ALLIANCE OF RESIDENTS CONCERNING O'HARE, Inc. "a grass roots organization"

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November 7, 2003

Ms. Gayle Borchard, EIR Manager
Port of Oakland
530 Water St.
Oakland, CA 94607

Dear Ms. Borchard:

The Alliance of Residents Concerning O'Hare (AReCO) is a respected Chicago area organization known globally and with many years experience, that has been at the vanguard of airport and aircraft related public health and environmental issues since the mid-nineties. AReCO is the leading organization protecting the public's health, safety and welfare related to key transportation projects. AReCO membership represents communities and members in 41 communities, with many top experts; thus, we bring strong, factual evidence to the table.

AReCO has a vital interest in assuring that the environmental protection process fully complies with full disclosure, all environmental laws and regulations and all other aspects that will protect citizens' health, safety, our environment and other quality of life issues.

Airports and their aircraft are among the worst polluters in the world, causing significant damage not only with their extraordinary contribution to climate change, but, also pandemic public health problems caused by their toxic pollution.

A recent prestigious eight-state EPA study found that collectively, the aircraft alone at Boston's Logan, Bradley, and Manchester airports emitted 3,538 tons of NOx, 4,461 tons of CO, and 700 tons of HC in 1999. The combined aircraft-related benzene emissions were 20 tons at the three airports in 1999. *By startling comparison, aggregate benzene emissions from the largest stationary sources in Massachusetts, Connecticut, and New Hampshire combined totaled only six tons in 1996.*[1]

In fact, extrapolating the study's findings to Chicago's O'Hare Airport and all its related aircraft operations demonstrates that it is not only the worst polluter in the state of Illinois, but among the worst, if not the worst man-made polluter in the whole United States! Government and independent studies show strong correlations that O'Hare Airport and its aircraft operations are a major contributor in full or part for the deaths of hundreds of people a year in these areas, from cancer alone.

We state these facts to qualify our credentials, realizing that though the Oakland airport is substantially smaller than O'Hare, most of the issues and concerns apply, just in smaller scale.

The Alliance of Residents Concerning O'Hare (AReCO) respectfully submits the following comments in respect to the Oakland Airport 2003 SEIR:

Thank you.

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[1] Northeast States for Coordinated Air Use Management and Center for Clean Air Policy. "Controlling Airport-Related Air Pollution," June 2003.

Sincerely,

Jack Saporito
Executive Director

The Alliance of Residents Concerning O'Hare (AReCO) Comments to the Port of Oakland re. Oakland International Airport 2003 SEIR

AReCO respectfully submits its comments to the Port of Oakland (the "Port"), regarding the 2003 SEIR.

The Port prepared this 2003 SEIR (supplement to the 1997 EIR) to comply with a California State Court of Appeal's August 2001 decision. In addition, this SEIR evaluates changes to the ADP that have occurred since completion of the 1997 EIR and 1999 SEIR, as well as changes in circumstances or new information that could not have been known when the 1997 EIR and 1999 SEIR were prepared.

After the Port completed the 1999 SEIR and the five addenda, the State Court of Appeal ruled in August 2001 that the Port must prepare an SEIR to further address the following issues: (1) assessment of the potential noise from increased nighttime flights in 2010; (2) quantification of mobile-source emissions of toxic air contaminants that would be emitted from normal operation conducted as part of the ADP, and analysis of whether these emissions of toxic air contaminants would result in significant health impacts; and (3) mitigation for impacts to western burrowing owls. On December 23, 2002, the Superior Court entered a Revised Judgment and on December 26, 2002, issued a Revised Writ of Mandate. The Revised Judgment authorized the Port to proceed with specified components of the ADP and provided further detail regarding this information required in the second supplement to the 1997 EIR (2003 SEIR) in order to comply with the Court of Appeal's decision.

We take this opportunity to comment specifically on item (2) above, including areas associated with or relevant to the issues.

Quantification of mobile-source emissions of toxic air contaminants that would be emitted from normal operation conducted as part of the ADP, and analysis of whether these emissions of toxic air contaminants would result in significant health impacts.

(1) In order to successfully achieve this overall objective, the Port first must quantify the projected overall net expected air contaminant emissions from all aircraft operations (the "mobile source"). Ideally, this should be done by calculating current fleet emissions and comparing that to the expected emissions after project completion, as well as for subsequent maximum expected operational capability reached some time in the future.

These important future-vs.-today differences are often purposely minimized through manipulation of the figures to both jack up current emission numbers while minimizing future projected emissions. A tactic often employed here is to create a "do-nothing" condition i.e., no project implementation, in order to show that emissions will be ratcheted much higher even if the project is not implemented, generally through the assumption of vastly increased taxiing and idling times. This portrayal of the assumed do-nothing condition is typically not backed up with any solid technical or economical science that would support such assumptions; for instance, that airlines would not reduce operations in the face of tremendous delays at the facility or falloffs in passenger demand due to such delays.

Another minimization tactic is to project future operations at less than the maximum safe design level which, once approved and built, would allow for many more operations than originally environmentally analyzed.

The Port appears to have done a good job here in that even though projected operational levels have been reduced over the last several years, due to new information on circumstances and alternatives, the operational level assumed for emissions analysis has been kept conservatively high.

(2) Another critical requirement to air contaminant emission quantification is knowledge of the exact expected emissions of all possible significant contaminants from numerous types and ages of engines, mounted on many types of aircraft and operating under many different conditions.

This characterization is not helped by the fact that the airlines and aircraft/engine manufacturing industry have been extremely lax (some would say purposefully so) in providing such information at the time of certification. This failure to act in the United States falls first in responsibility upon the FAA, with their powers of aviation enforcement, and secondly upon the USEPA, responsible for setting engine emission standards and regulations. These failures are facilitated by foot-dragging and inaction by the air transportation-dominated International Civil Aviation Organization (ICAO), which postures international compatibility and treaty positions in order to justify their continuing lack of attentiveness to the engine characterization process.

In view of these failures, the Port, working closely with CARB, has had to construct estimates of these emissions and again is to be congratulated on doing an overall good job, excepting one area.

Referring to "APPENDIX C, HUMAN HEALTH RISK ASSESSMENT IN SUPPORT OF THE SUPPLEMENTAL TOXIC AIR CONTAMINANTS ANALYSIS IN THE SEIR", the following quotations (indented) are germane to our comments (* following the quotes).

> "To estimate chemical-specific emissions for aircraft in each of the four flight categories, the following information was used: (1) HC emission factors for each engine, (2) metals composition in Jet A and fuel consumption for each engine, (3) fleet mix and operational activity for each flight category, (4) TIM, and (5) chemical speciation for aircraft HC and PM emissions."

*We agree, though we comment that the subsequent metals emissions calculations excluded mercury, based on a position of "not detected" in the assumed fuels, whereas other studies (e.g. turbine power plants) have detected mercury constituents and, with the volume of fuel burn at the airport, we believe that net mercury emissions could be meaningful. The Port should review this aspect.

> "2.1.3 Emission Factors
> Mode-specific HC emission factors in EDMS were used for both turbine and piston engines. All engines selected were included in the EDMS 4.11 database; therefore,

substitution from the International Civil Aviation Organization (ICAO) database was not required.

2.1.4 Chemical Speciation
Emissions of individual TACs in the hydrocarbons emitted by aircraft were calculated using "speciation profiles." California Air Resources Board (CARB) had developed an organic speciation profile (No. 586) for aircraft engines, based on data presented in a report prepared in the early 1980s (Spicer et al. 1984). Since that time, at least four other source tests that reported speciated emissions from aircraft engines have been published (Spicer et al. 1987; Spicer et al. 1988; Spicer et al. 1990; Gerstle et al. 1999).

On April 11, 2003, and confirmed on April 14, 2003, CARB informed the Port that it recommends using all available test data to develop a composite speciation profile (CARB 2003a,b). On May 1, 2003, the Port presented its proposed profile for aircraft engine exhaust for turbofans and turboprops. CARB indicated that the approach used to develop turbine aircraft speciation profiles was acceptable (CARB 2003c). … The speciation profiles (mass fractions relative to total HC) used to estimate TAC emissions from turbine engine aircraft operating at OAK are presented in Table 2-5."

*We agree. It appears that a responsible process was followed and we are not in a knowledgeable position to refute any of the key emission factors settled on.

"2.1.3 Emission Factors (cont.)
Mode-specific PM emission factors for aircraft turbine engines were determined based on methodology contained in recent literature (Wayson 2002). PM emissions were estimated using a formula relating smoke number (SN) to black carbon PM emissions:
EI PM = 0.6*SN^1.8 mg/kg fuel (Equation 2-1)
where: EIPM = PM Emission Index, in mg/kg fuel
SN = ICAO reported smoke number, unitless
Turboprop and piston aircraft PM emission factors were estimated from the one turboprop engine PM emission index provided in the Fifth Edition of AP-42, Volume 2 (U.S. EPA 1985). Mode-specific PM emission factors for each engine selected for this SEIR are presented in Table 2-4."

*This crude PM estimation is unfortunately required because of the authority and airline failures, identified above, to even minimally measure and characterize engine PM emissions. The ancient "smoke number" was created to respond to negative public reactions to "smoke" visibility issues and remains just that. Even more unfortunate is the fact that this crude calculation does not provide for separation of total PM into the categories of PM2.5, PM10, especially important due to their known health hazard differences. *These problems, amongst others, are dealt with (see below) by discarding all aircraft PM generation from the health hazard calculations. We heartily disagree with this "ultimate solution" to the problem and strongly recommend that the Port reconsider this area, finding a better way to estimate the aircraft PM emissions and resulting health hazards.*

"5.3.1 Evaluation for Particulates in Jet Exhaust

Diesel exhaust is expected to be emitted in large quantities from Airport-related sources under the ADP alternatives and the No Project, and is therefore quantitatively evaluated in the HHRA. Only diesel exhaust from ground sources (e.g., trucks and buses) is included in these evaluations. Aircraft emissions were not included in the quantification of diesel emissions because aircraft engines are not diesel engines. There is insufficient information regarding the nature and toxicity of total petroleum hydrocarbon (TPH) emissions associated with aircraft and toxicity criteria for these emissions are not available. Toxicity criteria are available for diesel exhaust in general, however, extrapolation of these criteria to TPH emitted from aircraft was not considered scientifically justifiable. Aircraft use a lighter fuel and a substantially different combustion process than do diesel engines and have therefore very different emissions.

Toxicological research indicates that the component of diesel exhaust responsible for most toxicological effects is PM and U.S. EPA's reference concentration (RfC) for diesel exhaust is based entirely upon PM. Diesel engines produce particulate matter in large amounts. Burning of jet fuel in engines using modern turbine technology creates much less particulate matter than is created during diesel fuel combustion. Due to different fuels and combustion processes in jet engines and diesel engines, particulate emissions from both types of engines are also expected to differ chemically, physically, and therefore, toxicologically. These issues are discussed in more detail in Sections 2 and 3.

Due to expected toxicological differences, extrapolation of PM emissions from diesel exhaust to jet exhaust is not considered appropriate or scientifically justifiable. This was recognized in a January 2000 CARB Advisory Committee draft report on commercial airport activities. This report stated that it may not be appropriate to use the Cal EPA Unit Risk Factor for diesel PM in (3.0 x 10 -4 µg/m 3) when assessing toxic impacts associated with particulate emissions from aircraft.

The lack of quantitative evaluation of TPH emissions from aircraft results in some uncertainty in the risk estimates presented in the HHRA. However, ground sources are expected to emit large quantities of PM, and aircraft engines are expected to emit relatively little, and, therefore, any underestimation of diesel related risks, if they exist for aircraft emissions, are, in any case, still adequately characterized."

*The twisted hyperbole of this section does little to justify elimination of all aircraft-emitted PM from health hazard consideration and is not considered acceptable. At a bare minimum, and in keeping with other conservative study approaches, some estimation of a maximum level for PM2.5 and PM10 emissions should have been concluded and used in the subsequent air concentration and health hazard calculations. Use of the diesel Unit Risk Factor to facilitate that estimate would at least be better than the quite inadequate and patronizing conclusion that "…any underestimation of diesel related risks, if they exist for aircraft emissions, are, in any case, still adequately characterized." The Port should redo the PM portion of the study and conclusions, incorporating conservative and also maximum estimates for amounts, speciation, concentrations and health impacts of aircraft generated PM.

Toxic Air Contaminants Environmental Impact

> "The ADP in 2010 could result in an incremental acute non-cancer health hazard above the significance threshold of one for most population groups evaluated.
> 3.2.11.3 INCREMENTAL ACUTE NON-CANCER HAZARD IMPACTS The incremental acute non-cancer hazard estimates for all alternatives in 2010 are greater than the threshold of significance of one; accordingly, although the magnitude of the increase varies among the alternatives, all are deemed to result in significant incremental acute non-cancer hazard impacts in 2010. The acute noncancer effect is caused by the modeled concentrations of one TAC, acrolein. As previously discussed in subsection 3.2.8.3, incremental hazards due to acute exposure to acrolein under the ADP in 2010 are estimated to be as high as 4 for some residential locations near the Airport, and as high as 9.5 for one open space receptor.
>
> No feasible mitigation exists for the significant incremental acute non-cancer hazard impact due to increased acrolein emissions under the ADP in 2010 because the primary source of acrolein is exhaust from aircraft engines over which the Port has no jurisdiction or control."

And yet……..

> [P 3.2-54] "Under Criteria Pollutant Emission Mitigation #2, the Port will install … pre-conditioned air at newly constructed and renovated terminal gates to reduce the emissions associated with APUs and certain GSE. ... This mitigation measure will further reduce TAC emissions related to APUs and diesel PM from associated GSE. <u>This mitigation may result in some reductions in estimated incremental non-cancer hazard risks associated with acrolein because APUs are modeled as small turbine engines running on jet fuel.</u> "

* Noise also largely emanates from "…exhaust from aircraft engines over which the Port has no jurisdiction or control" and yet the Port, like many other airport authorities, has substantial and costly mitigation programs in place (e.g. residential and school "noise-proofing"). Since there appears to be no presentation and discussion of possible acrolein mitigation alternatives outside the airport boundaries, we strongly disagree with this conclusion. Indeed, the above statement demonstrates that such alternatives may actually exist, for example ensuring that all residences, schools, etc. in the unacceptable acrolein regions are equipped with pre-conditioned air (air conditioning, filtering and ionization mitigation). This is no different than with noise mitigation, a substantial portion of which involves air conditioning in order to "seal" the building from outside (noise) impacts.

<u>The Port needs to do more due-diligence in this area, with a thorough look at what the alternatives are to protect the citizens and to consider how those alternatives might be implemented in order to preserve the citizens', particularly children, health.</u>

Air Contaminant Concentration Simulation Modeling

The fundamental dispersion model used by the Port for simulating existing and future atmospheric contaminant concentrations from airport emissions is the ISCST3 model, viz:

> "Therefore, • /Q values were calculated for each emission source group using the U.S. EPA's ISCST3 air dispersion model, version 02035. U.S. EPA default model settings were used except that missing data processing routines were used (see discussion in Section 3.4). ISCST3 is a U.S. EPA-recommended air dispersion model (see 40 CFR Part 51, Appendix W: Guideline on Air Quality Models) and preferred by BAAQMD and CARB."

ISCST3 is a very old "workhorse" model and was used instead of the AERMOD model imbedded in the FAA's overall EDMS package. It was used instead of AERMOD because:

> "…AERMOD, the likely successor to ISCST3, is currently not yet recommended by U.S. EPA, CARB, or BAAQMD to evaluate the impacts of air toxics emissions for regulatory purposes, since it is still undergoing regulatory review."

In fact, we believe that ISCST3 is not a capable simulation model for this analysis (and that AERMOD would not have been as well). The primary reason is that ISCST3 is incapable of adequately modeling the complex atmospheric conditions that would typically be experienced in the airport surrounds.

The Oakland airport sits squarely on a coastal area and it would be expected that complex wind conditions would exist, conditions that would cause winds to shift dramatically away from the airport. These shifts would be caused by at least two phenomena (1) the terrain effect of the ridged area generally about 7 miles east of the airport and (2) "sea-breeze" effects which would act to create temporal direction changes, lateral stratifications with differing air movements and sea-breeze inland frontal zones creating substantial vertical wind components. These sea-breeze conditions, in addition to being characterized by complex wind fields, can also result in "fumigation" effects that effectively cause increased air contaminant concentrations. [It is well known that some of the worse pollution conditions exist in coastal regions due to these effects.]

It also appears that the entire area wind field characterization is made by assuming that the winds that exist at the airport, the measuring point, exist at the same level and direction at all times throughout the modeled region. Correcting this erroneous assumption is impossible as long as ISCST3 is the assumed model since it is generally incapable of accepting anything more.

A more capable model should be used for the analysis, such as perhaps CALPUFF. We are not here stating that CALPUFF is a perfect model but that it would provide more accurate air contaminant concentration results. Certainly CALPUFF is known to the Port and to CARB, so we are unable to state reasons why it may have not been chosen and applied. One reason might be that CALPUFF use would involve a greater investment of resources, including better definition of the (3D) complex area wind fields, especially as affected by the sea-breeze effects.

None-the-less, the primary objective should be to provide as accurate of results as possible, rather than to minimize analysis investments. In this case, CALPUFF (or other advanced alternatives) would very probably show concentration results that were significantly greater than now predicted and would substantially shift conclusion interpretations where, for example, cancer risk factors were thus moved from less than 10^-6 to greater than 10^-6 (per lifetime), the latter representing substantial health risk regulatory problems for the project.

We have attached (Appendix) for the Port's reference significant portions of an EPA document that compares ISCST3 modeling performance to CALPUFF's. Though none of the geographical areas examined were an exact coastal match to Oakland, the results for Medford Oregon are similar to what might be seen in a sea-breeze environment. We excerpt the following to support that view:

When all these and other meteorological conditions are recorded on an hourly basis and form a complete year of meteorological data, the effects on concentrations vary between the models and from region to region. The meteorologically induced variations in concentrations do not appear to be so much a regional phenomena, but the variations are related to how the hourly meteorological conditions occur preceding and during a given averaging period. It is possible to have 4 or 5 hours of winds in one general direction followed by 4 hours of calm winds, and then followed by several hours of reversed wind flow. This can occur in any one of the regions. However, the potential frequency of this occurrence may be higher for one region than another. Since calm winds have a causal relationship leading to higher concentrations, then a site such as Medford with a relatively greater incidence of calms (i.e.,, 22% calm hours versus the other regions having around 6%) will have higher concentrations associated with CALPUFF.

Indeed, periods of winds in one direction followed by winds in the opposite direction, interspersed with calm periods, is exactly what one sees on the surface (away from the frontal zone) in sea-breeze environments. We include the wind rose diagrams for both Oakland airport and Medford to further demonstrate similarity.

Figures L-3 and L-4 demonstrate that Medford type environments can easily result in contaminant increases of perhaps up to 4X (400%) as compared to ISCST3.

Monitoring

From: 3.2.3 GENERAL DESCRIPTION OF METHODS USED TO MEASURE AND ESTIMATE TACs

> "In the Bay Area, both BAAQMD and CARB operate TAC monitoring networks. BAAQMD has a TAC monitoring network of 11 sites located primarily in urban community settings. The BAAQMD TAC monitor nearest to the Airport is at 198 Oak Road in Oakland, about seven miles north of the Airport. At that site, BAAQMD monitors for vinyl chloride, methylene chloride, chloroform, ethylene dichloride, methyl chloroform, carbon tetrachloride, trichloroethylene, benzene, ethylene dibromide, perchloroethylene, toluene, and methyl tertiary-butyl ether (MTBE).
>
> CARB sponsors TAC monitoring at five stations in the Bay Area.7 At these sites, CARB monitors for many of the same TACs monitored by BAAQMD, plus additional gaseous compounds (e.g., formaldehyde and acetaldehyde) and some particulate-based TACs (e.g., toxic metals and several polycyclic aromatic hydrocarbons). CARB has a full-time TAC monitoring station in Fremont about 19 miles southeast of the Airport. This is CARB's site closest to the Airport with published data (BAAQMD, 2001)."

AReCO believes this degree of monitoring is totally incapable of adequately and accurately characterizing the actual toxic air contaminant levels in the area surrounding the airport e.g. 7-mile radius, since obviously there are only two monitors and both are well away from the airport. This is especially true, considering the area's wind environment (see wind rose in Appendix), which has little north or south content.

Equally important, whereas monitored data can be used to verify the validity of simulated results and therefore the validity of the model itself and the selected input/output parameters, in this case any data is basically useless. *This is unfortunate in that it leaves no credible "checks and balances" to ensure the Port's simulated results are credible.*

The Port should be required to verify the validity of any simulation model and parameter set by testing the results (current operations) against readings from toxic monitors temporarily located in the area east of the airport (e.g. along a line, at distances of 0.5, 3 and 7 miles distance). Approval of the project should also incorporate a requirement to implement permanent monitors at appropriate locations in the eastern region.

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Appendix

Advanced Dispersion Models

Conventional dispersion models (e.g. ISCST3) have significant limitations when dealing with situations such as light wind conditions, complex terrain and various source structures (e.g. tall stacks). This is due to the simplifications made to the atmospheric process to enable a model to run quickly. More advanced numerical models such as CALPUFF are now available that enable better representation of atmospheric processes using three dimensional meteorological fields

The CALPUFF model is more advanced than models such as ISCST3 as they model 3-dimensional wind flows in a region and track pollutant trajectories from hour to hour with spatially varying meteorological conditions. The ISC type models (called steady-state Gaussian dispersion models) predict the impact of a plume by assuming it travels in a constant direction for each given hour of meteorological conditions, and that the meteorological conditions do not change spatially. These models do not retain the position of the plume when the next hour is modelled. The CALPUFF model uses wind and temperature information at different levels above the ground, allowing for changes in meteorological conditions throughout the atmosphere that may influence ground-level concentrations. The use of 3-dimensional wind fields and dispersion in CALPUFF is very important for modelling particular situations such as:

- o Interaction of multiple pollution sources in a region;
- o Recirculation of pollutants and long range pollutant transport;
- o Tall stacks;
- o Light variable wind sites;
- o Complex terrain situations; and
- o Coastal locations.

EPA

United States Office of Air Quality EPA-454/R-98-020
Environmental Protection Planning and Standards December 1998
Agency Research Triangle Park, NC 27711 AIR

A Comparison of CALPUFF with ISC3

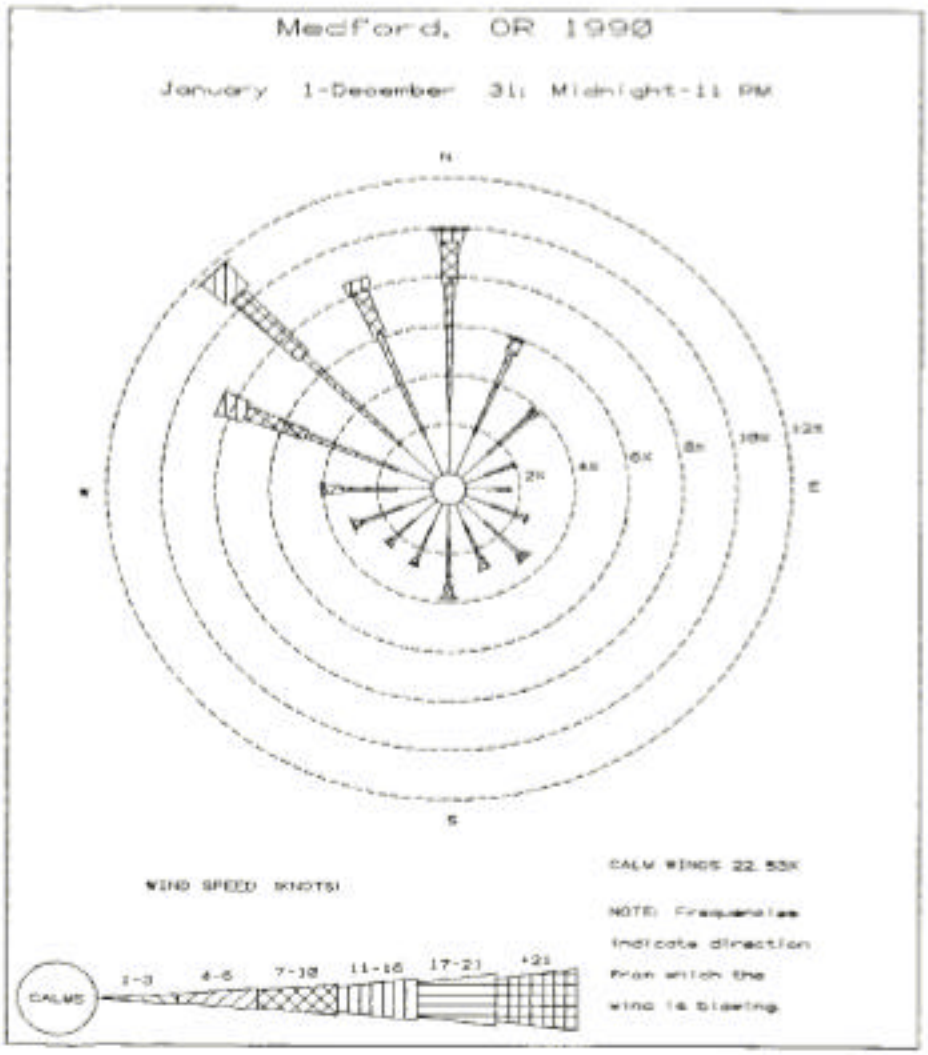
4.2 Variable Meteorological Conditions

To examine differences in model estimates when variable meteorological data are used, several studies were done. Actual full-year data sets from three climatologically different sites were used. The sites chosen were Boise, Idaho (1991), Medford, Oregon (1990) and Pittsburgh, Pennsylvania (1964). Using a synthesized meteorological data set, a preliminary set of studies was done to examine (1) differences in the way both models treat lateral _'s (CALPUFF was run using both puffs and slugs), and (2) puff versus slug differences within CALPUFF alone. Another study was done using the Boise data to examine the occurrence and location of concentration maxima estimated by ISC3 and the CALPUFF puff model. Then for all three sites, extensive sensitivity studies were done in which estimates by ISC3 were compared to CALPUFF (puff and slug models). In general, 36 - 45 receptors were placed on each of 15 concentric rings at successively more distant intervals.

In general, the differences between CALPUFF and ISC3 concentration results are caused by how emissions are transported and dispersed. CALPUFF limits downwind transport in based on the wind speed while there is no such limitation in ISC3 (it is a plume model). Under calm wind

conditions, CALPUFF continues to disperse each puff while the ISC3 model is arbitrarily set to not determine concentrations when the wind speed is less than 1 ms . CALPUFF is capable of $^{-1}$ tracking the puff emitted before, during and after wind shifts and reversals while ISC3 is only concerned with the current hour transport of its plume(s). CALPUFF continues to disperse each puff even when they are above an inversion layer while ISC3 determines its plume is above the inversion layer and cannot be advected to the ground (e.g,. concentrations = 0.0). When the inversion rises above the old puffs, they are dispersed to the ground creating impacts for any nearby receptors.

When all these and other meteorological conditions are recorded on an hourly basis and form a complete year of meteorological data, the effects on concentrations vary between the models and from region to region. The meteorologically induced variations in concentrations do not appear to be so much a regional phenomena, but the variations are related to how the hourly meteorological conditions occur preceding and during a given averaging period. It is possible to have 4 or 5 hours of winds in one general direction followed by 4 hours of calm winds, and then followed by several hours of reversed wind flow. This can occur in any one of the regions. However, the potential frequency of this occurrence may be higher for one region than another. Since calm winds have a causal relationship leading to higher concentrations, then a site such as Medford with a relatively greater incidence of calms (i.e.,, 22% calm hours versus the other regions having around 6%) will have higher concentrations associated with CALPUFF.



Medford, Oregon wind rose

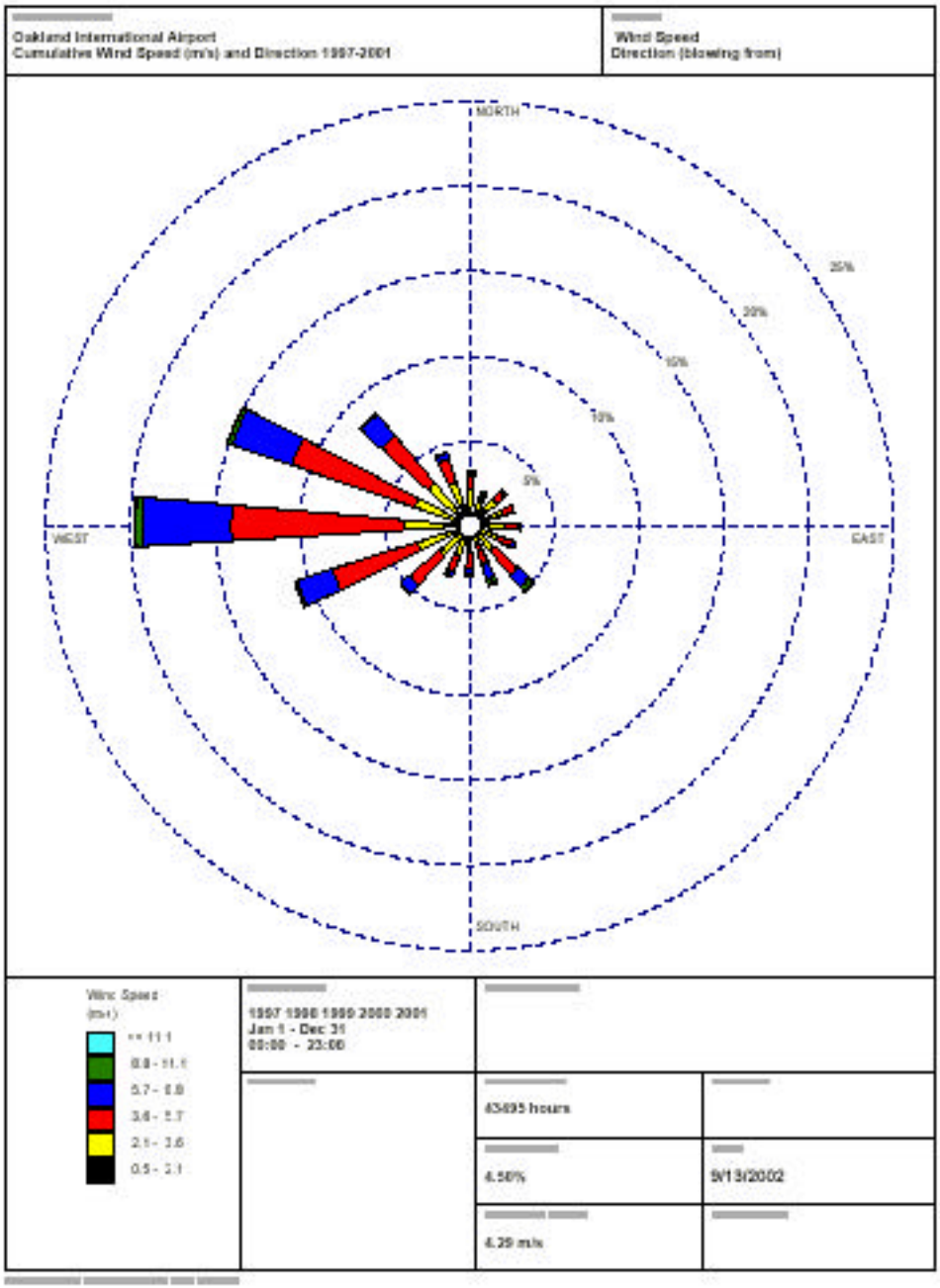


Figure 3-1
Oakland Windrose 1997-2001

4.3 Conclusion

Even though ISC3 and CALPUFF can be made to produce the same concentrations in a steady state environment, a variable state environment can produce higher-than-ISC3 ground-level concentrations with CALPUFF. Climatological characteristics of a region appear to be a factor, but the accumulation of hour-by-hour meteorological conditions on the transport of CALPUFF puffs is the key to understanding the differences that are produced by these two

models. This should come as no surprise as the meteorological assumptions used in formulating the downwind transport of the ISC3 and CALPUFF effluents and the dispersion from the respective plumes and puffs are different. This is also compounded by the different treatment of dispersion during calm wind conditions.

This complex interaction of transport, vertical mixing, and dispersion have an effect on concentrations with respect to downwind distances in CALPUFF. Occasionally, the accumulation of mass released over several hours will be transported in such a manner that the combined effect is to produce sharp localized maxima in simulated concentration values. The occurrence of such events is not predictable. It seems to occur with greater frequency at Medford. Calm winds play a part in these events. These maxima seem to occur at most locations in the receptor network, at all downwind distances. When they occur, they seem to affect in particular the results for the shorter averaging periods.

Overall trends have been noted in the percentage difference comparisons in simulated concentration values between CALPUFF and ISC3. For taller point sources, there is a trend toward higher concentrations being simulated by CALPUFF in comparison to ISC3. For annual averages, the closer a receptor is to the source and the taller the stack, the greater the chance that the CALPUFF concentration values will be higher than those simulated by ISC3. At the more distant downwind receptor rings, the bias changes direction from CALPUFF yielding higher concentrations, to CALPUFF yielding relatively lower concentrations and sometimes these concentrations are lower than their respective ISC3 counterpart.

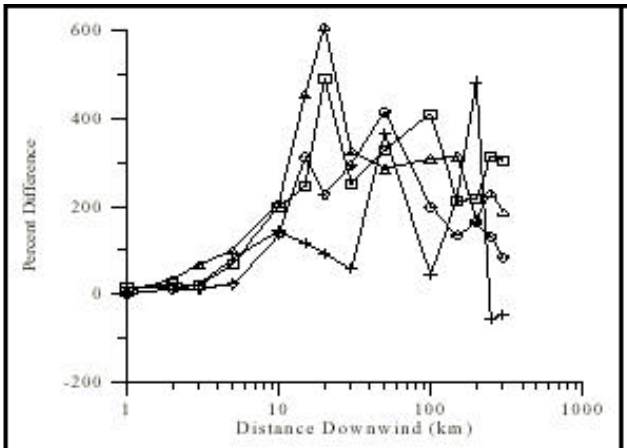


Figure L-3(c). Medford meteorological data.

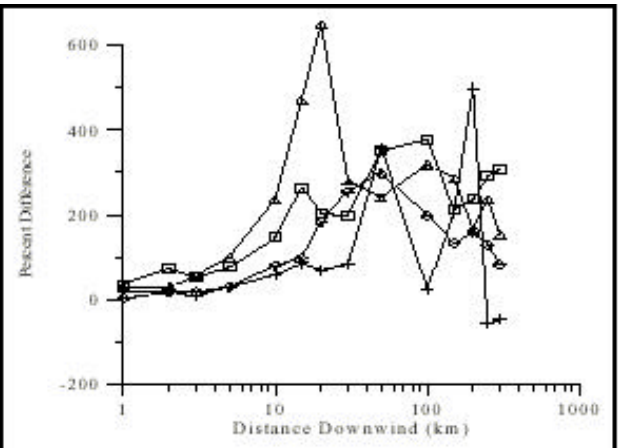


Figure L-3(d). Medford meteorological data.

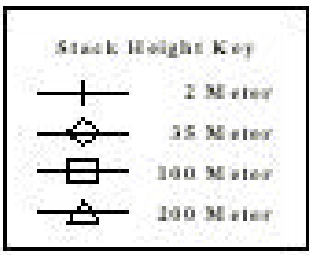


Figure L-3. Maximum 24-hour average concentrations by distance. Figures a, c, & e show CALPUFF *puffs*, whereas figures b, d, & f show *slugs*.
Note: $\%\ Difference = 100\ (\frac{\chi_{CALPUFF} - \chi_{ISC3}}{\chi_{ISC3}})$.

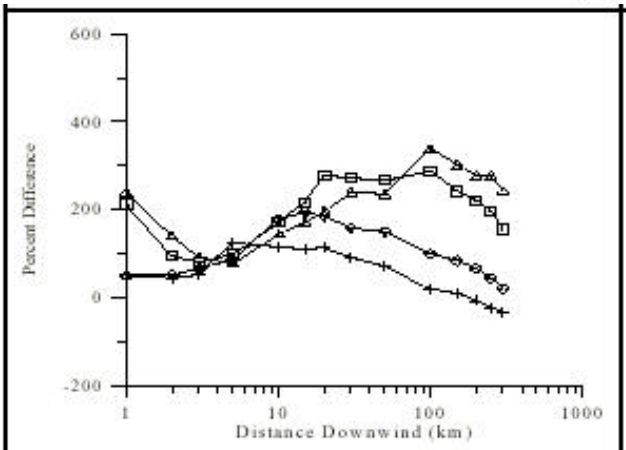


Figure L-4(c). Medford meteorological data.

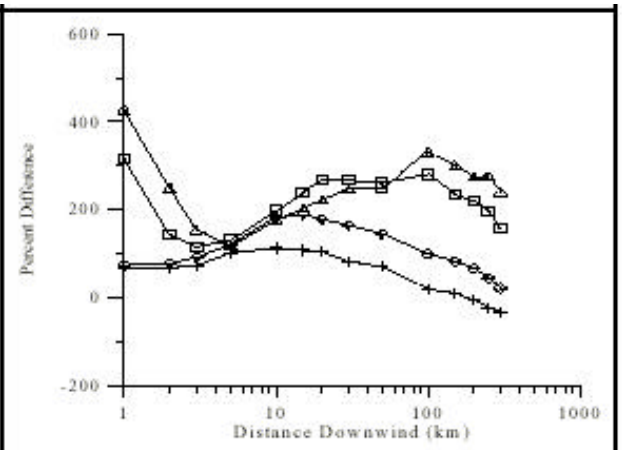


Figure L-4(d). Medford meteorological data.

Figure L-4. Maximum annual average concentrations by distance. Figures a, c, & e show CALPUFF *puffs*, whereas figures b, d, & f show *slugs*.
Note: $\%\ Difference = 100\ (\frac{\chi_{CALPUFF} - \chi_{ISC3}}{\chi_{ISC3}})$.