APPENDIX C

OFFSITE CONSEQUENCE ANALYSIS

Offsite Consequence Analysis

For

Polychemie Inc.
Los Angeles, California

Prepared by:
Global Environmental Solutions, Inc.
Marietta, Georgia

June 2004
GESI Project No. 02512.01

June 11, 2004

Mr. Brent Hanson
Environmental & Safety Manager
Floquip Engineering Co.
Two Chemical Plant Road
P.O. Box 250
Riceboro, Georgia 31323

Subject: **Offsite Consequence Analysis – Five Year Update**
Polychemie Inc. - Los Angeles, California
GESI Project No. 02512.01

Dear Mr. Hanson:

Enclosed is a copy of the updated offsite consequence analysis (OCA). This document provides the back-up documentation for the OCA results presented in the U.S. EPA RMP Submit and the California Accidental Release Program (CalARP) RMP.

The OCA for the Los Angeles facility was reviewed and updated as part of updating the U.S. EPA and CalARP RMPs. The changes to the offsite consequence analysis (OCA) include:

- Use of aqueous (60 percent) dimethylamine (DMA) rather than anhydrous DMA.
- Addition of DMA stored in railcars to the maximum quantity on-site.
- Analysis of DMA alternate case scenario for a release from a pressurized railcar.
- Use of 50 percent acrylamide rather than 52 percent solution.
- Analysis of release scenarios for formaldehyde and acrylamide based on predictive filing to account for the proposed larger storage tanks.

If you have any questions or comments on the enclosed, please contact us at (770) 690-9552. We appreciate the opportunity to assist you on this important project.

Sincerely,
GLOBAL ENVIRONMENTAL SOLUTIONS, INC.

Natasha S. Brash
Project Scientist

Brian A. Soucy, P.E.
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cc: M. Bender - Polychemie Inc.
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Summary

This review summarizes the results of our five year updated offsite consequence analysis (i.e., evaluation of worst-case and alternate release scenarios) as required by the United States Environmental Protection Agency's (EPA) accidental release program (40 CFR 68) and the California Accidental Release Program (CalARP; California Health and Safety Code, Chapter 6.95, Article 2). The CalARP regulation is similar to the federal program, except in general, more chemicals are subject to the regulation. This review documents how worst-case and alternate case scenarios were selected and provides details on how toxic endpoints were determined.

Worst-case and alternate case scenarios were updated to more accurately reflect current facility conditions. Changes to release scenarios include:

- Use of aqueous (60 percent) dimethylamine (DMA) rather than anhydrous DMA.
- Addition of DMA stored in railcars to the maximum quantity on-site.
- Analysis of DMA alternate case scenario for a release from a pressurized railcar.
- Use of 50 percent acrylamide rather than 52 percent solution.
- Analysis of release scenarios for formaldehyde and acrylamide based on predictive filing to account for the proposed larger storage tanks.

Background

EPA's accidental release program and CalARP deem a source applicable to the requirements of the rule when it has more than a threshold quantity of a listed/regulated substance on site. Processes subject to the rule are then classified into one of three programs as follows. Record keeping and reporting requirements vary between the programs.

Program 1
- No offsite accident history for the five years prior to the submission of the Risk Management Plan (RMP);
- The distance to a toxic or flammable endpoint for a worst case release scenario is less than the distance to any public receptor; and
- Emergency response procedures have been coordinated between the facility and local emergency planning and response organizations.

Program 2
- Does not meet the eligibility requirements of Program 1 or Program 3.

Program 3

- The process is in NAICS code 32211, 32411, 32511, 325181, 325188, 325192, 325199, 325211, 325311, or 32532; or
- The process is subject to OSHA process safety management (PSM) standard 29 CFR 1910.119.

The Polychemie Inc. Los Angeles, California stores two toxic substances over the minimum threshold: formaldehyde (37 percent) and acrylamide (50 percent). The facility also stores one flammable substance over the minimum threshold: dimethylamine (60 percent). Formaldehyde and dimethylamine are subject to both the federal and CalARP regulations. Acrylamide is subject to only the CalARP regulations.

Under the accidental release provisions of the Clean Air Act and CalARP, regulated sources are required to conduct hazard assessments, including offsite consequence analyses. Worst-case scenario analyses indicate that the distance to a toxic or flammable endpoint for all subject materials impacts public receptors. Therefore, the subject processes will be classified as follows:

- Program 3 (subject to OSHA PSM and federal and state accidental release programs): Mannich Process (formaldehyde, dimethylamine, and acrylamide)

- Program 2 (subject only to state accidental release program): ADAM-Quat Process (acrylamide)

For Program 2 and 3 processes, information must be provided for one worst-case release scenario for each toxic regulated substance present above the threshold quantity and one worst-case release scenario for flammable regulated substances present above the threshold quantity. An additional worst-case scenario must be submitted if a worst-case release from another process at the source would potentially impact public receptors different from those potentially impacted by the initial worst-case scenario(s) for flammable and toxic regulated substances.

In addition to a worst-case release scenario, information on alternate release scenarios must also be provided for Program 2 and 3 processes at the facility. Information must be presented on one alternate release scenario for each regulated toxic substance held above the threshold quantity and one alternate release scenario to represent all flammable substances held above the threshold quantity.

Methodology provided in the U.S. EPA's RMP Guidance for Offsite Consequence Analysis, April 1999 (OCA Guidance) using lookup tables and equations were employed to evaluate impacts of the worst-case and alternate release scenarios. The OCA Guidance provides simple methods and reference tables for determining distances to worst-case and alternate release scenario endpoints. Results obtained using these methods are typically conservative since conservative assumptions were introduced into the guidance methodologies to compensate for high levels of uncertainty across a

broad range of sources/processes. As allowed by the OCA Guidance, we also evaluated impacts using air dispersion models. Air dispersion models were used in instances where the selected meteorological/process conditions were not covered in the federal OCA Guidance tables.

The following narrative provides details of the scenarios evaluated including a discussion of the scenario parameters specified by the regulations and a discussion of the methods used for evaluating the impact of both the worst-case and alternate release scenarios.

Worst-Case Scenario Description

EPA has defined a worst-case release as a release of the largest quantity of a regulated substance from a vessel or process line failure that results in the greatest distance to a specified endpoint. The largest quantity should be determined taking into account administrative controls. Administrative controls are procedures that limit the quantity of a substance that can be stored or processed in a vessel or pipe at any one time, or, alternatively, procedures that occasionally allow the vessel or pipe to store larger than usual quantities (e.g., during shutdown/turnaround). If a process handling a smaller quantity of a regulated substance at a higher temperature or pressure or a process that is located closer to a property boundary results in a greater distance to the endpoint, this scenario must be selected as the worst case scenario. For the worst-case analysis, you do not need to consider the possible causes of the worst-case release or the probability that such a release might occur, the release is simply assumed to take place. All releases are assumed to take place at ground level for the worst-case analysis.

When using the OCA Guidance, meteorological conditions for the worst case scenario are specified by the regulations as atmospheric stability of F (stable atmosphere), wind speed of 1.5 meters per second, and an ambient temperature of 77°F. If the OCA Guidance is not used (i.e., air dispersion modeling is completed), meteorological conditions for the worst case scenario are specified by the regulations as atmospheric stability class F, wind speed of 1.5 meters per second (m/s), and the highest daily maximum air temperature and average humidity for the site during the past three years. For modeling, a maximum daily temperature of 112°F was used based on historical data for the area.

Since the Los Angeles site is located in a metropolitan area, urban topography conditions were selected for the evaluation. The area is also classified as urban according to the Auer land use procedure recommended in 40 CFR Part 51 (Part III, April 2003). Using this procedure, the area is urban since more than 50 percent of the area surrounding the facility in a 3 km radius is classified as heavy industrial, light-to-moderate industrial, commercial, or compact residential. Aerial photographs showing the surrounding area are included in Appendix B.

The following scenarios were selected for evaluation for toxic and flammable substances:

Toxic Substances

The worst case release scenario for each of the toxic substances was assumed to be a catastrophic release from a vessel. Per the OCA Guidance, the worst case scenario was assumed to be the release of the entire vessel quantity. For this facility, releases from pipelines were not evaluated since the quantities handled are much less than in the on-site vessels. The quantities released are shown in Table 1. The specific vessel/scenarios evaluated for each substance are as follows:

- Formaldehyde: The largest formaldehyde tank on-site is the formaldehyde storage tank. The formaldehyde storage tank is maintained at ambient temperature. Since the Formaldehyde-Dimethylamine reactor (preparation tank) is operated at a higher temperature than the storage tank conditions, a catastrophic release from the reactor was also evaluated in addition to a release from the storage tank. Because formaldehyde is delivered by truck and the delivery vessel remains connected to the motive power, a release from the tank truck was not evaluated, per the regulations.

- Acrylamide: Various release scenarios were analyzed for acrylamide. The largest acrylamide tank on-site is the acrylamide storage tank. Railcars containing smaller quantities are staged on-site while disconnected from their motive power. Because a catastrophic release from a railcar would not be contained, this scenario was analyzed. Since the PAM and ADAM-Quat reactors are operated at a higher temperature than the storage tank conditions, a catastrophic release from these two reactors were also evaluated in addition to a release from the storage tank and railcar.

The above materials were evaluated as toxic liquid releases. The release rate for toxic liquids was assumed to be the rate of evaporation from the pool formed by the released liquid. For the worst case scenario, the total quantity in the vessel was assumed to be instantaneously released into the pool. Passive mitigation measures were taken into account, where applicable, in determining the area of the pool and the release rate. The evaporation rate of releases from storage tanks was determined assuming the pool and surroundings were at the selected ambient conditions. The release scenarios for reactors were evaluated at the process temperature or the ambient temperature, whichever was greater.

The following toxic endpoints were chosen as the thresholds for serious injury from exposure to the toxic substances in the air:

- Formaldehyde: 0.012 mg/L, from the federal OCA Guidance and 40 CFR 68.22.
- Acrylamide: 0.11 mg/L, from California OES, CalARP Administering Agency Guidance Document.

In accordance with the OCA Guidance, only the first 10 minutes of the release needs to be considered for common water solutions under ambient conditions because the toxic component in a solution evaporates fastest during the first few minutes of the spill when its concentration is highest.

Flammable Substances

For regulated flammable substances, including both flammable gases and volatile flammable liquids, the worst-case release was assumed to result in a vapor cloud containing the total quantity of the substance that could be released from a vessel or pipeline. The entire quantity in the cloud was assumed to be between the upper and lower flammability limits of the substance. For the worst-case consequence analysis, the vapor cloud was assumed to detonate.

The endpoint for the consequence analysis of a vapor cloud explosion of a regulated flammable substance is an overpressure of 1 pound per square inch (psi). This endpoint was chosen as the threshold for potential serious injuries as a result of property damage caused by an explosion (e.g., injuries from flying glass from shattered windows or falling debris from damaged houses).

A worst-case release scenario was evaluated for a catastrophic release of dimethylamine from a tank or railcar (both are the same volume and, therefore, result in the same estimated distance to endpoint). Table 1 presents the worst-case scenario release quantities. Per the OCA Guidance, it was assumed that the entire vessel contents were released as a vapor that subsequently detonates with 10 percent of the released quantity participating in a vapor cloud explosion.

Alternate Release Scenario Descriptions

At least one alternate release scenario is required for each regulated toxic substance in Program 2 or Program 3 processes. One alternate release scenario must be analyzed for flammable substances in Program 2 or 3 processes as a class. An alternate release scenario does not need to be analyzed for each flammable substance. Even if a substance is above the threshold in several processes or locations, only one alternate release scenario needs to be analyzed for that substance.

Active mitigation systems, such as interlocks, shutdown systems, pressure relieving devices, flares, emergency isolation systems, and fire water and deluge systems, as well as passive mitigation systems, may be considered in estimating the impact of alternate release scenarios.

There are a number of options for selecting alternate release scenarios including:

- The worst-case release scenario may be used considering an active mitigation system to limit the quantity released and the duration of the release.

- Information from a process hazard analysis, if available, may be used to select a scenario.
- An actual accident may be used as the basis of your scenario.
- A review of facility operations may be used to identify possible events and failures.

Whichever approach is selected, the key information to define is the quantity to be released and the time over which it will be released. This allows for the release rate to be estimated.

The alternate release scenarios were selected as follows:

Toxic Substances

Based on review of potential release scenarios that could occur, a release due to the uncoupling or rupture of a hose during unloading operations was selected as the more probable or alternate release scenario. This scenario was identified as a probable event due to the frequency and, when compared to other operations, the higher likelihood for a release or spill to occur. The discharge rate due to gravity or pressure flow from a delivery vessel was used as the release rate since this flow rate was higher than the pumping rate. The liquid pools formed would then evaporate resulting in toxic gas releases occurring over a 10-minute time period. In accordance with the OCA Guidance, only the first 10 minutes of the release needs to be considered for common water solutions under ambient conditions because the toxic component in a solution evaporates fastest during the first few minutes of the spill when its concentration is highest. Table 2 lists the quantities released and release durations for each of the toxic substances.

As discussed above, the toxic endpoint for formaldehyde is 0.012 mg/l, and the toxic endpoint for acrylamide is 0.11 mg/l.

Flammable Substances

The alternate release scenario evaluated for the Program 3 flammable substance, dimethylamine, involved a release due to uncoupling or rupture of a hose during unloading operations. The discharge rate due to gravity or pressure flow from a delivery vessel was used as the release rate since this flow rate was higher than the pumping rate. A 5-minute response time to stop the release was used. The release rate was calculated using OCA Guidance methods, and the response time was based on information provided by similar facilities.

Estimated release quantities and durations are summarized on Table 2. The OCA Guidance specifies that a vapor cloud explosion be evaluated for the worst-case release scenario. However, the OCA Guidance also states that a vapor cloud explosion is an unlikely scenario at most facilities. Therefore, a vapor cloud fire and a pool fire were evaluated for the alternate release scenario.

Estimated Scenario Impacts

Worst-Case Scenario

Table 1 summarizes the estimated endpoint distances for the worst-case scenarios evaluated. As required by the regulations, only one toxic substance and one flammable substance worst-case scenario must be reported in the RMP. The following substances with the furthest worst-case scenario endpoints, which will be reported in the RMP, are:

Toxic Substance:
Formaldehyde - 0.2 mile

Flammable Substance:
Dimethylamine - 0.32 mile

Plots for formaldehyde and dimethylamine showing the radius of impact for the worst-case scenarios are shown on Figures 1 and 2. The calculations and modeling outputs for all the scenarios evaluated are included in Appendix A.

Alternate Release Scenario

Table 2 summarizes the results for the alternate release scenarios evaluated. As required by the regulations, an alternate case scenario must be reported in the RMP for each applicable toxic substance and for one flammable substance. A summary of the alternate release scenario endpoints is:

Toxic Substances:
Formaldehyde – 0.1 mile (shortest reportable distance)
Acrylamide – 0.1 mile (shortest reportable distance)

Flammable Substance:
Dimethylamine - 0.1 mile (shortest reportable distance)

Plots for the above materials showing the radius of impact for the alternate release scenarios are shown in Figures 1 through 3. The calculations and modeling outputs are included in Appendix A.

Wind Rose Analysis

Meteorological data for the Los Angeles, California weather station was obtained from the EPA's bulletin board system. The data was used in the wind rose program, WRPLOT, to develop a plot of the frequency distribution of wind direction and wind speed. The program, WRPLOT, was also obtained from the EPA's bulletin board system. The program performs a statistical analysis of the data and plots a wind rose depicting the frequency of occurrence of winds in each of 16 directions and six wind speed classes. Meteorological data for the years 1984 through 1992 were used to develop the wind rose. Figure 4 shows the results of the wind rose analysis. Note that the frequencies indicate the direction from which the wind is blowing. The results of the wind rose show a prevailing wind from the southwest. Therefore, a more likely area or direction of impact for the worst-case or alternate release scenarios would be to the northeast of the spill/release.

Estimated Impacted Population and Environmental Receptors

Census population data, aerial photographs, topographic maps, and general knowledge of the area were used to estimate impacted residential populations. The types of public receptors impacted are residential and industrial areas. Data used to estimate impacted populations in included in Appendix B.

TABLES

TABLE 1
Summary of Worst-Case Release Scenarios
Polychemie Inc. - Los Angeles, CA
GESI Project No. 02512.01

Substance	Quantity Released (lbs)	Toxic Endpoint (mg/l)	U.S. EPA OCA Guidance Method Distance to Endpoint (miles)
Toxic Substance Formaldehyde, 37%	160,000 (solution) 58,000 (pure)	0.012	0.2
			U.S. EPA OCA Guidance Method Distance to Overpressure of 1 psi (miles)
Flammable Substance Dimethylamine, 60%	130,000 (solution)	N/A	0.32

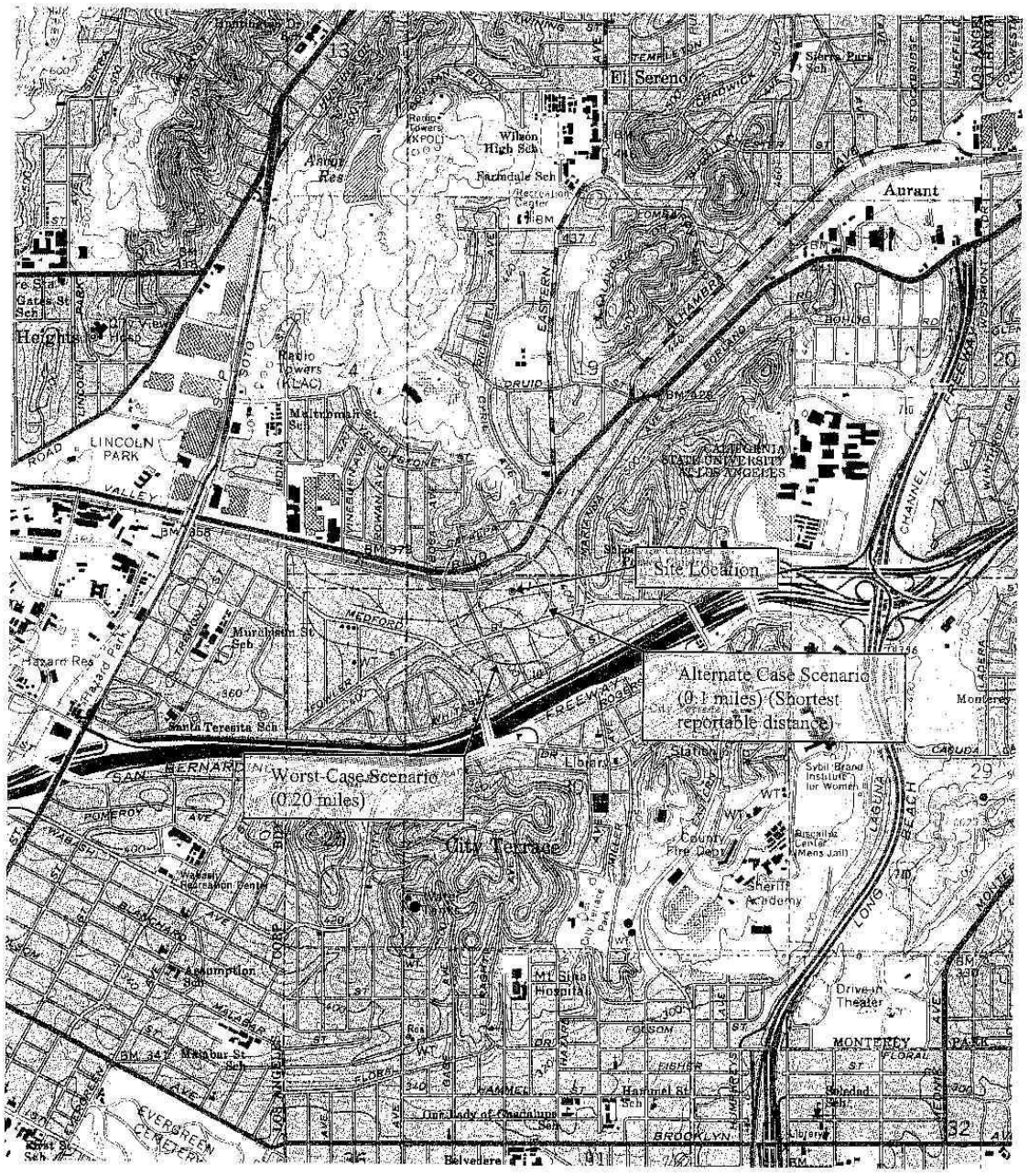
NOTES:
- Calculations are based on U.S. EPA RMP Guidance for Offsite Consequence Analysis provided by the EPA dated April 15, 1999.

TABLE 2
Summary of Alternate Release Scenarios
Polychemie Inc. - Los Angeles, CA
GESI Project No. 02512.01

Toxic Liquid	Total Liquid Released (lbs)	Maximum Evaporation Release Duration (min)	Evaporation Release Rate (lbs/min)	Toxic Endpoint[1] (mg/l)	EPA OCA Guidance Method Distance to Toxic Endpoint (miles)
Formaldehyde, 37%	5,500 (solution) 2,000 (pure)	10	0.72	0.012	0.1
Acrylamide, 50% (state only toxic substance)	23,000 (solution) 12,000 (pure)	10	0.11	0.11	0.1
Flammable Liquid	Total Liquid Released (lbs)	Release Duration (min)	Dischage Rate (lbs/min)	Lower Flammability Limit (LFL)	EPA OCA Guidance Method Distance to Vapor Cloud Fire Lower Flammability Limit (miles)
Dimethylamine, 60%	33,000 (solution)	5	6,500	52 mg/L (2.8%)	0.1

NOTES:
- Calculations are based on U.S. EPA RMP Guidance for Offsite Consequence Analysis provided by the EPA dated April 15, 1999.

FIGURES


Site Location
Alternate Case Scenario (0.1 miles) (Shortest reportable distance)
Worst-Case Scenario (0.20 miles)
City Terrace
El Sereno
Alhambra
Monterey Park
LINCOLN PARK
Source: 1981 LOS ANGELES, CALIFORNIA Quadrangle, 7.5 Minute Series (Topographic), Scale: 1in. ~ 2,000 ft.
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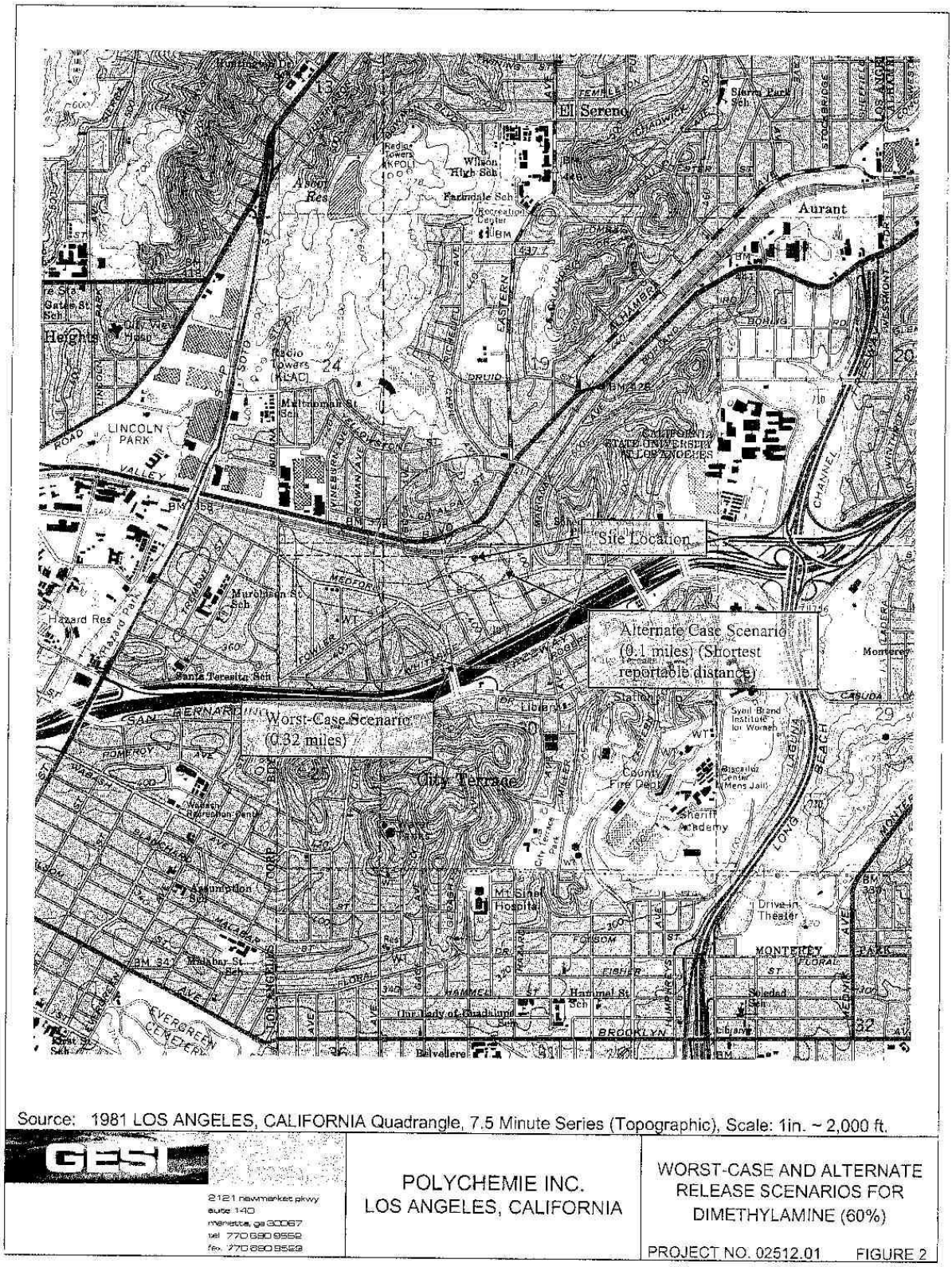
POLYCHEMIE INC.
LOS ANGELES, CALIFORNIA
WORST-CASE AND ALTERNATE RELEASE SCENARIOS FOR FORMALDEHYDE (37%)
PROJECT NO. 02512.01
FIGURE 1



Source: 1981 LOS ANGELES, CALIFORNIA Quadrangle, 7.5 Minute Series (Topographic), Scale: 1in. ~ 2,000 ft.

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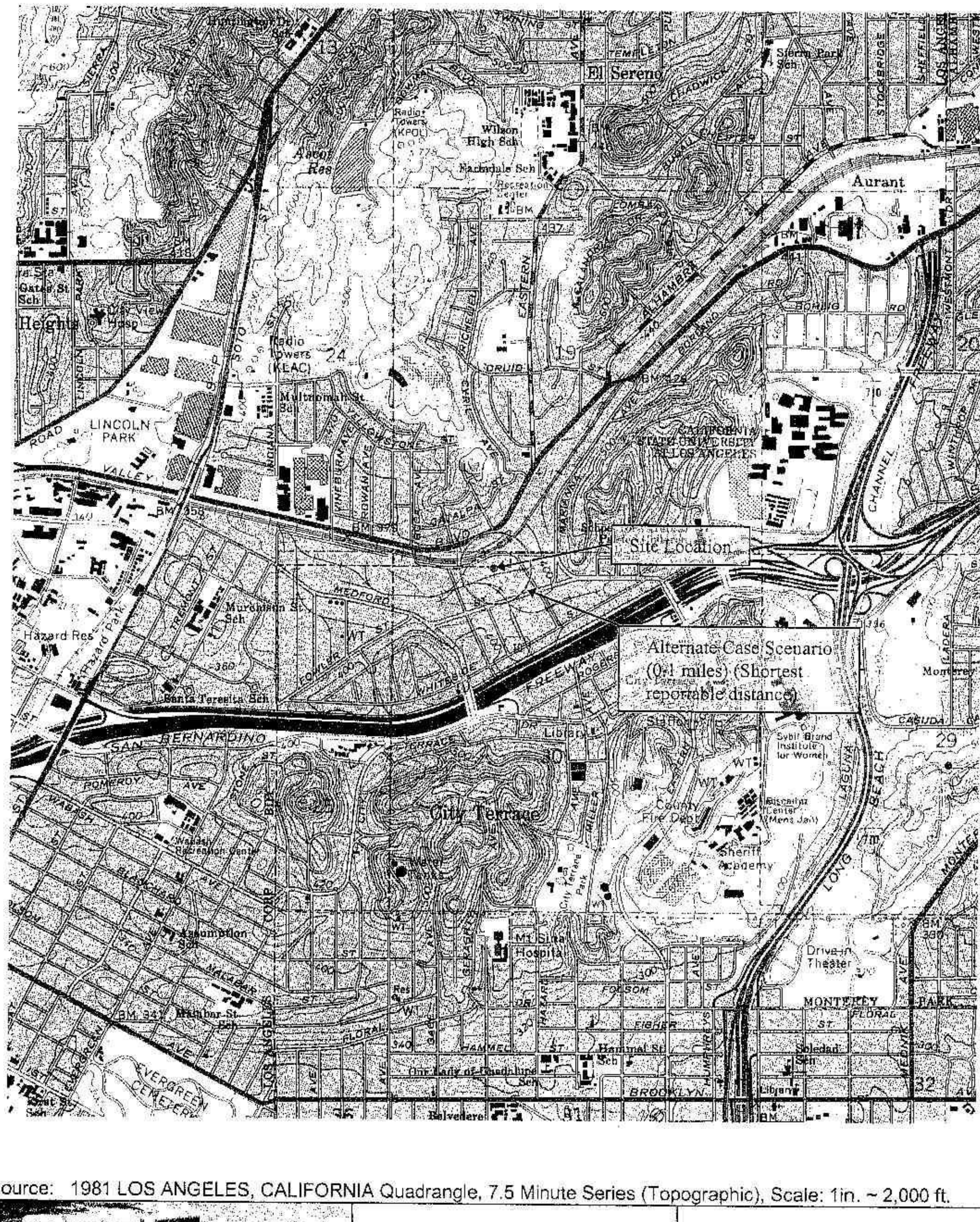
POLYCHEMIE INC.
LOS ANGELES, CALIFORNIA

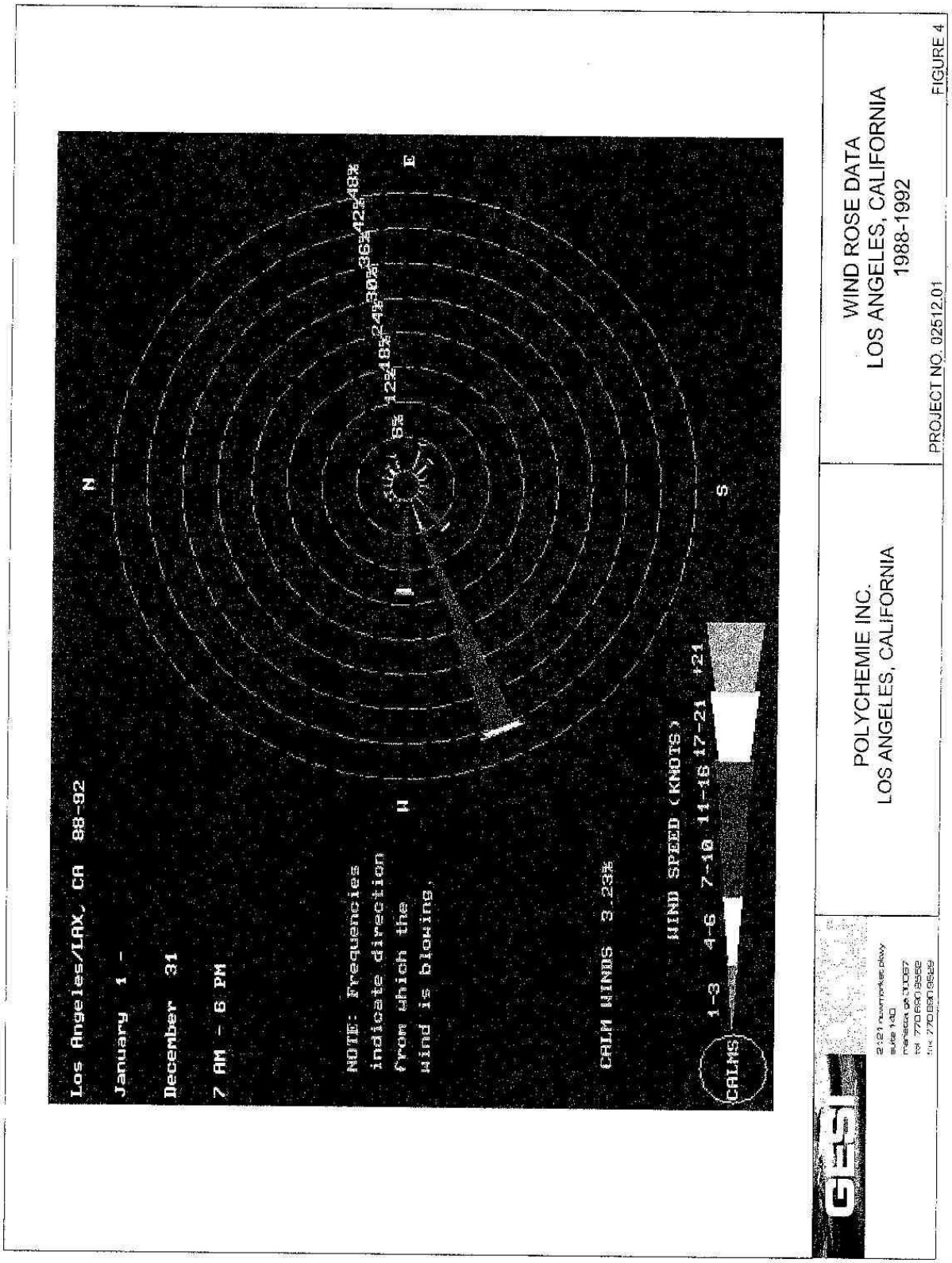
WORST-CASE AND ALTERNATE RELEASE SCENARIOS FOR DIMETHYLAMINE (60%)

PROJECT NO. 02512.01 FIGURE 2



Source: 1981 LOS ANGELES, CALIFORNIA Quadrangle, 7.5 Minute Series (Topographic), Scale: 1in. ~ 2,000 ft.

GESI 2121 newmarket pkwy, suite 140, marietta, ga 30067, tel 770 690 9559, fax 770 690 9529	POLYCHEMIE INC. LOS ANGELES, CALIFORNIA	ALTERNATE RELEASE SCENARIO FOR ACRYLAMIDE (50%)
		PROJECT NO. 02512.01 FIGURE 3


Los Angeles/LAX, CA 88-92
January 1 -
December 31
7 AM - 8 PM
N
E
S
NOTE: Frequencies indicate direction from which the wind is blowing.
CALM WINDS 3.23%
WIND SPEED (KNOTS)
1-3 4-6 7-10 11-16 17-21 >21
CALMS
6%
12%
18%
24%
30%
36%
42%
48%
POLYCHEMIE INC.
LOS ANGELES, CALIFORNIA
WIND ROSE DATA
LOS ANGELES, CALIFORNIA
1988-1992
PROJECT NO. 02512.01
FIGURE 4