Routes 7/15 Interchange
Norwalk, Connecticut
State Project No. 102-358

Environmental Assessment,
Draft Section 4(F) Evaluation and
Environmental Impact Evaluation

Appendix D
Air Quality Study

August 2022

Prepared for:
Connecticut Department of
Transportation Federal Highway
Administration

Table of Contents

List of Attachments

An air quality assessment was performed for the Connecticut Department of Transportation's (CTDOT's) proposed improvements (Project) at the Route 7 and Merritt Parkway (Route 15) interchange. The Project will improve Routes 7/15 interconnections with local roads in the City of Norwalk, Connecticut. The potential air quality impacts that may result from implementation of the Project are summarized below.

1.0 Air Quality Studies

The studies that were performed to assess the potential air quality impacts associated with the proposed Project were: (i) a mesoscale emissions inventory, (ii) microscale dispersion modeling, (iii) a Mobile Source Air Toxics (MSAT) analysis, (iv) an assessment of transportation conformity, and (v) an assessment of air pollutant and pollutant precursor emissions due to construction activities. These studies were evaluated for the projected year (2045) without the proposed interchange improvements (the "No Build" condition), and with proposed interchange improvements (the "Build" condition) for two Alternatives (21D and 26). The methodology and results of the air quality studies are detailed in the following sections. Additional details regarding the methodology and analysis results are provided as an Attachment to this Appendix.

1.1. Mesoscale Emissions Inventory

The mesoscale analysis was performed to estimate the change in daily volatile organic compounds (VOC), and oxides of nitrogen (NO_x) emissions within the study corridor that would be associated with the No Build and Build conditions. VOC and NO_x emissions are most problematic as they lead to ozone (O_3) formation.

The mesoscale analysis considers the length of roadways, average daily traffic volumes, and travel speeds. To be conservative, motor vehicle travel speeds were assumed to be the same for the evaluation of both the No Build and Build conditions. This assumption results in conservative results for the Build condition because no credit is taken for reduction in travel speed and vehicular delay which would reduce emission levels.

VOC and NO_x emission factors were obtained from the U.S. Environmental Protection Agency's (EPA's) MOtor Vehicle Emission Simulator (MOVES, Version 2014b) model.[1] The vehicle-miles-travelled (VMT) used in the analysis were based on project specific data, while the vehicle fleet and meteorological assumptions were developed using default settings in MOVES.

Table 1 provides the mesoscale emission results. As shown, Build Alternatives 21D and 26 would result in lower emissions of VOC and NO_x than the No Build condition. As such, the proposed Project would not regionally contribute to adverse impacts of VOC and NO_x, the precursors to O_3.

[1] EPA, *Latest Version of Motor Vehicle Emissions Simulator (MOVES), MOVES2014b*, December 2018, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

Table 1 – Mesoscale Emissions Inventory

Scenario	VOC		NO_x	
	Tons/Day	Difference from No Build (%)	Tons/Day	Difference from No Build (%)
No Build	0.234	--	0.158	--
Build Alternative 21D	0.226	-3.3	0.152	-3.3
Build Alternative 26	0.231	-1.2	0.156	-1.2

Notes: VOC = volatile organic compounds, and NOx = nitrogen oxides.
Source: KB Environmental Sciences, Inc., 2019.

1.2. Microscale Dispersion Modeling

Microscale dispersion modeling of concentrations of carbon monoxide (CO) resulting from motor vehicle emissions was also performed. This analysis was performed in accordance with accepted practice for microscale analyses as well as the criteria established by the U. S. EPA's *Project-Level Conformity and Hot-Spot Analyses* guidelines.[2] The dispersion modeling focused on signalized intersections within the study area that would be at Level-of-Service (LOS) D, E, or F in the year 2045 or that are forecast to deteriorate to LOS D, E, or F due to increased traffic volumes related to the proposed Project. The analysis focused on these Intersections because the delay and congestion associated with the lower LOS could cause or contribute to a potential CO exceedance of the National Ambient Air Quality Standards (NAAQS)[3]. The analysis was based on Project traffic data as updated in 2020 (Appendix B of the Routes 7 and 15 Environmental Assessment).

Following EPA guidance, all intersections forecast to operate at LOS D, E, or F within the study area were ranked by traffic volume and degree of delay. The two intersections with a combination of the highest traffic volume and greatest delay were then subjected to the dispersion modeling. This methodology assumes that as the LOS decreases, the number of vehicles processed through the intersection exceeds the intersection's capacity, resulting in long vehicle queues and increases in vehicle emissions due to idling.

Table 2 lists the two intersections for which microscale dispersion modeling was performed. The LOS, delay (in seconds) and the forecast year 2045 traffic volumes are also provided for both the AM and PM peak periods. The peak period (AM or PM) with the greatest traffic volume and total delay were evaluated.

[2] EPA, *Guideline for Modeling Carbon Monoxide from Roadway Intersections*, November 1992 [EPA-454-R-92-005], http://www.epa.gov/scram001/guidance/guide/coguide.pdf; and *Using MOVES2014 in Project-Level Carbon Monoxide Analyses*, March 2015 [EPA-420-B-15-028], http://www.epa.gov/otaq/stateresources/transconf/documents/420b15028.pdf.
[3] EPA, *National Ambient Air Quality Standards (NAAQS) Table*, November 2019, https://www.epa.gov/criteria-air-pollutants/naaqs-table.

Table 2 – Modeled Intersections for 2045 No Build and Build Alternatives 21D and 26

Intersection	Peak Hour	No Build				Alternative 21D				Alternative 26			
		LOS	Delay (sec)	Vol.	Total Delay (min)	LOS	Delay (sec)	Vol.	Total Delay (min)	LOS	Delay (sec)	Vol.	Total Delay (min)
Site 1: Main Ave at West Rocks Rd	AM	E	71.6	4,440	5,298	E	71.6	4,440	5,298	E	71.6	4,440	5,298
	PM	F	126	4,740	9,954	F	126	4,740	9,954	F	126	4,740	9,954
Site 2: Route 7 at Grist Mill Rd	AM	F	155.6	5,630	14,600	F	151.7	5,620	14,209	F	151.7	5,620	14,209
	PM	F	123.5	5,270	10,847	F	114.4	5,210	9,934	F	114.4	5,210	9,934

Notes: min = minutes, LOS = level of service, sec = seconds, and Vol. = volume.
The peak period (AM or PM) with the worst total delay for each intersection were analyzed for CO. These are denoted in red.
Source: Stantec and KB Environmental Sciences, Inc., 2019.

The microscale analysis was performed using the CAL3QHC dispersion model.[4] CAL3QHC is an EPA-approved micro-scale atmospheric dispersion model that combines roadway design, operational parameters, motor vehicle emission rates, and meteorological conditions to produce estimates of CO concentrations at specified receptor locations along roadways, interchanges, or intersections.

For the Routes 7/15 Interchange analysis, receptors (i.e., locations at which CO concentrations were predicted) were located where the maximum concentrations of CO are expected to occur. Following EPA guidance, receptors were evaluated at a height of approximately 6 feet (1.8 meters), approximately 82, 164, and 246 feet (25, 50, and 75 meters) from each intersection cross street.

Project-specific data including the intersection approach volumes, signal timing cycles, and queue delays, were obtained from the project traffic study and Highway Capacity Model (HCM) Synchro traffic data reports.

The CAL3QHC model provided CO concentrations for a 1-hour averaging period. These values were converted to an 8-hour averaging period using a persistence factor of 0.7 to account for the variability in both traffic and meteorological conditions over time. **Table 3** summarizes the CAL3QHC meteorological conditions and the input parameters that were used in the microscale dispersion analysis.

Table 3 – CAL3QHC Input Parameters

Parameter	Input Data
Atmospheric Stability Class	D (Neutral)
Wind Speed	1 meter per second (m/s)
Wind Direction	360° in 10° increments
Mixing Height	1,000 meters (m)
Surface Roughness	100 centimeters (cm)
Persistence Factor	0.70
Receptor Height	1.8 meters
Emission Rates	MOVES2014b (see **Table 4**)
Links	Developed based on aerial imagery, future intersection geometry, and traffic data.
Source: KB Environmental Sciences, Inc., 2019.	

Emission rates, in grams per vehicle-mile (for free-flowing vehicles) and grams per vehicle-hour (for queuing vehicles) were obtained from the MOVES model and were based upon model input parameters provided by the Bureau of Air Management of the Connecticut (CT) Department of Energy & Environmental Protection (DEEP), as well as project-specific data.

Table 4 summarizes the input data that was used in MOVES to obtain motor vehicle emission rates.

[4] EPA, User's Guide to CAL3QHC Version 2: *A Modeling Methodology for Predicting Pollutant Concentration near Roadway Intersections*, November 1992, [EPA-454/R-92-006], http://www.epa.gov/ttn/scram/userg/regmod/cal3qhcug.pdf.

Table 4 – MOVES Inputs

Parameter	Input Data
Evaluation Year(s)	2045
Location	Fairfield County
Evaluation Month	January (winter) and July (summer)
Days	Weekdays
Evaluation Hour	January 7AM – 8AM and July 2PM - 3PM
Links	Developed based on aerial imagery and future intersection geometry.
Link Source Type	Vehicle fleet mix varies by roadway link. See **Table 5** for more details.
Link Speeds	35 miles per hour (mph)
Roadway Type	Urban unrestricted (e.g., freeways/interstates/ramps)
Average Temperature	Winter: 19.2 °F and Summer: 83.7 °F
Relative Humidity	Winter: 69.9% and Summer: 53.5%
Vehicle Age Distribution	Provided by CT DEEP
I/M Programs	
Fuel Data	
Notes: CT DEEP = Connecticut Department of Energy & Environmental Protection, and mph = miles per hour. Source: KB Environmental Sciences, Inc., 2019.	

Table 5 presents the percentage of heavy and light vehicles that were assumed for the vehicle fleet mix for each of the evaluated intersections. For the purpose of obtaining emission rates from MOVES, heavy vehicles were assumed to be diesel single unit short-haul trucks and light vehicles were assumed to be a composite of diesel- and gasoline-fueled passenger cars and trucks.

Table 5 – Vehicle Fleet Mix

Time Period	Intersection	Input Data	% Heavy Vehicles	% Light Vehicles
AM	Route 7/Main Av/DMV	SB	5	95
		WB	18	82
		NB	5	95
		EB	4	96
	Route 7/Grist Mill/Glover	SB	--	100
		WB	5	95
		NB	15	75
		EB	4	96
	Route 7/Grist Mill Rd	SB	--	100
		WB	6	94
		NB	4	96
		EB	1	99
PM	Route 7/Foxboro Drive	SB	3	97
		WB	--	100
		NB	1	99
		EB	--	100
	Route 7/West Rocks Rd	SB	3	97

Time Period	Intersection	Input Data	% Heavy Vehicles	% Light Vehicles
		WB	1	99
		NB	1	99
		EB	--	100
Source: Stantec, 2019.				

MOVES emission rates for future year 2045 conditions were based on information (i.e., vehicle/fuel mix, fuel specifications, inspection/maintenance program, etc.) specific to Fairfield County. Both winter (January) and summer (July) rates were obtained to determine "worst-case" levels. For the future No Build condition, intersection legs (i.e., links) were developed using aerial imagery and Build conditions were developed using proposed intersection geometry.

Background concentrations representing other local sources of CO were based on ambient air monitoring data. The nearest monitoring station that collects data for CO is located at Roosevelt School Park Avenue in Bridgeport, approximately 12 miles east of the Route 7 project study corridor. The maximum measured level over the last five years (i.e., 2014 – 2018) was used as the future 2045 CO background concentration (**Table 6**).

Table 6 – CO Background Concentrations

Averaging Period	CO (ppm)
1-hour	2.5
8-hour	1.8
Notes: CO = Carbon Monoxide and ppm = parts per million. Source: U.S. EPA AirData, 2019.	

Table 7 presents the results of the CO intersection modeling analysis compared to the NAAQS. As shown, the concentrations of CO are well below the NAAQS both with and without the proposed improvements and, neither Alternative 21D or 26 would increase or decrease predicted levels. Therefore, the proposed Project will not cause or contribute to adverse impacts of CO.

Table 7 – Maximum Potential CO Concentrations (ppm)

Intersection	Averaging Period	No Build	Build Alternative 21D	Build Alternative 26	NAAQS
Site 1: Main Ave. at West Rocks Rd.	1-hour	3.2	3.2	3.2	35
	8-hour	2.3	2.3	2.3	9
Site 2: Route 7 at Grist Mill Rd.	1-hour	3.2	3.2	3.2	35
	8-hour	2.3	2.3	2.3	9
Notes: CO = Carbon Monoxide and ppm = parts per million, and NAAQS = National Ambient Air Quality Standards. Source: U.S. EPA AirData, 2019.					

Notably, a review of the intersection analysis for future 2045 conditions with the proposed improvements revealed that the proposed Project would not produce a significant increase in the number of diesel vehicles. As such, and based on EPA regulation (40 CFR 93.123 (b)), a microscale analysis of particulate matter 2.5 microns of less in diameter ($PM_{2.5}$) was not performed.

1.3. Mobile Source Air Toxics (MSAT) Analysis

The evaluation of MSATs was performed following the procedures in the Federal Highway Administration's (FHWA's) Memorandum entitled *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*[5], dated October 18, 2016—an update to the December 2012, Interim Guidance that advised FHWA Division Offices on when and how to analyze MSAT under the National Environmental Policy Act (NEPA) process. FHWA's current guidance for assessing MSAT impacts of transportation projects under NEPA classifies projects and the level of analysis required, into the following three categories, depending on specific project circumstances:

- *Category 1 – No analysis for projects with no potential for meaningful MSAT effects;*
- *Category 2 – Qualitative analysis for projects with low potential MSAT effects; or*
- *Category 3 – Quantitative analysis to differentiate alternatives for projects with high potential MSAT effects.*

A project is best characterized as having a low potential for MSAT effects if, in the design year, traffic is projected to be less than 140,000 to 150,000 average annual daily traffic (AADT). Projects that have a high potential to effect MSATs are projects that create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location, or cause a significant increase in the number of diesel vehicles as well as projects that create new capacity of add significant capacity to urban highways where the AADT is project to be in the rage of 140,000 to 150,000 or greater by the design year. Because the forecast traffic volume for the Route 7 project is less than 140,000, MSAT emissions were qualitatively evaluated.

The following sections describe regulatory background information on the MSATs and MSAT research. This information has been taken from the 2016 *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*.

> <u>*MSAT Background*</u> *- Controlling air toxic emissions became a national priority with the passage of the Federal CAA Amendments of 1990, whereby Congress mandated that the U.S. EPA regulate 188 air toxics, also known as hazardous air pollutants (HAPs). The U.S. EPA assessed this expansive list in its rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System (IRIS).*[6] *In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA).*[7] *These nine compounds include: 1,3-butadiene,acetaldehyde, acrolein, benzene, diesel particulate matter*

[5] FHWA, *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*, October 18, 2016, https://www.fhwa.dot.gov/environMent/air_quality/air_toxics/policy_and_guidance/msat/.
[6] EPA, *Integrated Risk Information Systems*, https://www.epa.gov/iris.
[7] EPA, *National Air Toxics Assessment*, https://www.epa.gov/national-air-toxics-assessment.

(diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules. The 2007 EPA rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines.

MSAT Research - Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA. The FHWA, U.S. EPA, the Health Effects Institute (HEI), and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this field.

The daily VMT values are provided in **Table 8**. For each project Alternative, that is, the No Build and Build conditions, the amount of MSAT emitted is proportional to the VMT, assuming that other variables such as fleet mix are the same for each alternative. Because the VMT estimated for the segments directly associated with the project and those roadways in the affected network for the No Build are overall predominantly higher than for the Build conditions, lower levels of MSAT are expected from either of the Build conditions compared to the No Build.

Table 8 – VMT Data

Corridor	No Build VMT	Build Alternative 21D			Build Alternative 26		
		VMT	Change in VMT	Change in VMT (%)	VMT	Change in VMT	Change in VMT (%)
Route 7	318,178	331,797	13,619	4	342,018	23,840	7
Route 15	338,548	318,949	-19,599	-6	332,067	-6,480	-2
Main Avenue	96,423	77,215	-19,208	-20	69,776	-26,647	-28
Total	**753,148**	**727,960**	**-25,188**	**-3**	**743,861**	**-9,287**	**-1**

Notes: VMT = Vehicle-Miles-Travelled.
Source: Stantec and KB Environmental Sciences, Inc., 2019.

As also shown in Table 8, because the estimated VMT under each of the Build Alternatives are nearly the same, it is expected there would be no appreciable difference in overall MSAT emissions between the two alternatives. Furthermore, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of the U.S. EPA's national control programs that are projected to reduce annual MSAT emissions by over 90 percent from 2010 to 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in virtually all locations.

Under each alternative there may be localized areas where VMT would increase, and other areas where VMT would decrease. Therefore, it is possible that localized increases and decreases in MSAT emissions may occur. The localized increases in MSAT emissions would likely be most pronounced along Route 7, under the 2045 Build Alternatives 21D and 26. However, even if these increases do occur, they too will be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations.

Furthermore, in FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. This topic is further addressed in the FHWA's *"Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis"* provided as an Attachment to this Appendix.

1.4. Transportation Conformity

Projects that are within areas designated by the EPA to be nonattainment or maintenance for any of the pollutants for which there are NAAQS and that require Federal approval, such as the Routes 7/15 Interchange project, are subject to the CAA's Transportation Conformity Rule. This rule requires that transportation planning within such areas be consistent with the air quality goals of the state.

CTDOT, in cooperation with the Metropolitan Planning Organizations (MPO) and the Rural Regional Planning Organizations evaluates State Transportation Improvement Programs (STIP) and State and Regional Long-Range Transportation Plans to determine if the plans conform to the SIP. Connecticut SIP information indicates that the proposed Project is included in the 2015 STIP (Project ID #0102-0358) which was evaluated for air quality purposes and approved by EPA in November 2014. Because the Project is included in the 2015 STIP, the project is in compliance with the CAA's Transportation Conformity requirements.

1.5. Construction-related Emissions

Air pollutant and pollutant precursor emissions that would result from construction activities are temporary. Emissions from project-related construction equipment and vehicles would be mitigated through "housekeeping and best management practices" following the CTDOT Office of Construction (OOC) guidelines and regulations.[8]

[8] CTDOT, https://portal.ct.gov/DOT/Office-of-Construction/OOC---Home.

2.0 Summary

The potential air quality impacts that may result from the implementation of the proposed Routes 7/15 Interchange project, were evaluated and are briefly summarized below.

The mesoscale analysis results show that Build Alternatives 21D and 26 would result in lower emissions of VOC and NOx (approximately 3% and 1%, respectively) than the No Build condition. As such, the proposed Project would not regionally contribute to adverse impacts of VOC and NO_x, the precursors to O_3.

The concentrations of CO are well below the NAAQS both with and without the proposed improvements and, neither Alternative 21D or 26 would increase or decrease predicted levels. Therefore, the proposed Project will not cause or contribute to adverse impacts of CO at the project-level. Additionally, because the proposed Project would not produce a significant increase in the number of diesel vehicles, based on EPA regulation (40 CFR 93.123 (b)), a microscale analysis of $PM_{2.5}$ was not performed.

The MSAT analysis shows that, under each alternative, there may be localized increases and decreases in MSAT emissions. However, even if these increases do occur, they too will be substantially reduced in the future due to implementation of the U.S. EPA's vehicle and fuel regulations.

Connecticut State SIP information indicates that the proposed Project is included in the 2015 STIP (Project ID #0102-0358) which was evaluated for air quality purposes and approved in November 2014. Because the proposed Project is included in the STIP, the project is in compliance with the Federal CAA's Transportation Conformity requirements.

Emissions from project-related construction activities will be mitigated through "housekeeping and best management practices" following CTDOT's OCC guidelines and regulations.

Attachment 1 – Example Moves Input File

APPENDIX AIR QUALITY STUDY: ATTACHMENT 1

Example MOVES Input File (2045 No Build Condition)


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Example CAL3QHC Model Input and Output File (2045 No Build Condition)

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** Lakes Environmental Software Inc.
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**
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CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221   PAGE 1

JOB: Met Condition 1   RUN: CAL3QHC RUN

DATE : 10/29/19
TIME : 12:21:12

The MODE flag has been set to C for calculating CO averages.

SITE & METEOROLOGICAL VARIABLES

VS = 0.0 CM/S   VD = 0.0 CM/S   Z0 = 100. CM
U = 1.0 M/S   CLAS = 4 (D)   ATIM = 60. MINUTES   MIXH = 1000. M   AMB = 0.0 PPM

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (M)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (M)	W (M)	V/C	QUEUE (VEH)
1. Link1	632474.94	4557567.00	632509.50	4557554.50	37.	110.	BR	12.	100.0	1.5	4.3	0.80	6.1
2. Link2	632390.69	4557602.50	632474.94	4557567.00	91.	113.	AG	330.	0.9	0.0	10.3		
3. Link3	632474.94	4557567.00	632507.75	4557555.00	35.	110.	BR	330.	0.9	1.5	10.3		
4. Link4	632507.75	4557555.00	632522.62	4557547.50	17.	117.	AG	330.	0.9	0.0	10.3		
5. Link5	632522.62	4557547.50	632562.56	4557518.00	50.	126.	AG	800.	0.9	0.0	9.7		
6. Link6	632562.56	4557518.00	632585.25	4557492.00	35.	139.	AG	800.	0.9	0.0	9.7		
7. Link7	632585.25	4557492.00	632598.25	4557461.50	33.	157.	AG	800.	0.9	0.0	9.7		
8. Link8	632598.25	4557461.50	632596.75	4557401.50	60.	181.	AG	800.	0.9	0.0	9.7		
9. Link9	632596.75	4557401.50	632590.31	4557363.00	39.	189.	AG	800.	0.9	0.0	9.7		
10. Link10	632590.31	4557363.00	632569.69	4557282.50	83.	194.	AG	800.	0.9	0.0	9.7		
11. Link11	632569.69	4557282.50	632553.81	4557247.00	39.	204.	AG	800.	0.9	0.0	9.7		
12. Link12	632557.69	4557246.00	632573.12	4557282.50	40.	23.	AG	530.	0.9	0.0	9.7		
13. Link13	632573.12	4557282.50	632597.00	4557375.00	96.	14.	AG	530.	0.9	0.0	9.7		
14. Link14	632597.00	4557375.00	632601.56	4557407.00	32.	8.	AG	530.	0.9	0.0	9.7		
15. Link15	632601.56	4557407.00	632602.38	4557460.50	54.	1.	AG	530.	0.9	0.0	9.7		
16. Link16	632602.38	4557460.50	632591.88	4557492.50	34.	342.	AG	530.	0.9	0.0	9.7		
17. Link17	632591.88	4557492.50	632567.62	4557520.50	37.	319.	AG	530.	0.9	0.0	9.7		
18. Link18	632567.62	4557520.50	632529.00	4557553.00	50.	310.	AG	530.	0.9	0.0	13.3		
19. Link19	632567.62	4557520.50	632545.25	4557539.00	29.	310.	AG	25.	100.0	0.0	7.3	0.69	4.9
20. Link20	632529.00	4557553.00	632506.25	4557559.50	24.	286.	AG	260.	0.9	0.0	10.3		
21. Link21	632506.25	4557559.50	632477.69	4557570.50	31.	291.	BR	260.	0.9	1.5	10.3		
22. Link22	632477.69	4557570.50	632393.12	4557606.00	92.	293.	AG	260.	0.9	0.0	10.3		
23. Link23	632326.12	4557314.50	632458.25	4557465.50	201.	41.	AG	2400.	0.9	0.0	13.3		
24. Link24	632454.50	4557468.50	632523.31	4557547.00	104.	41.	AG	160.	0.9	0.0	9.1		
25. Link25	632454.69	4557469.00	632654.38	4557695.50	302.	41.	AG	15.	100.0	0.0	3.0	2.16	50.3
26. Link26	632526.94	4557544.00	632589.56	4557616.00	95.	41.	AG	2110.	0.9	0.0	12.7		
27. Link27	632589.56	4557616.00	632614.62	4557653.00	45.	34.	AG	2110.	0.9	0.0	12.7		
28. Link28	632614.62	4557653.00	632632.19	4557691.50	42.	25.	AG	2110.	0.9	0.0	12.7		
29. Link29	632632.19	4557691.50	632645.75	4557730.50	41.	19.	AG	2110.	0.9	0.0	12.7		
30. Link30	632632.19	4557691.50	632725.88	4557962.50	287.	19.	AG	13.	100.0	0.0	6.7	1.06	47.8
31. Link31	632645.75	4557730.50	632651.94	4557782.50	52.	7.	AG	2050.	0.9	0.0	12.7		
32. Link32	632651.94	4557782.50	632649.50	4557824.50	42.	357.	AG	2050.	0.9	0.0	12.7		
33. Link33	632638.31	4557732.50	632617.75	4557681.00	55.	202.	AG	1480.	0.8	0.0	12.7		
34. Link34	632617.75	4557681.00	632600.06	4557646.00	39.	207.	AG	1480.	0.8	0.0	12.7		
35. Link35	632600.06	4557646.00	632569.19	4557607.00	50.	218.	AG	1160.	0.8	0.0	12.7		
36. Link36	632569.19	4557607.00	632518.19	4557549.50	77.	222.	AG	1160.	0.8	0.0	12.7		

Link	X1	Y1	X2	Y2	LENGTH	BRG	TYPE	VPH	EF	H	W	V/C	QUEUE
37. Link37	* 632600.06	4557646.00	632336.62	4557313.00 *	424.	218.	AG	23.	100.0	0.0	6.7	1.24	70.7
38. Link38	* 632569.19	4557607.00	632287.94	4557289.00 *	424.	222.	AG	23.	100.0	0.0	6.7	1.24	70.7
39. Link39	* 632602.06	4557644.50	632583.12	4557616.00 *	34.	214.	AG	320.	0.8	0.0	9.7		
40. Link40	* 632583.06	4557616.00	632523.31	4557547.00 *	91.	221.	AG	320.	0.8	0.0	9.7		
41. Link41	* 632602.06	4557644.50	632186.88	4557019.50 *	750.	214.	AG	15.	100.0	0.0	3.7	3.30	125.0
42. Link42	* 632583.06	4557616.00	632093.19	4557048.00 *	750.	221.	AG	15.	100.0	0.0	3.7	3.30	125.0
43. Link43	* 632518.19	4557549.50	632446.19	4557466.00 *	110.	221.	AG	1590.	0.8	0.0	12.7		
44. Link44	* 632446.19	4557466.00	632414.56	4557425.50 *	51.	218.	AG	1590.	0.8	0.0	12.7		

PAGE 2

JOB: Met Condition 1 RUN: CAL3QHC RUN

DATE : 10/29/19
TIME : 12:21:12

LINK VARIABLES

LINK DESCRIPTION *	X1	Y1	X2	Y2 *	LENGTH (M)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (M)	W (M)	V/C	QUEUE (VEH)
45. Link45	* 632414.56	4557425.50	632321.88	4557320.50 *	140.	221.	AG	1590.	0.8	0.0	12.7		
46. Link56	* 632459.88	4557464.00	632528.38	4557543.00 *	105.	41.	AG	2240.	0.9	0.0	15.8		
47. Link57	* 632487.06	4557496.00	633170.12	4558276.50 *	1037.	41.	AG	35.	100.0	0.0	9.8	1.70	172.9
48. Link58	* 632641.44	4557828.00	632643.81	4557783.00 *	45.	177.	AG	1530.	0.8	0.0	15.8		
49. Link59	* 632641.44	4557828.00	632701.50	4556690.00 *	1140.	177.	AG	43.	100.0	0.0	9.8	3.05	189.9
50. Link60	* 632643.81	4557783.00	632638.31	4557732.50 *	51.	186.	AG	1530.	0.8	0.0	15.8		
51. Link61	* 632643.81	4557783.00	632521.62	4556650.00 *	1140.	186.	AG	43.	100.0	0.0	9.8	3.05	189.9

PAGE 3

JOB: Met Condition 1 RUN: CAL3QHC RUN

DATE : 10/29/19
TIME : 12:21:12

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION *	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
1. Link1 *	90	66	2.0	330	1861	6.29	2	3
19. Link19 *	90	66	2.0	530	1727	6.29	2	3
25. Link25 *	90	82	2.0	160	1668	6.29	2	3
30. Link30 *	90	34	2.0	2110	1717	6.29	2	3
37. Link37 *	90	61	2.0	1160	1686	6.29	2	3
38. Link38 *	90	61	2.0	1160	1686	6.29	2	3
41. Link41 *	90	81	2.0	320	1752	6.29	2	3
42. Link42 *	90	81	2.0	320	1752	6.29	2	3
47. Link57 *	90	62	2.0	2240	1649	6.29	2	3
49. Link59 *	90	77	2.0	1530	1675	6.29	2	3
51. Link61 *	90	77	2.0	1530	1675	6.29	2	3

RECEPTOR LOCATIONS

RECEPTOR *	X (M)	Y (M)	Z (M) *
1. 6 *	632487.00	4557556.00	1.8 *
2. 1 *	632391.56	4557596.00	1.8 *
3. 2 *	632416.50	4557585.00	1.8 *
4. 3 *	632438.12	4557576.50	1.8 *
5. 4 *	632453.06	4557570.00	1.8 *
6. 7 *	632507.19	4557548.50	1.8 *
7. 33 *	632550.00	4557519.50	1.8 *
8. 34 *	632568.81	4557502.00	1.8 *

9. 35	*	632580.06	4557489.50	1.8	*
10. 37	*	632592.31	4557460.50	1.8	*
11. 38	*	632592.06	4557441.50	1.8	*
12. 39	*	632591.50	4557422.00	1.8	*
13. 56	*	632607.19	4557422.00	1.8	*
14. 40	*	632591.31	4557402.00	1.8	*
15. 41	*	632586.81	4557375.00	1.8	*
16. 42	*	632583.12	4557356.50	1.8	*
17. 43	*	632576.62	4557333.00	1.8	*
18. 44	*	632570.19	4557308.00	1.8	*
19. 45	*	632563.94	4557283.00	1.8	*
20. 47	*	632549.00	4557250.50	1.8	*
21. 48	*	632562.56	4557243.50	1.8	*
22. 49	*	632572.69	4557267.50	1.8	*
23. 46	*	632558.81	4557271.50	1.8	*
24. 50	*	632578.75	4557281.00	1.8	*
25. 51	*	632585.06	4557305.50	1.8	*
26. 52	*	632591.12	4557329.50	1.8	*
27. 53	*	632596.94	4557354.00	1.8	*
28. 54	*	632602.00	4557374.00	1.8	*
29. 55	*	632606.19	4557398.50	1.8	*
30. 57	*	632607.50	4557442.00	1.8	*
31. 58	*	632607.81	4557462.00	1.8	*
32. 59	*	632601.81	4557480.00	1.8	*
33. 36	*	632585.75	4557476.00	1.8	*

RECEPTOR	*	X	Y	Z	*
34. 60	*	632595.94	4557496.00	1.8	*
35. 61	*	632581.75	4557513.00	1.8	*
36. 62	*	632575.69	4557520.00	1.8	*
37. 63	*	632560.00	4557536.50	1.8	*
38. 64	*	632542.88	4557551.50	1.8	*
39. 93	*	632519.50	4557562.00	1.8	*
40. 96	*	632460.06	4557585.00	1.8	*
41. 94	*	632494.94	4557570.50	1.8	*
42. 97	*	632444.50	4557591.00	1.8	*
43. 98	*	632423.56	4557600.00	1.8	*
44. 99	*	632398.25	4557611.00	1.8	*
45. 20	*	632332.38	4557310.50	1.8	*
46. 21	*	632348.50	4557329.00	1.8	*
47. 22	*	632364.88	4557347.50	1.8	*
48. 23	*	632381.31	4557366.50	1.8	*
49. 24	*	632397.94	4557385.00	1.8	*
50. 25	*	632414.69	4557404.00	1.8	*
51. 26	*	632430.62	4557422.50	1.8	*
52. 27	*	632447.06	4557442.00	1.8	*
53. 65	*	632558.94	4557570.00	1.8	*
54. 66	*	632575.69	4557589.50	1.8	*
55. 68	*	632595.88	4557612.50	1.8	*
56. 69	*	632610.12	4557633.00	1.8	*
57. 70	*	632621.75	4557650.00	1.8	*
58. 71	*	632632.00	4557673.00	1.8	*
59. 72	*	632639.38	4557689.00	1.8	*
60. 73	*	632646.19	4557709.50	1.8	*
61. 74	*	632652.94	4557729.50	1.8	*
62. 75	*	632656.06	4557754.50	1.8	*
63. 76	*	632659.19	4557781.50	1.8	*
64. 77	*	632657.62	4557808.50	1.8	*
65. 78	*	632656.56	4557827.00	1.8	*
66. 83	*	632629.62	4557734.00	1.8	*
67. 84	*	632622.00	4557711.50	1.8	*
68. 86	*	632610.06	4557681.50	1.8	*
69. 85	*	632616.12	4557697.50	1.8	*
70. 87	*	632599.38	4557662.00	1.8	*

RECEPTOR	X	Y	Z
71. 88	* 632592.25	4557649.00	1.8 *
72. 89	* 632578.19	4557630.50	1.8 *
73. 90	* 632565.50	4557614.00	1.8 *
74. 91	* 632551.38	4557598.00	1.8 *
75. 92	* 632534.75	4557579.00	1.8 *
76. 95	* 632479.88	4557577.00	1.8 *
77. 5	* 632471.06	4557562.50	1.8 *
78. 67	* 632587.38	4557603.00	1.8 *
79. 8	* 632493.88	4557532.50	1.8 *
80. 9	* 632475.75	4557512.50	1.8 *
81. 10	* 632463.56	4557497.00	1.8 *
82. 11	* 632451.50	4557483.50	1.8 *
83. 12	* 632440.75	4557470.00	1.8 *
84. 13	* 632424.88	4557450.00	1.8 *
85. 14	* 632409.06	4557429.50	1.8 *
86. 15	* 632392.62	4557411.00	1.8 *
87. 16	* 632376.00	4557392.00	1.8 *
88. 17	* 632359.94	4557373.50	1.8 *
89. 18	* 632343.12	4557354.50	1.8 *
90. 19	* 632326.69	4557336.00	1.8 *

PAGE 5

JOB: Met Condition 1 RUN: CAL3QHC RUN

RECEPTOR	* COORDINATES (M) * X	Y	Z *
91. 28	* 632464.88	4557457.50	1.8 *
92. 29	* 632482.81	4557478.00	1.8 *
93. 30	* 632498.50	4557495.50	1.8 *
94. 31	* 632516.12	4557516.00	1.8 *
95. 32	* 632531.56	4557533.50	1.8 *
96. 79	* 632631.94	4557827.50	1.8 *
97. 80	* 632634.00	4557803.00	1.8 *
98. 81	* 632634.69	4557783.50	1.8 *
99. 82	* 632632.06	4557759.50	1.8 *

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: .-360.

WIND * CONCENTRATION
ANGLE * (PPM)

------*?? REC11 REC12 REC13 REC14 REC15 REC16 REC17 REC18 REC19 REC20

(DEGR)*	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.1	0.1	0.	0.	0.	0.	0.
10. *	0.	0.	0.	0.	0.	0.	0.2	0.	0.	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.
20. *	0.	0.	0.	0.	0.	0.	0.2	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
30. *	0.	0.	0.	0.	0.	0.	0.2	0.1	0.1	0.1	0.1	0.1	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40. *	0.	0.	0.	0.	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1
50. *	0.1	0.	0.	0.	0.	0.2	0.1	0.	0.1	0.1	0.1	0.1	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1
60. *	0.1	0.	0.	0.	0.	0.3	0.1	0.	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
70. *	0.	0.	0.	0.	0.	0.3	0.	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.
80. *	0.	0.	0.	0.	0.	0.2	0.	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.
90. *	0.	0.	0.	0.	0.	0.2	0.	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.
100. *	0.	0.	0.	0.	0.	0.2	0.	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.
110. *	0.	0.	0.	0.	0.	0.2	0.	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.
120. *	0.	0.	0.	0.	0.	0.2	0.	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.
130. *	0.	0.	0.	0.	0.	0.2	0.	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
140. *	0.	0.	0.	0.	0.	0.2	0.	0.	0.1	0.1	0.1	0.1	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1
150. *	0.	0.	0.	0.	0.	0.2	0.	0.1	0.1	0.1	0.1	0.1	0.	0.1	0.1	0.1	0.1	0.1	0.1	0.1

```
160. *   0.   0.   0.   0.   0.   0.2   0.   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1
170. *   0.   0.   0.   0.   0.   0.2   0.   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1
180. *   0.   0.   0.   0.   0.   0.4   0.   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1
190. *   0.   0.   0.   0.   0.   0.4   0.   0.   0.   0.1   0.1   0.1   0.2   0.1   0.1   0.1   0.1   0.   0.   0.
200. *   0.   0.   0.   0.   0.   0.3   0.   0.   0.   0.   0.   0.   0.3   0.   0.   0.   0.   0.   0.   0.
210. *   0.   0.   0.   0.   0.   0.3   0.   0.   0.   0.   0.   0.   0.2   0.   0.   0.   0.   0.   0.   0.
220. *   0.   0.   0.   0.   0.   0.1   0.   0.   0.   0.   0.   0.   0.2   0.   0.   0.   0.   0.   0.   0.
230. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.2   0.   0.   0.   0.   0.   0.   0.
240. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.2   0.   0.   0.   0.   0.   0.   0.
250. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.1   0.   0.   0.   0.   0.   0.   0.
260. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.1   0.   0.   0.   0.   0.   0.   0.
270. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.1   0.   0.   0.   0.   0.   0.   0.
------*???????????????????????????????????????????????????????????????????????   0.   0.   0.1   0.   0.   0.   0.   0.   0.   0.
MAX  *   0.1   0.   0.   0.   0.   0.4   0.2   0.1   0.1   0.1   0.1   0.1   0.3   0.1   0.1   0.1   0.1   0.1   0.1   0.1
DEGR. *   50   0   0   0   0   180   10   30   20   10   10   10   200   0   0   10   10   10   10   20
```



```
    MODEL RESULTS
    -------------

    REMARKS : In search of the angle corresponding to
              the maximum concentration, only the first
              angle, of the angles with same maximum
              concentrations, is indicated as maximum.

 WIND ANGLE RANGE:    .-360.

 WIND  * CONCENTRATION
 ANGLE *      (PPM)
 (DEGR)* REC1   REC2   REC3   REC4   REC5   REC6   REC7   REC8   REC9   REC10  REC11  REC12  REC13  REC14  REC15  REC16  REC17
REC18  REC19  REC20
 ------*??????????????????????????????????????????????????????????????????????? REC11  REC12  REC13  REC14  REC15  REC16
REC17  REC18  REC19  REC20
280. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.1   0.   0.   0.   0.   0.   0.   0.
290. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.1   0.   0.   0.   0.   0.   0.   0.
300. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.1   0.   0.   0.   0.   0.   0.   0.
310. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.1   0.   0.   0.   0.   0.   0.   0.
320. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.2   0.   0.   0.   0.   0.   0.   0.
330. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.2   0.   0.   0.   0.   0.   0.   0.
340. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.2   0.   0.   0.   0.   0.   0.   0.
350. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.3   0.   0.   0.   0.   0.   0.   0.
360. *   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.2   0.1   0.1   0.   0.   0.   0.   0.
------*???????????????????????????????????????????????????????????????????????   0.   0.   0.2   0.1   0.1   0.   0.   0.   0.   0.
MAX  *   0.1   0.   0.   0.   0.   0.4   0.2   0.1   0.1   0.1   0.1   0.1   0.3   0.1   0.1   0.1   0.1   0.1   0.1   0.1
DEGR. *   50   0   0   0   0   180   10   30   20   10   10   10   200   0   0   10   10   10   10   20

    MODEL RESULTS
    -------------

    REMARKS : In search of the angle corresponding to
              the maximum concentration, only the first
              angle, of the angles with same maximum
              concentrations, is indicated as maximum.

 WIND ANGLE RANGE:    .-360.

 WIND  * CONCENTRATION
 ANGLE *      (PPM)
 (DEGR)* REC21  REC22  REC23  REC24  REC25  REC26  REC27  REC28  REC29  REC30  REC31  REC32  REC33  REC34  REC35  REC36  REC37
REC38  REC39  REC40
 ------*??????????????????????????????????????????????????????????????????????? REC11  REC12  REC13  REC14  REC15  REC16
REC17  REC18  REC19  REC20
   . *   0.   0.   0.   0.1   0.1   0.1   0.1   0.2   0.2   0.3   0.2   0.1   0.   0.   0.   0.   0.1   0.3   0.   0.
 10. *   0.1   0.1   0.1   0.1   0.2   0.2   0.2   0.2   0.1   0.3   0.3   0.1   0.1   0.1   0.   0.   0.1   0.4   0.   0.
 20. *   0.1   0.1   0.1   0.1   0.2   0.2   0.3   0.1   0.1   0.3   0.3   0.2   0.1   0.1   0.1   0.   0.1   0.3   0.   0.
 30. *   0.1   0.1   0.1   0.1   0.2   0.2   0.2   0.   0.   0.2   0.2   0.1   0.1   0.1   0.1   0.1   0.1   0.4   0.   0.
 40. *   0.1   0.1   0.1   0.1   0.1   0.2   0.2   0.   0.   0.2   0.2   0.1   0.1   0.1   0.1   0.1   0.1   0.4   0.1   0.
 50. *   0.1   0.1   0.1   0.1   0.1   0.2   0.2   0.   0.   0.2   0.2   0.1   0.1   0.1   0.1   0.1   0.   0.2   0.3   0.
```

60. * 0.1 0.1 0.1 0.1 0.1 0.1 0.2 0.2 0. 0.2 0.2 0.1 0.1 0.1 0.1 0. 0. 0.1 0.3 0.
70. * 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0. 0.1 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0.3 0.
80. * 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0. 0.1 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0.3 0.
90. * 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0. 0.1 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0.2 0.
100. * 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0. 0.1 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0.2 0.
110. * 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0. 0.1 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0.2 0.
120. * 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0. 0.1 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0.2 0.
130. * 0.1 0.1 0.1 0.1 0.1 0.1 0.2 0.1 0. 0.2 0.2 0.1 0.1 0.1 0.1 0. 0. 0. 0.2 0.
140. * 0.1 0.1 0.1 0.1 0.1 0.2 0.2 0. 0. 0.2 0.2 0.1 0.1 0.1 0.1 0.1 0. 0. 0.2 0.
------*??? 0.2 0.1 0.1 0.1 0.1 0.1 0. 0. 0.2
0.
MAX * 0.1 0.1 0.1 0.1 0.2 0.2 0.3 0.2 0.2 0.3 0.3 0.2 0.1 0.1 0.1 0.1 0.1 0.4 0.3 0.
DEGR. * 10 10 10 0 10 10 20 0 0 0 10 20 10 10 20 30 0 10 50 0

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: .-360.

WIND * CONCENTRATION
ANGLE * (PPM)
(DEGR)* REC21 REC22 REC23 REC24 REC25 REC26 REC27 REC28 REC29 REC30 REC31 REC32 REC33 REC34 REC35 REC36 REC37
REC38 REC39 REC40
------*??? REC11 REC12 REC13 REC14 REC15 REC16
REC17 REC18 REC19 REC20
150. * 0.1 0.1 0.1 0.1 0.1 0.2 0.2 0. 0. 0.2 0.2 0.1 0.1 0.1 0.1 0.1 0. 0.1 0.2 0.
160. * 0.1 0.1 0.1 0.1 0.2 0.2 0.2 0. 0. 0.3 0.3 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.2 0.
170. * 0.1 0.1 0.1 0.1 0.2 0.2 0.3 0. 0. 0.3 0.3 0.2 0.1 0.1 0.1 0.1 0.2 0. 0.2 0.
180. * 0.1 0.1 0.1 0.1 0.2 0.2 0.3 0.1 0.1 0.2 0.3 0.2 0.1 0.1 0.1 0.1 0.1 0. 0.3 0.
190. * 0. 0.1 0. 0.1 0.1 0.1 0.2 0.2 0.2 0.3 0.2 0.1 0. 0.1 0. 0. 0.1 0. 0.3 0.
200. * 0. 0. 0. 0. 0. 0.1 0.3 0.3 0.2 0.3 0.1 0. 0. 0. 0. 0. 0.1 0.1 0.3 0.
210. * 0. 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0. 0. 0. 0. 0. 0. 0.1 0.1 0.3 0.
220. * 0. 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0. 0. 0. 0. 0. 0.1 0.4 0.1 0.
230. * 0. 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0. 0. 0. 0. 0. 0.1 0.5 0. 0.
240. * 0. 0. 0. 0. 0. 0. 0.2 0.2 0.1 0.2 0.2 0. 0. 0. 0. 0. 0.1 0.4 0. 0.
250. * 0. 0. 0. 0. 0. 0. 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0. 0. 0.1 0.4 0. 0.
260. * 0. 0. 0. 0. 0. 0. 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0. 0. 0.2 0.3 0. 0.
270. * 0. 0. 0. 0. 0. 0. 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0. 0. 0.2 0.2 0. 0.
280. * 0. 0. 0. 0. 0. 0. 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0. 0.1 0. 0.2 0. 0.
290. * 0. 0. 0. 0. 0. 0. 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0. 0.1 0. 0.2 0. 0.
300. * 0. 0. 0. 0. 0. 0. 0.1 0.1 0.1 0.1 0.1 0. 0. 0. 0. 0.1 0. 0.2 0. 0.
310. * 0. 0. 0. 0. 0. 0. 0.2 0.1 0.1 0.2 0.2 0. 0. 0. 0. 0.1 0. 0.2 0. 0.
320. * 0. 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0. 0. 0. 0. 0. 0. 0.2 0. 0.
330. * 0. 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0. 0. 0. 0. 0. 0. 0.2 0. 0.
340. * 0. 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0. 0. 0. 0. 0. 0. 0. 0.2 0. 0.
350. * 0. 0. 0. 0. 0. 0. 0.3 0.2 0.2 0.3 0.1 0. 0. 0. 0. 0. 0.1 0.2 0. 0.
360. * 0. 0. 0. 0.1 0.1 0.1 0.1 0.2 0.2 0.3 0.2 0.1 0. 0. 0. 0. 0.1 0.3 0. 0.
------*??? 0.2 0.1 0. 0. 0. 0. 0.1 0.3 0. 0.
MAX * 0.1 0.1 0.1 0.1 0.2 0.2 0.3 0.3 0.2 0.3 0.3 0.2 0.1 0.1 0.1 0.1 0.2 0.5 0.3 0.
DEGR. * 10 10 10 0 10 10 20 200 0 0 10 20 10 10 20 30 170 230 50 0

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: .-360.

WIND * CONCENTRATION

ANGLE * (PPM)
(DEGR)* REC41 REC42 REC43 REC44 REC45 REC46 REC47 REC48 REC49 REC50 REC51 REC52 REC53 REC54 REC55 REC56 REC57
REC58 REC59 REC60
------*?? REC11 REC12 REC13 REC14 REC15 REC16
REC17 REC18 REC19 REC20
. * 0. 0. 0. 0. 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.5 0.5 0.6
10. * 0. 0. 0. 0. 0.1 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.2 0.3 0.4 0.4 0.3 0.3
------*?? 0.2 0.2 0.3 0.3 0.2 0.3 0.4 0.4 0.3
0.3
MAX * 0. 0. 0. 0. 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.2 0.3 0.4 0.5 0.5 0.6
DEGR. * 0 0 0 0 0 0 0 0 0 0 0 0 10 10 0 10 10 0 0 0

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: .-360.

WIND * CONCENTRATION
ANGLE * (PPM)
(DEGR)* REC41 REC42 REC43 REC44 REC45 REC46 REC47 REC48 REC49 REC50 REC51 REC52 REC53 REC54 REC55 REC56 REC57
REC58 REC59 REC60
------*?? REC11 REC12 REC13 REC14 REC15 REC16
REC17 REC18 REC19 REC20
20. * 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.4 0.4 0.6 0.5 0.1 0.3
30. * 0. 0. 0. 0. 0.2 0.2 0.3 0.2 0.2 0.2 0.2 0.2 0.4 0.4 0.5 0.5 0.6 0.5 0.1 0.2
40. * 0. 0. 0. 0. 0.2 0.3 0.2 0.2 0.2 0.2 0.3 0.1 0.4 0.3 0.4 0.5 0.6 0.5 0.2 0.3
50. * 0. 0. 0. 0. 0.2 0.2 0.1 0. 0. 0. 0. 0. 0.2 0.3 0.4 0.4 0.5 0.7 0.2 0.3
60. * 0.1 0. 0. 0. 0.1 0.2 0. 0. 0. 0. 0. 0. 0.1 0.2 0.3 0.3 0.4 0.6 0.2 0.2
70. * 0. 0. 0. 0. 0. 0.1 0. 0. 0. 0. 0. 0. 0.1 0.1 0.2 0.2 0.3 0.6 0.2 0.2
80. * 0. 0. 0. 0. 0. 0.1 0.1 0. 0. 0. 0. 0. 0. 0.1 0.2 0.2 0.3 0.5 0.2 0.2
90. * 0. 0. 0. 0. 0. 0.1 0.1 0.1 0. 0. 0. 0. 0. 0. 0.2 0.2 0.3 0.4 0.2 0.3
100. * 0. 0. 0. 0. 0. 0.1 0.1 0.1 0. 0. 0. 0. 0. 0. 0.2 0.2 0.3 0.3 0.2 0.2
110. * 0. 0. 0. 0. 0. 0.1 0.1 0.1 0. 0. 0. 0. 0. 0. 0.2 0.2 0.3 0.3 0.2 0.2
120. * 0. 0. 0. 0. 0. 0.1 0.1 0.1 0. 0. 0. 0. 0. 0. 0.2 0.2 0.3 0.3 0.2 0.3
130. * 0. 0. 0. 0. 0. 0.1 0.1 0.1 0. 0. 0. 0. 0. 0. 0.2 0.2 0.3 0.4 0.2 0.3
140. * 0. 0. 0. 0. 0. 0.1 0.1 0.1 0. 0. 0. 0. 0. 0. 0.2 0.3 0.3 0.4 0.2 0.3
150. * 0. 0. 0. 0. 0. 0.1 0.1 0.1 0. 0. 0. 0. 0. 0. 0.2 0.3 0.4 0.4 0.2 0.3
160. * 0. 0. 0. 0. 0. 0.1 0.1 0.1 0. 0. 0. 0. 0. 0.1 0.3 0.3 0.4 0.4 0.3 0.4
170. * 0. 0. 0. 0. 0. 0.1 0.1 0.1 0. 0. 0. 0. 0. 0.1 0.2 0.3 0.4 0.5 0.3 0.4
180. * 0. 0. 0. 0. 0. 0.1 0.1 0. 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.3 0.7 0.3 0.5
190. * 0. 0. 0. 0. 0. 0.1 0.1 0. 0. 0. 0. 0. 0. 0.1 0.1 0.2 0.2 0.6 0.3 0.4
200. * 0. 0. 0. 0. 0. 0.1 0.1 0. 0. 0. 0. 0. 0.1 0.1 0.2 0.2 0.2 0.6 0.3 0.4
210. * 0. 0. 0. 0. 0. 0.1 0.1 0. 0. 0. 0. 0. 0.2 0.2 0.3 0.3 0.3 0.6 0.4 0.2
220. * 0. 0. 0. 0. 0. 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.4 0.4 0.3 0.4 0.6 0.4 0.2
230. * 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.7 0.6 0.6 0.5 0.5 0.4 0.3 0.4
240. * 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.5 0.5 0.5 0.4 0.4 0.4 0.2 0.3
250. * 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.2 0.2 0.2 0.3 0.2 0.3
260. * 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.2 0.2 0.2 0.2 0.2 0.2 0.3
270. * 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.1 0.2 0.1 0.4
280. * 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.1 0.2 0.1 0.2 0.1 0.3
290. * 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.1 0.2 0.1 0.2 0.1 0.3
300. * 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.1 0.2 0.1 0.2 0.1 0.4
310. * 0. 0. 0. 0. 0. 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.1 0.2 0.1 0.3 0.1 0.4
320. * 0. 0. 0. 0. 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.1 0.2 0.1 0.3 0.3 0.2
330. * 0. 0. 0. 0. 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.2
340. * 0. 0. 0. 0. 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.3
350. * 0. 0. 0. 0. 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.4
360. * 0. 0. 0. 0. 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.5 0.5 0.6
------*?? 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.5 0.5
0.6
MAX * 0.1 0. 0. 0. 0.2 0.3 0.3 0.2 0.2 0.2 0.3 0.2 0.7 0.6 0.6 0.5 0.6 0.7 0.5 0.6
DEGR. * 60 0 0 0 20 40 30 0 0 0 40 0 230 230 230 30 20 50 0 0

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: .-360.

WIND * CONCENTRATION
ANGLE * (PPM)

------*?? REC11 REC12 REC13 REC14 REC15 REC16 REC17 REC18 REC19 REC20

(DEGR)*	REC61	REC62	REC63	REC64	REC65	REC66	REC67	REC68	REC69	REC70	REC71	REC72	REC73	REC74	REC75	REC76	REC77	REC78	REC79	REC80
. *	0.3	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
10. *	0.	0.1	0.	0.	0.	0.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.1	0.	0.
20. *	0.	0.1	0.1	0.	0.	0.3	0.2	0.1	0.2	0.	0.	0.	0.	0.	0.	0.	0.	0.3	0.	0.
30. *	0.	0.1	0.1	0.	0.	0.3	0.2	0.2	0.2	0.1	0.1	0.	0.	0.	0.	0.	0.	0.4	0.	0.
40. *	0.	0.	0.1	0.	0.	0.2	0.2	0.3	0.3	0.1	0.2	0.1	0.1	0.1	0.1	0.	0.	0.4	0.1	0.1
50. *	0.1	0.	0.1	0.	0.	0.2	0.2	0.2	0.4	0.2	0.2	0.1	0.2	0.2	0.2	0.	0.	0.4	0.3	0.3
60. *	0.1	0.	0.1	0.	0.	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.	0.	0.3	0.4	0.4
70. *	0.1	0.	0.	0.	0.	0.2	0.2	0.2	0.3	0.2	0.1	0.2	0.2	0.3	0.3	0.	0.	0.1	0.4	0.3
80. *	0.1	0.	0.	0.	0.	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.3	0.3	0.	0.	0.1	0.3	0.3
90. *	0.1	0.	0.	0.	0.	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.3	0.3	0.	0.	0.1	0.2	0.2
100. *	0.	0.	0.	0.	0.	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.	0.	0.1	0.2	0.2
110. *	0.	0.	0.	0.	0.	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.	0.	0.1	0.2	0.2
120. *	0.	0.	0.	0.	0.	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.	0.	0.1	0.2	0.2
130. *	0.	0.	0.	0.	0.	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.	0.	0.2	0.2	0.2
140. *	0.	0.	0.	0.	0.	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.	0.	0.2	0.2	0.1
150. *	0.	0.	0.	0.	0.	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.2	0.	0.	0.2	0.2	0.1
160. *	0.	0.	0.1	0.	0.	0.3	0.2	0.2	0.2	0.3	0.4	0.3	0.2	0.3	0.2	0.	0.	0.2	0.2	0.1
170. *	0.2	0.1	0.2	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.	0.	0.2	0.2	0.1
180. *	0.4	0.2	0.3	0.2	0.3	0.4	0.1	0.3	0.1	0.2	0.3	0.2	0.3	0.3	0.3	0.	0.	0.2	0.3	0.2
190. *	0.4	0.3	0.4	0.3	0.3	0.1	0.1	0.3	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.	0.	0.1	0.3	0.3
200. *	0.4	0.4	0.3	0.3	0.3	0.	0.	0.1	0.	0.2	0.2	0.2	0.3	0.3	0.3	0.	0.	0.2	0.3	0.3
210. *	0.5	0.4	0.3	0.3	0.2	0.	0.	0.1	0.	0.2	0.2	0.3	0.3	0.3	0.2	0.	0.	0.2	0.3	0.2
220. *	0.4	0.4	0.3	0.2	0.2	0.	0.	0.	0.	0.1	0.1	0.2	0.2	0.2	0.1	0.	0.	0.4	0.1	0.1
230. *	0.3	0.4	0.3	0.2	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.6	0.	0.
240. *	0.3	0.4	0.3	0.2	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.5	0.	0.
250. *	0.3	0.4	0.2	0.2	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
260. *	0.2	0.3	0.2	0.2	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
270. *	0.2	0.3	0.2	0.2	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
280. *	0.2	0.3	0.1	0.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
290. *	0.2	0.3	0.1	0.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
300. *	0.2	0.3	0.1	0.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
310. *	0.3	0.3	0.2	0.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
320. *	0.4	0.3	0.2	0.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
330. *	0.4	0.4	0.2	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
340. *	0.4	0.3	0.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
350. *	0.4	0.3	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.
360. *	0.3	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.	0.

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MAX *	0.5	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.	0.	0.6	0.4	0.4
DEGR. *	210	200	190	190	180	180	60	40	50	150	160	160	170	70	60	0	0	230	60	60

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: .-360.

WIND * CONCENTRATION
ANGLE * (PPM)
(DEGR)* REC81 REC82 REC83 REC84 REC85 REC86 REC87 REC88 REC89 REC90 REC91 REC92 REC93 REC94 REC95 REC96 REC97 REC98 REC99
------*??- m" lobal Definition"|"UNITS m" Global Definition"|"UNITS m

(DEGR)*	REC81	REC82	REC83	REC84	REC85	REC86	REC87	REC88	REC89	REC90	REC91	REC92	REC93	REC94	REC95	REC96	REC97	REC98	REC99
. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.2	0.2	0.2	0.1	0.	0.	0.1	0.
10. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.3	0.3	0.2	0.2	0.	0.1	0.1	0.1
20. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.3	0.3	0.4	0.3	0.	0.1	0.2	0.2
30. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.1	0.3	0.3	0.3	0.3	0.3	0.	0.1	0.1	0.2
40. *	0.1	0.2	0.3	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.	0.1	0.1	0.2
50. *	0.3	0.3	0.3	0.2	0.3	0.1	0.2	0.3	0.3	0.4	0.	0.1	0.1	0.2	0.1	0.	0.1	0.1	0.2
60. *	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.	0.	0.	0.	0.	0.	0.1	0.1	0.2
70. *	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.	0.	0.	0.	0.	0.	0.1	0.1	0.2
80. *	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.	0.	0.	0.	0.	0.	0.1	0.1	0.2
90. *	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.	0.	0.	0.	0.	0.1	0.1	0.1	0.2
100. *	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.	0.	0.	0.	0.	0.1	0.1	0.2	0.2
110. *	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.	0.	0.	0.	0.	0.1	0.1	0.2	0.2
120. *	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.	0.	0.	0.	0.	0.1	0.1	0.2	0.2
130. *	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.	0.	0.	0.	0.	0.1	0.1	0.2	0.2
140. *	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.	0.	0.	0.	0.	0.1	0.1	0.2	0.2
150. *	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.	0.	0.	0.	0.	0.2	0.2	0.3	0.2
160. *	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.	0.	0.	0.	0.	0.2	0.3	0.5	0.3
170. *	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.	0.	0.	0.	0.	0.3	0.3	0.5	0.3
180. *	0.2	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.	0.	0.	0.	0.	0.2	0.2	0.3	0.3
190. *	0.3	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.	0.	0.	0.	0.	0.1	0.1	0.1	0.1
200. *	0.3	0.3	0.4	0.2	0.3	0.3	0.3	0.3	0.2	0.1	0.	0.	0.	0.1	0.	0.	0.	0.	0.
210. *	0.2	0.2	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.
220. *	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.	0.	0.1	0.3	0.	0.	0.	0.
230. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.1	0.2	0.3	0.2	0.4	0.4	0.	0.	0.	0.
240. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.2	0.2	0.3	0.3	0.	0.	0.	0.
250. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.2	0.2	0.2	0.2	0.	0.	0.	0.
260. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.1	0.1	0.2	0.2	0.	0.	0.	0.
270. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.1	0.1	0.2	0.2	0.2	0.	0.	0.	0.
280. *	0.	0.	0.	0.	0.1	0.	0.1	0.1	0.	0.	0.1	0.1	0.2	0.2	0.2	0.	0.	0.	0.
290. *	0.	0.	0.	0.	0.1	0.1	0.1	0.1	0.1	0.	0.1	0.1	0.2	0.2	0.2	0.	0.	0.	0.
300. *	0.	0.	0.	0.	0.1	0.1	0.1	0.1	0.1	0.	0.	0.1	0.2	0.2	0.2	0.	0.	0.	0.
310. *	0.	0.	0.	0.	0.1	0.1	0.1	0.1	0.1	0.	0.	0.1	0.2	0.2	0.2	0.	0.	0.	0.
320. *	0.	0.	0.	0.	0.1	0.1	0.1	0.1	0.1	0.	0.	0.1	0.2	0.2	0.2	0.	0.	0.	0.
330. *	0.	0.	0.	0.	0.1	0.1	0.1	0.1	0.1	0.	0.	0.1	0.2	0.2	0.1	0.	0.	0.	0.
340. *	0.	0.	0.	0.	0.	0.	0.1	0.1	0.	0.	0.	0.1	0.2	0.2	0.1	0.	0.	0.	0.
350. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.1	0.1	0.2	0.2	0.1	0.	0.	0.	0.
360. *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	0.2	0.2	0.2	0.1	0.	0.	0.1	0.

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MAX *	0.4	0.4	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.5	0.3
DEGR. *	60	60	200	60	60	60	60	50	50	50	30	10	10	20	230	170	160	160	160

THE HIGHEST CONCENTRATION OF 0.70 ppm OCCURRED AT RECEPTOR REC58.

Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents (*Appendix C - Council on Environmental Quality (CEQ) Provisions Covering Incomplete or Unavailable Information (40 CFR 1502.22)*)

Sec. 1502.22 Incomplete Or Unavailable Information

When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.

- If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.
- If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement:
  - a statement that such information is incomplete or unavailable;
  - a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
  - a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and
  - the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts that have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.
- The amended regulation will be applicable to all environmental impact statements for which a Notice to Intent (40 CFR 1508.22) is published in the Federal Register on or after May 27, 1986. For environmental impact statements in progress, agencies may choose to comply with the requirements of either the original or amended regulation.

Incomplete Or Unavailable Information For Project-Specific MSAT Health Impacts Analysis

In FHWA’s view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the CAA and its amendments and have specific statutory obligations with respect to HAPs and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the IRIS, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects".[1] Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude. Other organizations are also active in the research and analyses of the human health effects of MSAT, including the HEI. A number of HEI studies are summarized in Appendix D of FHWA's *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*. Among the adverse health effects linked to MSAT compounds at high exposures are: cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations [2] or in the future as vehicle emissions substantially decrease.

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI.[3] As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA states that with respect to diesel engine exhaust, "[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk.[4]

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls

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[1] EPA, *Integrated Risk Information System*, https://www.epa.gov/iris.

[2] HEI, *Mobile-Source Air Toxics: A Critical Review of the Literature on Exposure and Health Effects*, *Special Report 16*, November 2007, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects.

[3] HEI, *Mobile-Source Air Toxics: A Critical Review of the Literature on Exposure and Health Effects*, *Special Report 16*, November 2007, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects.

[4] IRIS, Chemical Assessment Summary, Diesel Engine Exhaust; CASRN N.A., https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0642_summary.pdf.

are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an “acceptable” level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA’s approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.[5]

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

[5] Natural Resources Defense Council v. EPA, 529 F.3d 1077 (D.C. Cir. 2008), https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/$file/07-1053-1120274.pdf.