ISCST3 Modeling Results for Laguna POTW Aeration Basins

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SUMMARY

This technical memorandum summarizes a refined modeling analysis and health risk estimation for the Laguna WWTP Aeration Basins. A perchloroethylene emission rate of 80.9 pounds per year was used to estimate incremental health risks stemming from operations at the aeration basins . Version 3 of the Industrial Source Complex-Short Term model (ISCST3) was used to predict concentrations from the perchloroethylene emissions. The CAPCOA HRA guidelines were used to determine cancer risk and hazard indices from the concentrations predicted by ISCST3. The maximum values for cancer risk, chronic hazard index, and acute hazard index were predicted to occur on the property boundary to the west of the aeration basins (see Figure 1). Two sensitive receptors (SR) were chosen to represent impacts to the surrounding homes that are located to the north and to the east of the property boundary. The sensitive receptors are labeled SR1 and SR2. The following summarizes the incremental impacts predicted for each of the three receptors.

Receptor Label	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
Maximum Impact	1.48×10^{-6}	0.006	0.0009
SR 1	0.37×10^{-6}	0.002	0.0002
SR 2	0.22×10^{-6}	0.001	0.0003

METHODOLOGY

BASTE Version 3.0

An estimate of the perchloroethylene emissions increase released from the modified Laguna WWTP was performed using BASTE Version 3.0. A description of the modified facility is available elsewhere (Permit Application Package to the Bay Area Air Quality Management District for Authority to Construct the Laguna Advanced Treatment Upgrade Project, CH2M HILL, November 1, 1993). These emission estimates were used in the Risk Screening analysis and in the subsequent ISCST3 refined dispersion modeling.

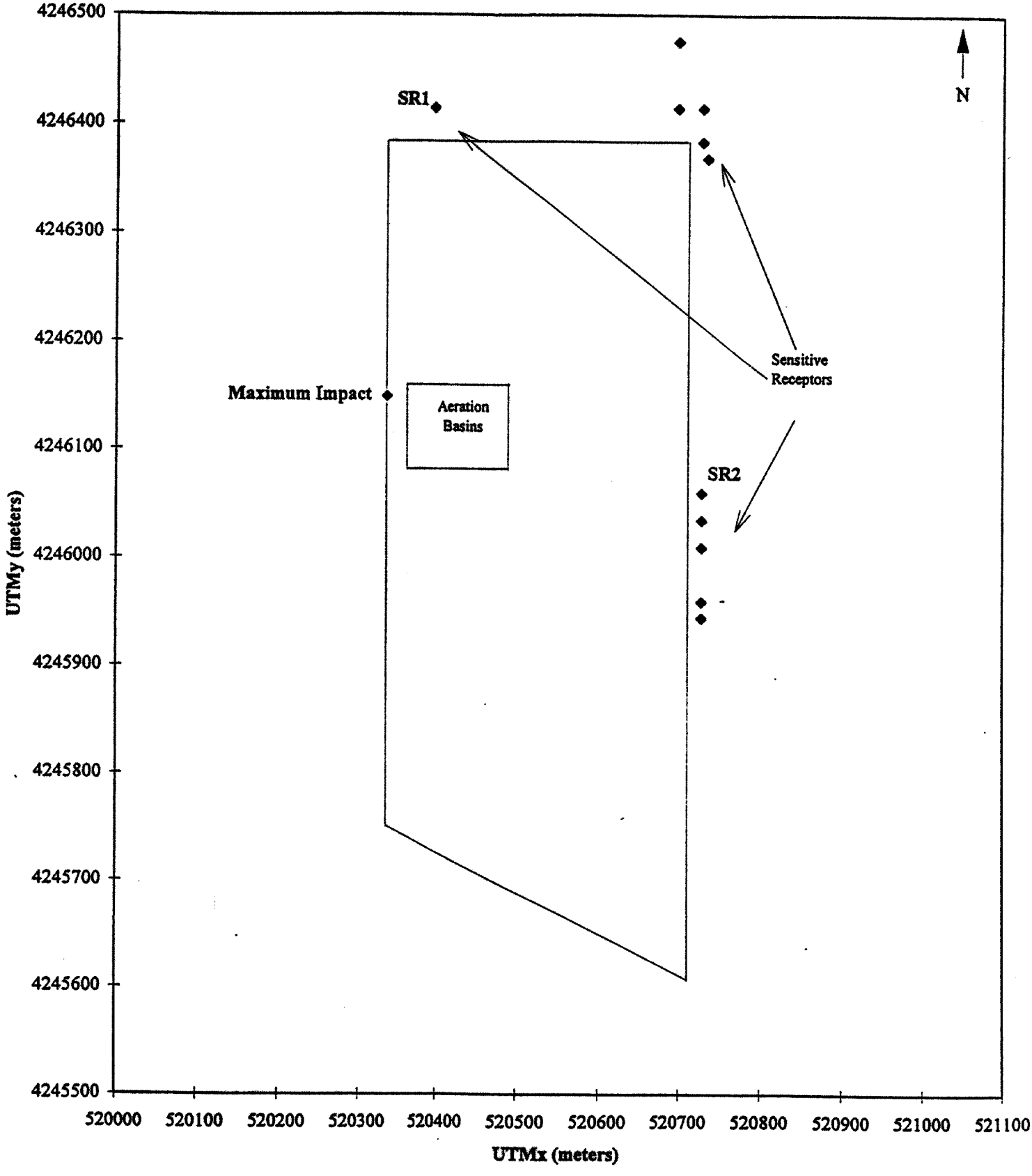

Figure 1
Locations of Maximum Impact and Sensitive Receptors

Risk Screening Analysis

A risk screening analysis was performed on the estimated perchloroethylene emissions for the future increase in flow rate and mass load. The risk screening performed was in accordance with the BAAQMD Risk Management Policy, May 9, 1991. The U.S. Environmental Protection Agency (EPA) dispersion model SCREEN Version 3 was used to calculate the one-hour maximum ground level concentrations.

The risk screening analysis for perchloroethylene yielded health risks greater than acceptable levels at nearby receptors. Therefore, the Santa Rosa Subregional System decided to perform ISCST3 refined dispersion modeling analysis on the perchloroethylene emissions. The refined dispersion modeling analysis provides results that are less conservative, and therefore more accurate than a screening analysis.

ISCST3 Refined Dispersion Model Analysis

The ISCST3 model was used to estimate ambient air concentrations of perchloroethylene from aeration basin emissions. ISCST3 is an EPA approved model used to assess emissions from a wide variety of industrial sources in either simple or complex terrain. The following options were selected for all ISCST3 runs:

- Rural dispersion
- Flat terrain
- Regulatory default features

Source Representation

The aeration basins were modeled as one area source. An area source is considered to have emissions that do not have an upward velocity. The perchloroethylene emissions were assumed to occur at ground level. A perchloroethylene emission increase of 80.9 pounds per year was used in the refined modeling. The maximum hourly emission increase was assumed to be equal to the annual emission rate divided by 8,760 hours per year.

Receptor Representation

A Cartesian coordinate receptor grid was used in ISCST3 to approximate the locations of maximum offsite exposure. The grid has points that are spaced 100 meters apart. The grid begins at the property line surrounding the treatment plant and extends 300 meters in all directions. In addition to this receptor grid, 11 sensitive receptors were located in places where homes are known to exist.

Meteorological Data

Five consecutive years of preprocessed meteorological data from BAAQMD were obtained for the Santa Rosa area, and were used in the modeling. The data contained hourly records from the years 1989 through 1993.

RESULTS

The ISCST3 model was run over the 5 consecutive years of meteorological data. The model determined maximum 1-hour and annual average concentrations of perchloroethylene at each point in the Cartesian coordinate receptor grid. The annual average concentrations

were used to estimate cancer risk and the chronic hazard indices. The maximum 1-hour concentrations were used to estimate acute hazard indices. The highest concentrations for all 5 years of data were used for comparison to the CAPCOA HRA Guideline Factors to predict cancer risk, chronic hazard and acute hazard indices.

The maximum incremental cancer risk from perchloroethylene emissions was predicted to be 1.48 in one million. The maximum incremental chronic and acute hazard indices were estimated to be 0.006 and 0.0009, respectively. A hazard index of less than 1.0 means that no adverse non-cancer health effects are expected to occur. The maximum cancer risk, maximum chronic and maximum acute hazard indices all occured at the same receptor grid point. This receptor point of maximum impact is located on the property boundary to the west of the aeration basins. Two sensitive receptors (SR) were chosen to represent impacts to the surrounding homes that are located to the north and to the east of the property boundary. The sensitive receptors are labeled SR1 and SR2. The following lists the predicted impacts at SR1 and SR2.

Receptor	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
SR1	0.37×10^{-6}	0.002	0.0002
SR2	0.22×10^{-6}	0.001	0.0003

The estimated cancer risks at SR1 and SR2 mean that the perchloroethylene emissions increase from the basins is expected to cause less than one (0.37 and 0.22) incidences of cancer per one million people living at SR1 and SR2 over the next 70 years. These cancer risks are below the acceptable level of risk of 10×10^{-6} that is specified by BAAQMD.