

## *Appendix G*

---

# ENVIRON

July 7, 2009

Shannon George  
David J. Powers & Associates, Inc.  
Environmental Consultants & Planners  
1885 The Alameda, Suite 204  
San Jose, California 95126

**Re: Accidental Release Assessment  
San Francisco 49ers Stadium – Santa Clara, California Site**

Dear Ms. George:

ENVIRON International Corporation (ENVIRON) prepared this letter report on the consequence analysis of potential toxic or flammable substance accidental releases from the commercial areas near the location of the proposed San Francisco 49ers stadium in Santa Clara, California (the "Site").

## **BACKGROUND**

ENVIRON understands that the City of Santa Clara Fire Department (the "Fire Department") is requesting an accidental release risk assessment for the proposed San Francisco 49ers football stadium (the "Site"). The proposed stadium would be constructed on an approximately 22-acre site bounded on the north by Tasman Drive, on the east by the Santa Clara Youth Soccer Park (soccer park) and the existing Marie P. DeBartolo Sports Centre, on the south by Silicon Valley Power's Northern Receiving Station (receiving station) and the City of Santa Clara's North Side Water Storage Tanks (water storage tanks), and on the west by San Tomas Aquino Creek. The majority of the stadium site is currently used as an overflow parking lot for the nearby California's Great America theme park (Great America). A map of the proposed project location is shown in Figure 1.

The stadium would be developed and owned by a public agency to be formed by the City of Santa Clara and the City's Redevelopment Agency. The stadium would be leased to the San Francisco 49ers (49ers team), a National Football League (NFL) franchise. In addition to football events, use of the stadium may range from incidental use of meeting room facilities within the main building, including support of Convention Center activities, to larger activities such as concerts and other sporting events that would use a significant amount of the available seating. The proposed stadium would have a permanent seating capacity of up to 68,500 seats and will be designed to expand to approximately 75,000 seats for special events. The event level of the stadium (i.e., ground level) would include the playing field, locker rooms, main commissary, facilities for grounds keeping staff, operations (including management, security, and janitorial), truck docks, and facilities for various other support functions.

The Fire Department identified several nearby facilities that store certain toxic or flammable gases in such quantities that could potentially affect sensitive receptors at the Site in the case of an accidental release. The concern expressed by the Fire Department for this Site is the potential for "worst-case" accidental chemical releases

from these nearby facilities. The Fire Department defined "worst-case" to be consistent with assumptions made by Federal and State accidental release prevention programs: the total quantity is released in 10 minutes. These worst case release scenarios were modeled using standard accidental release methodologies. The facilities, materials, and chemical quantities provided by the Fire Department are listed in Table 1. These facilities are also shown in Figure 1.

There are eight substances identified by the Fire Department as chemicals of concern at facilities in the vicinity of the Site that are regulated under the United States Environmental Protection Agency's (USEPA's) Risk Management Plan (RMP) Rule<sup>1</sup> and the California Accidental Release Prevention (CalARP)<sup>2</sup> program: arsine, chlorine, ammonia, hydrogen chloride, trichlorosilane, hydrogen selenide, potassium cyanide and sodium cyanide. David J. Powers & Associates requested ENVIRON's assistance in evaluating potential acute health risks at the Site due to accidental releases of the eight substances in the vicinity of the Proposed Project as discussed above.

## SCOPE OF WORK

In accordance with ENVIRON's March 17, 2009 proposal, the scope of ENVIRON's work consisted of conducting a consequence analysis for the worst-case release scenarios of the eight substances discussed above. The worst case scenarios analyzed are based on the release of the entirety of the quantities provided by the Fire Department and the definitions and the methods contained in the USEPA guidelines established for toxic and flammable substances for the RMP ("RMP Guidance").<sup>3</sup> ENVIRON's consequence analysis focused on the worst-case scenario, as requested by the Fire Department.

The RMP Guidance and CalARP have defined the worst-case release scenario as the release of the largest quantity of a regulated substance from a single vessel or process line failure that results in the greatest distance to an endpoint under conservative meteorological conditions. For worst-case release scenario analysis under these programs, the possible causes of the worst-case release or the probability that such a release might take place are not considered; the release is simply assumed to occur.<sup>4</sup> Worst-case distances are based on modeling results assuming the combination of worst-case conditions required by the RMP rule. This combination of conditions occurs rarely and is unlikely to persist for very long.<sup>5</sup>

The remainder of this letter report describes ENVIRON's technical approach and conclusions for the assessment of potential impact radii corresponding to toxic endpoints established under USEPA RMP guidelines.

## TECHNICAL APPROACH

This section describes the technical approach that ENVIRON used to perform the consequence analysis for the worst-case release scenario releases of arsine, chlorine,

---

<sup>1</sup> Code of Federal Regulations. Title 40 Part 68 - Chemical Accident Prevention Provisions

<sup>2</sup> California Code of Regulations, Title 19, Division 2, Chapter 4.5: California Accidental Release Prevention (CalARP) Program. 2004

<sup>3</sup> USEPA. 2009. Risk Management Program Guidance for Offsite Consequence Analysis. EPA 550-B-99-009. March. Available at: <http://www.epa.gov/emergencies/docs/chem/oca-chps.pdf>

<sup>4</sup> USEPA 2009 p. 2-1.

<sup>5</sup> USEPA 2009 p. 1-5

ammonia, hydrogen chloride, trichlorosilane, hydrogen selenide, potassium cyanide and sodium cyanide. The locations, chemicals, amounts, and concentrations of each release provided by the Fire Department are summarized in Table 1.

### ***Screening Analysis***

ENVIRON modeled each of the eight release scenarios using RMP\*Comp, software developed by USEPA to analyze compliance with its RMP rule. RMP\*Comp is based on the USEPA RMP Guidance document and represents a simplified but conservative approach.

### **Assumptions**

The worst case scenario assumptions provided in USEPA RMP Guidance were used for all eight substances. These include the release of the full contents of a given vessel over a 10 minute period. Meteorological conditions are assumed to be a wind speed of 1.5 meters per second, air temperature of 77 degrees F (25 degrees C) and stability class F.

ENVIRON further assumed that topography for all eight releases was urban. Urban terrain is defined as terrain having many obstacles in the immediate area. In contrast, rural terrain is defined as generally flat and unobstructed. While urban topography is a less conservative assumption, it realistically reflects the terrain in the developed area in which the Proposed Project and nearby facilities are located, as shown in Figure 1. USEPA and CalARP guidance provide for using urban topography as appropriate for modeling of worst-case release scenarios.<sup>6,7</sup>

The worst case release scenario defined in the RMP and CalARP Guidance documents allows for passive mitigation measures, including mitigation due to a release occurring inside an enclosed building. The release rate is taken to be ten percent of the calculated worst case scenario evaporation rate for a release that occurs within a building.<sup>8</sup> Specifically, the RMP\*Comp program includes an option to indicate that the material is "release in an enclosed space, in direct contact with outside air. An enclosed space in direct contact with outside air would be a building or shed with openings to the outside, as opposed to a room inside a building or a very airtight building." However, ENVIRON did not assume any passive mitigation measures due to the lack of specific information on the storage of these chemicals and after discussions with the Fire Department.<sup>9</sup>

### **Material Details**

Five of the eight materials of concern are toxic gases at room temperature. These include arsine, chlorine, ammonia, hydrogen chloride and hydrogen selenide. Trichlorosilane is considered a flammable liquid under the RMP and CalARP programs. The endpoint used was the distance to 1 psi overpressure due to a vapor cloud explosion, as described in more detail below. In addition,

---

<sup>6</sup> USEPA 2009 p. 2-1.

<sup>7</sup> California Code of Regulations. 2004. Section 2750.2.e.

<sup>8</sup> USEPA 2009 p. 3-10

<sup>9</sup> Personal Communication. D. Parker of Santa Clara Fire Department in telephone conversation with D. Daugherty of ENVIRON. March 27.

the liquid temperature was assumed to be 77 degrees Fahrenheit, equal to the ambient temperature under the worst case scenario meteorological conditions. Two of the materials of concern, sodium cyanide and potassium cyanide, are crystalline compounds. All of the cyanide was assumed to acidify to form hydrogen cyanide gas or hydrocyanic acid (HCN) at 100% concentration as requested by the Fire Department. The calculation of the quantity of HCN released is shown in Table 2.

The inputs to the model for the seven toxic gases are shown in Table 3. Model inputs for the one flammable release are shown in Table 4.

## RESULTS OF CONSEQUENCE ANALYSIS

This section describes the results of the consequence analysis performed by ENVIRON for the eight worst-case release scenarios. It includes the potential impact radii of the release scenarios discussed above.

### ***Toxic Releases***

The American Industrial Hygiene Association (AIHA) has developed criteria to determine what concentration of a released chemical will be of concern. These criteria are set in a series of Emergency Response Guidelines (ERPGs). The ERPG-2 concentrations for six of the seven toxic chemicals of concern in this analysis correspond to the toxic endpoints for these chemicals defined in CalARP Guidance<sup>10</sup> and were used to determine an acceptable chemical concentration at the radius of impact. ERPG-2 concentrations are defined as the maximum concentration below which nearly all individuals could be exposed to for up to 1 hour without experiencing or developing irreversible or other serious side effects of symptoms that would prevent people from taking protective action. The exception to the use of ERPG-2 in the modeling was for arsine, for which the CalARP toxic endpoint differs from the ERPG-2 concentration. The CalARP toxic endpoint was used to determine the impact radius for arsine. Table 5 presents the endpoint criteria used for each release and the related acceptable maximum concentration. The distances to these endpoints are presented in Table 6 and shown in Figure 2 for the worst-case scenario.

### ***Flammable Releases***

The USEPA has established the overpressure endpoint of flammable substances to be 1 pound per square inch (psi) since "an overpressure of 1 psi is unlikely to have serious direct effects on people"<sup>11</sup>, but note that this level of overpressure would result in some window shattering and potential damage to structures. ENVIRON used the approach described in the previous section and the RMP overpressure end point to determine impact distances for the release of the only flammable substance identified by the Fire Department, trichlorosilane. The distance to the overpressure end point is presented in Table 6 and shown in Figure 2 for the worst-case scenario.

---

<sup>10</sup> California Code of Regulations, 2004, Appendix A.

<sup>11</sup> USEPA, 1998.

## RESULTS SUMMARY

Following the methodologies outlined above, ENVIRON's worst-case offsite consequence analysis showed the following results, summarized in Table 6:

- Our analysis of the non-flammable worst-case toxic gas release scenarios results in impact radii as presented in Table 6 and shown in Figure 2.
  - The proposed Site is within the impact radius for the arsine and hydrogen selenide release scenario at 1375 Norman Avenue.
  - The proposed Site is not within the impact radius for the chlorine, ammonia, or hydrogen chloride release scenarios.
  - The proposed Site is not within the impact radius for the hydrogen cyanide release scenarios.
  
- Analysis of the flammable worst-case scenario results in an impact radius of 0.04 km for trichlorosilane, as shown in Table 6.
  - The proposed project area is not within this impact radius as shown in Figure 2.

## CONCLUSIONS AND MITIGATION MEASURES

The Fire Department indicated that 4 facilities in the vicinity of the proposed Project Site store chemicals that could have off-site consequences if catastrophically released. The facilities and the toxic chemicals stored in quantities of concern are summarized below:

- 1375 Norman Avenue, Santa Clara, CA - Arsine - 50 lbs - 100%
- 1375 Norman, Santa Clara, CA - Chlorine - 100 lbs - 100%
- 1375 Norman, Santa Clara, CA - Ammonia - 500 lbs - 100%
- 1375 Norman, Santa Clara, CA - Hydrogen Selenide – 22 lbs - 100%
- 1375 Norman, Santa Clara, CA - Hydrogen Chloride – 599 lbs - 100%
- 2201 Laurelwood Rd, Santa Clara, CA - Trichlorosilane - 550 lbs - 100%
- 2262 Calle del Mundo, Santa Clara, CA - Potassium Cyanide - 110 lbs - 100% acidified to HCN
- 1650 Russell Avenue, Santa Clara, CA - Sodium Cyanide - 100 lbs - 100% acidified to HCN

ENVIRON evaluated the potential risk posed by these chemicals at these 4 facilities by evaluating worst-case release scenarios as defined under RMP, as requested by the Fire Department. For the evaluation of impacts from accidental releases, ENVIRON understands that the Fire Department requested the use of ERPG-2 endpoints, consistent with CalARP Guidance. The endpoints are specified in Table 5. Our off-site consequence analysis using USEPA approved methodologies showed that it is unlikely that a worst-case release (i.e., a catastrophic, instantaneous release) of the chemicals evaluated from these four facilities would have off-site consequences that would potentially affect individuals at these criteria of concern at the Proposed Project Site, with the following exception:

- 1375 Norman Avenue – arsine and hydrogen selenide;

Note that in worst-case release scenario analysis under RMP/CalARP, the possible causes of the worst-case release or the probability that such a release might take place are not considered; the release is simply assumed to occur. Worst-case release scenarios represent the failure modes that would result in the worst possible off-site consequences, however unlikely, and not more likely smaller releases that would potentially result in smaller impacts.

Furthermore, one of the goals of the USEPA's RMP is to provide information to local emergency responders and communities near RMP facilities to prepare and respond to potential accidental releases.<sup>12,13</sup> Thus, notwithstanding the findings discussed above, but in accordance with the goals of USEPA's RMP, the City of Santa Clara should recognize the presence of these chemicals at the facilities evaluated above, which is in proximity to developed areas of Santa Clara including the Proposed Project Site, and consider the information presented in this report for emergency response planning purposes.

ENVIRON believes an emergency response plan, coordinated with first-responders and other emergency agencies, with evaluation of evacuation measures would aid the Proposed Project Site in developing mitigation measures for catastrophic off-site consequences from the Norman Avenue facility. Note there is no guarantee that any mitigation measure or plan will fully protect occupants at the Site under all release scenarios. Site-specific emergency response and/or evacuation plans have been developed for public venues such as stadiums, including AT&T Park in San Francisco.<sup>14</sup> Guidance to consider during the development of such plans include information from public agencies such as the Federal Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA), California Governor's Office of Homeland Security, and Occupational Safety and Health Administration (OSHA) guidance on Emergency Action Plans (EAPs). In addition, professional societies for stadium venues such as the Stadium Managers Association and International Association of Assembly Managers, Inc. (IAAM) are also resources for emergency response information. As an emergency response and/or evacuation plan is to be tailored to an individual site and coordinated with local planners and emergency response systems, the development of these plans require coordination between the proposed Project, the Normal Avenue facility, the Santa Clara Fire and Police Department, the Santa Clara Planning Department, and potentially other emergency agencies.

## LIMITATIONS

This memorandum has been prepared exclusively for use by David J. Powers & Associates, 49ers Stadium LLC, and the City of Santa Clara and contains information considered to be confidential information. This memorandum may not be relied upon by any other person or entity without ENVIRON's express written permission. The conclusions presented in this report represent ENVIRON's professional judgment based

---

<sup>12</sup> United States Environmental Protection Agency (USEPA). 2009. Updates to *General Guidance on Risk Management Programs for Chemical Accident Prevention*. Office of Solid Waste and Emergency Response. EPA-550-B-04-001. March.

<sup>13</sup> United States Environmental Protection Agency (USEPA). 2004. *General Guidance on Risk Management Programs for Chemical Accident Prevention*. Office of Solid Waste and Emergency Response. EPA-550-B-04-001. April.

<sup>14</sup> Pape, Pat. 2007. "Can You Get Them All Out?". Venue Safety & Security, 1:1. International Association of Assembly Managers, Inc. (IAAM).

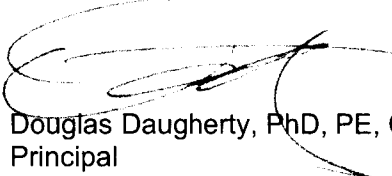
on the information available to us during the course of this assignment and on conditions that existed at the time of the assessment. ENVIRON made reasonable efforts to verify the information provided to us but did not perform an independent evaluation of the information. Nonetheless, this report is accurate and complete only to the extent that information provided to ENVIRON was itself accurate and complete.

**CLOSING**

We appreciate the opportunity of providing our service to David J. Powers & Associates and the City of Santa Clara. Please call Douglas Daugherty at (510) 420-2513 if you have any questions or comments regarding this letter report.

Sincerely,

  
Loren F Bentley Tammero, PhD  
Senior Associate

  
Douglas Daugherty, PhD, PE, CIH  
Principal

Attachments: Tables  
Figures  
Attachment A: Modeling Output Files



## TABLES

**Table 1: Summary of Release Scenarios  
San Francisco 49ers Stadium Site  
Santa Clara, California**

| Scenario | Facility             | Chemical   | CAS #      | Quantity Stored | Units | Concentration            |
|----------|----------------------|--|------------|-----------------|-------|--------------------------|
| 1        | 1375 Norman Avenue   | Arsine   | 7784-42-1  | 50              | lbs   | 100%                     |
| 2        |                      | Chlorine   | 7782-50-5  | 100             | lbs   | 100%                     |
| 3        |                      | Ammonia  | 7664-41-7  | 500             | lbs   | 100%                     |
| 4        |                      | Hydrogen Chloride                                    | 7647-01-0  | 599             | lbs   | 100%                     |
| 5        |                      | Hydrogen Selenide                                    | 7783-07-5  | 22              | lbs   | 100%                     |
| 6        | 2201 Laurelwood Rd   | Trichlorosilane                                      | 10025-78-2 | 550             | lbs   | 100%                     |
| 7        | 2262 Calle del Mundo | Potassium Cyanide<br>(Acidified to Hydrogen Cyanide) | 74-90-8    | 110             | lbs   | 100% acidified<br>to HCN |
| 8        | 1650 Russell Avenue  | Sodium Cyanide<br>(Acidified to Hydrogen Cyanide)    | 74-90-8    | 100             | lbs   | 100% acidified<br>to HCN |

**Source:**

George, Shannon; David J Powers and Associates. Email to Doug Daugherty of ENVIRON. March 16 2009.

**Table 2: Hydrocyanic Acid Release Quantity Calculation  
San Francisco 49ers Stadium Site  
Santa Clara, California**

|                   |      | Mass Crystalline Compound |       | Molecular weight<br>g/mol | Molar Amount |                        | Molecular weight<br>g HCN/mol | Mass Hydrogen Cyanide |        |
|-------------------|------|---------------------------|-------|---------------------------|--------------|------------------------|-------------------------------|-----------------------|--------|
|                   |      | lbs                       | grams |                           | moles CN     | moles HCN <sup>a</sup> |                               | g HCN                 | lb HCN |
| Potassium Cyanide | KCN  | 110                       | 49895 | 65.12                     | 766.20       | 766.20                 | 27.03                         | 20710                 | 45.7   |
| Sodium Cyanide    | NaCN | 100                       | 45359 | 49.01                     | 925.51       | 925.51                 | 27.03                         | 25017                 | 55.2   |

**Notes:**

a. Assume 100% conversion of cyanide salts to hydrogen cyanide as requested by the Santa Clara Fire Department.

**Table 3: Toxic Gas RMP\*Comp Inputs  
San Francisco 49ers Stadium Site  
Santa Clara, California**

| Chemical                                | Arsine           | Chlorine         | Ammonia<br>(anhydrous) | Hydrogen chloride<br>(anhydrous) | Hydrogen<br>selenide | Hydrocyanic<br>acid | Hydrocyanic<br>acid |
|---|------------------|------------------|------------------------|----------------------------------|----------------------|---------------------|---------------------|
| CAS #                                   | 7784-42-1        | 7782-50-5        | 7664-41-7              | 7647-01-0                        | 7783-07-5            | 74-90-8             | 74-90-8             |
| Category                                | Toxic Gas        | Toxic Gas        | Toxic Gas              | Toxic Gas                        | Toxic Gas            | Toxic Gas           | Toxic Gas           |
| Scenario                                | Worst-case       | Worst-case       | Worst-case             | Worst-case                       | Worst-case           | Worst-case          | Worst-case          |
| Quantity Released                       | 50 pounds        | 100 pounds       | 500 pounds             | 599 pounds                       | 22 pounds            | 45.7 pounds         | 55.2 pounds         |
| Release Duration                        | 10 min           | 10 min           | 10 min                 | 10 min                           | 10 min               | 10 min              | 10 min              |
| Release Rate (lb/min)                   | 5                | 10               | 50                     | 59.9                             | 2.2                  | 4.57                | 5.52                |
| Mitigation Measures                     | NONE             | NONE             | NONE                   | NONE                             | NONE                 | NONE                | NONE                |
| Topography                              | Urban            | Urban            | Urban                  | Urban                            | Urban                | Urban               | Urban               |
| Toxic Endpoint <sup>a</sup>             | 0.0019           | 0.0087           | 0.14                   | 0.03                             | 0.00066              | 0.011               | 0.011               |
| Estimated Distance to<br>Toxic Endpoint | 1.6 miles        | 0.3 miles        | 0.1 miles              | 1.1 miles                        | 1.7 miles            | 0.3 miles           | 0.4 miles           |
|   | (2.6 kilometers) | (0.5 kilometers) | (0.2 kilometers)       | (1.8 kilometers)                 | (2.7 kilometers)     | (0.5 kilometers)    | (0.6 kilometers)    |

**Notes:**

a. See Table 5 for endpoint information.

**Abbreviations:**

lb - pound

mg/L - milligrams per Liter

min - minute

**Table 4: Flammable Liquid RMP\*Comp Inputs  
Offsite Consequence Analysis  
San Francisco 49ers Stadium Site  
Santa Clara, California**

|  |   |
|--|---|
| <b>Chemical</b>                                      | <b>Trichlorosilane [Silane, trichloro-]</b> |
| <b>CAS #</b>   | 10025-78-2                                  |
| <b>Category</b>                                      | Flammable Liquid                            |
| <b>Scenario</b>                                      | Worst-case                                  |
| <b>Quantity Released</b>                             | 550 pounds                                  |
| <b>Release Type</b>                                  | Vapor Cloud Explosion                       |
| <b>Liquid Temperature</b>                            | 77 F  |
| <b>Mitigation Measures</b>                           | NONE  |
| <b>Release Rate to Outside Air<sup>a</sup></b>       | 51.3 pounds per minute                      |
| <b>Quantity Evaporated in 10 Minutes<sup>a</sup></b> | 513 pounds                                  |
| <b>Estimated Distance to 1 psi overpressure</b>      | .03 miles (.04 kilometers)                  |

**Notes:**

a. Calculated by RMP\*Comp based on the liquid temperature of 77 F.

**Table 5: Endpoint Criteria for Accidental Release Scenarios  
San Francisco 49ers Stadium Site  
Santa Clara, California**

| Chemical   | Concern Criterion             | Concentration |        | Source |
|--|-------------------------------|---------------|--------|--------|
|  |                               | ppm           | mg/L   |        |
| Arsine   | CalARP Toxic endpoint         | 0.6           | 0.0019 | a,c    |
| Chlorine   | CalARP Toxic endpoint/ ERPG-2 | 3             | 0.0087 | a,c    |
| Ammonia  | CalARP Toxic endpoint/ ERPG-2 | 200           | 0.1400 | a,c    |
| Hydrogen Chloride                                    | CalARP Toxic endpoint/ ERPG-2 | 20            | 0.0300 | a,c    |
| Hydrogen Selenide                                    | CalARP Toxic endpoint/ ERPG-2 | 0.2           | 0.0007 | a,c    |
| Trichlorosilane                                      | 1 psi overpressure            |               |        | b      |
| Potassium Cyanide<br>(Acidified to Hydrogen Cyanide) | CalARP Toxic endpoint/ ERPG-2 | 10            | 0.011  | a,c    |
| Sodium Cyanide<br>(Acidified to Hydrogen Cyanide)    | CalARP Toxic endpoint/ ERPG-2 | 10            | 0.011  | a,c    |

**Source:**

- a. USEPA. 2009. Risk Management Program Guidance for Offsite Consequence Analysis. EPA 550-B-99-009. March. Exhibit B-1 Data for Toxic Gases. Available at: <http://www.epa.gov/oem/docs/chem/oca-and.s.pdf>
- b. California Code of Regulations, Title 19, Division 2, Chapter 4.5: California Accidental Release Prevention (CalARP) Program. 2004. Section 2750.2
- c. California Code of Regulations, Title 19, Division 2, Chapter 4.5: California Accidental Release Prevention (CalARP) Program. 2004. Appendix A.

**Abbreviations:**

- CalARP - California Accidental Release Prevention Program
- EHS - Extremely Hazardous Substances
- ERPG-2 - Emergency Response Planning Guideline 2
- IDLH - Immediately Dangerous to Life and Health
- LOC - Level of Concern
- mg/L - milligrams per Liter
- ppm - parts per million
- psi - pounds per square inch

**Table 6: Results of Worst Case Scenario Modeling  
San Francisco 49ers Stadium Site  
Santa Clara, California**

| Scenario | Facility             | Chemical                      | CAS #           | Quantity Stored (lbs) | Category         | Endpoint (mg/L)    | Estimated Distance to Toxic Endpoint <sup>a</sup> |            | Distance from Site Boundary |            |
|----------|----------------------|-------------------------------|-----------------|-----------------------|------------------|--------------------|---|------------|-----------------------------|------------|
|          |                      |                               |                 |                       |                  |                    | miles   | km         | miles                       | km         |
| 1        | 1375 Norman Avenue   | Arsine                        | 7784-42-1       | 50                    | Toxic Gas        | 0.0019             | <b>1.6</b>  | <b>2.6</b> | <b>1.3</b>                  | <b>2.1</b> |
| 2        |                      | Chlorine                      | 7782-50-5       | 100                   | Toxic Gas        | 0.0087             | 0.3   | 0.5        | 1.3                         | 2.1        |
| 3        |                      | Ammonia                       | 7664-41-7       | 500                   | Toxic Gas        | 0.14               | 0.1   | 0.2        | 1.3                         | 2.1        |
| 4        |                      | Hydrogen Chloride             | 7647-01-0       | 599                   | Toxic Gas        | 0.03               | 1.1   | 1.8        | 1.3                         | 2.1        |
| 5        |                      | Hydrogen Selenide             | 7783-07-5       | 22                    | Toxic Gas        | 0.00066            | <b>1.7</b>  | <b>2.7</b> | <b>1.3</b>                  | <b>2.1</b> |
| 6        | 2201 Laurelwood Rd   | Trichlorosilane               | 10025-78-2      | 550                   | Flammable Liquid | 1 psi overpressure | 0.03  | 0.04       | 1.2                         | 1.9        |
| 7        | 2262 Calle del Mundo | <i>Potassium Cyanide</i>      | <i>151-50-8</i> | <i>110</i>            | Toxic Gas        | 0.011              | 0.3   | 0.5        | 0.4                         | 0.7        |
|          |                      | Acidified to Hydrogen Cyanide | 74-90-8         | 45.7                  |                  |                    |   |            |                             |            |
| 8        | 1650 Russell Avenue  | <i>Sodium Cyanide</i>         | <i>143-33-9</i> | <i>100</i>            | Toxic Gas        | 0.011              | 0.4   | 0.6        | 1.2                         | 1.9        |
|          |                      | Acidified to Hydrogen Cyanide | 74-90-8         | 55.2                  |                  |                    |   |            |                             |            |

**Notes:**

a. Analysis based on RMP\*Comp, Version 1.07. USEPA. Available at: [http://www.epa.gov/oem/content/rmp/rmp\\_comp.htm](http://www.epa.gov/oem/content/rmp/rmp_comp.htm)

**Abbreviations:**

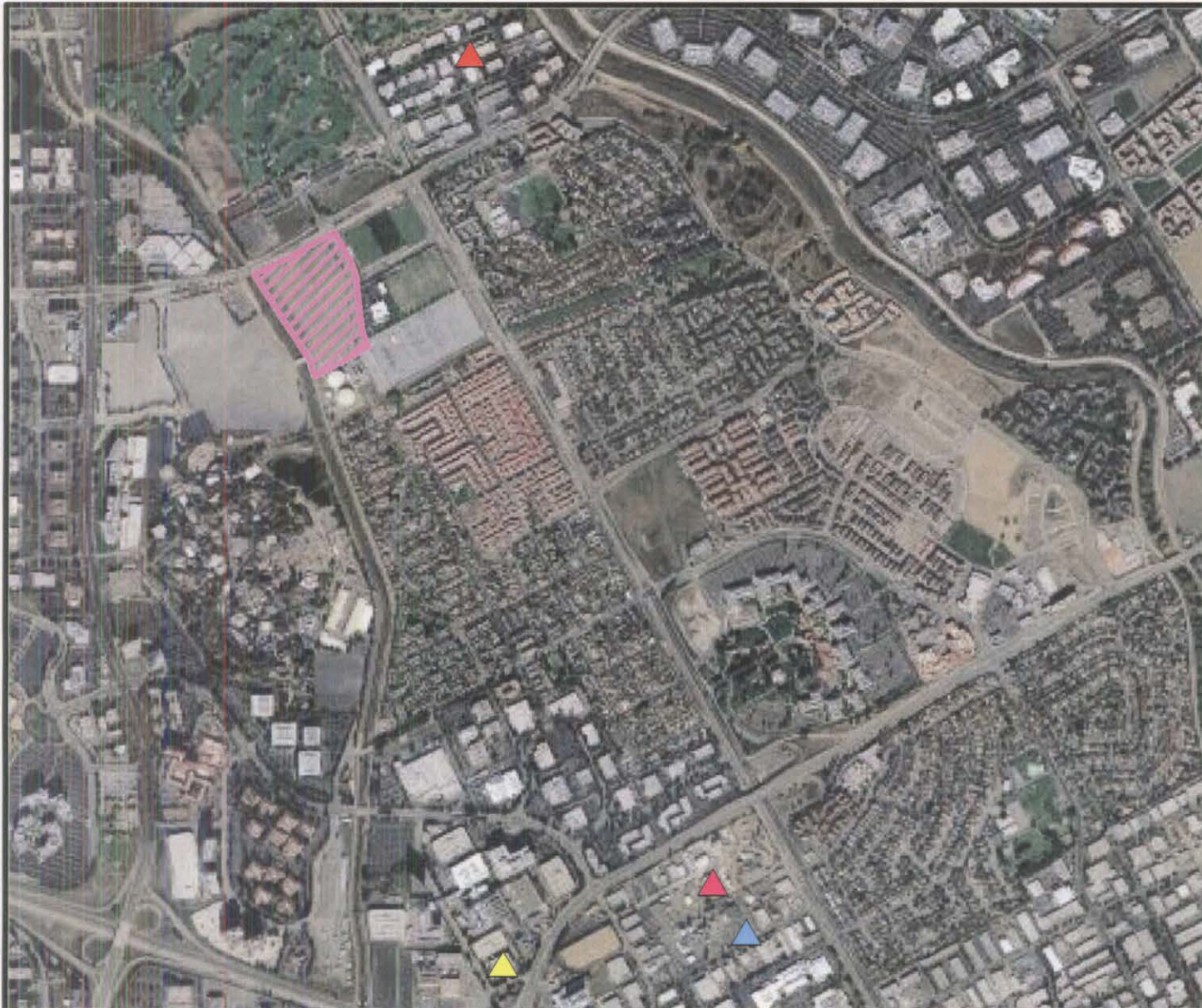
lbs - pound

km - kilometer

mg/L - milligrams per Liter

## FIGURES






**Legend**

 Project Boundary

**Release Locations**

-  2262 Calle del Mundo
-  2201 Laurelwood Rd
-  1375 Norman Avenue
-  1650 Russell Avenue



0 0.15 0.3 0.6  
 Kilometers

**ENVIRON**

6001 Shellmound St., Suite 700, Emeryville, CA 94608

**Proposed Project Site and Chemical Storage Locations  
 San Francisco 49ers Stadium Site  
 Santa Clara, California**

Figure

**1**

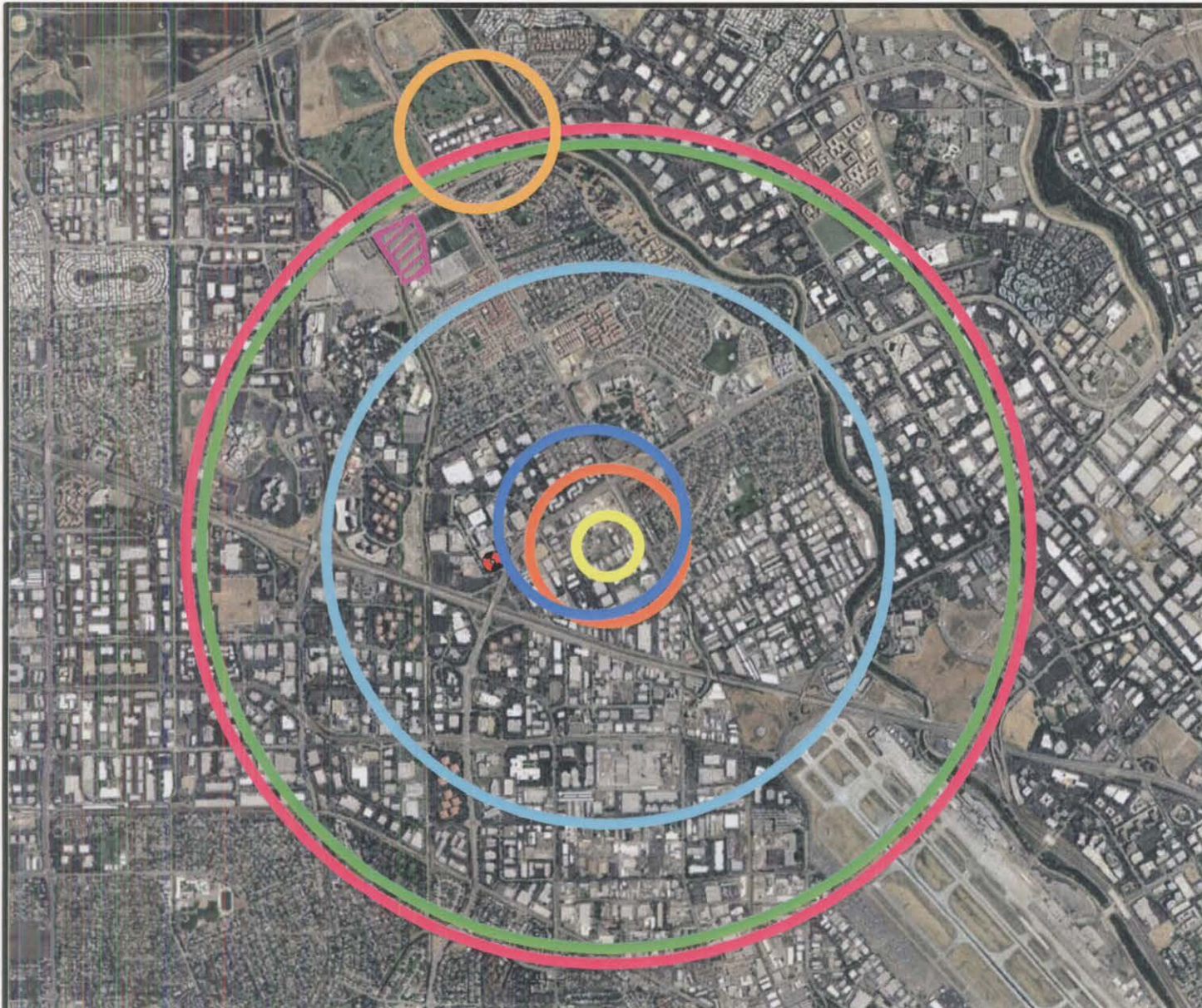
Drafter: MD

Date: 03/26/09

Contract Number:

Approved:

Revised:



### Legend

 Project Boundary

### Endpoint Radii

#### Chemical

-  Ammonia
-  Arsine
-  Chlorine
-  Hydrogen Chloride
-  Hydrogen Selenide
-  Potassium Cyanide
-  Sodium Cyanide
-  Trichlorosilane



**ENVIRON**

6001 Shellmound St., Suite 700, Emeryville, CA 94608

Modeled Distances to Endpoints for Worst Case Release Scenarios  
 San Francisco 49ers Stadium Site  
 Santa Clara, California

Figure  
 2

Drafter: MLS

Date: 03/31/09

Contract Number:

Approved:

Revised:

**ATTACHMENT A**  
**Modeling Output Files**

RMP\*Comp Ver. 1.07

Results of Consequence Analysis

Chemical: Ammonia (anhydrous)

CAS #: 7664-41-7

Category: Toxic Gas

Scenario: Worst-case

Quantity Released: 500 pounds

Release Duration: 10 min

Release Rate: 50.0 pounds per min

Mitigation Measures: NONE

Topography: Urban surroundings (many obstacles in the immediate area)

Toxic Endpoint: 0.14 mg/L; basis: ERPG-2

Estimated Distance to Toxic Endpoint: 0.1 miles (0.2 kilometers)

-----Assumptions About This Scenario-----

Wind Speed: 1.5 meters/second (3.4 miles/hour)

Stability Class: F

Air Temperature: 77 degrees F (25 degrees C)

-----

RMP\*Comp Ver. 1.07

Results of Consequence Analysis

Chemical: Arsine

CAS #: 7784-42-1

Category: Toxic Gas

Scenario: Worst-case

Quantity Released: 50 pounds

Release Duration: 10 min

Release Rate: 5.00 pounds per min

Mitigation Measures: NONE

Topography: Urban surroundings (many obstacles in the immediate area)

Toxic Endpoint: 0.0019 mg/L; basis: EHS-LOC (IDLH)

Estimated Distance to Toxic Endpoint: 1.6 miles (2.6 kilometers)

-----Assumptions About This Scenario-----

Wind Speed: 1.5 meters/second (3.4 miles/hour)

Stability Class: F

Air Temperature: 77 degrees F (25 degrees C)

-----

RMP\*Comp Ver. 1.07

Results of Consequence Analysis

Chemical: Chlorine

CAS #: 7782-50-5

Category: Toxic Gas

Scenario: Worst-case

Quantity Released: 100 pounds

Release Duration: 10 min

Release Rate: 10.0 pounds per min

Mitigation Measures: NONE

Topography: Urban surroundings (many obstacles in the immediate area)

Toxic Endpoint: 0.0087 mg/L; basis: ERPG-2

Estimated Distance to Toxic Endpoint: 0.3 miles (0.5 kilometers)

-----Assumptions About This Scenario-----

Wind Speed: 1.5 meters/second (3.4 miles/hour)

Stability Class: F

Air Temperature: 77 degrees F (25 degrees C)

-----

RMP\*Comp Ver. 1.07

Results of Consequence Analysis

Chemical: Hydrogen chloride (anhydrous)

CAS #: 7647-01-0

Category: Toxic Gas

Scenario: Worst-case

Quantity Released: 599 pounds

Release Duration: 10 min

Release Rate: 59.9 pounds per min

Mitigation Measures: NONE

Topography: Urban surroundings (many obstacles in the immediate area)

Toxic Endpoint: 0.030 mg/L; basis: ERPG-2

Estimated Distance to Toxic Endpoint: 1.1 miles (1.8 kilometers)

-----Assumptions About This Scenario-----

Wind Speed: 1.5 meters/second (3.4 miles/hour)

Stability Class: F

Air Temperature: 77 degrees F (25 degrees C)

-----

RMP\*Comp Ver. 1.07

Results of Consequence Analysis

Chemical: Hydrocyanic acid

CAS #: 74-90-8

Category: Toxic Gas

Scenario: Worst-case

Quantity Released: 45.7 pounds

Release Duration: 10 min

Release Rate: 4.57 pounds per min

Mitigation Measures: NONE

Topography: Urban surroundings (many obstacles in the immediate area)

Toxic Endpoint: 0.011 mg/L; basis: ERPG-2

Estimated Distance to Toxic Endpoint: 0.3 miles (0.5 kilometers)

-----Assumptions About This Scenario-----

Wind Speed: 1.5 meters/second (3.4 miles/hour)

Stability Class: F

Air Temperature: 77 degrees F (25 degrees C)

-----



RMP\*Comp Ver. 1.07

Results of Consequence Analysis

Chemical: Hydrocyanic acid

CAS #: 74-90-8

Category: Toxic Gas

Scenario: Worst-case

Quantity Released: 55.2 pounds

Release Duration: 10 min

Release Rate: 5.52 pounds per min

Mitigation Measures: NONE

Topography: Urban surroundings (many obstacles in the immediate area)

Toxic Endpoint: 0.011 mg/L; basis: ERPG-2

Estimated Distance to Toxic Endpoint: 0.4 miles (0.6 kilometers)

-----Assumptions About This Scenario-----

Wind Speed: 1.5 meters/second (3.4 miles/hour)

Stability Class: F

Air Temperature: 77 degrees F (25 degrees C)

-----

RMP\*Comp Ver. 1.07

Results of Consequence Analysis

Chemical: Hydrogen selenide

CAS #: 7783-07-5

Category: Toxic Gas

Scenario: Worst-case

Quantity Released: 22 pounds

Release Duration: 10 min

Release Rate: 2.20 pounds per min

Mitigation Measures: NONE

Topography: Urban surroundings (many obstacles in the immediate area)

Toxic Endpoint: 0.00066 mg/L; basis: EHS-LOC (IDLH)

Estimated Distance to Toxic Endpoint: 1.7 miles (2.7 kilometers)

-----Assumptions About This Scenario-----

Wind Speed: 1.5 meters/second (3.4 miles/hour)

Stability Class: F

Air Temperature: 77 degrees F (25 degrees C)

-----

RMP\*Comp Ver. 1.07

Results of Consequence Analysis

Chemical: Trichlorosilane [Silane, trichloro-]

CAS #: 10025-78-2

Category: Flammable Liquid

Scenario: Worst-case

Quantity Released: 550 pounds

Release Type: Vapor Cloud Explosion

Liquid Temperature: 77 F

Mitigation Measures: NONE

Release Rate to Outside Air: 51.3 pounds per minute

Quantity Evaporated in 10 Minutes: 513 pounds

Estimated Distance to 1 psi overpressure: .03 miles (.04 kilometers)

-----Assumptions About This Scenario-----

Wind Speed: 1.5 meters/second (3.4 miles/hour)

Stability Class: F

Air Temperature: 77 degrees F (25 degrees C)

-----