyant and ground-based (or nearly ground-based). In addition, the peak impacts from this type of facility occur in close proximity to the source. Under these circumstances the local terrain is relatively unimportant; therefore flat terrain is assumed in the dispersion modeling.

Modeling was performed at all 35 AQMD meteorological stations shown in Figure 1. The locations of each of the sites are given in Table 2. The data are available on the AQMD website (http://www.aqmd.gov/metdata/). A polar receptor grid is assumed at ten degree azimuth increments at the following downwind distances: 25, 30, 40, 50, 60, 70, 80, 90, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, and 1000 meters.

The peak model-predicted impacts at each downwind distance over the 36 azimuth angles are used to develop the health risk tables for gasoline service stations (see Tables 3 & 4).

Figure 1
Meteorological Monitoring Stations in the South Coast Air Basin

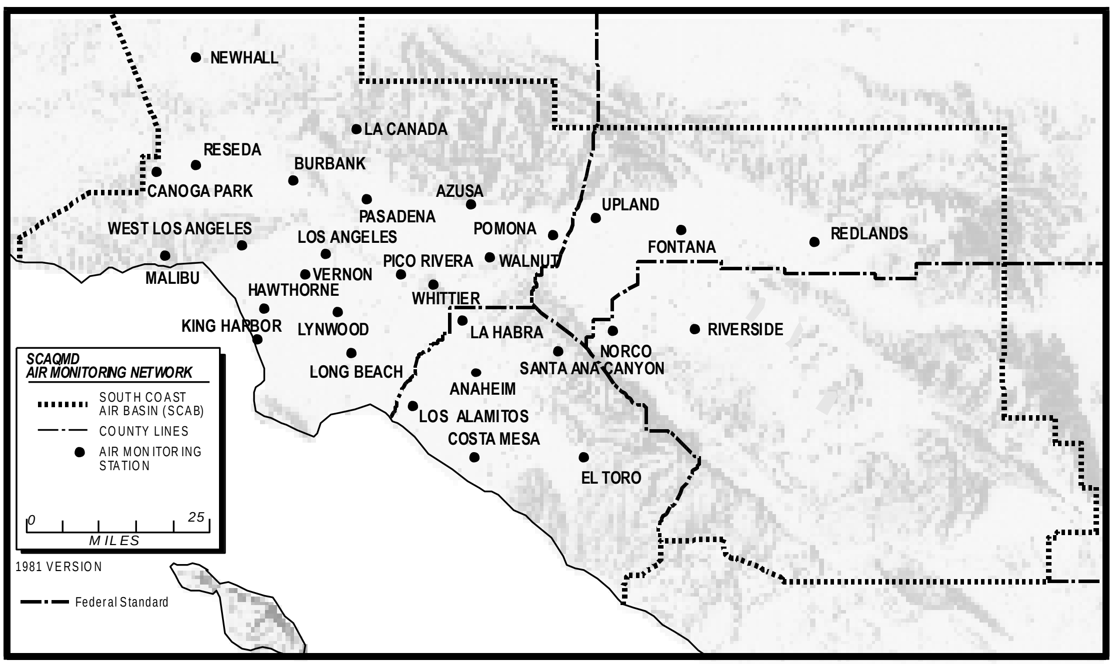

Table 2: Locations of Meteorological Stations

	UTM Coordinates (m)		Lat./Long. Coordinates	
Station name	**E-W**	**N-S**	**Latitude**	**Longitude**
Anaheim	415.0	3742.5	33°49'16"	117°55'07"
Azusa	414.9	3777.4	34°08'09"	117°55'23"
Banning	510.5	3754.5	33°55'58"	116°53'11"
Burbank	379.5	3783.0	34°10'58"	118°18'27"
Canoga Park	352.9	3786.0	34°12'23"	118°35'48"
Compton	385.5	3750.3	33°53'19"	118°14'17"
Costa Mesa	413.8	3724.2	33°39'21"	117°55'47"
Downtown Los Angeles	386.9	3770.1	34°04'02"	118°13'31"
El Toro	436.0	3720.9	33°37'39"	117°41'25"
Fontana	455.4	3773.9	34°06'24"	117°29'01"
Indio	572.3	3731.0	33°43'06"	116°13'11"
King Harbor	371.2	3744.4	33°50'00"	118°23'30"
La Canada	388.2	3786.1	34°12'42"	118°12'49"
La Habra	412.0	3754.0	33°55'28"	117°57'07"
Lancaster	396.0	3839.5	34°41'38"	118°08'08"
Lennox	373.0	3755.0	33°55'46"	118°22'26"
Long Beach	390.0	3743.0	33°49'24"	118°11'19"
Los Alamitos	404.5	3739.8	33°47'45"	118°01'54"
Lynwood	388.0	3754.0	33°55'20"	118°12'42"
Malibu	344.0	3766.9	34°01'59"	118°41'23"
Newhall	355.5	3805.5	34°22'59"	118°31'02"
Norco	446.8	3749.0	33°52'54"	117°34'31"
Palm Springs	542.5	3742.5	33°49'25"	116°32'27"
Pasadena	396.0	3778.5	34°08'38"	118°07'41"
Pico Rivera	402.3	3764.1	34°00'53"	118°03'29"
Pomona	430.8	3769.6	34°03'60"	117°44'60"
Redlands	486.2	3769.4	34°04'00"	117°09'00"
Reseda	359.0	3785.0	34°11'54"	118°31'49"
Riverside	464.8	3758.6	33°58'10"	117°22'50"
Santa Ana Canyon	431.0	3748.4	33°52'32"	117°44'46"
Upland	440.0	3773.1	34°05'55"	117°39'02"
Vernon	387.4	3762.5	33°59'55"	118°13'10"
Walnut	420.0	3761.7	33°59'41"	117°51'58"
West Los Angeles	372.3	3768.6	34°03'08"	118°23'01"
Whittier	405.3	3754.0	33°55'26"	118°01'28"

As mentioned earlier, CAPCOA has developed industry-wide risk assessment guidelines for gasoline service stations (CAPCOA, 1997). These guidelines were developed to promote consistency throughout the State. However, CAPCOA recognized that many of the districts in the State have developed modeling methods and procedures unique to their situations. To address these differences among districts, CAPCOA allows for a district to deviate from the published guidelines as evidenced by the following statement in the industry-wide risk assessment guidelines for gas stations (CAPCOA, 1997):

> *This effort was initiated to provide a cost effective and uniform method for calculating gasoline station emission inventories and risk assessment for the thousands of gasoline stations throughout the State. However, districts may use other emission information and modeling procedures appropriate in their district.*

The modeling performed here followed CAPCOA guidelines unless otherwise noted.

Loading and breathing emissions exit the underground storage tank vent pipe and are thus treated in ISCST3 as a point source. The height and diameter of the vent are assumed to be 3.7 meters (12 feet) and 0.05 meters (2 inches), respectively.

Refueling and spillage emissions are modeled as volume sources with horizontal dimensions of 13 meters by 13 meters to correspond to the dimensions of the pump islands and a vertical dimension of 5 meters to correspond to the height of the canopy. For refueling, the release height is assumed to be 1 meter to approximate the height of a vehicle fuel tank inlet, whereas spillage emissions are assumed to be released at ground level since nearly all the gasoline from spillage reaches the ground. These dimensions match CAPCOA's recommendations except for the vertical dimension of the volume source; CAPCOA recommends 4 meters. The AQMD has been requiring gas station risk assessments for permitting since early 1990s using a vertical dimension of the volume source corresponding to the pump island canopy top. Assuming a 5-meter vertical dimension continues this modeling practice.

Both the vent pipe and the volume sources are assumed to be co-located at the center of the service station property. Ideally, the locations of the vent pipes and pump islands would be determined on a site by site basis. Unfortunately, that level of detail is not feasible for the industry-wide risk assessment presented here due to the large number of facilities.

It is assumed that the gas station described above operates continuously throughout the year. Further, it is assumed that 80 percent of the daily emissions occur equally each hour from 6 a.m. to 8 p.m. and the remaining 20 percent of the daily emissions occur equally each hour from 8 p.m. to 6 a.m.

A sample ISCST3 model input file for the generic retail service station described above is given in Exhibit 1.

Exhibit 1: ISCST3 Model Input File for The Generic Gasoline Service Station

```
CO STARTING
   TITLEONE  Gasoline Dispensing - 1.0 MM gal/yr
   TITLETWO  80/20 emissions split; 5 m canopy top; West LA meteorology
   MODELOPT  NOCALM  URBAN  CONC
   AVERTIME  PERIOD
   POLLUTID  Benzene
   RUNORNOT  RUN
   ERRORFIL  ERRORS.OUT
CO FINISHED

SO STARTING
   LOCATION  1  POINT     0.0     0.0     0.0
   LOCATION  2  POINT     0.0     0.0     0.0
   LOCATION  3  VOLUME    0.0     0.0     0.0
   LOCATION  4  VOLUME    0.0     0.0     0.0

** Point Source            QS         HS        TS        VS        DS
** Volume Source           QS         HS      SYINIT    SZINIT
   SRCPARAM  1          1.81E-05     3.66     291.0    3.50E-04   0.051
   SRCPARAM  2          1.08E-06     3.66     289.0    1.06E-04   0.051
   SRCPARAM  3          1.38E-05     1.00      3.02      2.33
   SRCPARAM  4          6.04E-05     0.00      3.02      2.33
   EMISFACT  1-4  HROFDY   6*0.48  14*1.371  4*0.48
   SRCGROUP  ALL
SO FINISHED

RE STARTING
   GRIDPOLR POL1 STA
                 ORIG     0.0     0.0
                 DIST  25 30 40 50 60 70 80 90 100 125 150 175 200
                 DIST  250 300 350 400 450 500 600 700 800 900 1000
                 GDIR     36     10.0     10.0
   GRIDPOLR POL1 END
RE FINISHED

ME STARTING
   INPUTFIL  c:\metdata\ascii\wla.asc
   ANEMHGHT  10 METERS
   SURFDATA  52158  1981
   UAIRDATA  91919  1981
ME FINISHED

OU STARTING
   RECTABLE  ALLAVE  FIRST
OU FINISHED
```

Risk Assessment Methods

The risk assessment methods used in the AQMD's *Risk Assessment Procedures for Rule 1401 and 212 (Version 7.0)* are used to calculate the cancer risks from retail gasoline service stations. The cancer risk (CR) is calculated as follows:

CR = Cancer Potency (CP) • Dose-Inhalation (DI) • Multipathway Factor (MP)

where,

$$DI = C_{air} \cdot DBR \cdot EVF \cdot 10^{-6} \cdot MP$$

$$C_{air} = C_{ann} \cdot AF_{ann}$$

Therefore, the equation for calculating cancer risks is:

$$CR = CP \cdot C_{ann} \cdot AF_{ann} \cdot DBR \cdot EVF \cdot 10^{-6} \cdot MP$$

CP is cancer potency in units of $(mg/kg\text{-}day)^{-1}$. The cancer potency for benzene is 0.1 $(mg/kg\text{-}day)^{-1}$. C_{ann} is the model-predicted annual average benzene concentration in $\mu g/m^3$. AF_{ann} is a concentration adjustment factor. It adjusts the model-predicted annual average benzene concentration, which are 24 hrs/day and 7 days/week averages, to an average for the off-site worker exposure period (i.e., 8 hrs/day and 5 days/week). This is necessary because the worker breathing rate of 149 L/kg-day is only applicable to the work-day and work-week exposure. It is assumed that the worker is only exposed while at work. Since the generic gasoline service station is assumed to operate continuously, AF_{ann} is assumed to be 1 for both worker and residential receptors.

DBR is the daily breathing rate in units of L/kg-day. The daily breathing rates for workers and residents are 149 L/kg-day and 302 L/kg-day, respectively. EVF is the exposure value factor, which is assumed to be 0.38 for workers and 0.96 for residents. The multi-pathway adjustment factor (MP) is used for substances that may contribute to risk from exposures other than inhalation. Inhalation is the only pathway into the body for benzene; therefore, the multipathway factor is 1.

Risk Tables

Applying the methods and equations presented above, risk tables are developed for a generic retail gasoline service station. Tables 3 and 4 provide the maximum cancer risk for a gasoline dispensing station with a one million gallon per year throughput at various residential and occupational distances, respectively. The modeled stations are assumed to have 95% vapor recovery (Phase I and II) with cancer risk calculated for different locations.

Cancer risks from a typical gasoline service station can be estimated from Tables 3 and 4 as follows: First, determine which of the 35 locations in these tables is closest to the gas station or best represents the facility. AQMD staff made use of location information that is available in the AQMD's permit database. The South Coast AQMD is broken up into 38 source/receptor areas as shown in Figure 2. The source/receptor area is provided for each facility in AQMD's permit database. As shown in Table C-5, AQMD staff assigned one of the 35 meteorological sites to each source receptor area, which was then used to choose a meteorological site for each gasoline dispensing facility.

Next, determine the distance from the service station to the nearest residential and occupational location. Using the above information, pick the cancer risk from the appropriate cell in Tables 3 and 4. Lastly, scale the cancer risk by the actual gasoline throughput of the service station. An example of a risk calculation is provided for a hypothetical gasoline service station in a subsequent section.

AQMD followed CAPCOA's recommendation, and did not consider the one-hour maximum downwind concentrations of the components in gasoline emissions for non-cancer acute hazard index calculations. Appendix I of the CAPCOA document contains a detailed discussion of the relative toxicity of substances in gasoline. It shows that benzene is the most important substance driving the risk in the gasoline service stations. Toluene and xylene are the only substances which are associated with acute adverse health effects. Not until the benzene concentrations are more than two orders of magnitude above the 10 per million cancer risk threshold, do the emissions of toluene and xylene begin to cause adverse health effects. AQMD's preliminary calculations of gasoline service station cancer risk based on the information submitted by facilities, show that none of the gasoline service stations exceed a cancer risk of 100 per million, and therefore, the downwind toluene and xylene concentrations do not need to be determined.

Table 3: Residential Cancer Risks (in one million) for Gasoline Service Station (1 MM gal/yr throughput)

	Downwind Distance (meters)												
Location	**25**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**125**	**150**	**175**	**200**
Anaheim	3.15	2.43	1.58	1.10	0.81	0.62	0.49	0.40	0.33	0.22	0.16	0.12	0.09
Azusa	3.61	2.82	1.85	1.30	0.96	0.74	0.59	0.48	0.40	0.27	0.19	0.14	0.11
Banning	2.92	2.28	1.50	1.07	0.79	0.61	0.49	0.40	0.33	0.22	0.16	0.12	0.09
Burbank	3.15	2.50	1.68	1.20	0.90	0.69	0.55	0.45	0.38	0.25	0.18	0.14	0.11
Canoga Park	3.09	2.48	1.69	1.22	0.92	0.72	0.57	0.47	0.39	0.27	0.19	0.15	0.12
Compton	3.09	2.45	1.64	1.17	0.87	0.67	0.54	0.44	0.36	0.24	0.18	0.13	0.10
Costa Mesa	3.34	2.61	1.73	1.22	0.91	0.70	0.56	0.45	0.38	0.26	0.18	0.14	0.11
Downtown LA	2.31	1.85	1.25	0.90	0.67	0.52	0.42	0.34	0.28	0.19	0.14	0.10	0.08
El Toro	2.51	1.92	1.23	0.86	0.65	0.51	0.41	0.34	0.29	0.19	0.14	0.11	0.09
Fontana	3.58	2.93	2.05	1.50	1.14	0.89	0.72	0.59	0.50	0.34	0.25	0.19	0.15
Indio	2.48	1.96	1.30	0.92	0.69	0.53	0.42	0.34	0.29	0.19	0.14	0.10	0.08
King Harbor	2.75	2.14	1.39	0.97	0.72	0.55	0.43	0.35	0.29	0.19	0.14	0.10	0.08
La Canada	4.16	3.45	2.46	1.82	1.39	1.09	0.88	0.73	0.61	0.42	0.30	0.23	0.18
La Habra	2.97	2.28	1.51	1.11	0.84	0.66	0.53	0.44	0.37	0.25	0.18	0.14	0.11
Lancaster	3.56	2.82	1.89	1.35	1.01	0.78	0.62	0.51	0.42	0.29	0.21	0.16	0.12
Lennox	3.51	2.81	1.91	1.38	1.04	0.81	0.65	0.53	0.44	0.30	0.22	0.16	0.13
Long Beach	4.38	3.61	2.54	1.86	1.42	1.11	0.90	0.74	0.62	0.42	0.31	0.23	0.18
Los Alamitos	2.76	2.18	1.46	1.05	0.78	0.61	0.49	0.40	0.33	0.23	0.16	0.12	0.10
Lynwood	3.70	2.94	1.98	1.42	1.06	0.83	0.66	0.54	0.45	0.30	0.22	0.17	0.13
Malibu	2.91	2.32	1.60	1.16	0.87	0.68	0.55	0.45	0.38	0.26	0.19	0.14	0.11
Newhall	3.53	2.83	1.93	1.40	1.05	0.82	0.66	0.54	0.45	0.30	0.22	0.17	0.13
Norco	3.39	2.67	1.77	1.25	0.93	0.72	0.57	0.46	0.38	0.26	0.19	0.14	0.11
Palm Springs	3.61	2.90	1.99	1.43	1.08	0.84	0.68	0.55	0.46	0.31	0.23	0.17	0.14
Pasadena	2.89	2.37	1.66	1.22	0.93	0.73	0.59	0.48	0.40	0.28	0.20	0.15	0.12
Pico Rivera	3.52	2.78	1.85	1.32	0.98	0.76	0.61	0.49	0.41	0.28	0.20	0.15	0.12
Pomona	5.77	4.67	3.21	2.32	1.75	1.37	1.09	0.90	0.75	0.51	0.37	0.28	0.22
Redlands	4.89	4.11	2.98	2.22	1.71	1.35	1.09	0.90	0.76	0.52	0.38	0.29	0.23
Reseda	3.12	2.42	1.57	1.10	0.81	0.62	0.49	0.40	0.33	0.22	0.16	0.12	0.10
Riverside	4.13	3.29	2.21	1.58	1.18	0.92	0.73	0.60	0.50	0.33	0.24	0.18	0.14
Santa Ana Canyon	3.84	2.98	1.93	1.35	0.99	0.76	0.60	0.49	0.41	0.27	0.20	0.15	0.12
Upland	2.80	2.21	1.49	1.07	0.80	0.62	0.50	0.41	0.34	0.23	0.17	0.13	0.10
Vernon	3.97	3.25	2.26	1.65	1.25	0.98	0.79	0.64	0.54	0.37	0.27	0.20	0.16
Walnut	3.69	2.90	1.93	1.37	1.02	0.78	0.62	0.51	0.42	0.28	0.20	0.15	0.12
West LA	5.54	4.36	2.90	2.05	1.53	1.18	0.94	0.77	0.64	0.43	0.31	0.23	0.18
Whittier	2.63	2.05	1.40	1.01	0.76	0.60	0.48	0.39	0.33	0.22	0.16	0.12	0.10

Table 3(Cont.): Residential Cancer Risks (in one million) for Gasoline Service Station (1 MM gal/yr throughput)

	Downwind Distance (meters)										
Location	**250**	**300**	**350**	**400**	**450**	**500**	**600**	**700**	**800**	**900**	**1000**
Anaheim	0.06	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.00
Azusa	0.07	0.05	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01
Banning	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Burbank	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Canoga Park	0.08	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Compton	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Costa Mesa	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Downtown LA	0.05	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.00
El Toro	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Fontana	0.10	0.07	0.06	0.04	0.04	0.03	0.02	0.02	0.01	0.01	0.01
Indio	0.05	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.00
King Harbor	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00
La Canada	0.12	0.09	0.07	0.05	0.04	0.04	0.03	0.02	0.02	0.01	0.01
La Habra	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Lancaster	0.08	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Lennox	0.09	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Long Beach	0.12	0.09	0.07	0.05	0.04	0.04	0.03	0.02	0.02	0.01	0.01
Los Alamitos	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Lynwood	0.09	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Malibu	0.08	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Newhall	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01
Norco	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Palm Springs	0.09	0.07	0.05	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01
Pasadena	0.08	0.06	0.04	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Pico Rivera	0.08	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Pomona	0.15	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.02	0.01
Redlands	0.16	0.11	0.09	0.07	0.06	0.05	0.03	0.03	0.02	0.02	0.01
Reseda	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Riverside	0.09	0.07	0.05	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01
Santa Ana Canyon	0.08	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
Upland	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Vernon	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01
Walnut	0.08	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
West LA	0.12	0.09	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01
Whittier	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01

Table 4: Occupational Cancer Risks (in one million) for Gasoline Service Station (1 MM gal/yr throughput)

	Downwind Distance (meters)												
Location	**25**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**125**	**150**	**175**	**200**
Anaheim	0.62	0.48	0.31	0.22	0.16	0.12	0.10	0.08	0.06	0.04	0.03	0.02	0.02
Azusa	0.71	0.56	0.36	0.26	0.19	0.15	0.12	0.09	0.08	0.05	0.04	0.03	0.02
Banning	0.58	0.45	0.30	0.21	0.16	0.12	0.10	0.08	0.07	0.04	0.03	0.02	0.02
Burbank	0.62	0.49	0.33	0.24	0.18	0.14	0.11	0.09	0.07	0.05	0.04	0.03	0.02
Canoga Park	0.61	0.49	0.33	0.24	0.18	0.14	0.11	0.09	0.08	0.05	0.04	0.03	0.02
Compton	0.61	0.48	0.32	0.23	0.17	0.13	0.11	0.09	0.07	0.05	0.03	0.03	0.02
Costa Mesa	0.66	0.52	0.34	0.24	0.18	0.14	0.11	0.09	0.07	0.05	0.04	0.03	0.02
Downtown LA	0.46	0.36	0.25	0.18	0.13	0.10	0.08	0.07	0.06	0.04	0.03	0.02	0.02
El Toro	0.49	0.38	0.24	0.17	0.13	0.10	0.08	0.07	0.06	0.04	0.03	0.02	0.02
Fontana	0.71	0.58	0.40	0.30	0.22	0.18	0.14	0.12	0.10	0.07	0.05	0.04	0.03
Indio	0.49	0.39	0.26	0.18	0.14	0.10	0.08	0.07	0.06	0.04	0.03	0.02	0.02
King Harbor	0.54	0.42	0.27	0.19	0.14	0.11	0.09	0.07	0.06	0.04	0.03	0.02	0.02
La Canada	0.82	0.68	0.49	0.36	0.27	0.22	0.17	0.14	0.12	0.08	0.06	0.05	0.04
La Habra	0.59	0.45	0.30	0.22	0.17	0.13	0.11	0.09	0.07	0.05	0.04	0.03	0.02
Lancaster	0.70	0.56	0.37	0.27	0.20	0.15	0.12	0.10	0.08	0.06	0.04	0.03	0.02
Lennox	0.69	0.56	0.38	0.27	0.20	0.16	0.13	0.10	0.09	0.06	0.04	0.03	0.03
Long Beach	0.86	0.71	0.50	0.37	0.28	0.22	0.18	0.15	0.12	0.08	0.06	0.05	0.04
Los Alamitos	0.54	0.43	0.29	0.21	0.15	0.12	0.10	0.08	0.07	0.04	0.03	0.02	0.02
Lynwood	0.73	0.58	0.39	0.28	0.21	0.16	0.13	0.11	0.09	0.06	0.04	0.03	0.03
Malibu	0.57	0.46	0.31	0.23	0.17	0.14	0.11	0.09	0.07	0.05	0.04	0.03	0.02
Newhall	0.70	0.56	0.38	0.28	0.21	0.16	0.13	0.11	0.09	0.06	0.04	0.03	0.03
Norco	0.67	0.53	0.35	0.25	0.18	0.14	0.11	0.09	0.08	0.05	0.04	0.03	0.02
Palm Springs	0.71	0.57	0.39	0.28	0.21	0.17	0.13	0.11	0.09	0.06	0.04	0.03	0.03
Pasadena	0.57	0.47	0.33	0.24	0.18	0.14	0.12	0.10	0.08	0.05	0.04	0.03	0.02
Pico Rivera	0.69	0.55	0.37	0.26	0.19	0.15	0.12	0.10	0.08	0.05	0.04	0.03	0.02
Pomona	1.14	0.92	0.63	0.46	0.35	0.27	0.22	0.18	0.15	0.10	0.07	0.06	0.04
Redlands	0.96	0.81	0.59	0.44	0.34	0.27	0.22	0.18	0.15	0.10	0.08	0.06	0.05
Reseda	0.62	0.48	0.31	0.22	0.16	0.12	0.10	0.08	0.06	0.04	0.03	0.02	0.02
Riverside	0.81	0.65	0.44	0.31	0.23	0.18	0.14	0.12	0.10	0.07	0.05	0.04	0.03
Santa Ana Canyon	0.76	0.59	0.38	0.27	0.20	0.15	0.12	0.10	0.08	0.05	0.04	0.03	0.02
Upland	0.55	0.44	0.29	0.21	0.16	0.12	0.10	0.08	0.07	0.05	0.03	0.02	0.02
Vernon	0.78	0.64	0.45	0.33	0.25	0.19	0.15	0.13	0.11	0.07	0.05	0.04	0.03
Walnut	0.73	0.57	0.38	0.27	0.20	0.15	0.12	0.10	0.08	0.06	0.04	0.03	0.02
West LA	1.09	0.86	0.57	0.41	0.30	0.23	0.19	0.15	0.13	0.08	0.06	0.05	0.04
Whittier	0.52	0.40	0.28	0.20	0.15	0.12	0.09	0.08	0.06	0.04	0.03	0.02	0.02

Table 4(Cont.): Occupational Cancer Risks (in one million) for Gasoline Service Station (1 MM gal/yr throughput)

	Downwind Distance (meters)										
Location	**250**	**300**	**350**	**400**	**450**	**500**	**600**	**700**	**800**	**900**	**1000**
Anaheim	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Azusa	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Banning	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Burbank	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Canoga Park	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Compton	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Costa Mesa	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Downtown LA	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
El Toro	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fontana	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Indio	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
King Harbor	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
La Canada	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
La Habra	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Lancaster	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Lennox	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Long Beach	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Los Alamitos	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lynwood	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Malibu	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Newhall	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Norco	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Palm Springs	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Pasadena	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Pico Rivera	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Pomona	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Redlands	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
Reseda	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Riverside	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Santa Ana Canyon	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Upland	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vernon	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Walnut	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
West LA	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Whittier	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 2
Source/Receptor Areas

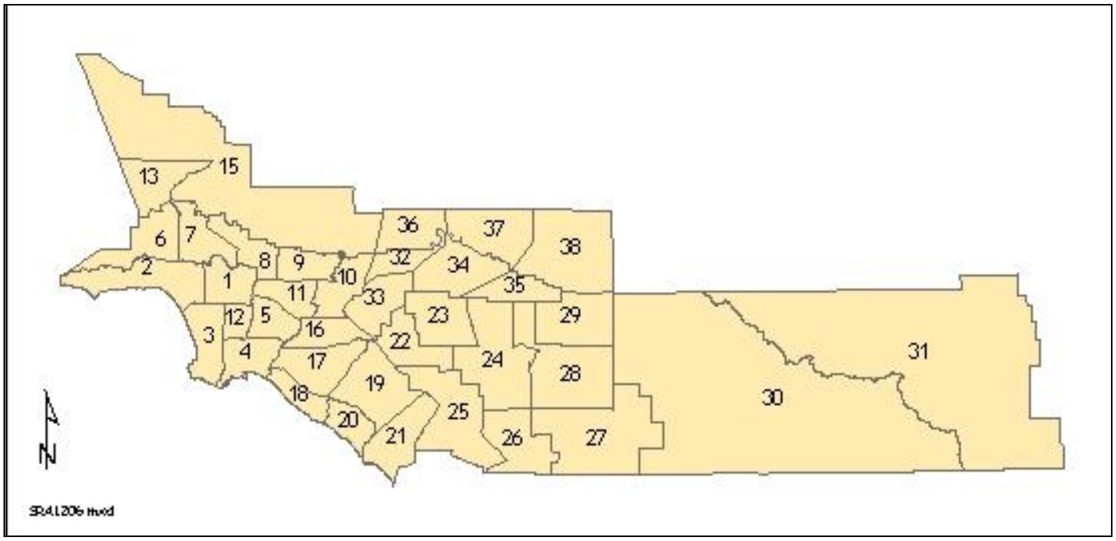

Table 5. Meteorological Stations for Each Source/Receptor Area.

Meteorological Station	Source/ Receptor Area	Meteorological Station	Source/ Receptor Area
Anaheim	17	Newhall	13, 15
Azusa	9	Palm Springs	30, 31
Banning	29	Pasadena	8
Burbank	7	Pico Rivera	11
Costa Mesa	18, 20	Pomona	10
Downtown Los Angeles	1	Redlands	35, 38
El Toro	19, 21	Reseda	6
Fontana	34, 37	Riverside	22-28
La Habra	16	Upland	32, 33, 36
Lennox	3	West Los Angeles	2
Long Beach	4	Whittier	5
Lynwood	12		

Example Calculations

The following example demonstrates how the AQMD staff plans to assign health risk values for retail gasoline dispensing facilities based on information received and using Tables 3 and 4.

The calculation steps are as follows:

1. **Cancer Risk (CR):** The AQMD will assign cancer risk values to each retail gasoline dispensing facility based on facility location, process information, and receptor proximity.
    a. *Residential CR:* Use the facility location and the distance to the nearest resident to identify the risk. The residential CRs for retail gasoline dispensing are contained in Table 3.
    b. *Occupational CR:* Use the facility location and the distance to the nearest worker to identify the risk. The occupational CRs for retail gasoline dispensing are contained in Table 4.
    c. *Maximum Individual CR (MICR):* Select the greater CR between the residential and occupational CRs (as identified above).

Please note the following when calculating risk values for gasoline dispensing facilities:

- The gasoline dispensing risk tables (Tables 3 and 4) are based on a gasoline throughput of 1 million (MM) gallons per year (gal/yr). Actual facility throughput should be multiplied by the values contained in the gasoline dispensing risk tables to calculate the appropriate facility risk.
- The AQMD maintains 35 meteorological stations as shown in Figure 1. If there are no meteorological stations in the city of the facility, the closest meteorological station to the facility should be used.
- The gasoline dispensing risk tables (Tables 3 and 4) are based on discrete downwind distances, which cover two pages. If the actual downwind distance is not listed in the tables, then linear interpolation between distance cells is acceptable.
- Although gasoline vapors and its TAC constituents (for example, benzene, toluene, and xylene) have non-cancer impacts, **the risks from retail gasoline dispensing facilities are dominated by cancer risk**. Therefore, hazard index for these facilities are not calculated.

Example: A retail gasoline dispensing facility submits the following information: 15 MM gal/yr gasoline throughput, located in Pomona, nearest residential receptor 250 meters away, and nearest occupational receptor 25 meters away.

In this example the actual downwind distances are in the tables. However, if the actual downwind distances are not in the table, then linear interpolation between distance cells is acceptable to obtain cancer risks for the actual downwind distances.

1. **Cancer Risk (CR):**

   a. *Residential CR:* Using Table 3, the residential cancer risk is 0.15 in one million (250 meters and Pomona) for 1 MM gal/yr. Since the facility's gasoline throughput for this example is 15 MM gal/yr, the corresponding residential cancer risk is 2.3 in one million.

   $$\textbf{Residential CR} = \frac{0.15 \text{ in one million}}{(1 \text{ MM gal/yr})} \times (15 \text{ MM gal/yr})$$

Residential CR = 2.3 in one million

   a. *Occupational CR:* Using Table 4, the occupational cancer risk is 1.14 in one million (25 meters and Pomona) for 1 MM gal/yr. Since the facility's gasoline throughput for this example is 15 MM gal/yr, the corresponding occupational cancer risk is 17.1 in one million.

   $$\textbf{Occupational CR (GDS)} = \frac{1.14 \text{ in one million}}{(1 \text{ MM gal/yr})} \times (15 \text{ MM gal/yr})$$

Occupational CR = 17.1 in one million

   b. *MICR:* The MICR for this IWS facility (GDS) is **17.1** in one million (occupational receptor).