Air quality impact analysis for the caesar hotel/casino transportation center in Atlantic City, New Jersey, USA
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Abstract
The authors prepared the air quality impact analysis on behalf of Caesars Hotel/Casino for their recently constructed transportation center in Atlantic City, New Jersey. Carbon monoxide (i.e. CO) concentration levels were estimated for both present and future time horizons in close proximity to the proposed facility utilizing the CALINE 3 air quality dispersion model as a predictive tool. Because of unrealistic conservative input requirements to the model mandated by the reviewing agency, marginal CO levels were projected when viewed versus the Ambient Air Quality Standards (AAQS) for CO in New Jersey. Subsequent direct monitoring of CO levels after operations began in the facility confirmed more realistic projections originally suggested by the authors.

Introduction
The authors were retained by Caesars Hotel/Casino in Atlantic City to prepare an air quality assessment associated with the construction of a multi-story garage housing approximately 2,500 automobiles (both self-parked and valet-parked) as well as a holding area for 12 buses and limousines. Since the proposed garage was to be built at the gateway to Atlantic City immediately from the terminus of the major traffic corridor (i.e. the Atlantic City Expressway) leading to the City, it was recognized by the reviewing agency, CAFRA, an agency of the New Jersey State Department of Environmental Protection and Energy (i.e. NJDEPE), that a comprehensive air quality analysis would be required of the applicant. Furthermore, although the design of multi-story garages in urban areas are generally considered to be positive from an air quality standpoint, the state, in order to enhance greater use by patrons of rail and bus service to
Atlantic City, were concerned of the potential for drawing additional vehicular traffic into the central downtown Atlantic City area with development of the proposal. To this end, the state required the applicant to test for compliance with the Ambient Air Quality Standards for New Jersey for carbon monoxide concentration levels for both existing and future time horizons utilizing the CALINE 3 [1] air quality dispersion model.

In order to maintain a safe air environment with respect to carbon monoxide, the AAQS for New Jersey, which were adopted from the Federal Clean Air Act of 1970, and maintained in amendments to the Act in 1977 and 1990, stipulate the following:

- The maximum one (1) hour average concentration level of CO should not exceed 35 parts per million (ppm), and
- The maximum eight (8) hour average concentration level of CO should not exceed 9 parts per million (ppm).

In general, it is rare in the State of New Jersey to exceed the one hour standard of 35 ppm, however, exceedances of the eight hour standard of 9 ppm do occur at times in urban areas of New Jersey during typical peak morning and afternoon weekday rush hours (i.e. 7 to 9 AM and 4 to 6 PM). In Atlantic City, because of its status as a hotel/casino/convention center, peak hours of vehicular volumes often occur on Friday and Saturday evenings between 6 PM and 8 PM since some 50 million people live within a 300 mile radius of the City and often commute on the weekends for dining and shows in addition to the 24 hour casino gambling. As such, typical weekday AM and PM rush hour volumes as well as weekend volumes were counted and analyzed by the traffic consultant to establish peak hourly and eight hour volumes to incorporate into the CALINE 3 model. It was found that Saturday evenings constituted the peak periods for vehicular traffic on thoroughfares immediately adjacent to the proposed garage.

The NJDEPE Bureau of Air Quality Control maintained a continuous air quality monitoring station within 500 feet of the proposal from 1970 to 1986. As such, this data served as a frame of reference for this study. From 1980 to 1986, there were no violations to the AAQS for CO at the station. For 1985 and 1986, the maximum 1 hour and 8 hour concentration levels of CO recorded at the station were 14.6 ppm (i.e. 1 hour) and 6.2 ppm (i.e. 8 hour) in 1985, and 13.2 ppm and 6.3 ppm, respectively, in 1986. The monitoring station was dismantled after 1986.

Land uses in the immediate vicinity of the proposed garage are as follows: the Trump Hotel/Casino garage; a liquor store, a six unit motel; a surface parking lot; a bank; a Texaco service station; a clothier; and a New Jersey
Department of Labor Rehabilitation Center. As such, the only critical receptor in the vicinity of the proposal was the six unit model where people could be expected to be exposed to area CO levels on a continuous basis. The CALINE 3 mathematical model sums CO contributions from a series of roadway links within approximately 500 feet of the proposal, and it can assess resultant CO concentration levels at a number of critical receptors selected by the model operator through development of a two-dimensional grid. The height dimension is usually held as a constant of 1.8 meters (or approximately 5 feet), the height at which the average person inhales air.

Required CALINE 3 model input and selected values mandated by the reviewing agency included the following:

- Peak hourly traffic volumes at all intersections of interest during the entire year. This typically occurs during the summer months of June, July, or August.

- Modal emission factors due to the signalized intersections and resultant queuing in the area of interest. These were calculated in accordance with the U.S. Environmental Protection Agency guidelines [2].

- Background area CO levels without traffic. Used in the analysis was 3 ppm for the 1 hour analysis, and 2 ppm for the 8 hour analysis.

- Persistence factor (i.e. the ratio of the 8 hour maximum average CO levels to the 1 hour maximum average CO level). Based on data from the previously noted air quality monitor in Atlantic City, a persistence factor of 0.6 was used in the model.

- An ambient temperature of $20^\circ$ Fahrenheit with 35% of the vehicles operating from a cold start.

- Emission rates utilizing Mobile 3 [3].

- A worst case wind speed of 1 meter/second.

Some of the data utilized above was extremely conservative for the following reasons:

- Analysis of the past decade of meteorological data at a weather station close to Atlantic City indicated that a 1 meter/second wind speed or less occurs only about 7 percent of the time in Atlantic City.
• During light or virtually no traffic volume conditions in Atlantic City (i.e. normally between 2 AM and 4 AM), background levels are usually in the range of only 0.5 to 1.0 ppm of CO, rather than 2 to 3 ppm.

• Ambient temperatures of 20°Fahrenheit, which produce higher emissions per vehicle than at higher temperatures, is typical of winter conditions in Atlantic City when peak traffic volumes are only about 2/3 of that typical of summer peak traffic. As such, either peak summer traffic volumes should be used with average summer temperatures (i.e. about 70°F) or winter traffic volumes should be used in the model with an ambient temperature of 20°F.

As a result of the conservatism in data utilization in the model, the results indicate that at various wind angles (i.e. for various wind directions), some of the receptors, at times, slightly exceeded the 9 ppm standard. The authors argued that these results would not occur if appropriate input was used, and when the facility was actually in operation.

Approvals were ultimately granted by the State of New Jersey for the construction and operation of the Caesars Transportation Center with the proviso that direct continuous monitoring of CO be conducted in close proximity to the garage to confirm conclusions drawn by the authors. The results of the direct monitoring program have indicated complete compliance to date with the AAQS, with a maximum eight hour average of approximately 7.5 ppm as the worst level recorded to date.

Conclusions

Since mathematical models such as CALINE 3 must be utilized to predict future CO concentration levels, the data input should reflect realistic conditions in order to hope to arrive at reasonable results from the model. Where possible, correlation of mathematical model output for existing conditions should be analyzed in conjunction with direct measurements of CO for existing conditions in order to verify the validity of data input to the model.
References

